

Subject: Shadow-Flicker Modeling
Marble River, NY.

Customer: Environmental Design & Research, P.C.
238 W. Division Street
Syracuse, NY 13204

Project type: Modeling

Prepared by: Arne Nielsen, WEI

Distribution: Benjamin Brazell, John Hecklau; EDRPC

Revision: 0

Date: Jan. 28, 2006

1. Introduction

This Project Briefing provides a brief explanation of the shadow-flicker phenomenon, the modeling approach employed and relevant explanations and results.

2. Shadow-Flicker Background

Shadow-flicker from wind turbines is defined as alternating changes in light intensity caused by rotating blades casting shadows on the ground and stationary objects such as a window at a dwelling. No shadow will be cast when the sun is obscured by clouds/fog or when the turbine is not operating.

Shadow-flicker can occur in project area homes when the turbine is located near a home and is in a position where the blades interfere with very low-angle sunlight. The most typical effect is the visibility of an intermittent light reduction in the rooms of the home facing the wind turbines and subject to the shadow-flicker. Such locations are here referred to as shadow-flicker receptors. Obstacles such as terrain, trees, or buildings between the wind turbine and a potential shadow-flicker receptor significantly reduce or eliminate shadow-flicker effects.

The spatial relationships between a wind turbine and receptor, as well as wind direction are key factors related to shadow-flicker time (hours per year). General industry practices place turbines at least 1000 ft from receptors. At this distance shadow flicker usually only occurs at sunrise or sunset when the cast shadows are sufficiently long.

Shadow flicker intensity is defined as the difference in brightness at a given location in the presence and absence of a shadow. Shadow flicker intensity diminishes with greater receptor-to-turbine separation distance and low visibility weather conditions, such as haze or fog.

The analysis performed for this report does not evaluate the shadow flicker intensity, but rather focuses on the total amount of time (hours and minutes/year) that shadow flicker can potentially occur at receptors regardless of whether the shadow flicker is barely noticeable or

clearly distinct. Consequently, it is likely that receptors will experience less shadow-flicker impact than modeled and reported, especially those that are further away from turbines. It is very likely that marginally affected receptors may not be able to identify shadow-flicker at all.

The shadow-flicker frequency is related to the rotor speed and number of blades on the rotor. The modeling results presented are based on a wind turbine with a 3-bladed, 90 meter diameter rotor, 78 meter hub height and a nominal rotor speed of 16.7 RPM which translates to a blade pass frequency of 0.8 Hz (less than 1 alternation per second). Health wise, such low frequencies are harmless. Frequencies higher than 3 Hz but below 10 Hz are widely used in discotheques and the Epilepsy Foundation has made statements that frequencies below 10 Hz are not likely to trigger epileptic seizures.

3. Modeling Approach

A near worst case approach has been adopted for reporting the shadow-flicker results. Additional general site and receptor-specific assessments such as obstacles, diurnal and seasonal cloud and fog patterns may further reduce the reported shadow flicker impacts. The analysis assumes windows are situated in direct alignment with the turbine to sun line of sight. Even when windows are so aligned, the analysis does not account for the difference between windows in rooms with primary use and enjoyment (e.g. living rooms) and other less frequently occupied or un-occupied rooms or garages.

The shadow-flicker model uses the following input:

- Turbine locations (coordinates)
- Shadow Flicker receptor (residence) locations (coordinates)
- USGS 1:24,000 topographic and USGS DEM (height contours)
- Turbine rotor diameter
- Turbine hub height
- Joint wind speed and direction frequency distribution
- Sunshine hours (long term monthly reference data)

The model calculates detailed shadow-flicker results at each assessed receptor location and the amount of shadow-flicker time (hours/year) everywhere surrounding the project (on an iso-line plot). A receptor in the model is defined as a 1 m² area 1 meter above ground level. This omni-directional approach produces shadow-flicker results at a receptor regardless of the direction of windows and provides similar results as a model with windows on various sides of the receptor.

The sun's path with respect to each turbine location is calculated by the software to determine the cast shadow paths every 2 minutes, every day over a full year.

The turbine run-time and direction (seen from the receptor) are calculated from the site's long-term wind speed and direction distribution.

Finally, the effects of cloud cover are calculated using long term reference data (monthly average sunshine hours) to arrive at the projected annual flicker time at each receptor.

Output from the model includes the following information:

- Calculated shadow-flicker time at selected receptors
- Tabulated and plotted time of day with shadow flicker at selected receptors
- Map showing turbine locations, selected shadow-flicker receptors and iso-line contours indicating projected shadow-flicker time (hours per year).

4. Conclusion

The shadow-flicker model assumptions applied to this project are very conservative and as such, the analysis is expected to over-predict the impacts. Additionally, many of the modeled shadow flicker hours are expected to be of very low intensity.

The results are therefore prudent projections of the anticipated shadow flicker levels that would be experienced at the nearby residences. The modeled results have been summarized below in fig. 1.

Receptor name	Shadow hours per year (worst case) [hh:mm / year]	Shadow days per year [days / year]	Max shadow hours per day [hh:mm / day]	Shadow hours per year (real) [hh:mm / year]
266	119:42	218	0:50	33:12
136	119:38	189	1:28	32:45
235	113:50	199	0:52	30:34
146	126:02	256	0:52	30:23
359	111:22	212	0:48	29:15
035	110:30	149	1:00	28:08
358	90:26	167	0:42	26:09
356	98:36	176	0:50	26:01
137	89:32	119	1:30	25:59
171	108:44	146	1:00	25:41
357	95:28	167	0:48	25:07

Fig. 1. Shadow-flicker listing, 25 hours and above.

The overall statistics are outlined below:

Cumulative shadow-flicker time	Number of receptors
Total	355
>0 hours	173
>10 hours	74
>15 hours	38
>20 hours	23
>25 hours	11

Fig. 2. Overall statistics, all modeled receptors.

The number of shadow-flicker hours calculated and reported above in the tables is common and lower than at other wind power projects installed around the USA.

For clarifications and eventual detailed analyses of expected influence at selected receptors please contact:

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Marble River, NY.

Customer: Environmental Design & Research, P.C.
238 W. Division Street
Syracuse, NY 13204

Project type: Modeling

Prepared by: Arne Nielsen, WEI

Distribution: Benjamin Brazell, John Hecklau; EDRPC

Revision: 1

Date: Mar. 25, 2006

1. Introduction

This Project Briefing is revision 1 of the original briefing dated January 8, 2006. The update reflects work conducted after receiving comments on the original briefing from Conestoga-Rovers & Associates. The major updates are:

1. Clarification of rotor RPM and how the RPM relates to shadow-flicker.
2. Clarification of the worst case and near worst case scenarios.
3. Evaluation of intensity.
4. Clarification of long term data use (cloudiness and wind)

All other results and explanations remain identical to the original briefing which provides a brief explanation of the shadow-flicker phenomenon, the modeling approach employed and relevant explanations and results.

2. Shadow-Flicker Background

Shadow-flicker from wind turbines is defined as alternating changes in light intensity caused by rotating blades casting shadows on the ground and stationary objects such as a window at a dwelling. No shadow will be cast when the sun is obscured by clouds/fog or when the turbine is not operating.

Shadow-flicker can occur in project area homes when the turbine is located near a home and is in a position where the blades interfere with very low-angle sunlight. The most typical effect is the visibility of an intermittent light reduction in the rooms of the home facing the wind turbines and subject to the shadow-flicker. Such locations are here referred to as shadow-flicker receptors. Obstacles such as terrain, trees, or buildings between the wind turbine and a potential shadow-flicker receptor significantly reduce or eliminate shadow-flicker effects.

The spatial relationships between a wind turbine and receptor, as well as wind direction are key factors related to shadow-flicker time (hours per year). General industry practices place turbines at least 1000 ft from receptors. At this distance shadow flicker usually only occurs after sunrise or before sunset when the cast shadows are sufficiently long.

Shadow flicker intensity is defined as the difference in brightness at a given location in the presence and absence of a shadow. Shadow flicker intensity diminishes with greater receptor-to-turbine separation distance and low visibility weather conditions, such as haze or fog.

Part of the analysis performed for this project evaluates the shadow flicker intensity. Normally, a shadow-flicker analysis is limited to focus on the total amount of time (hours and minutes/year) that shadow flicker can potentially occur at receptors regardless of whether the shadow flicker is barely noticeable or clearly distinct. There are two input parameters in the model that can be set at various values thus making an intensity evaluation possible. One parameter is the sun's minimum angle over the horizon. This parameter is normally set to 3 degrees which means that no shadow-flicker is "counted" at lower sun angles than 3 degrees. The rationale here is that a combination of the sun's size (as seen through the atmosphere) and intensity makes the cast shadows far less distinct. At sunset and sunrise the shadows from large objects are theoretically of infinite length whereas a shadow from a thin flagpole will dissipate within a few feet. This 3 degree parameter however, is not adjusted for the purposes of evaluating the intensity. The parameter that is adjusted is the maximum distance between a turbine and a receptor for shadow-flicker to be "counted". The normal distance is 1,000 or 1,500 meters (3,300 or 4,900 feet). At distances from 1,000 to 1,500 meters between the turbine and a receptor there will be virtually no distinct "chopping" of the sun-light. Only in rare occasions like in a dark room with a single window facing the turbine will it be possible to identify faint shadow-flickering on the opposite wall. At distances from 500 to 1,000 meters the flickering will be more distinct and may be possible to identify in rooms with more windows (more light) and may also be possible to identify outside on patios etc. By comparing results from two model runs with this maximum distance set at 1,000 meters and 500 meters, the conclusion can be made as to how many hours of shadow-flicker will be noticeable – as opposed to how many hours it will be barely noticeable.

It is likely that receptors will experience less shadow-flicker impact than modeled and reported, especially those that are at greater distances from turbines. It is emphasized the marginally affected receptors may not be able to identify shadow-flicker at all.

The shadow-flicker frequency is related to the rotor speed and number of blades on the rotor. The modeling results presented are based on a wind turbine with a 3-bladed, 90 meter diameter rotor, 78 meter hub height and a rotor speed 9 to 19 RPM, depending on the wind speed. This translates into a blade pass frequency (3P) of 0.45 to 0.95 Hz (less than 1 alternation per second). Health wise, such low frequencies are harmless. Frequencies higher than 3 Hz but below 10 Hz are widely used in discotheques and the Epilepsy Foundation has made statements that frequencies below 10 Hz are not likely to trigger epileptic seizures.

It is emphasized that the model calculates if shadow at neighboring receptors is possible or not thus the blade pass frequency or RPM is a rather irrelevant input parameter to the model.

Cloudiness for this project has been derived from charts published by NOAA. The charts have been based on data collected over the last 20-30 years depending on region. The charts are available upon request. Turbine run hours and direction has been established based on conservative assumptions for the region.

3. Modeling Approach

A near worst case approach has been adopted for reporting the shadow-flicker results. A worst case scenario would be where the “sun always shine” and the “turbine always run” (always windy). From the near worst case approach, additional general site and receptor-specific assessments such as obstacles, diurnal and seasonal cloud and fog patterns may further reduce the reported shadow flicker impacts. The analysis assumes windows are situated in direct alignment with the turbine to sun line of sight. Even when windows are so aligned, the analysis does not account for the difference between windows in rooms with primary use and enjoyment (e.g. living rooms) and other less frequently occupied or un-occupied rooms or garages.

The shadow-flicker model uses the following input:

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The sun’s path with respect to each turbine location is calculated by the software to determine the cast shadow paths every 2 minutes, every day over a full year.

The turbine run-time and direction (seen from the receptor) are calculated from the site’s long-term wind speed and direction distribution.

Finally, the effects of cloud cover are calculated using long term reference data (monthly average sunshine hours) to arrive at the projected annual flicker time at each receptor.

Output from the model includes the following information:

- Calculated shadow-flicker time at selected receptors
- Tabulated and plotted time of day with shadow flicker at selected receptors
- Map showing turbine locations, selected shadow-flicker receptors and iso-line contours indicating projected shadow-flicker time (hours per year).

4. Conclusion

The shadow-flicker model assumptions applied to this project are very conservative and as such, the analysis is expected to over-predict the impacts. Additionally, many of the modeled shadow flicker hours are expected to be of very low intensity.

The results are therefore prudent projections of the anticipated shadow flicker levels that would be experienced at the nearby residences. The modeled results have been summarized below in fig. 1.

Receptor name	Shadow hours per year (worst case) [hh:mm / year]	Shadow days per year [days / year]	Max shadow hours per day [hh:mm / day]	Shadow hours per year (real) [hh:mm / year]
266	119:42	218	0:50	33:12
136	119:38	189	1:28	32:45
235	113:50	199	0:52	30:34
146	126:02	256	0:52	30:23
359	111:22	212	0:48	29:15
035	110:30	149	1:00	28:08
358	90:26	167	0:42	26:09
356	98:36	176	0:50	26:01
137	89:32	119	1:30	25:59
171	108:44	146	1:00	25:41
357	95:28	167	0:48	25:07

Fig. 1. Shadow-flicker listing, 25 hours and above.

The overall statistics are outlined below:

Cumulative shadow-flicker time	Number of receptors	--of which receive relatively low intensity
Total	358	
>0 hours	175	126
>10 hours	75	44
>15 hours	38	
>20 hours	23	
>25 hours	11	

Fig. 2. Overall statistics, all modeled receptors.

Generally, receptors that receive relatively many hours of shadow-flicker receive it at relatively high intensity. This is quite logical in that turbines close to a receptor cast shadows for relatively longer time. Most of the receptors in fig. 1 therefore receive relatively high intensity shadow-flicker. The largest departures from this normal assumption are as follows:

10 of the 33 hours (approximately) received by receptor 266 are low intensity
 14 of the 33 hours (approximately) received by receptor 136 are low intensity
 10 of the 30 hours (approximately) received by receptor 235 are low intensity
 13 of the 30 hours (approximately) received by receptor 146 are low intensity
 16 of the 29 hours (approximately) received by receptor 359 are low intensity
 8 of the 26 hours (approximately) received by receptor 358 are low intensity

The number of shadow-flicker hours calculated and reported above in the tables is common and lower than at other wind power projects installed around the USA.

For clarifications and eventual detailed analyses of expected influence at selected receptors please contact:

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Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Main Result

Calculation: 060121 MidWest area2

Assumptions for shadow calculations

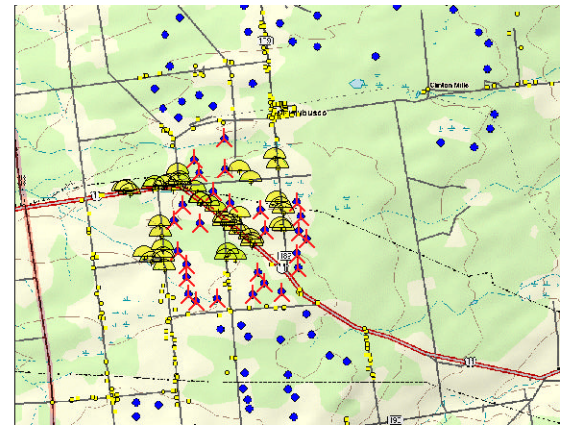
Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35

Operational time

N	NE	E	SE	S	SW	W	NW	Sum
1,850	1,325	800	713	625	663	700	1,275	7,950



Scale 1:200,000

▲ New WTG

▲ Shadow receptor

WTGs

UTM NAD27 Zone: 18			Row data/Description	WTG type		Power [kW]	Diam. [m]	Height [m]	RPM [RPM]
East	North	Z		Valid	Manufact. Type				
1	582,640	4,976,154	373 042	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
2	584,864	4,975,905	376 043	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
3	583,100	4,975,851	381 044	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
4	581,837	4,975,789	368 045	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
5	583,905	4,975,680	391 046	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
6	584,980	4,975,519	384 047	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
7	584,037	4,975,145	396 048-W	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
8	585,126	4,974,929	389 050	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
9	584,883	4,974,543	394 051	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
10	581,967	4,974,207	379 052	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
11	581,965	4,973,881	382 053	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
12	584,027	4,973,748	404 055	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
13	584,494	4,973,518	408 056	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
14	582,025	4,973,435	385 057	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
15	582,792	4,973,326	396 058	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
16	582,225	4,973,245	389 059	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
17	583,858	4,974,035	399 074	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
18	584,928	4,974,166	400 075A-W	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
19	581,734	4,974,567	373 077	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
20	582,305	4,975,307	375 078	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
21	584,931	4,975,128	390 081	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
22	582,264	4,976,648	359 083	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
23	582,131	4,977,001	352 084	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
24	582,952	4,976,751	363 085	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
25	582,926	4,977,575	357 087	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
26	581,613	4,975,371	364 150-W	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
27	583,734	4,973,440	404 206	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7

Shadow receptor-Input

UTM NAD27 Zone: 18			Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]		
No.	Name	Z							
116	116	581,715	4,976,612	358	1.0	1.0	1.0	0.0	0.0
117	117	581,750	4,976,409	364	1.0	1.0	1.0	0.0	0.0
118	118	581,747	4,976,327	365	1.0	1.0	1.0	0.0	0.0

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Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Main Result

Calculation: 060121 MidWest area2

...continued from previous page

UTM NAD27 Zone: 18

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window
		[m]	[m]	[m]	[m]	[m]	[m]	[°]	[°]
119	119	581,584	4,976,197	363	1.0	1.0	1.0	0.0	0.0
120	120	581,404	4,976,299	358	1.0	1.0	1.0	0.0	0.0
121	121	581,346	4,976,295	358	1.0	1.0	1.0	0.0	0.0
123	123	581,092	4,976,274	358	1.0	1.0	1.0	0.0	0.0
125	125	584,344	4,975,919	381	1.0	1.0	1.0	0.0	0.0
126	126	583,333	4,976,714	366	1.0	1.0	1.0	0.0	0.0
127	127	584,509	4,975,611	395	1.0	1.0	1.0	0.0	0.0
128	128	582,931	4,975,367	387	1.0	1.0	1.0	0.0	0.0
129	129	580,425	4,976,068	351	1.0	1.0	1.0	0.0	0.0
130	130	580,264	4,976,141	351	1.0	1.0	1.0	0.0	0.0
131	131	580,322	4,976,170	351	1.0	1.0	1.0	0.0	0.0
134	134	582,333	4,975,858	373	1.0	1.0	1.0	0.0	0.0
135	135	583,155	4,975,302	390	1.0	1.0	1.0	0.0	0.0
136	136	584,455	4,975,246	396	1.0	1.0	1.0	0.0	0.0
137	137	584,517	4,975,169	396	1.0	1.0	1.0	0.0	0.0
139	139	582,949	4,975,264	387	1.0	1.0	1.0	0.0	0.0
140	140	583,049	4,974,518	388	1.0	1.0	1.0	0.0	0.0
141	141	583,013	4,974,381	389	1.0	1.0	1.0	0.0	0.0
154	154	583,717	4,974,827	389	1.0	1.0	1.0	0.0	0.0
189	189	581,018	4,974,268	366	1.0	1.0	1.0	0.0	0.0
231	231	581,051	4,976,195	358	1.0	1.0	1.0	0.0	0.0
232	232	581,234	4,975,237	362	1.0	1.0	1.0	0.0	0.0
233	233	581,264	4,974,953	365	1.0	1.0	1.0	0.0	0.0
234	234	581,345	4,974,298	372	1.0	1.0	1.0	0.0	0.0
235	235	581,337	4,974,407	369	1.0	1.0	1.0	0.0	0.0
236	236	581,307	4,974,606	367	1.0	1.0	1.0	0.0	0.0
237	237	580,828	4,974,409	361	1.0	1.0	1.0	0.0	0.0
238	238	581,376	4,974,078	373	1.0	1.0	1.0	0.0	0.0
252	252	583,629	4,974,916	390	1.0	1.0	1.0	0.0	0.0
253	253	583,384	4,975,031	392	1.0	1.0	1.0	0.0	0.0
254	254	583,359	4,975,502	391	1.0	1.0	1.0	0.0	0.0
255	255	582,726	4,975,654	381	1.0	1.0	1.0	0.0	0.0
256	256	582,296	4,975,869	373	1.0	1.0	1.0	0.0	0.0
257	257	582,519	4,975,794	375	1.0	1.0	1.0	0.0	0.0
258	258	582,161	4,976,168	366	1.0	1.0	1.0	0.0	0.0
265	265	584,268	4,977,066	366	1.0	1.0	1.0	0.0	0.0
266	266	584,442	4,975,762	389	1.0	1.0	1.0	0.0	0.0
267	267	583,633	4,976,431	368	1.0	1.0	1.0	0.0	0.0
328	328	583,687	4,974,745	390	1.0	1.0	1.0	0.0	0.0
329	329	583,222	4,975,133	390	1.0	1.0	1.0	0.0	0.0
330	330	582,998	4,975,348	388	1.0	1.0	1.0	0.0	0.0
335	335	583,250	4,974,368	392	1.0	1.0	1.0	0.0	0.0
345	345	584,351	4,976,811	369	1.0	1.0	1.0	0.0	0.0

Calculation Results

No.	Name	Shadow, worst case			Shadow, expected values
		Shadow hours per year	Shadow days per year	Max shadow hours per day	Shadow hours per year
		[h/year]	[days/year]	[h/day]	[h/year]
116	116	25:08	51	0:38	7:40
117	117	57:36	115	0:40	16:07
118	118	20:04	69	0:24	5:45
119	119	1:18	18	0:06	0:21
120	120	17:34	68	0:24	4:41
121	121	27:52	85	0:30	7:06
123	123	15:18	49	0:26	3:38
125	125	78:44	150	0:50	20:06
126	126	81:18	152	0:54	23:00

Continued on next page...

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Main Result

Calculation: 060121 MidWest area2

...continued from previous page

No.	Name	Shadow, worst case		Shadow, expected values	
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
127	127	82:00	163	0:46	21:43
128	128	16:22	43	0:34	4:45
129	129	0:00	0	0:00	0:00
130	130	0:00	0	0:00	0:00
131	131	0:00	0	0:00	0:00
134	134	53:32	110	1:04	14:33
135	135	43:18	133	0:28	12:29
136	136	119:38	189	1:28	32:45
137	137	89:32	119	1:30	25:59
139	139	16:26	44	0:32	5:06
140	140	12:00	42	0:24	2:48
141	141	9:38	33	0:24	2:21
154	154	0:00	0	0:00	0:00
189	189	33:40	102	0:30	9:30
231	231	11:46	38	0:26	2:47
232	232	83:18	104	0:54	23:36
233	233	44:54	88	0:38	10:42
234	234	39:28	100	0:34	10:24
235	235	113:50	199	0:52	30:34
236	236	55:42	110	0:48	15:45
237	237	9:26	32	0:24	2:48
238	238	48:18	121	0:36	13:14
252	252	20:30	45	0:34	5:57
253	253	19:04	47	0:32	5:40
254	254	51:20	120	0:38	14:01
255	255	98:30	184	0:48	24:56
256	256	60:54	130	1:06	16:08
257	257	43:00	100	0:54	12:32
258	258	78:52	148	0:44	20:07
265	265	0:00	0	0:00	0:00
266	266	119:42	218	0:50	33:12
267	267	40:36	110	0:30	11:44
328	328	0:00	0	0:00	0:00
329	329	17:14	64	0:26	5:15
330	330	23:22	79	0:30	6:43
335	335	39:36	108	0:32	9:22
345	345	0:00	0	0:00	0:00

Project:

060119 Marble River

Description:

Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 116 - 116

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Table with 12 columns for months (January to December) and multiple rows for daily sun rise and set times, potential sun hours, and reduction factors. Includes summary rows for total sun hours and real sun hours.

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

Matrix with 5 columns: 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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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US-RIVERSIDE, CA 92506

Calculated:
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SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 117 - 117

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	
1	07:35 16:25	07:17 17:04	06:36 17:43	22 07:00 (1) 18:23	05:39 20:00	05:47 20:34	05:43 (22) 40 06:23 (22)
2	07:35 16:26	07:16 17:05	06:34 17:44	22 07:00 (1) 18:24	05:37 20:01	05:46 20:35	05:45 (22) 38 06:23 (22)
3	07:35 16:27	07:15 17:06	06:32 17:46	20 07:01 (1) 18:26	05:35 20:02	05:44 20:36	05:44 (22) 40 06:24 (22)
4	07:35 16:28	07:13 17:08	06:30 17:47	20 07:01 (1) 18:27	05:33 20:03	05:43 20:37	05:44 (22) 40 06:24 (22)
5	07:34 16:29	07:12 17:09	06:29 17:48	18 07:01 (1) 19:28	06:31 20:05	05:41 20:38	05:45 (22) 38 06:23 (22)
6	07:34 16:30	07:11 17:10	06:27 17:50	18 07:03 (1) 19:30	06:29 20:06	05:40 20:38	05:45 (22) 38 06:23 (22)
7	07:34 16:31	07:10 17:12	06:25 17:51	14 07:17 (1) 19:30	06:27 20:06	05:38 20:38	05:45 (22) 38 06:23 (22)
8	07:34 16:32	07:08 17:14	06:23 17:52	8 07:13 (1) 19:31	06:26 20:07	05:37 20:39	05:44 (22) 40 06:25 (22)
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:10	05:10 20:40	05:46 (22) 38 06:24 (22)
10	07:33 16:34	07:06 17:16	06:20 17:55	06:22 19:35	05:34 20:11	06:00 (22) 20:41	05:10 38 06:24 (22)
11	07:33 16:36	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:55 (22) 20:42	05:10 38 06:24 (22)
12	07:33 16:37	07:03 17:19	06:16 17:58	06:18 19:37	05:32 20:13	05:54 (22) 20:42	05:10 38 06:24 (22)
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	05:53 (22) 20:43	05:09 38 06:24 (22)
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	05:30 20:15	05:52 (22) 20:43	05:09 40 06:26 (22)
15	07:31 16:40	06:58 17:24	06:10 18:02	06:13 19:41	05:28 20:17	05:50 (22) 20:44	05:09 38 06:26 (22)
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	05:49 (22) 20:44	05:09 38 06:26 (22)
17	07:30 16:43	06:55 17:26	06:07 18:04	06:10 19:43	05:26 20:19	05:48 (22) 20:45	05:09 38 06:26 (22)
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	05:47 (22) 20:45	05:09 38 06:26 (22)
19	07:29 16:46	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:46 (22) 20:46	05:09 38 06:26 (22)
20	07:28 16:47	06:51 17:31	06:01 18:08	06:05 19:47	05:23 20:22	05:46 (22) 20:46	05:09 38 06:26 (22)
21	07:27 16:48	06:49 17:32	06:00 18:09	06:03 19:48	05:22 20:23	05:45 (22) 20:46	05:10 38 06:26 (22)
22	07:27 16:50	06:47 17:33	6 07:16 (1) 18:09	06:01 19:50	05:21 20:24	05:44 (22) 20:46	05:10 38 06:26 (22)
23	07:26 16:51	06:46 17:35	10 07:18 (1) 18:11	06:00 19:51	05:20 20:25	05:45 (22) 20:47	05:10 38 06:27 (22)
24	07:25 16:52	06:44 17:36	14 07:21 (1) 18:12	05:58 19:52	05:19 20:27	05:44 (22) 20:47	05:10 38 06:27 (22)
25	07:24 16:54	06:42 17:37	16 07:21 (1) 18:13	05:56 19:52	05:18 20:28	05:43 (22) 20:47	05:11 38 06:27 (22)
26	07:23 16:55	06:41 17:39	18 07:21 (1) 18:14	05:55 19:55	05:18 20:29	05:43 (22) 20:47	05:11 38 06:28 (22)
27	07:22 16:56	06:39 17:40	20 07:21 (1) 18:16	05:53 19:56	05:17 20:30	05:44 (22) 20:47	05:11 38 06:28 (22)
28	07:21 16:58	06:37 17:42	22 07:22 (1) 18:18	05:52 19:57	05:16 20:31	05:43 (22) 20:47	05:12 38 06:29 (22)
29	07:20 16:59		05:44 18:19	05:50 19:58	05:15 20:31	05:43 (22) 20:47	05:12 38 06:27 (22)
30	07:19 17:01		05:42 18:21	05:48 20:00	05:15 20:32	05:44 (22) 20:47	05:13 38 06:27 (22)
31	07:18 17:02		05:40 18:22	05:14 20:33	05:14 20:33	05:44 (22) 06:24 (22)	
Potential sun hours	286	291	369	380	-285		-254
Total, worst case		128	124		674		1152
Sun reduction		0.45	0.50		0.55		0.55
Oper. time red.		0.91	0.91		0.91		0.91
Wind dir. red.		0.62	0.62		0.55		0.55
Total reduction		0.25	0.28		0.28		0.28
Total, real		32	35		187		320

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 117 - 117

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes
Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:50 (22) 06:28 (22)	05:41 20:25	06:05 (22) 19:35	06:17 18:38	06:34 16:46
2	05:14 20:47	05:51 (22) 06:29 (22)	05:42 20:24	06:08 (22) 19:33	06:19 18:36	06:35 16:44
3	05:14 20:46	05:51 (22) 06:29 (22)	05:43 20:22	06:20 19:31	06:56 18:35	06:36 16:43
4	05:15 20:46	05:50 (22) 06:30 (22)	05:46 20:21	06:21 19:29	06:57 18:33	06:38 16:42
5	05:16 20:46	05:50 (22) 06:30 (22)	05:46 20:20	06:22 19:27	06:58 18:31	06:39 16:40
6	05:16 20:46	05:51 (22) 06:29 (22)	05:47 20:19	06:23 19:26	07:00 18:29	06:41 16:39
7	05:17 20:45	05:52 (22) 06:30 (22)	05:48 20:17	06:25 19:24	07:01 18:27	06:42 16:38
8	05:18 20:45	05:50 (22) 06:30 (22)	05:49 20:16	06:26 19:22	07:02 18:25	06:43 16:36
9	05:18 20:45	05:51 (22) 06:31 (22)	05:50 20:14	06:27 19:20	07:03 18:24	06:45 16:35
10	05:19 20:44	05:52 (22) 06:30 (22)	05:51 20:13	06:28 19:18	07:05 18:22	06:46 16:34
11	05:20 20:44	05:51 (22) 06:31 (22)	05:53 20:11	06:29 19:16	07:06 18:20	06:47 16:33
12	05:21 20:43	05:51 (22) 06:31 (22)	05:54 20:10	06:31 19:14	07:07 18:18	06:49 16:32
13	05:22 20:43	05:52 (22) 06:30 (22)	05:55 20:08	06:32 19:12	07:08 18:16	06:50 16:31
14	05:23 20:42	05:53 (22) 06:31 (22)	05:56 20:07	06:33 19:11	07:10 18:15	06:52 16:29
15	05:23 20:41	05:52 (22) 06:32 (22)	05:57 20:05	06:34 19:09	07:11 18:13	06:53 16:28
16	05:24 20:41	05:53 (22) 06:31 (22)	05:58 20:04	06:35 19:07	07:12 18:11	06:54 16:27
17	05:25 20:40	05:54 (22) 06:32 (22)	06:00 20:02	06:37 19:05	07:14 18:09	06:56 16:26
18	05:26 20:39	05:53 (22) 06:31 (22)	06:01 20:01	06:38 19:03	07:15 18:08	06:57 16:26
19	05:27 20:38	05:53 (22) 06:31 (22)	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:25
20	05:28 20:37	05:54 (22) 06:30 (22)	06:03 19:56	06:40 18:59	07:18 18:04	07:00 16:24
21	05:29 20:37	05:53 (22) 06:31 (22)	06:04 19:54	06:41 18:57	07:19 18:03	07:01 16:23
22	05:30 20:36	05:54 (22) 06:30 (22)	06:06 19:52	06:42 18:55	07:20 18:01	07:02 16:22
23	05:31 20:35	05:55 (22) 06:29 (22)	06:07 19:51	06:44 18:53	07:22 17:59	07:04 16:21
24	05:32 20:34	05:56 (22) 06:30 (22)	06:08 19:49	06:45 18:52	07:23 17:58	07:05 16:21
25	05:33 20:33	05:57 (22) 06:29 (22)	06:09 19:47	06:46 18:50	06:24 16:56	07:06 16:20
26	05:34 20:32	05:58 (22) 06:28 (22)	06:10 19:45	06:47 18:48	06:26 16:55	07:07 16:19
27	05:35 20:31	05:59 (22) 06:27 (22)	06:12 19:44	06:49 18:46	06:27 16:53	07:09 16:19
28	05:37 20:30	06:00 (22) 06:26 (22)	06:13 19:42	06:50 18:44	06:28 16:52	07:10 16:18
29	05:38 20:29	06:01 (22) 06:25 (22)	06:14 19:40	06:51 18:42	06:30 16:50	07:11 16:18
30	05:39 20:27	06:03 (22) 06:25 (22)	06:15 19:38	06:52 18:40	06:31 16:49	07:12 16:17
31	05:40 20:26	06:04 (22) 06:24 (22)	06:16 19:37	06:53 18:40	06:32 16:47	07:13 16:24
Potential sun hours	-272	4	376	341	288	274
Total, worst case	1096	26	256	256		
Sun reduction	0.58	0.55	0.45	0.45		
Oper. time red.	0.91	0.91	0.91	0.91		
Wind dir. red.	0.55	0.55	0.62	0.62		
Total reduction	0.29	0.28	0.25	0.25		
Total, real	321	7	65	65		

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, MidW part 2
 27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 120 - 120

Assumptions for shadow calculations

Maximum distance for influence

1,000 m

Minimum sun height over horizon for influence

3 °

Day step for calculation

1 days

Time step for calculation

2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December		
1	07:35	08:55 (4)	07:17	08:36	05:39	05:47	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13
2	07:35	08:59 (4)	07:16	08:34	05:37	05:46	05:13	05:14	05:42	06:06 (22)	06:19	06:55	06:35	07:15
3	07:35		07:15	08:32	05:35	05:44	05:12	05:14	05:43	06:07 (22)	06:20	06:56	06:36	07:16
4	07:35		07:14	08:30	05:33	05:43	06:04 (22)	05:12	05:44	06:08 (22)	06:21	06:57	06:38	07:17
5	07:35		07:13	08:29	05:31	05:41	06:10 (22)	05:12	05:45	06:09 (22)	06:22	06:58	06:39	07:18
6	07:34		07:12	08:27	05:29	05:39	06:11 (22)	05:12	05:46	06:10 (22)	06:23	06:59	06:40	07:19
7	07:34		07:11	08:26	05:27	05:38	06:12 (22)	05:13	05:47	06:11 (22)	06:24	07:00	06:41	07:20
8	07:34		07:10	08:25	05:25	05:37	06:13 (22)	05:14	05:48	06:12 (22)	06:25	07:01	06:42	07:21
9	07:34		07:09	08:24	05:23	05:36	06:14 (22)	05:15	05:49	06:13 (22)	06:26	07:02	06:43	07:22
10	07:33		07:08	08:23	05:21	05:35	06:15 (22)	05:16	05:50	06:14 (22)	06:27	07:03	06:44	07:23
11	07:33		07:07	08:22	05:19	05:34	06:16 (22)	05:17	05:51	06:15 (22)	06:28	07:04	06:45	07:24
12	07:33		07:06	08:21	05:17	05:33	06:17 (22)	05:18	05:52	06:16 (22)	06:29	07:05	06:46	07:25
13	07:33		07:05	08:20	05:15	05:32	06:18 (22)	05:19	05:53	06:17 (22)	06:30	07:06	06:47	07:26
14	07:32		07:04	08:19	05:13	05:31	06:19 (22)	05:20	05:54	06:18 (22)	06:31	07:07	06:48	07:27
15	07:31		07:03	08:18	05:11	05:30	06:20 (22)	05:21	05:55	06:19 (22)	06:32	07:08	06:49	07:28
16	07:31		07:02	08:17	05:09	05:29	06:21 (22)	05:22	05:56	06:20 (22)	06:33	07:09	06:50	07:29
17	07:30		07:01	08:16	05:07	05:28	06:22 (22)	05:23	05:57	06:21 (22)	06:34	07:10	06:51	07:30
18	07:30		07:00	08:15	05:05	05:27	06:23 (22)	05:24	05:58	06:22 (22)	06:35	07:11	06:52	07:31
19	07:29		06:59	08:14	05:03	05:26	06:24 (22)	05:25	05:59	06:23 (22)	06:36	07:12	06:53	07:32
20	07:28		06:58	08:13	05:01	05:25	06:25 (22)	05:26	06:00	06:24 (22)	06:37	07:13	06:54	07:33
21	07:27		06:57	08:12	04:59	05:24	06:26 (22)	05:27	06:01	06:25 (22)	06:38	07:14	06:55	07:34
22	07:27		06:56	08:11	04:57	05:23	06:27 (22)	05:28	06:02	06:26 (22)	06:39	07:15	06:56	07:35
23	07:26		06:55	08:10	04:55	05:22	06:28 (22)	05:29	06:03	06:27 (22)	06:40	07:16	06:57	07:36
24	07:25		06:54	08:09	04:53	05:21	06:29 (22)	05:30	06:04	06:28 (22)	06:41	07:17	06:58	07:37
25	07:24		06:53	08:08	04:51	05:20	06:30 (22)	05:31	06:05	06:29 (22)	06:42	07:18	06:59	07:38
26	07:23		06:52	08:07	04:49	05:19	06:31 (22)	05:32	06:06	06:30 (22)	06:43	07:19	07:00	07:39
27	07:22		06:51	08:06	04:47	05:18	06:32 (22)	05:33	06:07	06:31 (22)	06:44	07:20	07:01	07:40
28	07:21		06:50	08:05	04:45	05:17	06:33 (22)	05:34	06:08	06:32 (22)	06:45	07:21	07:02	07:41
29	07:20		06:49	08:04	04:43	05:16	06:34 (22)	05:35	06:09	06:33 (22)	06:46	07:22	07:03	07:42
30	07:19		06:48	08:03	04:41	05:15	06:35 (22)	05:36	06:10	06:34 (22)	06:47	07:23	07:04	07:43
31	07:18		06:47	08:02	04:39	05:14	06:36 (22)	05:37	06:11	06:35 (22)	06:48	07:24	07:05	07:44
Potential sun hours	286	291	369	380	386	254	272	264	122	376	341	288	274	278
Total, worst case	4				0.55			0.58	0.55					0.35
Sun reduction	0.45				0.91			0.91	0.91					0.91
Oper. time red.	0.91				0.54			0.54	0.54					0.69
Wind dir. red.	0.69				0.28			0.29	0.28					0.22
Total reduction	0.29				107			77	34					62
Total, real	1													

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: 060119 Marble River	Description: Marble River Wind Project Shadow-Flicker, MidW part 2 27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)	Printed/Page: 01/23/06 17:18 / 10 Licensed user: Wind Engineers, Inc. 7660 Whitegate Avenue US-RIVERSIDE, CA 92506 Calculated: 01/23/06 12:24/2.4.0.67
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SHADOW - Calendar

Calculation: 060121 MidWest area2 **Shadow receptor:** 121 - 121

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35

Operational time

N	NE	E	SE	S	SW	W	NW	Sum
1,850	1,325	800	713	625	663	700	1,275	7,950

	January	February	March	April	May	June	July	August	September	October	November	December				
1	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
2	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
3	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
4	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
5	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
6	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
7	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
8	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
9	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
10	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
11	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
12	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
13	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
14	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
15	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
16	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
17	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
18	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
19	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
20	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
21	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
22	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
23	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
24	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
25	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
26	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
27	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
28	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
29	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
30	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
31	07:35	08:29 (4)	07:17	06:36	05:39	05:47	06:08 (22)	05:14	05:13	05:41	06:05 (22)	06:18	06:53	06:34	07:13	08:23 (4)
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	274	800			
Total, worst case	242				306			142			10		800			
Sun reduction	0.45				0.55			0.58			0.35		0.35			
Oper. time red.	0.91				0.91			0.91			0.91		0.91			
Wind dir. red.	0.69				0.55			0.55			0.69		0.69			
Total reduction	0.29				0.28			0.30			0.22		0.22			
Total, real	69				86			42			2		178			

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 (WTG causing flicker first time)	Last time (hh:mm) with flicker (WTG causing flicker last time)
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Project:

060119 Marble River

Description:

Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page

01/23/06 17:18 / 11

Licensed user:

Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:

01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 123 - 123

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Table with columns for months (January to December) and rows for days (1 to 31), showing sun rise and set times and shadow reduction percentages. Includes summary rows for 'Potential sun hours' and 'Total, real'.

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

Matrix with columns: 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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 17:18 / 12
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 125 - 125

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34 16:25	07:17 17:03	07:49 (6) 06:35 08:17 (6) 17:43	16:08 (5) 05:38 16:32 (5) 18:23	06:08 (2) 05:47 06:48 (2) 20:00	05:13 20:34
2	07:34 16:26	07:16 17:05	07:50 (6) 06:34 16:24 (5) 17:44	16:12 (5) 05:37 16:28 (5) 18:24	06:09 (2) 05:45 06:47 (2) 20:01	05:13 20:35
3	07:34 16:27	07:14 17:06	07:50 (6) 06:32 16:28 (5) 17:46	16:17 (5) 05:35 16:25 (5) 18:26	06:09 (2) 05:44 06:47 (2) 20:02	05:12 20:36
4	07:34 16:28	07:13 17:08	07:51 (6) 06:30 16:31 (5) 17:47	16:22 (5) 05:33 18:27	06:09 (2) 05:42 06:45 (2) 20:03	05:12 20:37
5	07:34 16:29	07:12 17:09	07:52 (6) 06:28 16:32 (5) 17:48	16:27 (5) 05:31 19:28	07:09 (2) 05:41 07:45 (2) 20:04	05:11 20:37
6	07:34 16:30	07:11 17:11	07:52 (6) 06:27 16:34 (5) 17:50	16:29 (5) 05:29 19:29	07:09 (2) 05:40 07:43 (2) 20:06	05:11 20:38
7	07:34 16:31	07:09 17:12	07:55 (6) 06:25 16:35 (5) 17:51	16:27 (5) 05:27 19:31	07:09 (2) 05:38 07:41 (2) 20:07	05:11 20:39
8	07:34 16:32	07:08 17:13	07:56 (6) 06:23 16:38 (5) 17:52	16:26 (5) 05:26 19:32	07:12 (2) 05:37 07:40 (2) 20:08	05:10 20:40
9	07:34 16:33	07:07 17:15	07:58 (6) 06:21 16:38 (5) 17:54	16:24 (5) 05:24 19:33	07:12 (2) 05:36 07:38 (2) 20:09	05:10 20:40
10	07:33 16:34	07:05 17:16	16:03 (5) 06:19 16:39 (5) 17:55	16:22 (5) 05:22 19:34	07:14 (2) 05:34 07:36 (2) 20:11	05:10 20:41
11	07:33 16:35	07:04 17:18	16:01 (5) 06:18 16:39 (5) 17:56	16:20 (5) 05:20 19:36	07:16 (2) 05:33 07:34 (2) 20:12	05:10 20:42
12	07:33 16:37	07:03 17:19	16:02 (5) 06:16 16:40 (5) 17:57	16:18 (5) 05:18 19:37	07:19 (2) 05:32 07:31 (2) 20:13	05:09 20:42
13	07:32 16:38	07:01 17:21	16:00 (5) 06:14 16:40 (5) 17:59	16:17 (5) 05:17 19:38	05:31 20:14	05:09 20:43
14	07:32 16:39	07:55 (6) 07:00 08:01 (6) 17:22	16:01 (5) 06:12 16:41 (5) 18:00	16:15 (5) 05:15 19:39	05:29 20:15	05:09 20:43
15	07:31 16:40	07:55 (6) 06:58 08:05 (6) 17:23	15:59 (5) 06:10 16:41 (5) 18:01	16:13 (5) 05:13 19:41	05:28 20:16	05:09 20:44
16	07:31 16:42	07:54 (6) 06:57 08:06 (6) 17:25	16:00 (5) 06:08 16:42 (5) 18:03	16:11 (5) 05:11 19:42	05:27 20:18	05:09 20:44
17	07:30 16:43	07:53 (6) 06:55 08:07 (6) 17:26	16:00 (5) 06:06 16:42 (5) 18:04	16:10 (5) 05:10 19:43	05:26 20:19	05:09 20:45
18	07:29 16:44	07:53 (6) 06:54 08:09 (6) 17:28	16:01 (5) 06:05 16:43 (5) 18:05	06:31 (2) 06:08 06:35 (2) 19:45	05:25 20:20	05:09 20:45
19	07:29 16:45	07:52 (6) 06:52 08:10 (6) 17:29	16:01 (5) 06:03 16:41 (5) 18:07	06:25 (2) 06:06 06:41 (2) 19:46	05:24 20:21	05:09 20:45
20	07:28 16:47	07:51 (6) 06:50 08:11 (6) 17:30	16:01 (5) 06:01 16:41 (5) 18:08	06:21 (2) 06:04 06:43 (2) 19:47	05:23 20:22	05:09 20:46
21	07:27 16:48	07:50 (6) 06:49 08:12 (6) 17:32	16:00 (5) 05:59 16:42 (5) 18:09	06:19 (2) 06:03 06:45 (2) 19:48	05:22 20:23	05:10 20:46
22	07:27 16:49	07:49 (6) 06:47 08:13 (6) 17:33	16:02 (5) 05:57 16:40 (5) 18:10	06:17 (2) 06:01 06:47 (2) 19:50	05:21 20:24	05:10 20:46
23	07:26 16:51	07:48 (6) 06:46 08:14 (6) 17:35	16:02 (5) 05:55 16:40 (5) 18:12	06:15 (2) 05:59 06:47 (2) 19:51	05:20 20:25	05:10 20:46
24	07:25 16:52	07:48 (6) 06:44 08:16 (6) 17:36	16:03 (5) 05:53 16:39 (5) 18:13	06:13 (2) 05:58 06:47 (2) 19:52	05:19 20:26	05:10 20:47
25	07:24 16:54	07:49 (6) 06:42 08:17 (6) 17:37	16:03 (5) 05:51 16:39 (5) 18:14	06:14 (2) 05:56 06:48 (2) 19:53	05:18 20:27	05:11 20:47
26	07:23 16:55	07:48 (6) 06:41 08:18 (6) 17:39	16:03 (5) 05:50 16:37 (5) 18:15	06:12 (2) 05:55 06:50 (2) 19:55	05:18 20:28	05:11 20:47
27	07:22 16:56	07:48 (6) 06:39 08:19 (6) 17:40	16:06 (5) 05:48 16:36 (5) 18:17	06:12 (2) 05:53 06:50 (2) 19:56	05:17 20:29	05:11 20:47
28	07:21 16:58	07:47 (6) 06:37 08:17 (6) 17:41	16:08 (5) 05:46 16:34 (5) 18:18	06:10 (2) 05:51 06:50 (2) 19:57	05:16 20:30	05:12 20:47
29	07:20 16:59	07:48 (6) 06:36 08:18 (6) 17:42	05:44 18:19	06:10 (2) 05:50 06:48 (2) 19:58	05:15 20:31	05:12 20:47
30	07:19 17:01	07:49 (6) 06:35 08:17 (6) 17:43	05:42 18:21	06:10 (2) 05:48 06:48 (2) 20:00	05:15 20:32	05:13 20:47
31	07:18 17:02	07:48 (6) 06:34 08:18 (6) 17:44	05:40 18:22	06:08 (2) 05:46 06:48 (2) 20:01	05:14 20:33	05:13 20:47
Potential sun hours	286	291	369	380	-285	-254
Total, worst case	396	1112	478	360		
Sun reduction	0.45	0.45	0.50	0.55		
Oper. time red.	0.91	0.91	0.91	0.91		
Wind dir. red.	0.65	0.59	0.62	0.62		
Total reduction	0.27	0.24	0.28	0.31		
Total, real	105	266	134	112		

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/23/06 17:18 / 13
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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 125 - 125

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	06:17 19:35	07:15 (2) 07:33 (2)	06:53 18:38	06:34 15:33 (5)
2	05:14 20:47	05:42 20:24	06:19 19:33	07:13 (2) 07:35 (2)	06:55 18:36	06:35 16:44
3	05:14 20:46	05:43 20:22	06:20 19:31	07:10 (2) 07:36 (2)	06:56 18:34	06:36 16:43
4	05:15 20:46	05:44 20:21	06:21 19:29	07:09 (2) 07:37 (2)	06:57 18:33	06:38 16:41
5	05:16 20:46	05:45 20:20	06:22 19:27	07:06 (2) 07:38 (2)	06:58 18:31	06:39 16:40
6	05:16 20:46	05:47 20:18	06:23 19:25	07:05 (2) 07:39 (2)	06:59 18:29	06:40 16:39
7	05:17 20:45	05:48 20:17	06:25 19:24	07:04 (2) 07:40 (2)	07:01 18:27	06:42 16:37
8	05:18 20:45	05:49 20:16	06:26 19:22	07:03 (2) 07:39 (2)	07:02 18:25	06:43 16:36
9	05:18 20:44	05:50 20:14	06:27 19:20	07:02 (2) 07:40 (2)	07:03 18:23	06:45 16:35
10	05:19 20:44	05:51 20:13	06:28 19:18	07:02 (2) 07:40 (2)	07:05 18:22	06:46 16:34
11	05:20 20:43	05:52 20:11	06:29 19:16	07:01 (2) 07:41 (2)	07:06 18:20	16:47 (5) 17:01 (5)
12	05:21 20:43	05:54 20:10	06:30 19:14	07:00 (2) 07:40 (2)	07:07 18:18	16:45 (5) 17:05 (5)
13	05:22 20:42	05:55 20:08	06:32 19:12	07:01 (2) 07:39 (2)	07:08 18:16	16:42 (5) 17:06 (5)
14	05:22 20:42	05:56 20:07	06:33 19:10	07:00 (2) 07:40 (2)	07:10 18:14	16:39 (5) 17:07 (5)
15	05:23 20:41	05:57 20:05	06:34 19:09	06:59 (2) 07:39 (2)	07:11 18:13	16:37 (5) 17:09 (5)
16	05:24 20:40	05:58 20:04	06:35 19:07	07:01 (2) 07:39 (2)	07:12 18:11	16:36 (5) 17:10 (5)
17	05:25 20:40	06:00 20:02	06:36 19:05	07:00 (2) 07:38 (2)	07:13 18:09	16:35 (5) 17:09 (5)
18	05:26 20:39	06:01 20:00	06:38 19:03	07:01 (2) 07:37 (2)	07:15 18:08	16:33 (5) 17:11 (5)
19	05:27 20:38	06:02 19:57	06:39 19:01	07:00 (2) 07:36 (2)	07:16 18:06	16:32 (5) 17:12 (5)
20	05:28 20:37	06:03 19:56	06:40 18:59	07:01 (2) 07:33 (2)	07:17 18:04	16:31 (5) 17:11 (5)
21	05:29 20:36	06:04 19:54	06:41 18:57	07:02 (2) 07:32 (2)	07:19 18:03	16:31 (5) 17:11 (5)
22	05:30 20:36	06:05 19:52	06:42 18:55	07:04 (2) 07:30 (2)	07:20 18:01	16:30 (5) 17:12 (5)
23	05:31 20:35	06:07 19:51	06:44 18:53	07:05 (2) 07:29 (2)	07:21 17:59	16:30 (5) 17:12 (5)
24	05:32 20:34	06:08 19:49	06:45 18:51	07:08 (2) 07:26 (2)	07:23 17:58	16:31 (5) 17:11 (5)
25	05:33 20:33	06:09 19:47	06:46 18:49	07:11 (2) 07:21 (2)	06:24 16:56	15:30 (5) 16:12 (5)
26	05:34 20:32	06:10 19:45	06:47 18:48	06:25 16:55	06:25 16:55	15:30 (5) 16:12 (5)
27	05:35 20:31	06:11 19:44	06:48 18:46	06:27 16:53	15:29 (5) 16:11 (5)	07:08 16:19
28	05:36 20:29	06:13 19:42	06:50 18:44	06:28 16:51	15:31 (5) 16:11 (5)	07:10 16:18
29	05:37 20:28	06:14 19:40	06:51 18:42	06:29 16:50	15:30 (5) 16:10 (5)	07:11 16:18
30	05:39 20:27	06:15 19:38	06:52 18:40	06:31 16:48	15:32 (5) 16:10 (5)	07:12 16:17
31	05:40 20:26	06:16 19:36	07:18 (2) 07:30 (2)	06:32 16:47	15:31 (5) 16:09 (5)	07:34 16:24
Potential sun hours	-272	4	376	341	288	274
Total, worst case		12	794	750	822	
Sun reduction		0.55	0.55	0.45	0.35	
Oper. time red.		0.91	0.91	0.91	0.91	
Wind dir. red.		0.62	0.62	0.57	0.63	
Total reduction		0.31	0.31	0.23	0.20	
Total, real		4	247	175	164	

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 17:18 / 14
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 126 - 126

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34 16:25	15:37 (1) 15:55 (1)	07:17 17:03	06:35 17:43	05:38 18:23	05:47 20:00
2	07:35 16:26	15:37 (1) 15:57 (1)	07:16 17:05	06:34 17:44	05:37 18:24	05:45 20:01
3	07:35 16:27	15:37 (1) 15:57 (1)	07:15 17:06	06:32 17:46	05:35 18:26	05:44 20:02
4	07:35 16:28	15:37 (1) 15:59 (1)	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03
5	07:34 16:29	15:37 (1) 16:01 (1)	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:05
6	07:34 16:30	15:37 (1) 16:01 (1)	07:11 17:11	06:27 17:50	06:29 19:29	05:40 20:06
7	07:34 16:31	15:38 (1) 16:02 (1)	07:10 17:12	06:25 17:51	06:27 19:31	05:38 20:07
8	07:34 16:32	15:38 (1) 16:02 (1)	07:08 17:13	06:23 17:52	06:26 19:32	05:37 20:08
9	07:34 16:33	15:38 (1) 16:04 (1)	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09
10	07:33 16:34	15:39 (1) 16:03 (1)	07:05 17:16	06:19 17:55	06:22 19:35	05:34 20:11
11	07:33 16:35	15:39 (1) 16:05 (1)	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12
12	07:33 16:37	15:40 (1) 16:04 (1)	07:03 17:19	06:16 17:58	06:18 19:37	05:32 20:13
13	07:32 16:38	15:40 (1) 16:06 (1)	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14
14	07:32 16:39	15:41 (1) 16:05 (1)	07:00 17:22	06:12 18:00	06:15 19:40	05:29 20:15
15	07:31 16:40	15:41 (1) 16:05 (1)	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:17
16	07:31 16:42	15:42 (1) 16:06 (1)	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18
17	07:30 16:43	15:41 (1) 16:05 (1)	06:55 17:26	06:07 18:04	06:10 19:43	05:26 20:19
18	07:30 16:44	15:43 (1) 16:07 (1)	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20
19	07:29 16:45	15:44 (1) 16:06 (1)	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21
20	07:28 16:47	15:45 (1) 16:05 (1)	06:51 17:30	06:01 18:08	06:04 19:47	05:23 20:22
21	07:27 16:48	15:46 (1) 16:04 (1)	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23
22	07:27 16:49	15:47 (1) 16:05 (1)	06:47 17:33	05:57 18:10	06:01 19:50	05:21 20:24
23	07:26 16:51	15:49 (1) 16:05 (1)	06:46 17:35	05:55 18:12	05:59 19:51	05:20 20:25
24	07:25 16:52	15:50 (1) 16:04 (1)	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:26
25	07:24 16:54	15:53 (1) 16:01 (1)	06:42 17:37	05:52 18:14	05:56 19:53	05:18 20:27
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	05:55 19:55	05:18 20:28
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:53 19:56	05:17 20:29
28	07:21 16:58	06:37 17:42	05:46 18:18	05:51 19:57	05:51 19:57	05:16 20:30
29	07:20 16:59	05:44 18:19	05:50 19:58	05:50 19:58	05:50 19:58	05:15 20:31
30	07:19 17:01	05:42 18:21	05:48 20:00	05:48 20:00	05:48 20:00	05:15 20:32
31	07:18 17:02	05:40 18:22	05:40 20:00	05:40 20:00	05:40 20:00	05:14 20:33
Potential sun hours	286	291	369	380	285	254
Total, worst case	538			1236		478
Sun reduction	0.45			0.55		0.55
Oper. time red.	0.91			0.91		0.91
Wind dir. red.	0.61			0.62		0.62
Total reduction	0.25			0.31		0.31
Total, real	133			385		149

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 17:18 / 15
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 126 - 126

Assumptions for shadow calculations

Maximum distance for influence
Minimum sun height over horizon for influence
Day step for calculation
Time step for calculation

1,000 m
3 °
1 days
2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	18:37 (24) 19:01 (24)	06:17 19:35	18:19 (24) 18:38	06:53 16:46
2	05:14 20:47	05:42 20:24	18:36 (24) 19:04 (24)	06:19 19:33	18:21 (24) 18:36	06:35 16:44
3	05:14 20:46	05:43 20:22	18:33 (24) 19:05 (24)	06:20 19:31	18:22 (24) 18:34	06:36 16:43
4	05:15 20:46	05:44 20:21	18:32 (24) 19:06 (24)	06:21 19:29	18:23 (24) 18:33	06:38 16:41
5	05:16 20:46	05:45 20:20	18:31 (24) 19:07 (24)	06:22 19:27	18:24 (24) 18:31	06:39 16:40
6	05:16 20:46	05:47 20:18	18:30 (24) 19:08 (24)	06:23 19:26	18:25 (24) 18:29	06:41 16:39
7	05:17 20:45	05:48 20:17	18:29 (24) 19:09 (24)	06:25 19:24	18:28 (24) 18:27	06:42 16:38
8	05:18 20:45	05:49 20:16	18:26 (24) 19:10 (24)	06:26 19:22	18:31 (24) 18:45 (24)	06:43 16:36
9	05:18 20:44	05:50 20:14	18:25 (24) 19:09 (24)	06:27 19:20	07:03 18:23	06:45 16:35
10	05:19 20:44	05:51 20:13	18:24 (24) 19:10 (24)	06:28 19:18	07:05 18:22	06:46 16:34
11	05:20 20:44	05:52 20:11	18:24 (24) 19:12 (24)	06:29 19:16	07:06 18:20	06:47 16:33
12	05:21 20:43	05:54 20:10	18:23 (24) 19:13 (24)	06:30 19:14	07:07 18:18	06:49 16:32
13	05:22 20:42	05:55 20:08	18:22 (24) 19:12 (24)	06:32 19:12	07:08 18:16	06:50 16:30
14	05:22 20:42	05:56 20:07	18:21 (24) 19:13 (24)	06:33 19:10	07:10 18:15	06:51 16:29
15	05:23 20:41	05:57 20:05	18:20 (24) 19:12 (24)	06:34 19:09	07:11 18:13	06:53 16:28
16	05:24 20:40	05:58 20:04	18:21 (24) 19:13 (24)	06:35 19:07	07:12 18:11	06:54 16:27
17	05:25 20:40	06:00 20:02	18:20 (24) 19:12 (24)	06:36 19:05	07:14 18:09	06:56 16:26
18	05:26 20:39	06:01 20:01	18:20 (24) 19:14 (24)	06:38 19:03	07:15 18:08	06:57 16:25
19	05:27 20:38	06:02 19:57	18:19 (24) 19:13 (24)	06:39 19:01	07:16 18:06	06:58 16:25
20	05:28 20:37	06:03 19:56	18:18 (24) 19:12 (24)	06:40 18:59	07:17 18:04	07:00 16:24
21	05:29 20:37	06:04 19:54	18:19 (24) 19:13 (24)	06:41 18:57	07:19 18:03	07:01 16:23
22	05:30 20:36	06:05 19:52	18:18 (24) 19:12 (24)	06:42 18:55	07:20 18:01	07:02 16:22
23	05:31 20:35	06:07 19:51	18:17 (24) 19:11 (24)	06:44 18:53	07:21 17:59	07:03 16:21
24	05:32 20:34	06:08 19:49	18:18 (24) 19:10 (24)	06:45 18:51	07:23 17:58	07:05 16:21
25	05:33 20:33	06:09 19:47	18:17 (24) 19:11 (24)	06:46 18:50	06:24 16:56	07:06 16:20
26	05:34 20:32	06:10 19:45	18:17 (24) 19:11 (24)	06:47 18:48	06:25 16:55	07:07 16:19
27	05:35 20:31	06:11 19:44	18:18 (24) 19:10 (24)	06:48 18:46	06:27 16:53	07:08 16:19
28	05:36 20:30	06:13 19:42	18:17 (24) 19:09 (24)	06:50 18:44	06:28 16:51	07:10 16:18
29	05:38 20:28	06:14 19:40	18:18 (24) 19:08 (24)	06:51 18:42	06:30 16:50	07:11 16:18
30	05:39 20:27	18:42 (24) 06:15 19:38	18:19 (24) 19:07 (24)	06:52 18:40	06:31 16:49	07:12 16:17
31	05:40 20:26	18:40 (24) 06:16 19:37	18:18 (24) 19:04 (24)	06:52 18:40	06:32 16:47	07:13 16:24
Potential sun hours	-272	4	376	341	288	274
Total, worst case	34	1454	256		286	596
Sun reduction	0.58	0.55	0.55		0.35	0.35
Oper. time red.	0.91	0.91	0.91		0.91	0.91
Wind dir. red.	0.62	0.62	0.62		0.61	0.61
Total reduction	0.33	0.31	0.31		0.19	0.19
Total, real	11	453	80		55	115

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 17:18 / 16
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 127 - 127

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34 16:25	15:07 (7) 15:41 (7)	07:17 17:03	06:35 17:43	06:56 (6) 07:12 (6)	05:38 18:23
2	07:34 16:26	15:09 (7) 15:41 (7)	07:16 17:05	06:34 17:44	06:54 (6) 07:16 (6)	05:37 18:24
3	07:34 16:27	15:09 (7) 15:41 (7)	07:14 17:06	06:32 17:46	06:53 (6) 07:17 (6)	05:35 18:26
4	07:34 16:28	15:09 (7) 15:41 (7)	07:13 17:08	06:30 17:47	06:51 (6) 07:19 (6)	05:33 18:27
5	07:34 16:29	15:11 (7) 15:43 (7)	07:12 17:09	06:28 17:48	06:49 (6) 07:19 (6)	06:31 19:28
6	07:34 16:30	15:11 (7) 15:43 (7)	07:11 17:11	06:27 17:50	06:47 (6) 07:21 (6)	06:29 19:29
7	07:34 16:31	15:12 (7) 15:42 (7)	07:09 17:12	06:25 17:51	06:45 (6) 07:21 (6)	06:27 19:31
8	07:34 16:32	15:12 (7) 15:42 (7)	07:08 17:13	06:23 17:52	06:43 (6) 07:21 (6)	06:26 19:32
9	07:34 16:33	15:14 (7) 15:44 (7)	07:07 17:15	06:21 17:54	06:42 (6) 07:22 (6)	06:24 19:33
10	07:33 16:34	15:13 (7) 15:43 (7)	07:05 17:16	06:19 17:55	06:42 (6) 07:22 (6)	06:22 19:34
11	07:33 16:35	15:15 (7) 15:43 (7)	07:04 17:18	06:18 17:56	06:40 (6) 07:22 (6)	06:20 19:36
12	07:33 16:36	15:16 (7) 15:42 (7)	07:03 17:19	06:16 17:57	06:40 (6) 07:22 (6)	06:18 19:37
13	07:32 16:37	15:16 (7) 15:42 (7)	07:01 17:21	06:14 17:59	06:40 (6) 07:22 (6)	06:17 19:38
14	07:32 16:38	15:17 (7) 15:43 (7)	07:00 17:22	06:12 18:00	06:38 (6) 07:22 (6)	06:15 19:39
15	07:31 16:40	15:19 (7) 15:43 (7)	06:58 17:23	06:10 18:01	06:38 (6) 07:22 (6)	06:13 19:41
16	07:31 16:41	15:20 (7) 15:42 (7)	06:57 17:25	06:08 18:03	06:39 (6) 07:21 (6)	06:11 19:42
17	07:30 16:42	15:21 (7) 15:41 (7)	06:55 17:26	06:06 18:04	06:39 (6) 07:21 (6)	06:10 19:43
18	07:29 16:43	15:23 (7) 15:41 (7)	06:54 17:28	06:05 18:05	06:39 (6) 07:19 (6)	06:08 19:44
19	07:29 16:44	15:26 (7) 15:38 (7)	06:52 17:29	06:03 18:07	06:39 (6) 07:19 (6)	06:06 19:46
20	07:28 16:45	15:29 (7) 15:37 (7)	06:50 17:30	06:01 18:08	06:39 (6) 07:17 (6)	06:04 19:47
21	07:27 16:46	06:49 17:32		05:59 18:09	06:41 (6) 07:15 (6)	06:03 19:48
22	07:27 16:47	06:47 17:33		05:57 18:10	06:41 (6) 07:15 (6)	06:01 19:50
23	07:26 16:48	06:46 17:35		05:55 18:12	06:41 (6) 07:13 (6)	05:59 19:51
24	07:25 16:49	06:44 17:36		05:53 18:13	06:43 (6) 07:09 (6)	05:58 19:52
25	07:24 16:50	06:42 17:37		05:51 18:14	06:46 (6) 07:08 (6)	05:56 19:53
26	07:23 16:51	06:41 17:39		05:50 18:15	06:48 (6) 07:04 (6)	05:55 19:55
27	07:22 16:52	06:39 17:40		05:48 18:17	06:54 (6) 06:58 (6)	05:53 19:56
28	07:21 16:53	06:37 17:41	07:00 (6) 07:08 (6)	05:46 18:18	05:51 19:57	05:16 18:52 (5)
29	07:20 16:54			05:44 18:19	05:50 19:58	05:15 20:31
30	07:19 17:01			05:42 18:21	05:48 20:00	05:13 20:32
31	07:18 17:02			05:40 18:22		05:14 20:33
Potential sun hours	286	291	369	380	-285	-254
Total, worst case	524	8	892	626		
Sun reduction	0.45	0.45	0.50	0.55		
Oper. time red.	0.91	0.91	0.91	0.91		
Wind dir. red.	0.62	0.62	0.62	0.63		
Total reduction	0.25	0.25	0.28	0.31		
Total, real	133	2	253	195		

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 17:18 / 17
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 127 - 127

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
 N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	06:17 19:35	18:41 (5) 19:11 (5)	06:53 18:38	07:18 (6) 16:46
2	05:14 20:46	05:42 20:24	06:19 19:33	18:41 (5) 19:09 (5)	06:55 18:36	07:18 (6) 16:44
3	05:14 20:46	05:43 20:22	06:20 19:31	18:42 (5) 19:08 (5)	06:56 18:34	07:19 (6) 16:43
4	05:15 20:46	05:44 20:21	06:21 19:29	18:43 (5) 19:05 (5)	06:57 18:33	07:18 (6) 16:41
5	05:16 20:46	05:45 20:20	06:22 19:27	18:44 (5) 19:04 (5)	06:58 18:31	07:19 (6) 16:40
6	05:16 20:46	05:47 20:18	06:23 19:25	18:45 (5) 19:01 (5)	06:59 18:29	07:21 (6) 16:39
7	05:17 20:45	05:48 20:17	06:24 19:24	18:48 (5) 19:00 (5)	07:01 18:27	07:22 (6) 16:37
8	05:18 20:45	05:49 20:16	06:26 19:22	18:45 (5) 18:25	07:02 18:25	07:23 (6) 16:36
9	05:18 20:44	05:50 20:14	06:27 19:20	18:45 (5) 18:23	07:03 18:23	07:25 (6) 16:35
10	05:19 20:44	05:51 20:13	06:28 19:18	18:45 (5) 18:22	07:05 18:22	07:26 (6) 16:34
11	05:20 20:43	05:52 20:11	06:29 19:16	18:45 (5) 18:20	07:06 18:20	07:27 (6) 16:33
12	05:21 20:43	05:54 20:10	06:30 19:14	18:45 (5) 18:18	07:07 18:18	07:29 (6) 16:32
13	05:22 20:42	05:55 20:08	06:32 19:12	18:45 (5) 18:16	07:08 18:16	07:30 (6) 16:30
14	05:22 20:42	05:56 20:07	06:33 19:10	18:45 (5) 18:14	07:10 18:14	07:31 (6) 16:29
15	05:23 20:41	05:57 20:05	18:58 (5) 19:06 (5)	06:34 19:08	07:11 18:13	06:53 16:28
16	05:24 20:40	05:58 20:04	18:53 (5) 19:09 (5)	06:35 19:07	07:12 18:11	06:54 16:27
17	05:25 20:40	06:00 20:02	18:52 (5) 19:10 (5)	06:36 19:05	07:13 (6) 18:09	06:55 16:26
18	05:26 20:39	06:01 20:00	18:49 (5) 19:11 (5)	06:38 19:03	07:15 (6) 18:08	06:57 16:25
19	05:27 20:38	06:02 19:57	18:49 (5) 19:13 (5)	06:39 19:01	07:16 (6) 18:06	06:58 16:24
20	05:28 20:37	06:03 19:56	18:46 (5) 19:14 (5)	06:40 18:59	07:17 (6) 18:04	06:59 16:24
21	05:29 20:36	06:04 19:54	18:45 (5) 19:15 (5)	06:41 18:57	07:19 (6) 18:03	07:01 16:23
22	05:30 20:36	06:05 19:52	18:44 (5) 19:16 (5)	06:42 18:55	07:20 (6) 18:01	07:02 16:22
23	05:31 20:35	06:07 19:51	18:43 (5) 19:15 (5)	06:44 18:53	07:21 (6) 17:59	6 15:11 (7) 16:21
24	05:32 20:34	06:08 19:49	18:42 (5) 19:16 (5)	06:45 18:51	07:22 (6) 17:58	12 15:05 (7) 16:21
25	05:33 20:33	06:09 19:47	18:41 (5) 19:15 (5)	06:46 18:49	07:21 (6) 17:56	18 15:00 (7) 16:21
26	05:34 20:32	06:10 19:45	18:41 (5) 19:17 (5)	06:47 18:48	07:20 (6) 17:55	20 14:59 (7) 16:19
27	05:35 20:31	06:11 19:44	18:42 (5) 19:16 (5)	06:48 18:46	07:20 (6) 17:53	22 15:21 (7) 16:19
28	05:36 20:29	06:13 19:42	18:41 (5) 19:15 (5)	06:50 18:44	07:21 (6) 17:51	24 14:58 (7) 16:18
29	05:37 20:28	06:14 19:40	18:40 (5) 19:14 (5)	06:51 18:42	07:20 (6) 17:50	26 14:57 (7) 16:18
30	05:39 20:27	06:15 19:38	18:41 (5) 19:13 (5)	06:52 18:40	07:19 (6) 17:48	26 14:56 (7) 16:17
31	05:40 20:26	06:16 19:36	18:40 (5) 19:12 (5)	06:52 18:40	07:19 (6) 17:48	26 14:55 (7) 16:17
Potential sun hours	-272	4	376	341	288	274
Total, worst case		480	636	430	180	1144
Sun reduction		0.55	0.55	0.45	0.35	0.35
Oper. time red.		0.91	0.91	0.91	0.91	0.91
Wind dir. red.		0.63	0.62	0.62	0.62	0.63
Total reduction		0.31	0.31	0.25	0.20	0.20
Total, real		150	198	110	35	228

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 17:18 / 18
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 128 - 128

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:03	06:35 17:43	05:38 18:23	17:23 (20) 20:00	05:47 20:34	05:14 20:47	05:13 20:25	05:41 19:35	06:17 18:38	18:11 (20) 18:15 (20)	06:34 16:46	07:13 16:17
2	07:35 16:26	07:16 17:05	06:34 17:44	05:37 18:24	17:27 (20) 20:01	05:45 20:35	05:13 20:47	05:42 20:24	06:19 19:33	06:55 18:36	4	06:35 16:44	07:14 16:16
3	07:35 16:27	07:15 17:06	06:32 17:46	05:35 18:26	17:33 (20) 20:02	05:44 20:36	05:12 20:46	05:43 20:22	06:20 19:31	06:56 18:35		06:36 16:43	07:16 16:16
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	05:12 20:37	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:33		06:37 16:41	07:17 16:16
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:05	05:12 20:37	05:16 20:46	05:45 20:20	06:22 19:27	06:58 18:31		06:39 16:40	07:18 16:16
6	07:34 16:30	07:11 17:11	06:27 17:50	06:29 19:29	05:40 20:06	05:11 20:38	05:16 20:46	05:47 20:18	06:23 19:26	07:00 18:29		06:41 16:39	07:19 16:15
7	07:34 16:31	07:10 17:12	06:25 17:51	06:27 19:31	05:38 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27		06:42 16:38	07:20 16:15
8	07:34 16:32	07:08 17:14	06:23 17:52	06:26 19:32	05:37 20:08	05:10 20:40	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25		06:43 16:36	07:21 16:15
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40	05:18 20:44	05:50 20:14	06:27 19:20	07:03 18:23		06:45 16:35	07:22 16:15
10	07:33 16:34	07:05 17:16	06:19 17:55	06:22 19:35	05:34 20:11	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22 (20)	4	06:46 16:34	07:23 16:15
11	07:33 16:36	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:10 20:42	05:20 20:44	05:53 20:11	06:29 19:16	07:06 18:15 (20)	14	06:47 16:33	07:24 16:15
12	07:33 16:37	07:03 17:19	06:16 17:58	06:18 19:37	05:32 20:13	05:09 20:42	05:21 20:43	05:54 20:10	06:31 19:14	07:07 18:12 (20)	20	06:49 16:32	07:24 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	05:09 20:43	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:09 (20)	24	06:50 16:30	07:25 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	05:30 20:15	05:09 20:43	05:23 20:42	05:56 20:07	06:33 19:10	07:10 18:08 (20)	26	06:51 16:29	07:26 16:15
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:17	05:09 20:44	05:23 20:41	05:57 20:05	06:34 19:09	07:11 18:07 (20)	26	06:53 16:28	07:27 16:15
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	05:09 20:44	05:24 20:40	05:58 20:04	06:35 19:07	07:12 18:05 (20)	30	06:54 16:27	07:28 16:16
17	07:30 16:43	06:55 17:26	06:07 18:04	06:10 19:43	05:26 20:19	05:09 20:45	05:25 20:40	06:00 20:02	06:36 19:05	07:14 18:04 (20)	32	06:56 16:26	07:28 16:16
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:01	06:38 19:03	07:15 18:03 (20)	32	06:57 16:25	07:29 16:16
19	07:29 16:46	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:09 20:45	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:02 (20)	34	06:58 16:25	07:30 16:17
20	07:28 16:47	06:51 17:31	06:01 18:08	06:05 19:47	05:23 20:22	05:09 20:46	05:28 20:37	06:03 19:56	06:40 18:59	07:17 18:01 (20)	34	06:59 16:24	07:30 16:17
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46	05:29 20:37	06:04 19:54	06:41 18:57	07:19 18:02 (20)	30	07:01 16:23	07:31 16:17
22	07:27 16:50	06:47 17:33	05:57 18:10	06:01 19:50	05:21 20:24	05:10 20:46	05:30 20:36	06:06 19:52	06:42 18:55	07:20 18:02 (20)	30	07:02 16:22	07:31 16:18
23	07:26 16:51	06:46 17:35	05:55 18:12	06:00 19:51	05:20 20:25	05:10 20:46	05:31 20:35	06:07 19:51	06:44 18:53	07:21 18:01 (20)	28	07:03 16:21	07:32 16:18
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:26	05:10 20:47	05:32 20:34	06:08 19:49	06:45 18:51	07:23 18:02 (20)	26	07:05 16:21	07:32 16:19
25	07:24 16:54	06:42 17:37	05:52 18:14	05:56 19:53	05:18 20:27	05:11 20:47	05:33 20:33	06:09 19:47	06:46 18:50	07:24 18:01 (20)	24	07:06 16:20	07:33 16:20
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	05:17 20:28	05:11 20:47	05:34 20:32	06:10 19:45	06:47 18:48	07:25 18:02 (20)	22	07:07 16:19	07:33 16:20
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	05:11 20:47	05:35 20:31	06:11 19:44	06:48 18:46	07:26 18:04 (20)	18	07:08 16:19	07:33 16:21
28	07:21 16:58	06:37 17:42	05:46 18:18	05:52 19:57	05:16 20:30	05:12 20:47	05:36 20:30	06:13 19:42	06:50 18:44	07:27 18:03 (20)	18	07:10 16:18	07:34 16:22
29	07:20 16:59	06:37 17:42	05:44 18:19	05:50 19:58	05:15 20:31	05:12 20:47	05:38 20:28	06:14 19:40	06:51 18:42	07:28 18:06 (20)	12	07:11 16:18	07:34 16:22
30	07:19 17:01	06:37 17:42	05:42 18:21	05:48 20:00	05:15 20:32	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	07:29 18:07 (20)	8	07:12 16:17	07:34 16:23
31	07:18 17:02	06:37 17:42	05:40 18:22	05:48 19:40 (20)	05:14 20:33	05:13 20:26	05:39 20:37	06:16 19:37	06:52 18:47	07:30 18:15 (20)		07:13 16:24	07:34 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	274	
Total, worst case			466	20					492	4			
Sun reduction			0.50	0.55					0.55	0.45			
Oper. time red.			0.91	0.91					0.91	0.91			
Wind dir. red.			0.61	0.61					0.61	0.61			
Total reduction			0.28	0.30					0.30	0.25			
Total, real			129	6					150	1			

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 17:18 / 19
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 134 - 134

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June		
1	07:35	07:17	16:09 (26)	06:36	05:39	06:09 (3)	05:47	05:14
	16:25	17:03	16:25 (26)	17:43	18:23	17:31 (4)	20:00	20:34
2	07:35	07:16	16:12 (26)	06:34	05:37	06:09 (3)	05:45	05:13
	16:26	17:05	16:24 (26)	17:44	18:24	17:29 (4)	20:01	20:35
3	07:35	07:15	16:14 (26)	06:32	05:35	06:09 (3)	05:44	05:12
	16:27	17:06	16:20 (26)	17:46	18:26	17:25 (4)	20:02	20:36
4	07:35	07:13	16:20 (26)	06:30	05:33	06:09 (3)	05:43	05:12
	16:28	17:08		17:47	18:27	17:21 (4)	20:03	20:37
5	07:34	07:12	16:20 (26)	06:28	06:31	07:11 (3)	05:41	05:12
	16:29	17:09		17:48	19:28	07:29 (3)	20:05	20:38
6	07:34	07:11	16:20 (26)	06:27	06:29	07:13 (3)	05:40	05:11
	16:30	17:11		17:50	19:29	07:25 (3)	20:06	20:38
7	07:34	07:10	16:20 (26)	06:25	06:27	07:16 (3)	05:38	05:11
	16:31	17:12		17:51	19:31	07:22 (3)	20:07	20:39
8	07:34	07:08	16:20 (26)	06:23	06:26		05:37	05:10
	16:32	17:14		17:52	19:32		20:08	20:40
9	07:34	07:07	16:20 (26)	06:21	06:24		05:36	05:10
	16:33	17:15		17:54	19:33		20:09	20:40
10	07:33	16:03 (26)	07:06	06:19	17:16 (4)	06:22	05:34	05:10
	16:34	16:07 (26)	17:16	17:55	17:30 (4)	19:35	20:11	20:41
11	07:33	16:03 (26)	07:04	06:18	17:12 (4)	06:20	05:33	05:10
	16:36	16:07 (26)	17:18	17:56	17:34 (4)	19:36	20:12	20:42
12	07:33	16:02 (26)	07:03	06:16	17:10 (4)	06:18	05:32	05:10
	16:37	16:08 (26)	17:19	17:58	17:34 (4)	19:37	20:13	20:42
13	07:32	16:02 (26)	07:01	06:14	17:08 (4)	06:17	05:31	05:09
	16:38	16:10 (26)	17:21	17:59	17:36 (4)	19:38	20:14	20:43
14	07:32	16:01 (26)	07:00	06:12	17:06 (4)	06:15	05:30	05:09
	16:39	16:11 (26)	17:22	18:00	17:36 (4)	19:40	20:15	20:43
15	07:31	16:01 (26)	06:58	06:10	17:05 (4)	06:13	05:28	05:09
	16:40	16:13 (26)	17:24	18:02	17:39 (4)	19:41	20:17	20:44
16	07:31	16:02 (26)	06:57	06:08	17:03 (4)	06:11	05:27	05:09
	16:42	16:14 (26)	17:25	18:03	17:39 (4)	19:42	20:18	20:44
17	07:30	16:01 (26)	06:55	06:07	17:03 (4)	06:10	05:26	05:09
	16:43	16:15 (26)	17:26	18:04	17:41 (4)	19:43	20:19	20:45
18	07:30	16:01 (26)	06:54	06:05	17:01 (4)	06:08	05:25	05:09
	16:44	16:17 (26)	17:28	18:05	17:41 (4)	19:45	20:20	20:45
19	07:29	16:02 (26)	06:52	06:03	17:01 (4)	06:06	05:24	05:09
	16:46	16:18 (26)	17:29	18:07	17:41 (4)	19:46	20:21	20:45
20	07:28	16:01 (26)	06:51	06:01	16:59 (4)	06:05	05:23	05:09
	16:47	16:19 (26)	17:31	18:08	17:41 (4)	19:47	20:22	20:46
21	07:27	16:02 (26)	06:49	05:59	06:23 (3)	06:03	05:22	05:10
	16:48	16:20 (26)	17:32	18:09	17:41 (4)	19:48	20:23	20:46
22	07:27	16:01 (26)	06:47	05:57	06:17 (3)	06:01	05:21	05:10
	16:50	16:21 (26)	17:33	18:10	17:39 (4)	19:50	20:24	20:46
23	07:26	16:03 (26)	06:46	05:55	06:15 (3)	06:00	05:20	05:10
	16:51	16:23 (26)	17:35	18:12	17:39 (4)	19:51	20:25	20:46
24	07:25	16:02 (26)	06:44	05:53	06:14 (3)	05:58	05:19	05:10
	16:52	16:26 (26)	17:36	18:13	17:40 (4)	19:52	20:26	20:47
25	07:24	16:03 (26)	06:42	05:52	06:12 (3)	05:56	05:18	05:11
	16:54	16:27 (26)	17:37	18:14	17:40 (4)	19:53	20:28	20:47
26	07:23	16:04 (26)	06:41	05:50	06:10 (3)	05:55	05:18	05:11
	16:55	16:28 (26)	17:39	18:16	17:38 (4)	19:55	20:29	20:47
27	07:22	16:05 (26)	06:39	05:48	06:10 (3)	05:53	05:17	05:11
	16:56	16:29 (26)	17:40	18:17	17:38 (4)	19:56	20:30	20:47
28	07:21	16:04 (26)	06:37	05:46	06:10 (3)	05:52	05:16	05:12
	16:58	16:28 (26)	17:42	18:18	17:36 (4)	19:57	20:30	20:47
29	07:20	16:04 (26)		05:44	06:08 (3)	05:50	05:15	05:12
	16:59	16:26 (26)		18:19	17:34 (4)	19:58	20:31	20:47
30	07:19	16:07 (26)		05:42	06:08 (3)	05:48	05:15	05:13
	17:01	16:27 (26)		18:21	17:34 (4)	20:00	20:32	20:47
31	07:18	16:08 (26)		05:40	06:08 (3)		05:14	
	17:02	16:26 (26)		18:22	17:32 (4)		20:33	
Potential sun hours	286	291	369	380		-285	-254	
Total, worst case	358	34	996	204				
Sun reduction	0.45	0.45	0.50	0.55				
Oper. time red.	0.91	0.91	0.91	0.91				
Wind dir. red.	0.59	0.59	0.61	0.61				
Total reduction	0.24	0.24	0.28	0.31				
Total, real	87	8	274	62				

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 17:18 / 20
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 134 - 134

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	06:17 19:35	06:53 18:38	17:49 (4) 18:15 (4)	06:34 16:46
2	05:14 20:47	05:42 20:24	06:19 19:33	06:55 18:36	17:50 (4) 18:12 (4)	06:35 16:44
3	05:14 20:46	05:43 20:22	06:20 19:31	06:56 18:35	17:51 (4) 18:09 (4)	06:36 16:43
4	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:33	17:56 (4) 18:04 (4)	06:38 16:42
5	05:16 20:46	05:46 20:20	06:22 19:27	07:12 (3) 07:18 (3)	06:58 18:31	06:39 16:40
6	05:16 20:46	05:47 20:18	06:23 19:26	07:09 (3) 07:21 (3)	07:00 18:29	06:41 16:39
7	05:17 20:45	05:48 20:17	06:25 19:24	07:06 (3) 07:24 (3)	07:01 18:27	06:42 16:38
8	05:18 20:45	05:49 20:16	06:26 19:22	07:03 (3) 18:13 (4)	07:02 18:25	06:43 16:36
9	05:18 20:45	05:50 20:14	06:27 19:20	07:03 (3) 18:19 (4)	07:03 18:24	06:45 16:35
10	05:19 20:44	05:51 20:13	06:28 19:18	07:02 (3) 18:22 (4)	07:05 18:22	06:46 16:34
11	05:20 20:44	05:53 20:11	06:29 19:16	07:01 (3) 18:23 (4)	07:06 18:20	06:47 16:33
12	05:21 20:43	05:54 20:10	06:31 19:14	07:00 (3) 18:24 (4)	07:07 18:18	06:49 16:32
13	05:22 20:42	05:55 20:08	06:32 19:12	06:59 (3) 18:25 (4)	07:08 18:16	06:50 16:31
14	05:23 20:42	05:56 20:07	06:33 19:11	06:58 (3) 18:26 (4)	07:10 18:15	06:52 16:29
15	05:23 20:41	05:57 20:05	06:34 19:09	06:59 (3) 18:25 (4)	07:11 18:13	06:53 16:28
16	05:24 20:41	05:58 20:04	06:35 19:07	06:59 (3) 18:27 (4)	07:12 18:11	06:54 16:27
17	05:25 20:40	06:00 20:02	06:36 19:05	07:00 (3) 18:26 (4)	07:14 18:09	06:56 16:26
18	05:26 20:39	06:01 20:01	06:38 19:03	06:59 (3) 18:27 (4)	07:15 18:08	06:57 16:25
19	05:27 20:38	06:02 19:57	06:39 19:01	07:00 (3) 18:26 (4)	07:16 18:06	06:58 16:25
20	05:28 20:37	06:03 19:56	06:40 18:59	07:01 (3) 18:25 (4)	07:18 18:04	07:00 16:24
21	05:29 20:37	06:04 19:54	06:41 18:57	07:02 (3) 18:26 (4)	07:19 18:03	07:01 16:23
22	05:30 20:36	06:06 19:52	06:42 18:55	07:06 (3) 18:26 (4)	07:20 18:01	07:02 16:22
23	05:31 20:35	06:07 19:51	06:44 18:53	07:45 (4) 18:25 (4)	07:22 17:59	07:03 16:21
24	05:32 20:34	06:08 19:49	06:45 18:51	07:44 (4) 18:24 (4)	07:23 17:58	07:05 16:21
25	05:33 20:33	06:09 19:47	06:46 18:50	07:43 (4) 18:23 (4)	06:24 16:56	07:06 16:20
26	05:34 20:32	06:10 19:45	06:47 18:48	07:44 (4) 18:22 (4)	06:26 16:55	07:07 16:19
27	05:35 20:31	06:12 19:44	06:48 18:46	07:44 (4) 18:22 (4)	06:27 16:53	07:09 16:19
28	05:37 20:30	06:13 19:42	06:50 18:44	07:45 (4) 18:19 (4)	06:28 16:52	07:10 16:18
29	05:38 20:28	06:14 19:40	06:51 18:42	07:46 (4) 18:18 (4)	06:30 16:50	07:11 16:18
30	05:39 20:27	06:15 19:38	06:52 18:40	07:47 (4) 18:15 (4)	06:31 16:49	07:12 16:17
31	05:40 20:26	06:16 19:37		06:32 16:47		07:34 16:24
Potential sun hours	-272	4	376	341	288	274
Total, worst case			1148	74	386	12
Sun reduction			0.55	0.45	0.35	0.35
Oper. time red.			0.91	0.91	0.91	0.91
Wind dir. red.			0.61	0.60	0.59	0.59
Total reduction			0.30	0.25	0.19	0.19
Total, real			348	18	73	2

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: 060119 Marble River Description: Marble River Wind Project Shadow-Flicker, MidW part 2 27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)

SHADOW - Calendar Calculation: 060121 MidWest area2 Shadow receptor: 135 - 135

Assumptions for shadow calculations Maximum distance for influence 1,000 m Minimum sun height over horizon for influence 3 ° Day step for calculation 1 days Time step for calculation 2 minutes Operational time Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Table with 13 columns (Jan-Dec) and 34 rows (1-34) showing sun rise/set times and shadow reduction percentages for various months. Includes a summary table at the bottom showing total reduction and real values.

Table layout: For each day in each month the following matrix apply Day in month Sun rise (hh:mm) Sun set (hh:mm) First time (hh:mm) with flicker Last time (hh:mm) with flicker (WTG causing flicker first time) (WTG causing flicker last time)

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 17:18 / 22
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 136 - 136

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34 16:25	07:17 17:03	07:39 (8) 07:47 (8)	06:35 17:43	06:56 (21) 17:06 (7)	05:38 18:23
2	07:34 16:26	07:16 17:05	07:38 (8) 07:50 (8)	06:34 17:44	06:54 (21) 17:12 (7)	05:37 18:24
3	07:34 16:27	07:14 17:06	07:36 (8) 07:50 (8)	06:32 17:46	06:55 (21) 17:15 (7)	05:35 18:26
4	07:34 16:28	07:13 17:08	07:35 (8) 07:51 (8)	06:30 17:47	06:53 (21) 17:17 (7)	05:33 18:27
5	07:34 16:29	07:12 17:09	07:34 (8) 07:52 (8)	06:28 17:48	06:53 (21) 17:19 (7)	06:31 19:28
6	07:34 16:30	07:11 17:11	07:32 (8) 07:52 (8)	06:27 17:50	06:51 (21) 17:19 (7)	06:29 19:29
7	07:34 16:31	07:09 17:12	07:31 (8) 07:53 (8)	06:25 17:51	06:51 (21) 17:21 (7)	06:27 19:31
8	07:34 16:32	07:08 17:13	07:30 (8) 07:54 (8)	06:23 17:52	06:49 (21) 17:21 (7)	06:26 19:32
9	07:34 16:33	07:07 17:15	07:28 (8) 07:54 (8)	06:21 17:54	06:50 (21) 17:22 (7)	06:24 19:33
10	07:33 16:34	07:05 17:16	07:27 (8) 07:55 (8)	06:19 17:55	06:50 (21) 17:24 (7)	06:22 19:34
11	07:33 16:35	07:04 17:18	07:25 (8) 07:55 (8)	06:18 17:56	06:50 (21) 17:24 (7)	06:20 19:36
12	07:33 16:37	07:03 17:19	07:26 (8) 07:54 (8)	06:16 17:57	06:50 (21) 17:24 (7)	06:18 19:37
13	07:32 16:38	07:01 17:21	07:26 (8) 07:54 (8)	06:14 17:59	06:50 (21) 17:24 (7)	06:17 19:38
14	07:32 16:39	07:00 17:22	07:27 (8) 07:55 (8)	06:12 18:00	06:50 (21) 17:24 (7)	06:15 19:39
15	07:31 16:40	06:58 17:23	07:27 (8) 07:53 (8)	06:10 18:01	06:50 (21) 17:24 (7)	06:13 19:41
16	07:31 16:42	06:57 17:25	07:28 (8) 07:52 (8)	06:08 18:03	06:51 (21) 17:23 (7)	06:11 19:42
17	07:30 16:43	06:55 17:26	07:28 (8) 07:52 (8)	06:06 18:04	06:53 (21) 17:23 (7)	06:10 19:43
18	07:29 16:44	06:54 17:28	07:31 (8) 07:51 (8)	06:05 18:05	06:53 (21) 17:23 (7)	06:08 19:44
19	07:29 16:45	06:52 17:29	07:31 (8) 07:49 (8)	06:03 18:07	06:55 (21) 17:23 (7)	06:06 19:46
20	07:28 16:47	06:50 17:30	07:33 (8) 07:45 (8)	06:01 18:08	06:55 (21) 17:21 (7)	06:04 19:47
21	07:27 16:48	06:49 17:32	07:33 (8) 18:09	06:00 18:09	06:57 (21) 17:21 (7)	06:03 19:48
22	07:27 16:49	06:47 17:33	07:32 (8) 18:10	05:59 18:10	07:01 (21) 17:19 (7)	06:01 19:50
23	07:26 16:51	06:46 17:35	07:32 (8) 18:12	05:57 18:12	16:37 (7) 17:19 (7)	05:59 19:51
24	07:25 16:52	06:44 17:36	07:09 (21) 07:19 (21)	05:53 18:13	16:37 (7) 17:17 (7)	05:58 19:52
25	07:24 16:54	06:42 17:37	07:05 (21) 07:23 (21)	05:51 18:14	16:40 (7) 17:16 (7)	05:56 19:53
26	07:23 16:55	06:41 17:39	07:01 (21) 07:25 (21)	05:50 18:15	16:40 (7) 17:14 (7)	05:55 19:55
27	07:22 16:56	06:39 17:40	07:00 (21) 07:28 (21)	05:48 18:17	16:42 (7) 17:14 (7)	05:53 19:56
28	07:21 16:58	06:37 17:41	06:58 (21) 07:28 (21)	05:46 18:18	16:44 (7) 17:10 (7)	05:51 19:57
29	07:20 16:59		05:44 18:19	05:44 18:19	16:46 (7) 17:08 (7)	05:50 19:58
30	07:19 17:01		05:42 18:21	05:42 18:21	16:48 (7) 17:04 (7)	05:48 20:00
31	07:18 17:02	07:40 (8) 07:44 (8)	05:40 18:22	05:40 18:22	05:14 20:33	05:37 (6) 06:11 (6)
Potential sun hours	286	291	369	380	-285	-254
Total, worst case	4	536	1878	376	1124	
Sun reduction	0.45	0.45	0.50	0.55	0.55	
Oper. time red.	0.91	0.91	0.91	0.91	0.91	
Wind dir. red.	0.62	0.62	0.60	0.57	0.57	
Total reduction	0.25	0.25	0.27	0.28	0.28	
Total, real	1	136	512	107	319	

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 17:18 / 23
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 136 - 136

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes
 Sun shine probabilities (part of time from sun rise to sun set with sun shine)
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
 Operational time
 N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:40 (6) 06:18 (6)	05:41 20:25	06:17 19:35	06:53 18:38	07:28 (21) 18:02 (7)
2	05:14 20:46	05:39 (6) 06:18 (6)	05:43 20:24	06:20 19:33	06:56 18:36	07:27 (21) 18:02 (7)
3	05:14 20:46	05:39 (6) 06:17 (6)	05:43 20:22	06:20 19:31	06:56 18:34	07:27 (21) 18:01 (7)
4	05:15 20:46	05:40 (6) 06:18 (6)	05:44 20:21	06:21 19:29	06:57 18:33	07:28 (21) 18:00 (7)
5	05:16 20:46	05:40 (6) 06:18 (6)	05:45 20:20	06:22 19:27	06:58 18:31	07:27 (21) 17:59 (7)
6	05:16 20:46	05:41 (6) 06:19 (6)	05:47 20:18	06:23 19:25	06:59 18:29	07:27 (21) 17:59 (7)
7	05:17 20:45	05:42 (6) 06:18 (6)	05:48 20:17	06:25 19:24	07:01 18:27	07:26 (21) 17:56 (7)
8	05:18 20:45	05:42 (6) 06:18 (6)	05:49 20:16	06:26 19:22	07:02 18:25	07:27 (21) 17:55 (7)
9	05:18 20:44	05:43 (6) 06:19 (6)	05:50 20:14	06:27 19:20	07:03 18:23	07:27 (21) 17:53 (7)
10	05:19 20:44	05:44 (6) 06:18 (6)	05:51 20:13	06:28 19:18	07:05 18:22	07:28 (21) 17:50 (7)
11	05:20 20:43	05:44 (6) 06:18 (6)	05:52 20:11	06:29 19:16	07:06 18:20	07:29 (21) 17:47 (7)
12	05:21 20:43	05:45 (6) 06:19 (6)	05:54 20:10	06:30 19:14	07:07 18:18	07:29 (21) 17:45 (7)
13	05:22 20:42	05:46 (6) 06:18 (6)	05:55 20:08	06:32 19:12	17:39 (7) 17:55 (7)	07:08 18:16
14	05:22 20:42	05:47 (6) 06:19 (6)	05:56 20:07	06:33 19:10	17:36 (7) 17:58 (7)	07:10 18:14
15	05:23 20:41	05:48 (6) 06:18 (6)	05:57 20:05	06:34 19:08	17:33 (7) 17:59 (7)	07:11 18:13
16	05:24 20:40	05:49 (6) 06:19 (6)	05:58 20:04	06:35 19:07	17:31 (7) 18:03 (7)	07:12 18:11
17	05:25 20:40	05:50 (6) 06:18 (6)	06:00 20:02	06:36 19:05	17:30 (7) 18:04 (7)	07:13 18:09
18	05:26 20:39	05:50 (6) 06:18 (6)	06:01 20:00	06:38 19:03	17:27 (7) 18:03 (7)	07:15 18:08
19	05:27 20:38	05:51 (6) 06:17 (6)	06:02 19:57	06:39 19:01	17:26 (7) 18:04 (7)	07:16 18:06
20	05:28 20:37	05:52 (6) 06:16 (6)	06:03 19:56	06:40 18:59	17:23 (7) 18:05 (7)	07:17 18:04
21	05:29 20:36	05:53 (6) 06:17 (6)	06:04 19:54	06:41 18:57	07:50 (21) 18:04 (7)	07:19 18:03
22	05:30 20:36	05:54 (6) 06:16 (6)	06:05 19:52	06:42 18:55	07:44 (21) 18:06 (7)	07:20 18:01
23	05:31 20:35	05:55 (6) 06:15 (6)	06:07 19:51	06:44 18:53	07:41 (21) 18:05 (7)	07:21 17:59
24	05:32 20:34	05:56 (6) 06:14 (6)	06:08 19:49	06:45 18:51	07:38 (21) 18:06 (7)	07:23 17:58
25	05:33 20:33	05:57 (6) 06:13 (6)	06:09 19:47	06:46 18:49	07:35 (21) 18:05 (7)	06:24 16:56
26	05:34 20:32	05:58 (6) 06:12 (6)	06:10 19:45	06:47 18:48	07:34 (21) 18:06 (7)	06:25 16:55
27	05:35 20:31	05:59 (6) 06:09 (6)	06:11 19:44	06:48 18:46	07:34 (21) 18:06 (7)	06:27 16:53
28	05:36 20:29	06:00 (6) 06:08 (6)	06:13 19:42	06:50 18:44	07:31 (21) 18:05 (7)	06:28 16:51
29	05:38 20:28	06:01 (6) 19:40	06:14 19:40	06:51 18:42	07:30 (21) 18:04 (7)	06:29 16:50
30	05:39 20:27	06:02 (6) 19:38	06:15 18:40	06:52 18:40	07:29 (21) 18:03 (7)	06:31 16:48
31	05:40 20:26	06:03 (6) 19:36	06:16 18:38	06:53 18:38	06:32 16:47	06:33 16:47
Potential sun hours	-272	4	376	341	288	274
Total, worst case	800		986	1284	190	
Sun reduction	0.58		0.55	0.45	0.35	
Oper. time red.	0.91		0.91	0.91	0.91	
Wind dir. red.	0.57		0.59	0.61	0.62	
Total reduction	0.30		0.30	0.25	0.20	
Total, real	239		293	320	37	

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/23/06 17:18 / 24
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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 137 - 137

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes
 Sun shine probabilities (part of time from sun rise to sun set with sun shine)
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
 Operational time
 N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34 16:25	07:17 17:03	06:35 17:43	07:22 (8) 05:38	06:22 (21) 05:47	05:13 20:34
2	07:34 16:26	07:16 17:05	06:34 17:44	07:26 (8) 05:37	06:23 (21) 05:45	05:13 20:35
3	07:34 16:27	07:14 17:06	06:32 17:46	07:32 (8) 18:24	05:35 06:23 (21)	05:44 05:12
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:26	06:23 (21) 05:42	05:12 20:36
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	07:23 (21) 05:41	05:11 20:37
6	07:34 16:30	07:11 17:11	06:27 17:50	06:29 19:29	07:25 (21) 05:40	05:11 20:38
7	07:34 16:31	07:09 17:12	06:25 17:51	06:27 19:31	07:25 (21) 05:38	05:11 20:39
8	07:34 16:32	07:08 17:13	07:30 (8) 06:23	06:26 19:32	07:28 (21) 05:37	05:10 20:40
9	07:34 16:33	07:07 17:15	07:28 (8) 06:21	06:24 19:33	07:30 (21) 05:36	05:10 20:40
10	07:33 16:34	07:05 17:16	07:27 (8) 06:19	06:22 19:34	07:32 (21) 05:34	05:10 20:41
11	07:33 16:35	07:04 17:18	07:25 (8) 06:18	06:46 (21) 06:20	07:36 (21) 05:33	05:10 20:42
12	07:33 16:37	07:03 17:19	07:24 (8) 06:16	06:42 (21) 06:18	18:11 (7) 05:32	05:09 20:42
13	07:32 16:38	07:01 17:21	07:22 (8) 06:14	07:02 (21) 19:37	18:11 (7) 05:31	05:09 20:43
14	07:32 16:39	07:00 17:22	07:21 (8) 06:12	06:38 (21) 06:17	18:13 (7) 05:29	05:09 20:43
15	07:31 16:40	06:58 17:23	07:19 (8) 06:10	07:06 (21) 19:41	18:15 (7) 05:28	05:09 20:44
16	07:31 16:42	06:57 17:25	07:18 (8) 06:08	06:32 (21) 06:13	18:33 (7) 05:26	05:09 20:44
17	07:30 16:43	06:55 17:26	07:16 (8) 06:06	07:09 (21) 19:42	18:28 (7) 05:25	05:09 20:45
18	07:29 16:44	06:54 17:28	07:15 (8) 06:05	06:31 (21) 06:10	06:29 (21) 06:08	05:25 20:45
19	07:29 16:45	06:52 17:29	07:15 (8) 06:03	07:11 (21) 19:44	06:27 (21) 06:06	05:24 20:45
20	07:28 16:47	06:50 17:30	07:13 (8) 06:01	06:27 (21) 06:04	06:27 (21) 06:04	05:23 20:46
21	07:27 16:48	06:49 17:32	07:14 (8) 05:59	06:25 (21) 06:03	05:22 05:10	20:46 20:46
22	07:27 16:49	06:47 17:33	07:14 (8) 05:57	06:25 (21) 06:01	05:21 05:10	20:46 20:46
23	07:26 16:51	06:46 17:35	07:14 (8) 05:55	06:23 (21) 05:59	05:20 05:10	20:46 20:46
24	07:25 16:52	06:44 17:36	07:15 (8) 05:53	06:23 (21) 05:58	05:19 05:10	20:46 20:47
25	07:24 16:54	06:42 17:37	07:15 (8) 05:51	06:22 (21) 05:56	05:18 05:11	20:47 20:47
26	07:23 16:55	06:41 17:39	07:17 (8) 05:50	06:22 (21) 05:55	05:18 05:11	20:47 20:47
27	07:22 16:56	06:39 17:40	07:18 (8) 05:48	06:22 (21) 05:53	05:17 05:11	20:47 20:47
28	07:21 16:58	06:37 17:41	07:20 (8) 05:46	06:22 (21) 05:51	05:16 05:12	20:47 20:47
29	07:20 16:59		05:44 18:19	06:22 (21) 05:50	05:15 05:13	20:47 20:47
30	07:19 17:01		05:42 18:21	06:22 (21) 05:48	05:15 05:13	20:47 20:47
31	07:18 17:02		05:40 18:22	06:22 (21) 17:48 (7)	05:14 20:33	20:47 20:47
Potential sun hours	286	291	369	380	892	-285
Total, worst case		514	1264	892		
Sun reduction		0.45	0.50	0.55		
Oper. time red.		0.91	0.91	0.91		
Wind dir. red.		0.61	0.62	0.62		
Total reduction		0.25	0.28	0.31		
Total, real		127	356	276		

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)
	Minutes with flicker		

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, MidW part 2
 27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated:

01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 137 - 137

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
 N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	06:17 19:35	07:35 (21) 18:38	06:53 18:38	07:18 (21) 16:46
2	05:14 20:46	05:42 20:24	06:19 19:33	07:31 (21) 18:36	06:55 18:36	07:22 (21) 16:44
3	05:14 20:46	05:43 20:22	06:20 19:31	07:28 (21) 18:34	06:56 18:34	07:38 (21) 16:43
4	05:15 20:46	05:44 20:21	06:21 19:29	07:25 (21) 18:33	06:57 18:33	07:25 (21) 16:41
5	05:16 20:46	05:45 20:20	06:22 19:27	07:22 (21) 18:31	06:58 18:31	07:22 (21) 16:40
6	05:16 20:46	05:47 20:18	06:23 19:25	07:21 (21) 18:29	06:59 18:29	07:21 (21) 16:39
7	05:17 20:45	05:48 20:17	06:24 19:24	07:18 (21) 18:27	07:01 18:27	07:18 (21) 16:37
8	05:18 20:45	05:49 20:16	06:26 19:22	07:17 (21) 18:25	07:02 18:25	07:17 (21) 16:36
9	05:18 20:44	05:50 20:14	06:27 19:20	07:16 (21) 18:23	07:03 18:23	07:16 (21) 16:35
10	05:19 20:44	05:51 20:13	06:28 19:18	07:16 (21) 18:22	07:04 18:22	07:16 (21) 16:34
11	05:20 20:43	05:52 20:11	06:29 19:16	07:15 (21) 18:20	07:06 18:20	07:15 (21) 16:33
12	05:21 20:43	05:54 20:10	06:30 19:14	07:14 (21) 18:18	07:07 18:18	07:14 (21) 16:32
13	05:22 20:42	05:55 20:08	06:32 19:12	07:13 (21) 18:16	07:08 18:16	07:13 (21) 16:30
14	05:22 20:42	05:56 20:07	06:33 19:10	07:12 (21) 18:14	07:10 18:14	07:12 (21) 16:29
15	05:23 20:41	05:57 20:05	06:34 19:08	07:11 (21) 18:13	07:11 18:13	07:11 (21) 16:28
16	05:24 20:40	05:58 20:04	06:35 19:07	07:11 (21) 18:11	07:12 18:11	07:11 (21) 16:27
17	05:25 20:40	06:00 20:02	06:36 19:05	07:10 (21) 18:09	07:13 18:09	07:10 (21) 16:26
18	05:26 20:39	06:01 20:00	06:38 19:03	07:11 (21) 18:08	07:15 18:08	07:11 (21) 16:25
19	05:27 20:38	06:02 19:57	06:39 19:01	07:10 (21) 18:06	07:16 18:06	07:10 (21) 16:24
20	05:28 20:37	06:03 19:56	06:40 18:59	07:09 (21) 18:04	07:17 18:04	07:09 (21) 16:23
21	05:29 20:36	06:04 19:54	06:41 18:57	07:10 (21) 18:03	07:19 18:03	07:10 (21) 16:22
22	05:30 20:36	06:05 19:52	06:42 18:55	07:10 (21) 18:01	07:20 18:01	07:10 (21) 16:21
23	05:31 20:35	06:07 19:51	06:44 18:53	07:11 (21) 17:59	07:21 17:59	07:11 (21) 16:20
24	05:32 20:34	06:08 19:49	06:45 18:51	07:10 (21) 17:58	07:23 17:58	07:10 (21) 16:19
25	05:33 20:33	06:09 19:47	06:46 18:49	07:11 (21) 17:57	06:24 17:57	07:11 (21) 16:18
26	05:34 20:32	06:10 19:45	06:47 18:48	07:12 (21) 17:55	06:25 17:55	07:12 (21) 16:17
27	05:35 20:31	06:11 19:44	06:48 18:46	07:12 (21) 17:53	06:27 17:53	07:12 (21) 16:16
28	05:36 20:29	06:13 19:42	06:50 18:44	07:13 (21) 17:51	06:28 17:51	07:13 (21) 16:15
29	05:38 20:28	06:14 19:40	06:51 18:42	07:14 (21) 17:49	06:29 17:49	07:14 (21) 16:14
30	05:39 20:27	06:15 19:38	06:52 18:40	07:15 (21) 17:47	06:31 17:47	07:15 (21) 16:13
31	05:40 20:26	06:16 19:36	06:53 18:40	07:16 (21) 17:45	06:32 17:45	07:16 (21) 16:12
Potential sun hours	-272	4	376	341	288	274
Total, worst case		108	2022	552	20	
Sun reduction		0.55	0.55	0.45	0.35	
Oper. time red.		0.91	0.91	0.91	0.91	
Wind dir. red.		0.62	0.62	0.61	0.61	
Total reduction		0.31	0.31	0.25	0.19	
Total, real		33	626	137	4	

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 139 - 139

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:34 16:25	07:17 17:03	06:35 17:43	05:38 18:23	17:45 (20) 20:00	05:47 20:34	05:14 20:47	05:41 20:25	06:17 19:35	18:35 (20) 19:07 (20)	06:53 18:38	06:34 16:46
2	07:35 16:26	07:16 17:05	06:34 17:44	05:37 18:24	17:43 (20) 20:01	05:45 20:35	05:13 20:47	05:42 20:24	06:19 19:33	18:37 (20) 19:09 (20)	06:55 18:36	06:35 16:44
3	07:35 16:27	07:15 17:06	06:32 17:46	05:35 18:26	17:41 (20) 20:02	05:44 20:36	05:12 20:46	05:43 20:22	06:20 19:31	18:36 (20) 19:08 (20)	06:56 18:35	06:36 16:43
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:27	17:41 (20) 20:03	05:43 20:37	05:12 20:46	05:44 20:21	06:21 19:29	18:35 (20) 19:05 (20)	06:57 18:33	06:38 16:41
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	18:39 (20) 20:05	05:41 20:37	05:12 20:46	05:46 20:20	06:22 19:27	18:34 (20) 19:04 (20)	06:58 18:31	06:39 16:40
6	07:34 16:30	07:11 17:11	06:27 17:50	06:29 19:29	18:39 (20) 20:06	05:40 20:38	05:11 20:46	05:47 20:18	06:23 19:26	18:35 (20) 19:01 (20)	07:00 18:29	06:41 16:39
7	07:34 16:31	07:10 17:12	06:25 17:51	06:27 19:31	18:38 (20) 20:07	05:38 20:39	05:11 20:45	05:48 20:17	06:25 19:24	18:34 (20) 19:00 (20)	07:01 18:27	06:42 16:38
8	07:34 16:32	07:08 17:14	06:23 17:52	06:26 19:32	18:38 (20) 20:08	05:37 20:40	05:10 20:45	05:49 20:16	06:26 19:22	18:35 (20) 18:57 (20)	07:02 18:25	06:43 16:36
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	18:38 (20) 20:09	05:36 20:40	05:10 20:44	05:50 20:14	06:27 19:20	18:35 (20) 18:57 (20)	07:03 18:23	06:45 16:35
10	07:33 16:34	07:05 17:16	06:19 17:55	06:22 19:35	18:38 (20) 20:11	05:34 20:41	05:10 20:44	05:51 20:13	06:28 19:18	18:36 (20) 18:54 (20)	07:05 18:22	06:46 16:34
11	07:33 16:36	07:04 17:18	06:18 17:56	06:20 19:36	18:38 (20) 20:12	05:33 20:42	05:10 20:44	05:53 20:11	06:29 19:16	18:37 (20) 18:53 (20)	07:06 18:20	06:47 16:33
12	07:33 16:37	07:03 17:19	06:16 17:58	06:18 19:37	18:37 (20) 20:13	05:32 20:42	05:09 20:43	05:54 20:10	06:31 19:14	18:38 (20) 18:50 (20)	07:07 18:18	06:49 16:32
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	18:39 (20) 20:14	05:31 20:43	05:09 20:42	05:55 20:08	06:32 19:12	18:39 (20) 18:49 (20)	07:08 18:16	06:50 16:30
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	18:39 (20) 20:15	05:30 20:43	05:09 20:42	05:56 20:07	06:33 19:10	18:44 (20) 18:44 (20)	07:10 18:15	06:51 16:29
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	18:39 (20) 20:17	05:28 20:44	05:09 20:41	05:57 20:05	06:34 19:09	18:42 (20) 18:13	07:11 18:28	06:53 16:28
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	18:40 (20) 20:18	05:27 20:44	05:09 20:40	05:58 20:04	06:35 19:07	18:43 (20) 18:11	07:12 18:27	06:54 16:27
17	07:30 16:43	06:55 17:26	06:07 18:04	06:10 19:43	18:42 (20) 20:19	05:26 20:45	05:09 20:40	06:00 20:02	06:36 19:05	18:44 (20) 18:09	07:14 18:26	06:56 16:26
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 19:45	18:44 (20) 20:20	05:25 20:45	05:09 20:39	06:01 20:01	06:38 19:03	18:57 (20) 18:08	07:15 18:25	06:57 16:25
19	07:29 16:46	06:52 17:29	06:03 18:07	06:06 19:46	18:47 (20) 20:21	05:24 20:45	05:09 20:38	06:02 19:57	06:39 19:01	18:48 (20) 18:06	07:16 18:25	06:58 16:25
20	07:28 16:47	06:51 17:31	06:01 18:08	06:05 19:47	05:23 20:22	05:09 20:46	05:28 20:37	06:03 19:56	06:40 18:59	18:49 (20) 18:04	07:17 18:24	07:00 16:17
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46	05:29 20:36	06:04 19:54	06:41 18:57	18:50 (20) 18:03	07:19 18:23	07:01 16:17
22	07:27 16:50	06:47 17:33	05:57 18:10	06:01 19:50	05:21 20:24	05:10 20:46	05:30 20:36	06:06 19:52	06:42 18:55	18:51 (20) 18:01	07:20 18:22	07:02 16:18
23	07:26 16:51	06:46 17:35	05:55 18:12	06:00 19:51	05:20 20:25	05:10 20:46	05:31 20:35	06:07 19:51	06:44 18:53	18:52 (20) 17:59	07:21 18:21	07:03 16:18
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:26	05:10 20:47	05:32 20:34	06:08 19:49	06:45 18:51	18:50 (20) 18:51	07:23 17:58	07:05 16:19
25	07:24 16:54	06:42 17:37	05:52 18:14	05:56 19:53	05:18 20:27	05:11 20:47	05:33 20:33	06:09 19:47	06:46 18:50	18:45 (20) 19:03 (20)	07:24 18:50	07:06 16:20
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	05:18 20:28	05:11 20:47	05:34 20:32	06:10 19:45	06:47 18:48	18:45 (20) 19:05 (20)	07:25 18:48	07:07 16:19
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	05:11 20:47	05:35 20:31	06:11 19:44	06:48 18:46	18:42 (20) 19:06 (20)	07:26 18:46	07:08 16:21
28	07:21 16:58	06:37 17:42	05:46 18:18	05:52 19:57	05:16 20:30	05:12 20:47	05:36 20:30	06:13 19:42	06:41 18:44	18:41 (20) 19:07 (20)	06:50 18:44	07:09 16:22
29	07:20 16:59		05:44 18:19	05:50 19:58	17:54 (20) 17:58 (20)	05:15 20:31	05:12 20:47	06:14 19:40	06:51 18:42	18:40 (20) 19:06 (20)	06:51 18:42	07:11 16:22
30	07:19 17:01		05:42 18:21	05:48 20:00	17:50 (20) 17:58 (20)	05:15 20:32	05:13 20:47	06:15 19:38	06:52 18:40	18:37 (20) 19:07 (20)	06:52 18:40	07:12 16:23
31	07:18 17:02		05:40 18:22	05:44 20:01	17:46 (20) 17:58 (20)	05:14 20:33	05:10 20:46	06:16 19:37	06:53 19:08 (20)	18:36 (20) 19:08 (20)	06:52 18:47	07:13 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	274
Total, worst case			24	464				186	312			
Sun reduction			0.50	0.55				0.55	0.55			
Oper. time red.			0.91	0.91				0.91	0.91			
Wind dir. red.			0.62	0.62				0.62	0.62			
Total reduction			0.28	0.31				0.31	0.31			
Total, real			7	145				58	97			

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 140 - 140

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:34 16:25	07:17 17:03	07:45 (17) 08:09 (17)	06:35 17:43	05:38 18:23	05:47 20:00	05:14 20:34	05:13 20:47	05:41 20:25	06:17 19:35	06:53 18:38	06:34 16:46
2	07:34 16:26	07:16 17:05	07:46 (17) 08:08 (17)	06:34 17:44	05:37 18:24	05:45 20:01	05:13 20:35	05:14 20:47	05:42 20:24	06:19 19:33	06:55 18:36	06:35 16:44
3	07:34 16:27	07:15 17:06	07:46 (17) 08:08 (17)	06:32 17:46	05:35 18:26	05:44 20:02	05:12 20:36	05:14 20:46	05:43 20:22	06:20 19:31	06:56 18:35	06:36 16:43
4	07:34 16:28	07:13 17:08	07:47 (17) 08:07 (17)	06:30 17:47	05:33 18:27	05:43 20:03	05:12 20:37	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:33	06:38 16:42
5	07:34 16:29	07:12 17:09	07:48 (17) 08:06 (17)	06:28 17:48	06:31 19:28	05:41 20:05	05:12 20:37	05:16 20:46	05:46 20:20	06:22 19:27	06:58 18:31	06:39 16:40
6	07:34 16:30	07:11 17:11	07:50 (17) 08:04 (17)	06:27 17:50	06:29 19:29	05:40 20:06	05:11 20:38	05:16 20:46	05:47 20:18	06:23 19:26	07:00 18:29	06:40 16:39
7	07:34 16:31	07:10 17:12	07:51 (17) 08:03 (17)	06:25 17:51	06:27 19:31	05:38 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27	06:42 16:38
8	07:34 16:32	07:08 17:14	07:56 (17) 08:00 (17)	06:23 17:52	06:26 19:32	05:37 20:08	05:10 20:40	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	06:43 16:36
9	07:34 16:33	07:07 17:15	07:57 (17) 08:01 (17)	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40	05:18 20:44	05:50 20:14	06:27 19:20	07:03 18:23	06:45 16:35
10	07:33 16:34	07:05 17:16	07:58 (17) 08:02 (17)	06:19 17:55	06:22 19:34	05:34 20:11	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	06:46 16:34
11	07:33 16:36	07:04 17:18	07:59 (17) 08:03 (17)	06:18 17:56	06:20 19:36	05:33 20:12	05:10 20:42	05:20 20:43	05:53 20:11	06:29 19:16	07:06 18:20	06:47 16:33
12	07:33 16:37	07:03 17:19	08:04 (17) 08:08 (17)	06:16 17:58	06:18 19:37	05:32 20:13	05:10 20:42	05:21 20:43	05:54 20:10	06:31 19:14	07:07 18:18	06:49 16:32
13	07:32 16:38	07:01 17:21	08:05 (17) 08:09 (17)	06:14 17:59	06:17 19:38	05:31 20:14	05:09 20:43	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:16	06:50 16:31
14	07:32 16:39	07:00 17:22	08:10 (17) 08:14 (17)	06:12 18:00	06:15 19:40	05:30 20:15	05:09 20:43	05:23 20:42	05:56 20:07	06:33 19:10	07:10 18:15	06:51 16:29
15	07:31 16:40	06:58 17:23	08:15 (17) 08:19 (17)	06:10 18:01	06:13 19:41	05:28 20:17	05:09 20:44	05:23 20:41	05:57 20:05	06:34 19:09	07:11 18:13	06:53 16:28
16	07:31 16:42	06:57 17:25	08:20 (17) 08:24 (17)	06:08 18:03	06:11 19:42	05:27 20:18	05:09 20:44	05:24 20:40	05:58 20:04	06:35 19:07	07:12 18:11	06:54 16:27
17	07:30 16:43	06:55 17:26	08:25 (17) 08:29 (17)	06:07 18:04	06:10 19:43	05:26 20:19	05:09 20:45	05:25 20:40	06:00 20:02	06:36 19:05	07:14 18:09	06:55 16:26
18	07:29 16:44	06:54 17:28	08:30 (17) 08:34 (17)	06:05 18:05	06:08 19:45	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:01	06:38 19:03	07:15 18:08	06:57 16:25
19	07:29 16:46	07:52 (17) 07:56 (17)	08:35 (17) 08:39 (17)	06:03 18:07	06:06 19:46	05:24 20:21	05:09 20:45	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:25
20	07:28 16:47	07:51 (17) 07:55 (17)	08:40 (17) 08:44 (17)	06:01 18:08	06:05 19:47	05:23 20:22	05:10 20:46	05:28 20:37	06:03 19:56	06:40 18:59	07:17 18:04	06:59 16:24
21	07:27 16:48	07:50 (17) 08:00 (17)	08:45 (17) 08:49 (17)	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46	05:29 20:36	06:04 19:54	06:41 18:57	07:19 18:03	07:01 16:23
22	07:27 16:50	07:49 (17) 08:03 (17)	08:50 (17) 08:54 (17)	05:57 18:10	06:01 19:50	05:21 20:24	05:10 20:46	05:30 20:36	06:06 19:52	06:42 18:55	07:20 18:01	07:02 16:22
23	07:26 16:51	07:48 (17) 08:04 (17)	08:55 (17) 08:59 (17)	05:55 18:12	06:00 19:51	05:20 20:25	05:10 20:46	05:31 20:35	06:07 19:51	06:44 18:53	07:21 17:59	07:03 16:21
24	07:25 16:52	07:48 (17) 08:06 (17)	09:00 (17) 09:04 (17)	05:53 18:13	05:58 19:52	05:19 20:26	05:10 20:47	05:32 20:34	06:08 19:49	06:45 18:51	07:23 17:58	07:05 16:21
25	07:24 16:54	07:47 (17) 08:07 (17)	09:05 (17) 09:09 (17)	05:52 18:14	05:56 19:53	05:18 20:27	05:11 20:47	05:33 20:33	06:09 19:47	06:46 18:50	07:24 17:56	07:06 16:20
26	07:23 16:55	07:46 (17) 08:06 (17)	09:10 (17) 09:14 (17)	05:50 18:16	05:55 19:55	05:18 20:28	05:11 20:47	05:34 20:32	06:10 19:45	06:47 18:48	07:25 17:55	07:07 16:19
27	07:22 16:56	07:45 (17) 08:07 (17)	09:15 (17) 09:19 (17)	05:48 18:17	05:53 19:56	05:17 20:29	05:11 20:47	05:35 20:31	06:12 19:44	06:48 18:46	07:26 17:53	07:08 16:19
28	07:21 16:58	07:45 (17) 08:07 (17)	09:20 (17) 09:24 (17)	05:46 18:18	05:52 19:57	05:16 20:30	05:12 20:47	05:37 20:30	06:13 19:42	06:50 18:44	07:27 17:52	07:10 16:18
29	07:20 16:59	07:44 (17) 08:08 (17)	09:25 (17) 09:29 (17)	05:44 18:19	05:50 19:58	05:15 20:31	05:12 20:47	05:38 20:28	06:14 19:40	06:51 18:42	07:28 17:50	07:11 16:18
30	07:19 17:01	07:45 (17) 08:07 (17)	09:30 (17) 09:34 (17)	05:42 18:21	05:48 19:59	05:15 20:32	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	07:29 17:49	07:12 16:17
31	07:18 17:02	07:46 (17) 08:08 (17)	09:35 (17) 09:39 (17)	05:40 18:22	05:46 19:59	05:14 20:33	05:10 20:46	05:40 20:26	06:16 19:36	06:32 17:47	07:30 17:47	07:13 16:16
Potential sun hours	286	291	369	380	285	254	272	4	376	341	288	274
Total, worst case	222	136									362	
Sun reduction	0.45	0.45									0.35	
Oper. time red.	0.91	0.91									0.91	
Wind dir. red.	0.65	0.65									0.65	
Total reduction	0.26	0.26									0.21	
Total, real	59	36									74	

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)
	Minutes with flicker		

Project:

060119 Marble River

Description:

Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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US-RIVERSIDE, CA 92506

Calculated:

01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 141 - 141

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December		
1	07:34 16:25	07:17 17:03	06:35 17:43	05:38 18:23	05:47 20:00	05:14 20:34	05:13 20:47	05:41 20:25	06:17 19:35	06:53 18:38	06:34 16:46	06:57 (17) 16:17		
2	07:34 16:26	07:16 17:05	06:34 17:44	05:37 18:24	05:45 20:01	05:13 20:35	05:14 20:47	05:42 20:24	06:19 19:33	06:55 18:36	06:35 16:44	06:58 (17) 16:16		
3	07:34 16:27	07:15 17:06	06:32 17:46	05:35 18:26	05:44 20:02	05:12 20:36	05:14 20:46	05:43 20:22	06:20 19:31	06:56 18:35	06:36 16:43	07:04 (17) 16:16		
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	05:12 20:37	05:15 20:46	05:44 20:21	06:21 19:29	06:38 18:33	06:38 16:42	06:58 16:16		
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:05	05:12 20:37	05:16 20:46	05:46 20:20	06:22 19:27	06:58 18:31	06:39 16:40	06:58 16:16		
6	07:34 16:30	07:11 17:11	06:27 17:50	06:29 19:29	05:40 20:06	05:10 20:38	05:16 20:46	05:47 20:18	06:23 19:26	07:00 18:29	06:40 16:39	06:58 16:15		
7	07:34 16:31	07:09 17:12	06:25 17:51	06:27 19:31	05:38 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27	06:42 16:38	06:58 16:15		
8	07:34 16:32	07:08 17:14	06:23 17:52	06:26 19:32	05:37 20:08	05:10 20:40	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	06:43 16:36	06:58 16:15		
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40	05:19 20:44	05:50 20:14	06:27 19:20	07:03 18:23	06:45 16:35	06:58 16:15		
10	07:33 16:34	07:05 17:16	06:19 17:55	06:22 19:34	05:34 20:11	05:10 20:44	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	06:46 16:34	06:58 16:15		
11	07:33 16:36	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:10 20:42	05:20 20:43	05:53 20:11	06:29 19:16	07:06 18:20	06:47 16:32	06:58 16:15		
12	07:33 16:37	07:03 17:19	06:16 17:58	06:18 19:37	05:32 20:13	05:10 20:42	05:21 20:43	05:54 20:10	06:31 19:14	07:07 18:18	06:49 16:31	06:58 16:15		
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	05:09 20:43	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:16	06:50 16:31	06:58 16:15		
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	05:30 20:15	05:09 20:43	05:23 20:42	05:56 20:07	06:33 19:10	07:10 18:15	06:51 16:29	06:58 16:15		
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:16	05:09 20:44	05:23 20:41	05:57 20:05	06:34 19:09	07:11 18:13	06:53 16:28	06:58 16:15		
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	05:09 20:44	05:24 20:40	05:58 20:04	06:35 19:07	07:12 18:11	06:54 16:27	06:58 16:16		
17	07:30 16:43	06:55 17:26	06:07 18:04	06:10 19:43	05:26 20:19	05:09 20:45	05:25 20:40	06:00 20:02	06:36 19:05	07:14 18:09	06:55 16:26	06:58 16:16		
18	07:29 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:01	06:38 19:03	07:15 18:08	06:57 16:25	06:58 16:16		
19	07:29 16:46	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:09 20:45	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:59 16:25	06:58 16:17		
20	07:28 16:47	06:50 17:31	06:01 18:08	06:05 19:47	05:23 20:22	05:10 20:46	05:28 20:37	06:03 19:56	06:40 18:59	07:17 18:04	06:59 16:24	06:58 16:17		
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46	05:29 20:36	06:04 19:54	06:41 18:57	07:19 18:03	07:01 16:23	06:58 16:17		
22	07:27 16:50	06:47 17:33	05:57 18:10	06:01 19:50	05:21 20:24	05:10 20:46	05:30 20:36	06:06 19:52	06:42 18:55	07:20 18:01	07:02 16:22	06:58 16:18		
23	07:26 16:51	06:46 17:35	05:55 18:12	06:00 19:51	05:20 20:25	05:10 20:46	05:31 20:35	06:07 19:51	06:44 18:53	07:21 17:59	07:03 16:21	06:58 16:18		
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:26	05:10 20:47	05:32 20:34	06:08 19:49	06:45 18:51	07:23 17:58	07:05 16:21	06:58 16:19		
25	07:24 16:54	06:42 17:37	05:52 18:14	05:56 19:53	05:18 20:27	05:11 20:47	05:33 20:33	06:09 19:47	06:46 18:50	07:24 17:58	07:06 16:20	06:58 16:20		
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	05:18 20:28	05:11 20:47	05:34 20:32	06:10 19:45	06:47 18:48	07:25 17:55	07:07 16:19	06:58 16:20		
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	05:11 20:47	05:35 20:31	06:12 19:44	06:48 18:46	07:26 17:53	07:08 16:19	06:58 16:21		
28	07:21 16:58	06:37 17:42	05:46 18:18	05:52 19:57	05:16 20:30	05:12 20:47	05:37 20:30	06:13 19:42	06:50 18:44	07:27 17:52	07:10 16:18	06:58 16:22		
29	07:20 16:59	06:36 17:43	05:45 18:19	05:51 19:58	05:15 20:31	05:12 20:47	05:38 20:28	06:14 19:40	06:51 18:42	07:28 17:51	07:11 16:18	06:58 16:22		
30	07:19 17:01	06:35 17:44	05:44 18:21	05:50 20:00	05:14 20:32	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	07:29 17:50	07:12 16:17	06:58 16:23		
31	07:18 17:02	06:34 17:45	05:43 18:22	05:49 20:01	05:13 20:33	05:14 20:48	05:40 20:26	06:16 19:36	06:53 18:40	07:30 17:50	07:13 16:17	06:58 16:24		
Potential sun hours	286	291	290	369	380	-285	-254	-272	4	376	341	288	16	274
Total, worst case			290										16	
Sun reduction			0.45										0.35	
Oper. time red.			0.91										0.91	
Wind dir. red.			0.60										0.60	
Total reduction			0.25										0.19	
Total, real			72										3	

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

Day in month	Sun rise (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:

060119 Marble River

Description:

Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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US-RIVERSIDE, CA 92506

Calculated:

01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 189 - 189

Assumptions for shadow calculations

Maximum distance for influence

1,000 m

Minimum sun height over horizon for influence

3 °

Day step for calculation

1 days

Time step for calculation

2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Table with columns for months (January to December) and rows for days (1 to 31). Each cell contains sun rise and set times, and a table of directional shadow probabilities (N, NE, E, SE, S, SW, W, NW, Sum). Summary rows at the bottom show total sun hours and various reductions.

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

Matrix with columns: 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: 060119 Marble River

Description: Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated: 01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 231 - 231

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Calendar grid showing months from January to December with columns for time slots (e.g., 07:35, 16:25) and numerical values representing shadow calculations. Includes summary rows at the bottom for 'Potential sun hours', 'Total, worst case', and various reduction factors.

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 (WTG causing flicker first time)
Last time (hh:mm) with flicker (WTG causing flicker last time)

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/23/06 17:18 / 33
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US-RIVERSIDE, CA 92506
Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 234 - 234

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:35	07:17	07:57 (11) 06:36	05:39	05:47	05:14
	16:25	17:04	26 08:23 (11) 17:43	18:23	20:00	20:34
2	07:35	07:16	07:58 (11) 06:34	05:37	05:46	05:13
	16:26	17:05	26 08:24 (11) 17:44	18:24	20:01	20:35
3	07:35	07:15	07:58 (11) 06:32	05:35	05:44	05:13
	16:27	17:06	24 08:22 (11) 17:46	18:26	20:02	20:36
4	07:35	07:13	07:59 (11) 06:30	05:33	05:43	05:12
	16:28	17:08	22 08:21 (11) 17:47	18:27	20:03	20:37
5	07:34	07:12	08:02 (11) 06:29	06:31	05:41	05:12
	16:29	17:09	18 08:20 (11) 17:48	19:28	20:05	20:38
6	07:34	07:11	08:03 (11) 06:27	06:29	05:40	05:11
	16:30	17:11	16 08:19 (11) 17:50	19:30	20:06	20:38
7	07:34	07:10	08:05 (11) 06:25	06:28	05:38	05:11
	16:31	17:12	10 08:15 (11) 17:51	19:31	20:07	20:39
8	07:34	07:08	06:23	06:50 (10) 06:26	05:37	05:11
	16:32	17:14	17:52	8 06:58 (10) 19:32	20:08	20:40
9	07:34	07:07	06:21	16 06:46 (10) 06:24	05:36	05:10
	16:33	17:15	17:54	16 07:02 (10) 19:33	20:09	20:40
10	07:33	08:03 (11) 07:06	06:20	20 06:44 (10) 06:22	05:35	05:10
	16:35	4 08:07 (11) 17:16	17:55	20 07:04 (10) 19:35	20:11	20:41
11	07:33	08:01 (11) 07:04	06:18	24 06:42 (10) 06:20	05:33	05:10
	16:36	8 08:09 (11) 17:18	17:56	24 07:06 (10) 19:36	20:12	20:42
12	07:33	07:58 (11) 07:03	06:16	26 06:40 (10) 06:19	05:32	05:10
	16:37	12 08:10 (11) 17:19	17:58	26 07:06 (10) 19:37	20:13	20:42
13	07:32	07:58 (11) 07:01	06:14	28 06:38 (10) 06:17	05:31	05:09
	16:38	16 08:14 (11) 17:21	17:59	28 07:06 (10) 19:38	20:14	20:43
14	07:32	07:57 (11) 07:00	06:12	32 06:36 (10) 06:15	05:30	05:09
	16:39	18 08:15 (11) 17:22	18:00	32 07:08 (10) 19:40	20:15	20:43
15	07:31	07:57 (11) 06:58	06:10	34 06:37 (10) 06:13	05:28	05:09
	16:41	20 08:17 (11) 17:24	18:02	32 07:09 (10) 19:41	20:17	20:44
16	07:31	07:56 (11) 06:57	06:08	32 06:37 (10) 06:11	05:27	05:09
	16:42	20 08:16 (11) 17:25	18:03	32 07:09 (10) 19:42	20:18	20:44
17	07:30	07:55 (11) 06:55	06:07	34 06:35 (10) 06:10	05:26	05:09
	16:43	22 08:17 (11) 17:26	18:04	34 07:09 (10) 19:43	20:19	20:45
18	07:30	07:55 (11) 06:54	06:05	32 06:35 (10) 06:08	05:25	05:09
	16:44	24 08:19 (11) 17:28	18:05	32 07:07 (10) 19:45	20:20	20:45
19	07:29	07:54 (11) 06:52	06:03	32 06:35 (10) 06:06	05:24	05:09
	16:46	26 08:20 (11) 17:29	18:07	32 07:07 (10) 19:46	20:21	20:45
20	07:28	07:55 (11) 06:51	06:01	32 06:35 (10) 06:05	05:23	05:10
	16:47	26 08:21 (11) 17:31	18:08	32 07:07 (10) 19:47	20:22	20:46
21	07:27	07:54 (11) 06:49	05:59	30 06:35 (10) 06:03	05:22	05:10
	16:48	28 08:22 (11) 17:32	18:09	30 07:05 (10) 19:48	20:23	20:46
22	07:27	07:55 (11) 06:47	05:57	30 06:35 (10) 06:01	05:21	05:10
	16:50	26 08:21 (11) 17:33	18:11	30 07:05 (10) 19:50	20:24	20:46
23	07:26	07:55 (11) 06:46	05:55	28 06:36 (10) 06:00	05:20	05:10
	16:51	28 08:23 (11) 17:35	18:12	28 07:04 (10) 19:51	20:25	20:46
24	07:25	07:54 (11) 06:44	05:54	26 06:36 (10) 05:58	05:19	05:10
	16:52	30 08:24 (11) 17:36	18:13	26 07:02 (10) 19:52	20:26	20:47
25	07:24	07:55 (11) 06:42	05:52	22 06:38 (10) 05:56	05:19	05:11
	16:54	28 08:23 (11) 17:38	18:14	22 07:00 (10) 19:53	20:28	20:47
26	07:23	07:56 (11) 06:41	05:50	20 06:38 (10) 05:55	05:18	05:11
	16:55	28 08:24 (11) 17:39	18:16	20 06:58 (10) 19:55	20:29	20:47
27	07:22	07:55 (11) 06:39	05:48	16 06:40 (10) 05:53	05:17	05:12
	16:57	30 08:25 (11) 17:40	18:17	16 06:56 (10) 19:56	20:30	20:47
28	07:21	07:56 (11) 06:37	05:46	8 06:44 (10) 05:52	05:16	05:12
	16:58	28 08:24 (11) 17:42	18:18	8 06:52 (10) 19:57	20:30	20:47
29	07:20	07:56 (11) 06:36	05:44	05:50	05:16	05:12
	16:59	28 08:24 (11) 17:43	18:19	19:58	20:31	20:47
30	07:19	07:55 (11) 06:35	05:42	05:49	05:15	05:13
	17:01	28 08:23 (11) 17:44	18:21	20:00	20:32	20:47
31	07:18	07:56 (11) 06:34	05:40	05:48	05:14	05:13
	17:02	28 08:24 (11) 17:45	18:22	20:01	20:33	20:47
Potential sun hours	286	291	369	380	-285	-254
Total, worst case	506	142	528			
Sun reduction	0.45	0.45	0.50			
Oper. time red.	0.91	0.91	0.91			
Wind dir. red.	0.66	0.66	0.63			
Total reduction	0.27	0.27	0.28			
Total, real	136	38	150			

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 234 - 234

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	06:18 19:35	06:53 18:38	07:19 (10) 16:34	07:13 16:17
2	05:14 20:47	05:42 20:24	06:19 19:33	06:55 18:36	07:20 (10) 16:44	07:14 16:17
3	05:15 20:46	05:43 20:22	06:20 19:31	06:56 18:35	07:21 (10) 16:43	07:16 16:16
4	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:33	07:22 (10) 16:42	07:17 16:16
5	05:16 20:46	05:46 20:20	06:22 19:27	06:58 18:31	07:24 (10) 16:40	07:18 16:16
6	05:16 20:46	05:47 20:19	06:23 19:26	07:00 18:29	06:41 16:39	07:19 16:15
7	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27	06:42 16:38	07:20 16:15
8	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	06:43 16:36	07:21 16:15
9	05:19 20:45	05:50 20:14	06:27 19:20	07:03 18:24	06:45 16:35	07:22 16:15
10	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	06:46 16:34	07:23 16:15
11	05:20 20:44	05:53 20:11	06:29 19:16	07:06 18:20	06:47 16:33	07:24 16:15
12	05:21 20:43	05:54 20:10	06:31 19:14	07:07 18:18	06:49 16:32	07:25 16:15
13	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:16	06:50 16:31	07:25 16:15
14	05:23 20:42	05:56 20:07	06:33 19:11	07:10 18:15	06:52 16:30	07:26 16:15
15	05:24 20:41	05:57 20:05	06:34 19:09	07:11 18:13	06:53 16:28	07:27 16:15
16	05:24 20:41	05:59 20:04	06:35 19:07	07:12 18:11	06:54 16:27	07:28 16:16
17	05:25 20:40	06:00 20:02	06:37 19:05	07:14 18:09	06:56 16:27	07:28 16:16
18	05:26 20:39	06:01 20:01	06:38 19:03	07:15 18:08	06:57 16:26	07:29 16:16
19	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:25	07:30 16:17
20	05:28 20:37	06:03 19:56	06:40 18:59	07:18 18:04	07:00 16:24	07:30 16:17
21	05:29 20:37	06:04 19:54	06:41 18:57	07:19 18:03	07:01 16:23	07:31 16:18
22	05:30 20:36	06:06 19:52	06:43 18:55	07:20 18:01	07:02 16:22	07:31 16:18
23	05:31 20:35	06:07 19:51	06:44 18:53	07:22 17:59	07:03 16:21	07:32 16:19
24	05:32 20:34	06:08 19:49	06:45 18:52	07:23 17:58	07:05 16:21	07:32 16:19
25	05:33 20:33	06:09 19:47	06:46 18:50	07:24 17:56	07:06 16:20	07:33 16:20
26	05:34 20:32	06:10 19:45	06:47 18:48	07:25 17:55	07:07 16:19	07:35 16:20
27	05:36 20:31	06:12 19:44	06:49 18:46	07:27 17:53	07:09 16:19	07:36 16:21
28	05:37 20:30	06:13 19:42	06:50 18:44	07:28 17:52	07:10 16:18	07:37 16:22
29	05:38 20:28	06:14 19:40	06:51 18:42	07:29 17:50	07:11 16:18	07:39 16:23
30	05:39 20:27	06:15 19:38	06:52 18:40	07:30 17:49	07:12 16:17	07:40 16:23
31	05:40 20:26	06:16 19:37		06:32 16:47		07:34 16:24
Potential sun hours	-272	4	376	341	288	274
Total, worst case			434	106	640	12
Sun reduction			0.55	0.45	0.35	0.35
Oper. time red.			0.91	0.91	0.91	0.91
Wind dir. red.			0.63	0.63	0.66	0.66
Total reduction			0.31	0.26	0.21	0.21
Total, real			136	27	134	3

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 17:18 / 35
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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 235 - 235

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:35	08:05 (11) 07:17	06:36	07:06 (10) 05:39	05:47	05:14
	16:25 28	08:33 (11) 17:04	17:43	32 07:38 (10) 18:23	20:00	20:34 52
2	07:35	08:07 (11) 07:16	06:34	07:06 (10) 05:37	05:46	05:13
	16:26 26	08:33 (11) 17:05	17:44	30 07:36 (10) 18:24	20:01	20:35 52
3	07:35	08:07 (11) 07:15	06:32	07:07 (10) 05:35	05:44	05:13
	16:27 28	08:35 (11) 17:06	17:46	30 07:37 (10) 18:26	20:02	20:36 50
4	07:35	08:07 (11) 07:13	06:30	07:05 (10) 05:33	05:43	05:12
	16:28 28	08:35 (11) 17:08	17:47	32 07:37 (10) 18:27	20:03	20:37 52
5	07:34	08:07 (11) 07:12	06:29	07:07 (10) 06:31	05:41	05:12
	16:29 28	08:35 (11) 17:09	17:48	28 07:35 (10) 19:28	20:05	20:38 52
6	07:34	08:09 (11) 07:11	06:27	07:07 (10) 06:29	05:40	05:11
	16:30 26	08:35 (11) 17:11	17:50	28 07:35 (10) 19:30	20:06	20:38 52
7	07:34	08:08 (11) 07:10	06:25	07:07 (10) 06:28	05:38	06:16 (19) 05:11
	16:31 28	08:36 (11) 17:12	17:51	26 07:33 (10) 19:31	20:07	14 06:30 (19) 20:39 50
8	07:34	08:08 (11) 07:08	06:23	07:08 (10) 06:26	05:37	06:13 (19) 05:11
	16:32 28	08:36 (11) 17:14	17:52	24 07:32 (10) 19:32	20:08	20 06:33 (19) 20:40 52
9	07:34	08:10 (11) 07:07	06:21	07:10 (10) 06:24	05:36	06:09 (19) 05:10
	16:33 26	08:36 (11) 17:15	17:54	20 07:30 (10) 19:33	20:09	26 06:35 (19) 20:40 52
10	07:33	08:09 (11) 07:06	06:20	07:12 (10) 06:22	05:35	06:08 (19) 05:10
	16:34 28	08:37 (11) 17:16	17:55	16 07:28 (10) 19:35	20:11	28 06:36 (19) 20:41 52
11	07:33	08:11 (11) 07:04	06:18	07:14 (10) 06:20	05:33	06:07 (19) 05:10
	16:36 26	08:37 (11) 17:18	17:56	10 07:24 (10) 19:36	20:12	30 06:37 (19) 20:42 50
12	07:33	08:10 (11) 07:03	06:16	06:19	05:32	06:04 (19) 05:10
	16:37 26	08:36 (11) 17:19	17:58	19:37	20:13	36 06:40 (19) 20:42 50
13	07:32	08:12 (11) 07:01	06:14	06:17	05:31	06:03 (19) 05:09
	16:38 26	08:38 (11) 17:21	17:59	19:38	20:14	38 06:41 (19) 20:43 50
14	07:32	08:11 (11) 07:00	06:12	06:15	05:30	06:04 (19) 05:09
	16:39 26	08:37 (11) 17:22	18:00	19:40	20:15	38 06:42 (19) 20:43 50
15	07:31	08:13 (11) 06:58	06:10	06:13	05:28	06:03 (19) 05:09
	16:40 24	08:37 (11) 17:24	18:02	19:41	20:17	40 06:43 (19) 20:44 52
16	07:31	08:14 (11) 06:57	06:08	06:11	05:27	06:02 (19) 05:09
	16:42 24	08:38 (11) 17:25	18:03	19:42	20:18	42 06:44 (19) 20:44 52
17	07:30	08:15 (11) 06:55	06:07	06:10	05:26	06:00 (19) 05:09
	16:43 22	08:37 (11) 17:26	18:04	19:43	20:19	42 06:42 (19) 20:45 52
18	07:30	08:15 (11) 06:54	06:05	06:08	05:25	06:00 (19) 05:09
	16:44 22	08:37 (11) 17:28	18:05	19:45	20:20	44 06:44 (19) 20:45 52
19	07:29	08:16 (11) 06:52	07:21 (10) 06:03	06:06	05:24	05:59 (19) 05:09
	16:46 20	08:36 (11) 17:29	4 07:25 (10) 18:07	19:46	20:21	46 06:45 (19) 20:45 52
20	07:28	08:17 (11) 06:51	07:16 (10) 06:01	06:05	05:23	06:00 (19) 05:10
	16:47 18	08:35 (11) 17:31	14 07:30 (10) 18:08	19:47	20:22	46 06:46 (19) 20:46 52
21	07:27	08:18 (11) 06:49	07:14 (10) 05:59	06:03	05:22	05:59 (19) 05:10
	16:48 16	08:34 (11) 17:32	18 07:32 (10) 18:09	19:48	20:23	46 06:45 (19) 20:46 52
22	07:27	08:21 (11) 06:47	07:12 (10) 05:57	06:01	05:21	05:58 (19) 05:10
	16:50 12	08:33 (11) 17:33	22 07:34 (10) 18:11	19:50	20:24	48 06:46 (19) 20:46 52
23	07:26	08:25 (11) 06:46	07:11 (10) 05:55	06:00	05:20	05:57 (19) 05:10
	16:51 6	08:31 (11) 17:35	24 07:35 (10) 18:12	19:51	20:25	50 06:47 (19) 20:46 52
24	07:25	06:44	07:09 (10) 05:54	05:58	05:19	05:58 (19) 05:10
	16:52	17:36 28	07:37 (10) 18:13	19:52	20:26	48 06:46 (19) 20:47 52
25	07:24	06:42	07:07 (10) 05:52	05:56	05:19	05:58 (19) 05:11
	16:54	17:38 30	07:37 (10) 18:14	19:53	20:28	50 06:48 (19) 20:47 52
26	07:23	06:41	07:07 (10) 05:50	05:55	05:18	05:57 (19) 05:11
	16:55	17:39 30	07:37 (10) 18:16	19:55	20:29	50 06:47 (19) 20:47 52
27	07:22	06:39	07:08 (10) 05:48	05:53	05:17	05:58 (19) 05:12
	16:57	17:40 30	07:38 (10) 18:17	19:56	20:30	50 06:48 (19) 20:47 52
28	07:21	06:37	07:06 (10) 05:46	05:52	05:16	05:57 (19) 05:12
	16:58	17:42 32	07:38 (10) 18:18	19:57	20:30	50 06:47 (19) 20:47 50
29	07:20		05:44	05:50	05:16	05:57 (19) 05:12
	16:59		18:19	19:58	20:31	52 06:49 (19) 20:47 50
30	07:19		05:42	05:49	05:15	05:58 (19) 05:13
	17:01		18:21	20:00	20:32	50 06:48 (19) 20:47 50
31	07:18		05:40		05:14	05:58 (19)
	17:02		18:22		20:33	50 06:48 (19)
Potential sun hours	286	291	369	380	-285	-254
Total, worst case	542	232	276	1034	1542	
Sun reduction	0.45	0.45	0.50	0.55	0.55	
Oper. time red.	0.91	0.91	0.91	0.91	0.91	
Wind dir. red.	0.68	0.62	0.62	0.55	0.55	
Total reduction	0.28	0.25	0.28	0.28	0.28	
Total, real	152	59	78	285	426	

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

Day in month	Sun rise (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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 17:18 / 36
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 235 - 235

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	06:04 (19) 20:25	05:41 34 06:49 (19)	06:18 19:35	06:53 18:38	06:34 16:46
2	05:14 20:47	06:03 (19) 20:24	05:42 30 06:48 (19)	06:19 19:33	06:55 18:36	06:35 16:44
3	05:15 20:46	06:03 (19) 20:22	05:43 28 06:47 (19)	06:20 19:31	06:56 18:35	07:51 (10) 08:03 (10)
4	05:15 20:46	06:04 (19) 20:21	05:44 24 06:44 (19)	06:21 19:29	06:57 18:33	07:48 (10) 08:06 (10)
5	05:16 20:46	06:04 (19) 20:20	05:46 18 06:41 (19)	06:22 19:27	06:58 18:31	07:46 (10) 08:08 (10)
6	05:16 20:46	06:05 (19) 20:19	05:47 12 06:38 (19)	06:23 19:26	07:00 18:29	07:45 (10) 08:09 (10)
7	05:17 20:45	06:04 (19) 20:17	05:48 19:24	06:25 18:27	07:01 18:28	07:42 (10) 08:10 (10)
8	05:18 20:45	06:04 (19) 20:16	05:49 19:22	06:26 18:25	07:02 18:28	07:41 (10) 08:09 (10)
9	05:19 20:45	06:05 (19) 20:14	05:50 19:20	06:27 18:24	07:03 18:30	07:41 (10) 08:11 (10)
10	05:19 20:44	06:06 (19) 20:13	05:51 19:18	06:28 18:22	07:05 18:30	07:40 (10) 08:10 (10)
11	05:20 20:44	06:05 (19) 20:11	05:53 19:16	06:29 18:20	07:06 18:32	07:39 (10) 08:11 (10)
12	05:21 20:43	06:05 (19) 20:10	05:54 19:14	06:31 18:18	07:07 18:32	07:39 (10) 08:11 (10)
13	05:22 20:42	06:06 (19) 20:08	05:55 19:12	06:32 18:16	07:08 18:30	07:40 (10) 08:10 (10)
14	05:23 20:42	06:05 (19) 20:07	05:56 19:11	06:33 18:15	07:10 18:30	07:39 (10) 08:09 (10)
15	05:24 20:41	06:06 (19) 20:05	05:57 19:09	06:34 18:13	07:11 18:30	07:39 (10) 08:09 (10)
16	05:24 20:41	06:07 (19) 20:04	05:59 19:07	06:35 18:11	07:12 18:28	07:40 (10) 08:08 (10)
17	05:25 20:40	06:06 (19) 20:02	06:00 19:05	06:37 18:09	07:14 18:28	07:39 (10) 08:07 (10)
18	05:26 20:39	06:07 (19) 20:01	06:01 19:03	06:38 18:08	07:15 18:26	07:41 (10) 08:07 (10)
19	05:27 20:38	06:08 (19) 19:57	06:02 19:01	06:39 18:06	07:16 18:24	07:42 (10) 08:06 (10)
20	05:28 20:37	06:08 (19) 19:56	06:03 18:59	06:40 18:04	07:18 18:20	07:44 (10) 08:04 (10)
21	05:29 20:37	06:07 (19) 19:54	06:04 18:57	06:41 18:03	07:19 18:18	07:45 (10) 08:03 (10)
22	05:30 20:36	06:08 (19) 19:52	06:06 18:55	06:43 18:01	07:20 18:10	07:48 (10) 08:10 (11)
23	05:31 20:35	06:09 (19) 19:51	06:07 18:53	06:44 17:59	07:22 18:16	07:53 (11) 08:13 (11)
24	05:32 20:34	06:08 (19) 19:49	06:08 18:52	06:45 17:58	07:23 18:22	07:52 (11) 08:14 (11)
25	05:33 20:33	06:09 (19) 19:47	06:09 18:50	06:46 16:56	07:24 16:20	07:53 (11) 08:15 (11)
26	05:34 20:32	06:10 (19) 19:45	06:10 18:48	06:47 16:55	07:25 16:19	07:53 (11) 08:17 (11)
27	05:36 20:31	06:11 (19) 19:44	06:12 18:46	06:49 16:53	07:27 16:19	07:52 (11) 08:16 (11)
28	05:37 20:30	06:12 (19) 19:42	06:13 18:44	06:50 16:52	07:28 16:18	07:51 (11) 08:17 (11)
29	05:38 20:28	06:14 (19) 19:40	06:14 18:42	06:51 16:50	07:29 16:18	07:53 (11) 08:19 (11)
30	05:39 20:27	06:13 (19) 19:38	06:15 18:40	06:52 16:49	07:30 16:17	07:52 (11) 08:18 (11)
31	05:40 20:26	06:14 (19) 19:37	06:16 16:47	06:53 16:47	07:31 16:17	07:54 (11) 16:24
Potential sun hours	-272	4	376	341	288	274
Total, worst case	1482	146	500	242	834	
Sun reduction	0.58	0.55	0.45	0.35	0.35	
Oper. time red.	0.91	0.91	0.91	0.91	0.91	
Wind dir. red.	0.55	0.55	0.62	0.68	0.68	
Total reduction	0.29	0.28	0.25	0.22	0.22	
Total, real	431	40	127	53	182	

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 17:18 / 37
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 236 - 236

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:35 16:25	07:17 17:04	28 07:47 (10) 08:15 (10)	06:36 17:43	05:39 18:23	06:25 (19) 05:47 20:00
2	07:35 16:26	07:16 17:05	28 07:48 (10) 08:16 (10)	06:34 17:44	05:37 18:24	46 06:25 (19) 07:11 (19) 20:01
3	07:35 16:27	07:15 17:06	26 07:48 (10) 08:14 (10)	06:32 17:46	05:35 18:26	46 06:25 (19) 07:09 (19) 20:02
4	07:35 16:28	07:13 17:08	26 07:47 (10) 08:15 (10)	06:30 17:47	05:33 18:27	44 06:25 (19) 07:09 (19) 20:03
5	07:34 16:29	07:12 17:09	28 07:48 (10) 08:16 (10)	06:29 17:48	06:31 19:28	42 07:25 (19) 08:07 (19) 20:05
6	07:34 16:30	07:11 17:11	26 07:49 (10) 08:15 (10)	06:27 17:50	06:29 19:30	40 07:25 (19) 08:05 (19) 20:06
7	07:34 16:31	07:10 17:12	24 07:49 (10) 08:13 (10)	06:25 17:51	06:28 19:31	40 07:26 (19) 08:06 (19) 20:07
8	07:34 16:32	07:08 17:14	24 07:50 (10) 08:14 (10)	06:23 17:52	06:26 19:32	38 07:26 (19) 08:04 (19) 20:08
9	07:34 16:33	07:07 17:15	20 07:52 (10) 08:12 (10)	06:21 17:54	06:24 19:33	34 07:28 (19) 08:02 (19) 20:09
10	07:33 16:34	07:06 17:16	18 07:53 (10) 08:11 (10)	06:20 17:55	06:22 19:35	32 07:28 (19) 08:00 (19) 20:11
11	07:33 16:36	07:04 17:18	14 07:56 (10) 08:10 (10)	06:18 17:56	06:20 19:36	28 07:30 (19) 07:58 (19) 20:12
12	07:33 16:37	07:03 17:19	8 07:58 (10) 08:06 (10)	06:16 17:58	06:18 19:37	24 07:31 (19) 07:55 (19) 20:13
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	16 07:35 (19) 07:51 (19)	05:31 20:14
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	8 07:39 (19) 07:47 (19)	05:30 20:15
15	07:31 16:40	06:58 17:24	06:10 18:02	06:47 (19) 06:59 (19)	06:13 19:41	05:28 20:17
16	07:31 16:42	06:57 17:25	06:08 18:03	06:43 (19) 07:03 (19)	06:11 19:42	05:27 20:18
17	07:30 16:43	06:55 17:26	06:07 18:04	06:39 (19) 07:05 (19)	06:10 19:43	05:26 20:19
18	07:30 16:44	06:54 17:28	06:05 18:05	06:37 (19) 07:07 (19)	06:08 19:45	05:25 20:20
19	07:29 16:46	06:52 17:29	06:03 18:07	06:35 (19) 07:09 (19)	06:06 19:46	05:24 20:21
20	07:28 16:47	06:51 17:31	06:01 18:08	06:33 (19) 07:09 (19)	06:05 19:47	05:23 20:22
21	07:27 16:48	06:49 17:32	05:59 18:09	06:31 (19) 07:11 (19)	06:03 19:48	05:22 20:23
22	07:27 16:50	06:47 17:33	05:57 18:11	06:29 (19) 07:11 (19)	06:01 19:50	05:21 20:24
23	07:26 16:51	06:46 17:35	05:55 18:12	06:30 (19) 07:12 (19)	06:00 19:51	05:20 20:25
24	07:25 16:52	06:44 17:36	05:54 18:13	06:28 (19) 07:12 (19)	05:58 19:52	05:19 20:26
25	07:24 16:54	06:42 17:38	05:52 18:14	06:28 (19) 07:12 (19)	05:56 19:53	05:19 20:28
26	07:23 16:55	06:41 17:39	05:50 18:16	06:26 (19) 07:12 (19)	05:55 19:55	05:18 20:29
27	07:22 16:57	06:39 17:40	05:48 18:17	06:26 (19) 07:12 (19)	05:53 19:56	05:17 20:30
28	07:21 16:58	06:37 17:42	05:46 18:18	06:26 (19) 07:12 (19)	05:52 19:57	05:16 20:31
29	07:20 16:59	06:37 17:42	05:44 18:19	06:24 (19) 07:12 (19)	05:50 19:58	05:16 20:31
30	07:19 17:01	06:37 17:42	05:42 18:21	06:24 (19) 07:12 (19)	05:49 20:00	05:15 20:32
31	07:18 17:02	06:37 17:42	05:40 18:22	06:25 (19) 07:11 (19)	05:48 19:59	05:14 20:33
Potential sun hours	286	291	369	380	482	-254
Total, worst case	250	272	650	482		
Sun reduction	0.45	0.45	0.50	0.55		
Oper. time red.	0.91	0.91	0.91	0.91		
Wind dir. red.	0.65	0.65	0.62	0.62		
Total reduction	0.26	0.26	0.28	0.31		
Total, real	66	72	185	151		

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 17:18 / 38
Licensed user:
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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 236 - 236

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	06:18 19:35	07:30 (19) 18:38	06:53 18:46	07:23 (10) 16:17
2	05:14 20:47	05:42 20:24	06:19 19:33	07:27 (19) 18:36	06:55 18:44	07:20 (10) 16:17
3	05:15 20:46	05:43 20:22	06:20 19:31	07:26 (19) 18:35	06:56 18:43	07:20 (10) 16:16
4	05:15 20:46	05:44 20:21	06:21 19:29	07:23 (19) 18:33	06:57 18:42	07:19 (10) 16:16
5	05:16 20:46	05:46 20:20	06:22 19:27	07:22 (19) 18:31	06:58 18:40	07:19 (10) 16:16
6	05:16 20:46	05:47 20:19	06:23 19:26	07:21 (19) 18:29	07:00 18:39	07:18 (10) 16:15
7	05:17 20:45	05:48 20:17	06:25 19:24	07:20 (19) 18:27	07:01 18:38	07:18 (10) 16:15
8	05:18 20:45	05:49 20:16	06:26 19:22	07:20 (19) 18:25	07:02 18:36	07:17 (10) 16:15
9	05:19 20:45	05:50 20:14	06:27 19:20	07:19 (19) 18:24	07:03 18:35	07:19 (10) 16:15
10	05:19 20:44	05:51 20:13	06:28 19:18	07:18 (19) 18:22	07:05 18:34	07:18 (10) 16:15
11	05:20 20:44	05:53 20:11	06:29 19:16	07:17 (19) 18:20	07:06 18:33	07:17 (10) 16:15
12	05:21 20:43	05:54 20:10	06:31 19:14	07:16 (19) 18:18	07:07 18:32	07:19 (10) 16:15
13	05:22 20:42	05:55 20:08	06:32 19:12	07:15 (19) 18:16	07:08 18:31	07:18 (10) 16:15
14	05:23 20:42	05:56 20:07	06:33 19:11	07:14 (19) 18:15	07:10 18:30	07:20 (10) 16:15
15	05:24 20:41	05:57 20:05	06:34 19:09	07:16 (19) 18:13	07:11 18:28	07:21 (10) 16:15
16	05:24 20:41	05:59 20:04	06:35 19:07	07:15 (19) 18:11	07:12 18:27	07:21 (10) 16:16
17	05:25 20:40	06:00 20:02	06:37 19:05	07:14 (19) 18:09	07:14 18:26	07:22 (10) 16:16
18	05:26 20:39	06:01 20:01	06:38 19:03	07:15 (19) 18:08	07:15 18:25	07:24 (10) 16:16
19	05:27 20:38	06:02 19:57	06:39 19:01	07:14 (19) 18:06	07:16 18:24	07:25 (10) 16:17
20	05:28 20:37	06:03 19:56	06:40 18:59	07:15 (19) 18:04	07:18 18:23	07:26 (10) 16:17
21	05:29 20:37	06:04 19:54	06:41 18:57	07:17 (19) 18:03	07:19 18:22	07:28 (10) 16:18
22	05:30 20:36	06:06 19:52	06:43 18:55	07:16 (19) 18:01	07:20 18:21	07:31 (10) 16:18
23	05:31 20:35	06:07 19:51	06:44 18:53	07:17 (19) 17:59	07:22 18:20	07:32 (10) 16:19
24	05:32 20:34	06:08 19:49	06:45 18:52	07:18 (19) 17:58	07:23 18:19	07:32 (10) 16:19
25	05:33 20:33	06:09 19:47	06:46 18:50	07:19 (19) 17:56	06:24 18:18	07:33 (10) 16:20
26	05:34 20:32	06:10 19:45	06:47 18:48	07:21 (19) 17:55	06:26 18:17	07:33 (10) 16:20
27	05:36 20:31	06:12 19:44	06:49 18:46	07:24 (19) 17:53	06:27 18:16	07:33 (10) 16:21
28	05:37 20:30	06:13 19:42	06:50 18:44	07:27 (19) 17:52	06:28 18:15	07:34 (10) 16:22
29	05:38 20:28	06:14 19:40	06:51 18:42	07:38 (19) 17:50	06:30 18:14	07:34 (10) 16:23
30	05:39 20:27	06:15 19:38	06:52 18:40	07:33 (19) 17:49	06:32 18:13	07:34 (10) 16:23
31	05:40 20:26	06:16 19:37	06:53 19:37	07:31 (19) 17:47	06:34 18:12	07:34 (10) 16:24
Potential sun hours	-272	4	376	341	288	274
Total, worst case		52	1102	26	508	
Sun reduction		0.55	0.55	0.45	0.35	
Oper. time red.		0.91	0.91	0.91	0.91	
Wind dir. red.		0.62	0.62	0.65	0.65	
Total reduction		0.31	0.31	0.26	0.21	
Total, real		16	344	7	105	

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)
	Minutes with flicker		

Project: 060119 Marble River	Description: Marble River Wind Project Shadow-Flicker, MidW part 2 27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)	Printed/Page: 01/23/06 17:18 / 39 Licensed user: Wind Engineers, Inc. 7660 Whitegate Avenue US-RIVERSIDE, CA 92506 Calculated: 01/23/06 12:24/2.4.0.67
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SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 237 - 237

Assumptions for shadow calculations

Maximum distance for influence	1,000 m	Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Minimum sun height over horizon for influence	3 °	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Day step for calculation	1 days	0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
Time step for calculation	2 minutes	Operational time
		N NE E SE S SW W NW Sum
		1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:35 16:25	07:17 17:04	06:36 17:43	05:39 18:23	05:47 20:00	05:14 20:34	05:13 20:47	05:41 20:25	06:18 19:35	06:40 (19) 06:54 (19)	06:53 18:38	06:34 16:46	07:13 16:17
2	07:35 16:26	07:16 17:05	06:34 17:44	05:37 18:25	05:46 20:01	05:13 20:35	05:14 20:47	05:42 20:24	06:19 19:33	06:41 (19) 06:51 (19)	06:55 18:36	06:35 16:44	07:14 16:17
3	07:35 16:27	07:15 17:06	06:32 17:46	05:35 18:26	05:44 20:02	05:13 20:36	05:15 20:46	05:43 20:22	06:20 19:31		06:56 18:35	06:36 16:43	07:16 16:16
4	07:35 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	05:12 20:37	05:15 20:46	05:44 20:21	06:21 19:29		06:57 18:33	06:38 16:42	07:17 16:16
5	07:34 16:29	07:12 17:09	06:29 17:48	06:31 19:28	05:41 20:05	05:12 20:38	05:16 20:46	05:46 20:20	06:22 19:27		06:58 18:31	06:39 16:40	07:18 16:16
6	07:34 16:30	07:11 17:11	06:27 17:50	06:29 19:30	05:40 20:06	05:11 20:38	05:16 20:46	05:47 20:19	06:24 19:26		07:00 18:29	06:41 16:39	07:19 16:15
7	07:34 16:31	07:10 17:12	06:25 17:51	06:28 19:31	05:39 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:25 19:24		07:01 18:27	06:42 16:38	07:20 16:15
8	07:34 16:32	07:08 17:14	06:23 17:52	06:26 19:32	05:37 20:08	05:11 20:40	05:18 20:45	05:49 20:16	06:26 19:22		07:02 18:25	06:43 16:36	07:21 16:15
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:10	05:10 20:40	05:19 20:45	05:50 20:14	06:27 19:20		07:03 18:24	06:45 16:35	07:22 16:15
10	07:33 16:35	07:06 17:16	06:20 17:55	06:22 19:35	06:42 (19) 05:35	05:10 20:11	05:19 20:44	05:51 20:13	06:28 19:18		07:05 18:22	06:46 16:34	07:23 16:15
11	07:33 16:36	07:04 17:18	06:18 17:56	06:20 19:36	06:40 (19) 05:33	05:10 20:12	05:20 20:44	05:53 20:11	06:29 19:16		07:06 18:20	06:47 16:33	07:24 16:15
12	07:33 16:37	07:03 17:19	06:16 17:58	06:19 19:37	06:39 (19) 05:32	05:10 20:13	05:21 20:43	05:54 20:10	06:31 19:14		07:07 18:18	06:49 16:32	07:25 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	06:37 (19) 05:31	05:10 20:14	05:22 20:42	05:55 20:08	06:32 19:12		07:08 18:16	06:50 16:31	07:25 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	06:35 (19) 05:30	05:09 20:15	05:23 20:42	05:56 20:07	06:33 19:11		07:10 18:15	06:52 16:30	07:26 16:15
15	07:31 16:41	06:58 17:24	06:10 18:02	06:13 19:41	06:33 (19) 05:28	05:09 20:17	05:24 20:41	05:57 20:05	06:34 19:09		07:11 18:13	06:53 16:29	07:27 16:16
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	06:34 (19) 05:27	05:09 20:18	05:24 20:41	05:59 20:04	06:35 19:07		07:12 18:11	06:54 16:28	07:28 16:16
17	07:30 16:43	06:55 17:26	06:07 18:04	06:10 19:43	06:34 (19) 05:26	05:09 20:19	05:25 20:40	06:00 20:02	06:37 19:05		07:14 18:09	06:56 16:27	07:28 16:16
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 19:45	06:32 (19) 05:25	05:09 20:20	05:26 20:39	06:01 20:01	06:38 19:03	06:46 (19) 06:52 (19)	07:15 18:08	06:57 16:26	07:29 16:16
19	07:29 16:46	06:52 17:29	06:03 18:07	06:06 19:46	06:33 (19) 05:24	05:09 20:21	05:27 20:38	06:02 19:57	06:39 19:01		07:16 18:06	06:58 16:25	07:30 16:17
20	07:28 16:47	06:51 17:31	06:01 18:08	06:05 19:47	06:33 (19) 05:23	05:10 20:22	05:28 20:37	06:03 19:56	06:42 (19) 18:59	06:43 (19) 06:56 (19)	07:18 18:04	07:00 16:24	07:30 16:17
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	06:33 (19) 05:22	05:10 20:23	05:29 20:37	06:04 19:54	06:39 (19) 18:57	06:41 (19) 06:57 (19)	07:19 18:03	07:01 16:23	07:31 16:18
22	07:27 16:50	06:47 17:33	05:57 18:11	06:01 19:50	06:36 (19) 05:21	05:10 20:24	05:30 20:36	06:06 19:52	06:38 (19) 18:55	06:43 (19) 06:58 (19)	07:20 18:01	07:02 16:22	07:31 16:18
23	07:26 16:51	06:46 17:35	05:55 18:12	06:00 19:51	06:36 (19) 05:20	05:10 20:25	05:31 20:35	06:07 19:51	06:37 (19) 18:53	06:44 (19) 06:59 (19)	07:22 17:59	07:04 16:21	07:32 16:19
24	07:25 16:52	06:44 17:36	05:54 18:13	05:58 19:52	06:39 (19) 05:19	05:11 20:27	05:32 20:34	06:08 19:49	06:36 (19) 18:52	06:45 (19) 06:58 (19)	07:23 17:58	07:05 16:21	07:32 16:19
25	07:24 16:54	06:42 17:38	05:52 18:14	05:56 19:53	06:41 (19) 05:19	05:11 20:28	05:33 20:33	06:09 19:47	06:36 (19) 18:50	06:46 (19) 07:00 (19)	07:24 17:58	07:06 16:20	07:33 16:20
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	06:45 (19) 05:18	05:11 20:29	05:34 20:32	06:10 19:45	06:37 (19) 18:48	06:47 (19) 06:59 (19)	07:25 17:55	07:07 16:19	07:33 16:20
27	07:22 16:57	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:30	05:12 20:47	05:36 20:31	06:12 19:44	06:36 (19) 18:46	06:49 (19) 06:58 (19)	07:27 18:42	07:09 16:19	07:33 16:21
28	07:21 16:58	06:37 17:42	05:46 18:18	05:52 19:57	05:16 20:31	05:12 20:47	05:37 20:30	06:13 19:42	06:35 (19) 18:44	06:50 (19) 06:57 (19)	07:28 18:42	07:10 16:18	07:34 16:22
29	07:20 16:59		05:44 18:19	05:50 19:58	05:16 20:31	05:12 20:47	05:38 20:29	06:14 19:40	06:36 (19) 18:42	06:51 (19) 06:58 (19)	07:29 18:42	07:11 16:18	07:34 16:23
30	07:19 17:01		05:42 18:21	05:49 20:00	05:15 20:32	05:13 20:47	05:39 20:27	06:15 19:38	06:37 (19) 18:40	06:52 (19) 18:40	07:30 18:40	07:12 16:17	07:34 16:23
31	07:18 17:02		05:40 18:22		05:14 20:33	05:14 20:26	05:40 20:26	06:16 19:37	06:38 (19) 16	06:54 (19)	07:31 16:47	07:13 16:24	07:34 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376		341	288	274
Total, worst case				282				260	24				
Sun reduction				0.55				0.55	0.55				
Oper. time red.				0.91				0.91	0.91				
Wind dir. red.				0.60				0.60	0.60				
Total reduction				0.30				0.30	0.30				
Total, real				84				77	7				

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)

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 238 - 238

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes
 Sun shine probabilities (part of time from sun rise to sun set with sun shine)
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
 Operational time
 N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June			
1	07:34	08:31 (14)	07:17	06:36	07:08 (11)	05:39	05:47	06:26 (10)	05:14
	16:25	6 08:37 (14)	17:04	17:43	34 07:42 (11)	18:23	20:00	32 06:58 (10)	20:34
2	07:35	08:33 (14)	07:16	06:34	07:08 (11)	05:37	05:46	06:25 (10)	05:13
	16:26	4 08:37 (14)	17:05	17:44	34 07:42 (11)	18:24	20:01	32 06:57 (10)	20:35
3	07:35		07:15	06:32	07:09 (11)	05:35	05:44	06:25 (10)	05:13
	16:27		17:06	17:46	32 07:41 (11)	18:26	20:02	32 06:57 (10)	20:36
4	07:35		07:13	06:30	07:09 (11)	05:33	05:43	06:26 (10)	05:12
	16:28		17:08	17:47	32 07:41 (11)	18:27	20:03	30 06:56 (10)	20:37
5	07:34		07:12	06:29	07:09 (11)	06:31	05:41	06:27 (10)	05:12
	16:29		17:09	17:48	30 07:39 (11)	19:28	20:05	28 06:55 (10)	20:38
6	07:34		07:11	06:27	07:09 (11)	06:29	05:40	06:27 (10)	05:11
	16:30		17:11	17:50	30 07:39 (11)	19:30	20:06	26 06:53 (10)	20:38
7	07:34		07:10	06:25	07:11 (11)	06:28	05:38	06:30 (10)	05:11
	16:31		17:12	17:51	26 07:37 (11)	19:31	20:07	22 06:52 (10)	20:39
8	07:34		07:08	06:23	07:12 (11)	06:26	05:37	06:31 (10)	05:11
	16:32		17:14	17:52	24 07:36 (11)	19:32	20:08	20 06:51 (10)	20:40
9	07:34		07:07	06:21	07:14 (11)	06:24	05:36	06:31 (10)	05:10
	16:33		17:15	17:54	20 07:34 (11)	19:33	20:09	18 06:49 (10)	20:40
10	07:33		07:06	06:20	07:16 (11)	06:22	05:35	06:34 (10)	05:10
	16:35		17:16	17:55	16 07:32 (11)	19:35	20:11	12 06:46 (10)	20:41
11	07:33		07:04	06:18	07:18 (11)	06:20	05:33	06:37 (10)	05:10
	16:36		17:18	17:56	8 07:26 (11)	19:36	20:12	6 06:43 (10)	20:42
12	07:33		07:03	06:16		06:19	05:32		05:10
	16:37		17:19	17:58		19:37	20:13		20:42
13	07:32		07:01	06:14		06:17	05:31		05:09
	16:38		17:21	17:59		19:38	20:14		20:43
14	07:32		07:00	06:12		06:15	05:30		05:09
	16:39		17:22	18:00		19:40	20:15		20:43
15	07:31		06:58	06:10		06:13	06:37 (10)	05:28	05:09
	16:41		17:24	18:02		19:41	14 06:51 (10)	20:17	20:44
16	07:31		06:57	06:08		06:11	06:36 (10)	05:27	05:09
	16:42		17:25	18:03		19:42	18 06:54 (10)	20:18	20:44
17	07:30		06:55	06:07		06:10	06:34 (10)	05:26	05:09
	16:43		17:26	18:04		19:43	22 06:56 (10)	20:19	20:45
18	07:30		06:54	07:21 (11)	06:05	06:08	06:32 (10)	05:25	05:09
	16:44		17:28	12 07:33 (11)	18:05	19:45	24 06:56 (10)	20:20	20:45
19	07:29		06:52	07:19 (11)	06:03	06:06	06:31 (10)	05:24	05:09
	16:46		17:29	16 07:35 (11)	18:07	19:46	28 06:59 (10)	20:21	20:45
20	07:28		06:51	07:16 (11)	06:01	06:05	06:29 (10)	05:23	05:10
	16:47		17:31	22 07:38 (11)	18:08	19:47	30 06:59 (10)	20:22	20:46
21	07:27		06:49	07:14 (11)	05:59	06:03	06:27 (10)	05:22	05:10
	16:48		17:32	24 07:38 (11)	18:09	19:48	32 06:59 (10)	20:23	20:46
22	07:27		06:47	07:12 (11)	05:57	06:01	06:28 (10)	05:21	05:10
	16:50		17:33	28 07:40 (11)	18:11	19:50	32 07:00 (10)	20:24	20:46
23	07:26		06:46	07:13 (11)	05:55	06:00	06:26 (10)	05:20	05:10
	16:51		17:35	28 07:41 (11)	18:12	19:51	34 07:00 (10)	20:25	20:46
24	07:25		06:44	07:11 (11)	05:54	05:58	06:27 (10)	05:19	05:10
	16:52		17:36	30 07:41 (11)	18:13	19:52	34 07:01 (10)	20:26	20:47
25	07:24		06:42	07:11 (11)	05:52	05:56	06:25 (10)	05:19	05:11
	16:54		17:38	30 07:41 (11)	18:14	19:53	36 07:01 (10)	20:28	20:47
26	07:23		06:41	07:09 (11)	05:50	05:55	06:26 (10)	05:18	05:11
	16:55		17:39	32 07:41 (11)	18:16	19:55	34 07:00 (10)	20:29	20:47
27	07:22		06:39	07:10 (11)	05:48	05:53	06:24 (10)	05:17	05:12
	16:57		17:40	32 07:42 (11)	18:17	19:56	36 07:00 (10)	20:30	20:47
28	07:21		06:37	07:08 (11)	05:46	05:52	06:24 (10)	05:16	05:12
	16:58		17:42	34 07:42 (11)	18:18	19:57	34 06:58 (10)	20:30	20:47
29	07:20				05:44	05:50	06:25 (10)	05:16	05:12
	16:59				18:19	19:58	34 06:59 (10)	20:31	20:47
30	07:19				05:42	05:49	06:26 (10)	05:15	05:13
	17:01				18:21	20:00	34 07:00 (10)	20:32	20:47
31	07:18				05:40			05:14	
	17:02				18:22			20:33	
Potential sun hours	286	291	369	380	476	258		-254	
Total, worst case	10	288	286	476	258				
Sun reduction	0.45	0.45	0.50	0.55	0.55				
Oper. time red.	0.91	0.91	0.91	0.91	0.91				
Wind dir. red.	0.69	0.61	0.61	0.59	0.59				
Total reduction	0.28	0.25	0.28	0.30	0.30				
Total, real	3	73	80	141	76				

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 238 - 238

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35

Operational time										
N	NE	E	SE	S	SW	W	NW	Sum		
1,850	1,325	800	713	625	663	700	1,275	7,950		

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25		06:18 19:35	06:53 18:38	06:34 16:46
2	05:14 20:47	05:42 20:24	06:46 (10)	06:19 19:33	06:55 18:36	06:35 16:44
3	05:15 20:46	05:43 20:22	06:43 (10)	06:20 19:31	06:56 18:35	07:55 (11) 08:07 (11)
4	05:15 20:46	05:44 20:21	06:42 (10)	06:21 19:29	06:57 18:33	07:50 (11) 08:10 (11)
5	05:16 20:46	05:46 20:20	06:39 (10)	06:22 19:27	06:58 18:31	07:50 (11) 08:12 (11)
6	05:16 20:46	05:47 20:19	06:38 (10)	06:23 19:26	07:00 18:29	07:47 (11) 08:13 (11)
7	05:17 20:45	05:48 20:17	06:37 (10)	06:25 19:24	07:01 18:27	07:46 (11) 08:14 (11)
8	05:18 20:45	05:49 20:16	06:36 (10)	06:26 19:22	07:02 18:25	07:45 (11) 08:13 (11)
9	05:19 20:45	05:50 20:14	06:36 (10)	06:27 19:20	07:03 18:24	07:45 (11) 08:15 (11)
10	05:19 20:44	05:51 20:13	06:35 (10)	06:28 19:18	07:05 18:22	07:44 (11) 08:16 (11)
11	05:20 20:44	05:53 20:11	06:34 (10)	06:29 19:16	07:06 18:20	07:43 (11) 08:15 (11)
12	05:21 20:43	05:54 20:10	06:33 (10)	06:31 19:14	07:07 18:18	07:43 (11) 08:15 (11)
13	05:22 20:42	05:55 20:08	06:32 (10)	06:32 19:12	07:08 18:16	07:42 (11) 08:16 (11)
14	05:23 20:42	05:56 20:07	06:33 (10)	06:33 19:11	07:10 18:15	07:41 (11) 08:15 (11)
15	05:24 20:41	05:57 20:05	06:32 (10)	06:34 19:09	07:11 18:13	07:41 (11) 08:15 (11)
16	05:24 20:41	05:59 20:04	06:31 (10)	06:35 19:07	07:12 18:11	07:42 (11) 08:14 (11)
17	05:25 20:40	06:00 20:02	06:33 (10)	06:37 19:05	07:14 18:09	07:41 (11) 08:13 (11)
18	05:26 20:39	06:01 20:01	06:32 (10)	06:38 19:03	07:15 18:08	07:43 (11) 08:13 (11)
19	05:27 20:38	06:02 19:57	06:33 (10)	06:39 19:01	07:16 18:06	07:44 (11) 08:12 (11)
20	05:28 20:37	06:03 19:56	06:32 (10)	06:40 18:59	07:18 18:04	07:44 (11) 08:10 (11)
21	05:29 20:37	06:04 19:54	06:33 (10)	06:41 18:57	07:19 18:03	07:45 (11) 08:09 (11)
22	05:30 20:36	06:06 19:52	06:32 (10)	06:43 18:55	07:20 18:02	07:46 (11) 08:06 (11)
23	05:31 20:35	06:07 19:51	06:33 (10)	06:44 18:53	07:22 18:01	07:50 (11) 08:04 (11)
24	05:32 20:34	06:08 19:49	06:34 (10)	06:45 18:52	07:23 17:59	07:53 (11) 08:01 (11)
25	05:33 20:33	06:09 19:47	06:36 (10)	06:46 18:50	06:24 18:56	07:06 16:20
26	05:34 20:32	06:10 19:45	06:37 (10)	06:47 18:48	06:26 18:55	07:07 16:19
27	05:36 20:31	06:12 19:44	06:38 (10)	06:49 18:46	06:27 18:53	07:09 16:19
28	05:37 20:30	06:13 19:42	06:41 (10)	06:50 18:44	06:28 18:52	07:10 16:18
29	05:38 20:28	06:14 19:40		06:51 18:42	06:30 18:50	07:11 16:18
30	05:39 20:27	06:15 19:38		06:52 18:40	06:31 18:49	07:12 16:17
31	05:40 20:26	06:16 19:37			06:32 16:47	07:34 16:24
Potential sun hours	-272	4	376	341	288	274
Total, worst case		744		578		258
Sun reduction		0.55		0.45		0.35
Oper. time red.		0.91		0.91		0.91
Wind dir. red.		0.59		0.61		0.69
Total reduction		0.30		0.25		0.22
Total, real		220		146		57

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)

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 252 - 252

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:34 16:25	07:17 17:03	06:35 17:43	05:38 18:23	05:47 20:00	05:14 20:34	05:51 (7) 20:47	05:13 20:25	05:50 (7) 20:25	06:17 19:35	06:53 18:38	06:34 16:46
2	07:34 16:26	07:16 17:05	06:34 17:44	05:37 18:24	05:45 20:01	05:13 20:35	05:51 (7) 20:47	05:14 20:24	05:50 (7) 20:24	06:19 19:33	06:55 18:36	06:35 16:44
3	07:34 16:27	07:14 17:06	06:32 17:46	05:35 18:26	05:44 20:02	05:12 20:36	05:09 (7) 20:46	05:14 20:22	05:51 (7) 20:22	06:20 19:31	06:56 18:34	06:36 16:43
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	05:12 20:37	05:48 (7) 20:46	05:15 20:21	05:52 (7) 20:21	06:21 19:29	06:57 18:33	06:38 16:41
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:05	05:12 20:37	05:47 (7) 20:46	05:16 20:20	05:52 (7) 20:20	06:22 19:27	06:58 18:31	06:39 16:40
6	07:34 16:30	07:11 17:11	06:27 17:50	06:29 19:29	05:40 20:06	05:11 20:38	05:47 (7) 20:46	05:16 20:18	05:53 (7) 20:18	06:23 19:25	07:00 18:29	06:40 16:39
7	07:34 16:31	07:09 17:12	06:25 17:51	06:27 19:31	05:38 20:07	05:11 20:39	05:47 (7) 20:45	05:17 20:17	05:54 (7) 20:17	06:25 19:24	07:01 18:27	06:42 16:38
8	07:34 16:32	07:08 17:13	06:23 17:52	06:26 19:32	05:37 20:08	05:10 20:40	05:46 (7) 20:45	05:18 20:16	05:54 (7) 20:16	06:26 19:22	07:02 18:25	06:43 16:36
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40	05:46 (7) 20:44	05:18 20:14	05:55 (7) 20:14	06:27 19:20	07:03 18:23	06:45 16:35
10	07:33 16:34	07:05 17:16	06:19 17:55	06:22 19:34	05:34 20:11	05:10 20:41	05:46 (7) 20:44	05:19 20:13	05:56 (7) 20:13	06:28 19:18	07:05 18:22	06:46 16:34
11	07:33 16:36	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:10 20:42	05:46 (7) 20:43	05:20 20:11	05:59 (7) 20:11	06:29 19:16	07:06 18:20	06:47 16:33
12	07:33 16:37	07:03 17:19	06:16 17:58	06:18 19:37	05:32 20:13	05:09 20:42	05:46 (7) 20:43	05:21 20:10	05:59 (7) 20:10	06:30 19:14	07:07 18:18	06:49 16:32
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	05:09 20:43	05:46 (7) 20:42	05:22 20:08	06:02 (7) 20:08	06:32 19:12	07:08 18:16	06:50 16:30
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	05:29 20:15	05:09 20:43	05:46 (7) 20:42	05:23 20:07	05:56 (7) 19:10	06:33 19:10	07:10 18:15	06:51 16:29
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:16	05:09 20:44	05:46 (7) 20:41	05:23 20:05	05:57 (7) 19:09	06:34 19:09	07:11 18:13	06:53 16:28
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	05:09 20:44	05:46 (7) 20:40	05:24 20:04	05:58 (7) 19:07	06:35 19:07	07:12 18:11	06:54 16:27
17	07:30 16:43	06:55 17:26	06:06 18:04	06:10 19:43	05:26 20:19	05:09 20:45	05:46 (7) 20:40	05:25 20:02	05:58 (7) 19:05	06:36 19:05	07:14 18:09	06:55 16:26
18	07:29 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	05:09 20:45	05:46 (7) 20:39	05:26 20:01	06:01 (7) 19:03	06:38 19:03	07:15 18:08	06:57 16:25
19	07:29 16:45	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:09 20:45	05:46 (7) 20:38	05:27 20:02	06:02 (7) 19:01	06:39 19:01	07:16 18:06	06:58 16:25
20	07:28 16:47	06:50 17:30	06:01 18:08	06:04 19:47	05:23 20:22	05:09 20:46	05:46 (7) 20:37	05:28 20:06	06:03 (7) 18:59	06:40 18:59	07:17 18:04	06:59 16:24
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46	05:46 (7) 20:36	05:29 20:03	06:04 (7) 18:57	06:41 18:57	07:19 18:03	07:01 16:23
22	07:27 16:49	06:47 17:33	05:57 18:10	06:01 19:50	05:21 20:24	05:10 20:46	05:46 (7) 20:36	05:30 20:03	06:06 (7) 18:55	06:42 18:55	07:20 18:01	07:02 16:22
23	07:26 16:51	06:46 17:35	05:55 18:12	05:59 19:51	05:20 20:25	05:10 20:46	05:47 (7) 20:35	05:31 20:03	06:07 (7) 18:53	06:44 18:53	07:21 17:59	07:03 16:21
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:26	05:10 20:47	05:47 (7) 20:34	05:32 20:04	06:08 (7) 18:51	06:45 18:51	07:23 17:58	07:05 16:21
25	07:24 16:54	06:42 17:37	05:52 18:14	05:56 19:53	05:18 20:27	05:11 20:47	05:47 (7) 20:33	05:33 20:04	06:09 (7) 18:50	06:46 18:50	06:24 17:56	07:06 16:20
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	05:18 20:28	05:11 20:47	05:48 (7) 20:32	05:34 20:02	06:10 (7) 19:45	06:47 18:48	06:25 16:55	07:07 16:19
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	05:11 20:47	05:48 (7) 20:31	05:35 20:01	06:11 (7) 19:44	06:48 18:46	06:27 16:53	07:08 16:19
28	07:21 16:58	06:37 17:42	05:46 18:18	05:51 19:57	05:16 20:30	05:12 20:47	05:48 (7) 20:29	05:36 20:02	06:13 (7) 19:42	06:50 18:44	06:28 16:52	07:10 16:18
29	07:20 16:59	06:35 18:19	05:44 18:19	05:50 19:58	05:15 20:31	05:12 20:47	05:49 (7) 20:28	05:38 20:02	06:14 (7) 19:40	06:51 18:42	06:30 16:50	07:11 16:18
30	07:19 17:01	06:34 18:21	05:42 20:00	05:48 20:00	05:15 20:32	05:13 20:47	05:49 (7) 20:27	05:39 20:02	06:15 (7) 19:38	06:52 18:40	06:31 16:49	07:12 16:17
31	07:18 17:02	06:33 18:22	05:40 20:00	05:14 20:00	05:14 20:33	05:14 20:47	05:49 (7) 20:26	05:40 20:02	06:16 (7) 19:36	06:53 18:47	06:32 16:47	07:13 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	274
Total, worst case					16	908	306					
Sun reduction					0.55	0.55	0.58					
Oper. time red.					0.91	0.91	0.91					
Wind dir. red.					0.58	0.58	0.58					
Total reduction					0.29	0.29	0.30					
Total, real					5	261	93					

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)
	Minutes with flicker		

Project: 060119 Marble River

Description: Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page: 01/23/06 17:18 / 43

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated: 01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 253 - 253

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Table with columns for months (January-December) and rows for days of the month, showing sun rise and set times. Includes summary rows for 'Total, worst case', 'Sun reduction', 'Oper. time red.', 'Wind dir. red.', 'Total reduction', and 'Total, real'.

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)

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 17:18 / 44
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 254 - 254

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34 16:25	07:17 17:03 22	07:39 (7) 08:01 (7)	06:35 17:43	05:38 18:23	05:13 18:23
2	07:34 16:26	07:16 17:05 24	07:38 (7) 08:02 (7)	06:34 17:44	05:37 18:24	05:13 20:35
3	07:35 16:27	07:15 17:06 26	07:36 (7) 08:02 (7)	06:32 17:46	05:35 18:26	05:12 20:36
4	07:34 16:28	07:13 17:08 26	07:37 (7) 08:03 (7)	06:30 17:47	05:33 18:27	05:12 20:37
5	07:34 16:29	07:12 17:09 28	07:36 (7) 08:04 (7)	06:28 17:48	06:31 19:28	05:11 20:37
6	07:34 16:30	07:11 17:11 28	07:36 (7) 08:04 (7)	06:27 17:50	06:29 19:29	05:11 20:38
7	07:34 16:31	07:10 17:12 28	07:35 (7) 08:03 (7)	06:25 17:51	06:27 19:31	05:11 20:39
8	07:34 16:32	07:08 17:13 28	07:36 (7) 08:04 (7)	06:23 17:52	06:26 19:32	05:10 20:40
9	07:34 16:33	07:07 17:15 28	07:36 (7) 08:04 (7)	06:21 17:54	06:24 19:33	05:10 20:40
10	07:33 16:34	07:05 17:16 26	07:37 (7) 08:03 (7)	06:19 17:55	06:22 19:34	05:10 20:41
11	07:33 16:36	07:04 17:18 26	07:37 (7) 08:03 (7)	06:18 17:56	06:20 19:36	05:10 20:42
12	07:33 16:37	07:03 17:19 24	07:38 (7) 08:02 (7)	06:16 17:58	06:18 19:37	05:09 20:42
13	07:32 16:38	07:01 17:21 24	07:38 (7) 08:02 (7)	06:14 17:59	06:17 19:38	05:09 20:43
14	07:32 16:39	07:00 17:22 22	07:39 (7) 08:01 (7)	06:12 18:00	06:15 19:40	05:09 20:43
15	07:31 16:40	06:58 17:23 18	07:41 (7) 07:59 (7)	06:10 18:01	06:13 19:41	05:09 20:44
16	07:31 16:42	06:57 17:25 16	07:42 (7) 07:58 (7)	06:08 18:03	06:11 19:42	05:09 20:44
17	07:30 16:43	06:55 17:26 10	07:44 (7) 07:54 (7)	06:07 18:04	06:10 19:43	05:09 20:45
18	07:29 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	05:09 20:45
19	07:29 16:45	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:09 20:45
20	07:28 16:47	06:50 17:30	06:01 18:08	06:04 19:47	05:23 20:22	05:09 20:46
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46
22	07:27 16:49	06:47 17:33	05:57 18:10	06:01 19:50	05:21 20:24	05:10 20:46
23	07:26 16:51	06:46 17:35	05:55 18:12	05:59 19:51	05:20 20:25	05:10 20:46
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:26	05:10 20:47
25	07:24 16:54	06:42 17:37	05:52 18:14	05:56 19:53	06:23 (5) 06:29 (5)	05:11 20:47
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	06:17 (5) 06:33 (5)	05:11 20:47
27	07:22 16:56	06:39 07:47 (7) 17:40	05:48 18:17	05:53 19:56	06:16 (5) 06:36 (5)	05:11 20:47
28	07:21 16:58	06:37 07:43 (7) 17:42	05:46 18:18	05:51 19:57	06:14 (5) 06:36 (5)	05:12 20:47
29	07:20 16:59	06:36 07:42 (7) 17:42	05:44 18:19	05:50 19:58	06:11 (5) 06:39 (5)	05:12 20:47
30	07:19 17:01	06:35 07:41 (7) 17:42	05:42 18:21	05:48 20:00	06:11 (5) 06:39 (5)	05:13 20:47
31	07:18 17:02	06:34 07:40 (7) 17:42	05:40 18:22	05:46 18:23	05:14 20:33	05:13 20:47
Potential sun hours	286	291	369	380	-285	-254
Total, worst case	64	404	120	942	4	4
Sun reduction	0.45	0.45	0.55	0.55	0.55	0.55
Oper. time red.	0.91	0.91	0.91	0.91	0.91	0.91
Wind dir. red.	0.63	0.63	0.56	0.56	0.56	0.56
Total reduction	0.26	0.26	0.28	0.28	0.28	0.28
Total, real	17	105	34	267	1	1

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 17:18 / 45
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 254 - 254

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35

Operational time

N	NE	E	SE	S	SW	W	NW	Sum
1,850	1,325	800	713	625	663	700	1,275	7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25 38	06:15 (5) 06:53 (5)	06:17 19:35	06:53 18:38	06:34 16:46 26
2	05:14 20:47	05:42 20:24 38	06:16 (5) 06:54 (5)	06:19 19:33	06:55 18:36	06:35 16:44 28
3	05:14 20:46	05:43 20:22 38	06:15 (5) 06:53 (5)	06:20 19:31	06:56 18:34	06:36 16:43 28
4	05:15 20:46	05:44 20:21 36	06:16 (5) 06:52 (5)	06:21 19:29	06:57 18:33	06:38 16:41 28
5	05:16 20:46	05:45 20:20 38	06:15 (5) 06:53 (5)	06:22 19:27	06:58 18:31	06:39 16:40 26
6	05:16 20:46	05:47 20:18 36	06:16 (5) 06:52 (5)	06:23 19:25	07:00 18:29	06:40 16:39 28
7	05:17 20:45	05:48 20:17 36	06:15 (5) 06:51 (5)	06:25 19:24	07:01 18:27	06:42 16:38 26
8	05:18 20:45	05:49 20:16 36	06:16 (5) 06:52 (5)	06:26 19:22	07:02 18:25	06:43 16:36 26
9	05:18 20:44	05:50 20:14 36	06:15 (5) 06:51 (5)	06:27 19:20	07:03 18:23	06:45 16:35 24
10	05:19 20:44	05:51 20:13 34	06:17 (5) 06:51 (5)	06:28 19:18	07:05 18:22	06:46 16:34 22
11	05:20 20:43	05:52 20:11 32	06:18 (5) 06:50 (5)	06:29 19:16	07:06 18:20	06:47 16:33 20
12	05:21 20:43	06:29 (5) 06:35 (5) 20:10 30	05:54 06:49 (5)	06:30 19:14	07:07 18:18	06:49 16:32 16
13	05:22 20:42	06:26 (5) 06:38 (5) 20:08 28	05:55 06:48 (5)	06:32 19:12	07:08 18:16	06:50 16:30 14
14	05:23 20:42	06:25 (5) 06:41 (5) 20:07 26	05:56 06:45 (5)	06:33 19:10	07:10 18:15	06:51 16:29 10
15	05:23 20:41	06:24 (5) 06:42 (5) 20:05 22	05:57 06:44 (5)	06:34 19:09	07:11 18:13	06:53 16:28 4
16	05:24 20:40	06:23 (5) 06:43 (5) 20:04 18	05:58 06:41 (5)	06:35 19:07	07:12 18:11	06:54 16:27
17	05:25 20:40	06:22 (5) 06:44 (5) 20:02 12	06:00 06:38 (5)	06:36 19:05	07:14 18:09	06:56 16:26
18	05:26 20:39	06:20 (5) 06:44 (5) 20:01 4	06:01 06:36 (5)	06:38 19:03	07:15 18:08	06:57 16:25
19	05:27 20:38	06:21 (5) 06:45 (5) 19:57	06:02 19:01	06:39 18:06	07:16 18:06	06:58 16:25
20	05:28 20:37	06:20 (5) 06:46 (5) 19:56	06:03 19:56	06:40 18:59	07:17 18:04	06:59 16:24
21	05:29 20:36	06:19 (5) 06:47 (5) 19:54	06:04 19:54	06:41 18:57	07:19 18:03	07:01 16:23
22	05:30 20:36	06:18 (5) 06:48 (5) 19:52	06:06 19:52	06:42 18:55	07:20 18:01	07:02 16:22
23	05:31 20:35	06:17 (5) 06:49 (5) 19:51	06:07 19:51	06:44 18:53	07:21 17:59	07:03 16:21
24	05:32 20:34	06:18 (5) 06:50 (5) 19:49	06:08 19:49	06:45 18:51	07:23 17:58	07:05 16:21
25	05:33 20:33	06:17 (5) 06:51 (5) 19:47	06:09 19:47	06:46 18:50	06:24 16:56 12	07:06 07:26 (7) 16:20
26	05:34 20:32	06:16 (5) 06:50 (5) 19:45	06:10 19:45	06:47 18:48	06:25 16:55 16	07:12 (7) 07:07 07:28 (7) 16:19
27	05:35 20:31	06:17 (5) 06:51 (5) 19:44	06:11 19:44	06:48 18:46	06:27 16:53 20	07:09 (7) 07:08 07:29 (7) 16:19
28	05:36 20:30	06:16 (5) 06:52 (5) 19:42	06:13 19:42	06:50 18:44	06:28 16:52 22	07:09 (7) 07:10 07:31 (7) 16:18
29	05:38 20:28	06:15 (5) 06:51 (5) 19:40	06:14 19:40	06:51 18:42	06:30 16:50 24	07:08 (7) 07:11 07:32 (7) 16:18
30	05:39 20:27	06:16 (5) 06:52 (5) 19:38	06:15 19:38	06:52 18:40	06:31 16:49 24	07:08 (7) 07:12 07:32 (7) 16:17
31	05:40 20:26	06:16 (5) 06:54 (5) 19:36	06:16 19:36	06:52 18:40	06:32 16:47 26	07:07 (7) 07:33 (7)
Potential sun hours	-272	4	376	341	288	274
Total, worst case	538	538	144	326		
Sun reduction	0.58	0.55	0.45	0.35		
Oper. time red.	0.91	0.91	0.91	0.91		
Wind dir. red.	0.56	0.56	0.63	0.63		
Total reduction	0.30	0.28	0.26	0.20		
Total, real	161	153	37	66		

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 17:18 / 46
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 255 - 255

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34 15:23 (20)	07:17 15:37 (20)	06:35 16:05 (20)	05:38 17:43	05:47 18:23	05:14 18:23 (3)
2	07:35 15:23 (20)	07:16 15:38 (20)	06:34 16:04 (20)	05:37 17:44	05:45 18:24	05:13 18:23 (3)
3	07:35 15:23 (20)	07:15 15:40 (20)	06:32 16:02 (20)	05:35 17:46	05:44 18:26	05:12 18:24 (3)
4	07:35 15:23 (20)	07:13 15:43 (20)	06:30 16:01 (20)	05:33 17:47	05:43 18:27	05:12 18:26 (3)
5	07:34 15:25 (20)	07:12 15:46 (20)	06:28 16:01 (20)	06:31 17:48	05:41 18:28	05:12 18:27 (3)
6	07:34 15:25 (20)	07:11 15:50 (20)	06:27 16:02 (20)	06:29 17:49	05:40 18:29	05:11 18:28 (3)
7	07:34 15:24 (20)	07:10 16:02 (20)	06:25 16:03 (20)	06:27 17:50	05:38 18:30	05:11 18:29 (3)
8	07:34 15:24 (20)	07:08 16:04 (20)	06:23 16:04 (20)	06:26 17:51	05:37 18:31	05:10 18:30 (3)
9	07:34 15:26 (20)	07:07 16:05 (20)	06:21 16:05 (20)	06:24 17:52	05:36 18:32	05:10 18:31 (3)
10	07:33 15:25 (20)	07:05 16:06 (20)	06:19 16:06 (20)	06:22 17:53	05:34 18:33	05:10 18:32 (3)
11	07:33 15:25 (20)	07:04 16:07 (20)	06:18 16:07 (20)	06:20 17:54	05:33 18:34	05:10 18:33 (3)
12	07:33 15:26 (20)	07:03 16:08 (20)	06:16 16:08 (20)	06:18 17:55	05:32 18:35	05:09 18:34 (3)
13	07:32 15:26 (20)	07:01 16:09 (20)	06:14 16:09 (20)	06:17 17:56	05:31 18:36	05:09 18:35 (3)
14	07:32 15:25 (20)	07:00 16:10 (20)	06:12 16:10 (20)	06:15 17:57	05:30 18:37	05:09 18:36 (3)
15	07:31 15:27 (20)	06:58 16:11 (20)	06:10 16:11 (20)	06:13 17:58	05:28 18:38	05:09 18:37 (3)
16	07:31 15:26 (20)	06:57 16:12 (20)	06:08 16:12 (20)	06:11 17:59	05:27 18:39	05:09 18:38 (3)
17	07:30 15:27 (20)	06:55 16:13 (20)	06:07 16:13 (20)	06:10 18:00	05:26 18:40	05:09 18:39 (3)
18	07:30 15:27 (20)	06:54 16:14 (20)	06:05 16:14 (20)	06:08 18:01	05:25 18:41	05:09 18:40 (3)
19	07:29 15:28 (20)	06:52 16:15 (20)	06:03 16:15 (20)	06:06 18:02	05:24 18:42	05:09 18:41 (3)
20	07:28 15:27 (20)	06:51 16:16 (20)	06:01 16:16 (20)	06:05 18:03	05:23 18:43	05:09 18:42 (3)
21	07:27 15:28 (20)	06:49 16:17 (20)	06:00 16:17 (20)	06:03 18:04	05:22 18:44	05:10 18:43 (3)
22	07:27 15:29 (20)	06:47 16:18 (20)	05:57 16:18 (20)	06:01 18:05	05:21 18:45	05:10 18:44 (3)
23	07:26 15:29 (20)	06:46 16:19 (20)	05:55 16:19 (20)	06:00 18:06	05:20 18:46	05:10 18:45 (3)
24	07:25 15:30 (20)	06:44 16:20 (20)	05:53 16:20 (20)	05:58 18:07	05:19 18:47	05:10 18:46 (3)
25	07:24 15:31 (20)	06:42 16:21 (20)	05:52 16:21 (20)	05:56 18:08	05:18 18:48	05:11 18:47 (3)
26	07:23 15:32 (20)	06:41 16:22 (20)	05:50 16:22 (20)	05:55 18:09	05:18 18:49	05:11 18:48 (3)
27	07:22 15:33 (20)	06:39 16:23 (20)	05:48 16:23 (20)	05:53 18:10	05:17 18:50	05:11 18:49 (3)
28	07:21 15:32 (20)	06:37 16:24 (20)	05:46 16:24 (20)	05:52 18:11	05:16 18:51	05:12 18:50 (3)
29	07:20 15:32 (20)	06:35 16:25 (20)	05:44 16:25 (20)	05:50 18:12	05:15 18:52	05:12 18:51 (3)
30	07:19 15:35 (20)	06:33 16:26 (20)	05:42 16:26 (20)	05:48 18:13	05:14 18:53	05:13 18:52 (3)
31	07:18 15:36 (20)	06:31 16:27 (20)	05:40 16:27 (20)	05:46 18:14	05:13 18:54	05:13 18:53 (3)
Potential sun hours	286	291	369	380	285	254
Total, worst case	1160	106	204	266	1352	
Sun reduction	0.45	0.45	0.55	0.55	0.55	0.55
Oper. time red.	0.91	0.91	0.91	0.91	0.91	0.91
Wind dir. red.	0.61	0.61	0.63	0.57	0.57	0.57
Total reduction	0.25	0.25	0.31	0.29	0.29	0.29
Total, real	290	27	64	76	386	

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

Day in month	Sun rise (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: **060119 Marble River**

Description: Marble River Wind Project
 Shadow-Flicker, MidW part 2
 27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

Printed/Page
 01/23/06 17:18 / 47
 Licensed user:
Wind Engineers, Inc.
 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated:
 01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 255 - 255

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35

Operational time										
N	NE	E	SE	S	SW	W	NW	Sum		
1,850	1,325	800	713	625	663	700	1,275	7,950		

	July	August	September	October	November	December
1	05:13 20:47	05:48 (3) 05:41 06:32 (3) 20:25	06:17 19:35	18:59 (4) 06:53 19:11 (4) 18:38	06:34 16:46	07:13 16:17
2	05:14 20:47	05:48 (3) 05:42 06:32 (3) 20:24	06:19 19:33	19:01 (4) 06:55 19:09 (4) 18:36	06:35 16:44	07:14 16:16
3	05:14 20:46	05:49 (3) 05:43 06:33 (3) 20:22	06:20 19:31	19:02 (4) 06:56 19:08 (4) 18:35	06:36 16:43	07:16 16:16
4	05:15 20:46	05:50 (3) 05:44 06:34 (3) 20:21	06:21 19:29	19:03 (4) 06:57 19:07 (4) 18:33	06:38 16:42	07:17 16:16
5	05:16 20:46	05:50 (3) 05:46 06:32 (3) 20:20	06:22 19:27	06:58 18:31	06:39 16:40	07:18 16:16
6	05:16 20:46	05:51 (3) 05:47 06:33 (3) 20:18	06:23 19:26	07:00 18:29	06:41 16:39	07:19 16:15
7	05:17 20:45	05:50 (3) 05:48 06:32 (3) 20:17	06:25 19:24	07:01 18:27	06:42 16:38	07:20 16:15
8	05:18 20:45	05:50 (3) 05:49 06:32 (3) 20:16	06:26 19:22	07:02 18:25	06:43 16:36	07:21 16:15
9	05:18 20:44	05:51 (3) 05:50 06:31 (3) 20:14	06:27 19:20	07:03 18:23	06:45 16:35	07:22 16:15
10	05:19 20:44	05:52 (3) 05:51 06:32 (3) 20:13	06:28 19:18	07:05 18:22	06:46 16:34	07:23 16:15
11	05:20 20:44	05:53 (3) 05:53 06:31 (3) 20:11	06:29 19:16	07:06 18:20	06:47 16:33	07:24 16:15
12	05:21 20:43	05:53 (3) 05:54 06:31 (3) 20:10	06:31 19:14	07:07 18:18	06:49 16:32	07:25 16:15
13	05:22 20:42	05:54 (3) 05:55 06:30 (3) 20:08	06:32 19:12	07:08 18:16	06:50 16:30	07:25 16:15
14	05:23 20:42	05:55 (3) 05:56 06:29 (3) 20:07	06:33 19:10	07:10 18:15	06:51 16:29	07:26 16:15
15	05:23 20:41	05:56 (3) 05:57 06:30 (3) 20:05	06:34 19:09	07:11 18:13	06:53 16:28	07:27 16:15
16	05:24 20:40	05:57 (3) 05:58 06:29 (3) 20:04	06:35 19:07	07:12 18:11	06:54 16:27	07:28 16:16
17	05:25 20:40	06:00 (3) 06:00 06:28 (3) 20:02	06:36 19:05	07:14 18:09	06:56 16:26	07:28 16:16
18	05:26 20:39	06:01 (3) 06:01 06:27 (3) 20:01	06:38 19:03	07:15 18:08	06:57 16:25	07:29 16:16
19	05:27 20:38	06:01 (3) 06:02 06:25 (3) 19:57	06:39 19:01	07:16 18:06	06:58 16:25	07:30 16:17
20	05:28 20:37	06:04 (3) 06:03 06:22 (3) 19:56	06:40 18:59	07:18 18:04	07:00 16:24	07:30 16:17
21	05:29 20:37	06:05 (3) 06:04 06:21 (3) 19:54	06:41 18:57	07:19 18:03	07:01 16:23	07:31 16:17
22	05:30 20:36	06:10 (3) 06:06 06:16 (3) 19:52	06:42 18:55	07:20 18:01	07:02 16:22	07:31 16:18
23	05:31 20:35	06:07 19:51	06:44 18:53	07:21 17:59	07:03 16:21	07:32 16:18
24	05:32 20:34	06:08 19:49	06:45 18:51	07:23 17:58	07:05 16:21	07:32 16:19
25	05:33 20:33	06:09 19:47	06:46 18:50	07:24 17:56	07:06 16:20	07:33 16:20
26	05:34 20:32	06:10 19:45	06:47 18:48	07:26 17:55	07:07 16:19	07:33 16:20
27	05:35 20:31	06:12 19:44	06:48 18:46	07:27 17:53	07:08 16:19	07:33 16:21
28	05:36 20:30	06:13 19:42	06:50 18:44	07:28 17:52	07:10 16:18	07:34 16:22
29	05:38 20:28	06:14 19:40	06:51 18:42	07:30 17:50	07:11 16:18	07:34 16:22
30	05:39 20:27	06:15 19:38	06:52 18:40	07:31 17:49	07:12 16:17	07:34 16:23
31	05:40 20:26	06:16 19:37	06:53 18:38	07:32 17:47	07:13 16:17	07:34 16:24
Potential sun hours	-272	4	376	341	288	274
Total, worst case	754	178	30		870	990
Sun reduction	0.58	0.55	0.55		0.35	0.35
Oper. time red.	0.91	0.91	0.91		0.91	0.91
Wind dir. red.	0.57	0.63	0.63		0.61	0.61
Total reduction	0.30	0.31	0.31		0.19	0.19
Total, real	227	56	9		169	193

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 17:18 / 48
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 256 - 256

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes
 Sun shine probabilities (part of time from sun rise to sun set with sun shine)
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
 Operational time
 N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June		
1	07:35	15:51 (26)	07:17	06:36	05:39	06:11 (3)	05:47	05:14
	16:25	4 15:55 (26)	17:03	17:43	18:23	44 17:21 (4)	20:00	20:34
2	07:35	15:51 (26)	07:16	06:34	05:37	06:13 (3)	05:45	05:13
	16:26	6 15:57 (26)	17:05	17:44	18:24	32 17:17 (4)	20:01	20:35
3	07:35	15:51 (26)	07:15	06:32	05:35	06:13 (3)	05:44	05:12
	16:27	6 15:57 (26)	17:06	17:46	18:26	16 06:29 (3)	20:02	20:36
4	07:35	15:51 (26)	07:13	06:30	05:33	06:15 (3)	05:43	05:12
	16:28	8 15:59 (26)	17:08	17:47	18:27	12 06:27 (3)	20:03	20:37
5	07:34	15:51 (26)	07:12	06:28	06:31		05:41	05:12
	16:29	10 16:01 (26)	17:09	17:48	19:28		20:05	20:38
6	07:34	15:51 (26)	07:11	06:27	17:13 (4)	06:29	05:40	05:11
	16:30	10 16:01 (26)	17:11	17:50	8 17:21 (4)	19:30	20:06	20:38
7	07:34	15:50 (26)	07:10	06:25	17:07 (4)	06:27	05:38	05:11
	16:31	12 16:02 (26)	17:12	17:51	18 17:25 (4)	19:31	20:07	20:39
8	07:34	15:52 (26)	07:08	06:23	17:04 (4)	06:26	05:37	05:10
	16:32	12 16:04 (26)	17:14	17:52	24 17:28 (4)	19:32	20:08	20:40
9	07:34	15:52 (26)	07:07	06:21	17:02 (4)	06:24	05:36	05:10
	16:33	12 16:04 (26)	17:15	17:54	28 17:30 (4)	19:33	20:09	20:40
10	07:33	15:51 (26)	07:06	06:19	17:00 (4)	06:22	05:34	05:10
	16:34	14 16:05 (26)	17:16	17:55	32 17:32 (4)	19:35	20:11	20:41
11	07:33	15:51 (26)	07:04	06:18	16:58 (4)	06:20	05:33	05:10
	16:36	16 16:07 (26)	17:18	17:56	34 17:32 (4)	19:36	20:12	20:42
12	07:33	15:52 (26)	07:03	06:16	16:56 (4)	06:18	05:32	05:10
	16:37	16 16:08 (26)	17:19	17:58	38 17:34 (4)	19:37	20:13	20:42
13	07:32	15:52 (26)	07:01	06:14	16:56 (4)	06:17	05:31	05:09
	16:38	18 16:10 (26)	17:21	17:59	38 17:34 (4)	19:38	20:14	20:43
14	07:32	15:51 (26)	07:00	06:12	16:54 (4)	06:15	05:30	05:09
	16:39	20 16:11 (26)	17:22	18:00	40 17:34 (4)	19:40	20:15	20:43
15	07:31	15:53 (26)	06:58	06:10	16:55 (4)	06:13	05:28	05:09
	16:40	20 16:13 (26)	17:24	18:02	40 17:35 (4)	19:41	20:17	20:44
16	07:31	15:52 (26)	06:57	06:08	16:53 (4)	06:11	05:27	05:09
	16:42	22 16:14 (26)	17:25	18:03	42 17:35 (4)	19:42	20:18	20:44
17	07:30	15:53 (26)	06:55	06:07	16:53 (4)	06:10	05:26	05:09
	16:43	22 16:15 (26)	17:26	18:04	42 17:35 (4)	19:43	20:19	20:45
18	07:30	15:53 (26)	06:54	06:05	16:51 (4)	06:08	05:25	05:09
	16:44	24 16:17 (26)	17:28	18:05	44 17:35 (4)	19:45	20:20	20:45
19	07:29	15:54 (26)	06:52	06:03	16:51 (4)	06:06	05:24	05:09
	16:46	24 16:18 (26)	17:29	18:07	44 17:35 (4)	19:46	20:21	20:45
20	07:28	15:53 (26)	06:51	06:01	06:21 (3)	06:05	05:23	05:09
	16:47	26 16:19 (26)	17:31	18:08	54 17:35 (4)	19:47	20:22	20:46
21	07:27	15:54 (26)	06:49	05:59	06:19 (3)	06:03	05:22	05:10
	16:48	26 16:20 (26)	17:32	18:09	58 17:35 (4)	19:48	20:23	20:46
22	07:27	15:55 (26)	06:47	05:57	06:17 (3)	06:01	05:21	05:10
	16:50	24 16:19 (26)	17:33	18:11	60 17:33 (4)	19:50	20:24	20:46
23	07:26	15:55 (26)	06:46	05:55	06:15 (3)	06:00	05:20	05:10
	16:51	26 16:21 (26)	17:35	18:12	62 17:33 (4)	19:51	20:25	20:47
24	07:25	15:56 (26)	06:44	05:53	06:14 (3)	05:58	05:19	05:10
	16:52	24 16:20 (26)	17:36	18:13	64 17:34 (4)	19:52	20:26	20:47
25	07:24	15:57 (26)	06:42	05:52	06:12 (3)	05:56	05:18	05:11
	16:54	22 16:19 (26)	17:37	18:14	66 17:32 (4)	19:53	20:28	20:47
26	07:23	15:58 (26)	06:41	05:50	06:12 (3)	05:55	05:18	05:11
	16:55	22 16:20 (26)	17:39	18:16	66 17:32 (4)	19:55	20:29	20:47
27	07:22	15:59 (26)	06:39	05:48	06:12 (3)	05:53	05:17	05:11
	16:56	20 16:19 (26)	17:40	18:17	62 17:30 (4)	19:56	20:30	20:47
28	07:21	16:02 (26)	06:37	05:46	06:10 (3)	05:52	05:16	05:12
	16:58	16 16:18 (26)	17:42	18:18	60 17:28 (4)	19:57	20:30	20:47
29	07:20	16:02 (26)		05:44	06:10 (3)	05:50	05:15	05:12
	16:59	14 16:16 (26)		18:19	58 17:26 (4)	19:58	20:31	20:47
30	07:19	16:05 (26)		05:42	06:10 (3)	05:48	05:15	05:13
	17:01	8 16:13 (26)		18:21	52 17:24 (4)	20:00	20:32	20:47
31	07:18			05:40	06:10 (3)		05:14	
	17:02			18:22	50 17:22 (4)		20:33	
Potential sun hours	286	291	369	380	-285	-254		
Total, worst case	504		1184	104				
Sun reduction	0.45		0.50	0.55				
Oper. time red.	0.91		0.91	0.91				
Wind dir. red.	0.60		0.60	0.61				
Total reduction	0.25		0.27	0.31				
Total, real	123		324	32				

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

Day in month	Sun rise (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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/23/06 17:18 / 49
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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 256 - 256

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	06:17 19:35	06:53 18:38	17:35 (4) 18:13 (4)	06:34 16:46
2	05:14 20:47	05:42 20:24	06:19 19:33	06:55 18:36	17:36 (4) 18:12 (4)	06:35 16:44
3	05:14 20:46	05:43 20:22	06:20 19:31	06:56 18:35	17:37 (4) 18:09 (4)	06:36 16:43
4	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:33	17:38 (4) 18:08 (4)	06:38 16:42
5	05:16 20:46	05:46 20:20	06:22 19:27	06:58 18:31	17:40 (4) 18:06 (4)	06:39 16:40
6	05:16 20:46	05:47 20:18	06:23 19:26	07:00 18:29	17:43 (4) 18:03 (4)	06:41 16:39
7	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27	17:46 (4) 18:00 (4)	06:42 16:38
8	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	17:49 (4) 18:03 (4)	06:43 16:36
9	05:18 20:45	05:50 20:14	06:27 19:20	07:03 18:23	17:52 (4) 18:06 (4)	06:44 16:35
10	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:20	17:55 (4) 18:09 (4)	06:45 16:34
11	05:20 20:44	05:53 20:11	06:29 19:16	07:06 18:18	17:58 (4) 18:12 (4)	06:46 16:33
12	05:21 20:43	05:54 20:10	06:31 19:14	07:07 18:16	18:00 (4) 18:15 (4)	06:47 16:32
13	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:14	18:18 (4) 18:16 (4)	06:48 16:31
14	05:23 20:42	05:56 20:07	06:33 19:11	07:10 18:12	18:18 (4) 18:15 (4)	06:49 16:30
15	05:23 20:41	05:57 20:05	06:34 19:09	07:11 18:10	18:15 (4) 18:13 (4)	06:50 16:29
16	05:24 20:41	05:58 20:04	06:35 19:07	07:12 18:08	18:13 (4) 18:11 (4)	06:51 16:28
17	05:25 20:40	06:00 20:02	06:36 19:05	07:14 18:06	18:11 (4) 18:09 (4)	06:52 16:27
18	05:26 20:39	06:01 20:01	06:38 19:03	07:15 18:04	18:07 (4) 18:08 (4)	06:53 16:26
19	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:02	18:06 (4) 18:06 (4)	06:54 16:25
20	05:28 20:37	06:03 19:56	06:40 18:59	07:18 18:00	18:04 (4) 18:04 (4)	06:55 16:24
21	05:29 20:37	06:04 19:54	06:41 18:57	07:19 18:00	18:03 (4) 18:03 (4)	06:56 16:23
22	05:30 20:36	06:06 19:52	06:42 18:55	07:20 18:00	18:02 (4) 18:01 (4)	06:57 16:22
23	05:31 20:35	06:07 19:51	06:44 18:53	07:22 17:59	18:00 (4) 17:59 (4)	06:58 16:21
24	05:32 20:34	06:08 19:49	06:45 18:51	07:23 17:58	17:57 (4) 17:58 (4)	06:59 16:20
25	05:33 20:33	06:09 19:47	06:46 18:50	07:24 17:56	17:55 (4) 17:56 (4)	07:00 16:19
26	05:34 20:32	06:10 19:45	06:47 18:48	07:26 17:55	17:54 (4) 17:55 (4)	07:01 16:18
27	05:35 20:31	06:12 19:44	06:48 18:46	07:27 17:53	17:53 (4) 17:54 (4)	07:02 16:17
28	05:37 20:30	06:13 19:42	06:50 18:44	07:28 17:52	17:52 (4) 17:53 (4)	07:03 16:16
29	05:38 20:28	06:14 19:40	06:51 18:42	07:29 17:50	17:51 (4) 17:51 (4)	07:04 16:15
30	05:39 20:27	06:15 19:38	06:52 18:40	07:30 17:49	17:50 (4) 17:49 (4)	07:05 16:14
31	05:40 20:26	06:16 19:37	06:53 18:37	07:31 17:47	17:48 (4) 17:47 (4)	07:06 16:13
Potential sun hours	-272	4	376	341	288	274
Total, worst case			1116	196	394	156
Sun reduction			0.55	0.45	0.35	0.35
Oper. time red.			0.91	0.91	0.91	0.91
Wind dir. red.			0.60	0.60	0.60	0.60
Total reduction			0.30	0.24	0.19	0.19
Total, real			337	48	75	30

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: 060119 Marble River

Description: Marble River Wind Project Shadow-Flicker, MidW part 2 27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)

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Calculated: 01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 257 - 257

Assumptions for shadow calculations

Maximum distance for influence 1,000 m Minimum sun height over horizon for influence 3 ° Day step for calculation 1 days Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time N NE E SE S SW W NW Sum 1,850 1,325 800 713 625 663 700 1,275 7,950

Monthly shadow calculation table with columns for months (January-December) and rows for each day, showing sun rise/set times, shadow lengths, and various reduction metrics.

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

Matrix for daily shadow calculations: 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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 258 - 258

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June			
1	07:35 16:25	14:39 (4) 15:23 (4)	07:17 17:03	06:36 17:43	07:12 (3) 07:24 (3)	05:39 18:23	06:15 (1) 06:57 (1)	05:47 20:00	05:14 20:34
2	07:35 16:26	14:41 (4) 15:23 (4)	07:16 17:05	06:34 17:44	07:16 (3) 07:22 (3)	05:37 18:24	06:13 (1) 06:57 (1)	05:45 20:01	05:13 20:35
3	07:35 16:27	14:41 (4) 15:23 (4)	07:15 17:06	06:32 17:46	07:16 (3) 07:22 (3)	05:35 18:26	06:13 (1) 06:55 (1)	05:44 20:02	05:12 20:36
4	07:35 16:28	14:41 (4) 15:23 (4)	07:13 17:08	06:30 17:47	07:16 (3) 07:22 (3)	05:33 18:27	06:13 (1) 06:55 (1)	05:43 20:03	05:12 20:37
5	07:34 16:29	14:43 (4) 15:25 (4)	07:12 17:09	06:28 17:48	07:16 (3) 07:22 (3)	05:31 18:29	07:13 (1) 07:55 (1)	05:41 20:05	05:12 20:38
6	07:34 16:30	14:43 (4) 15:25 (4)	07:11 17:11	06:27 17:50	07:16 (3) 07:22 (3)	05:29 19:30	07:11 (1) 07:53 (1)	05:40 20:06	05:11 20:38
7	07:34 16:31	14:44 (4) 15:24 (4)	07:10 17:12	06:25 17:51	07:16 (3) 07:22 (3)	05:27 19:31	07:12 (1) 07:54 (1)	05:38 20:07	05:11 20:39
8	07:34 16:32	14:44 (4) 15:24 (4)	07:08 17:14	06:23 17:52	07:16 (3) 07:22 (3)	05:26 19:32	07:12 (1) 07:52 (1)	05:37 20:08	05:10 20:40
9	07:34 16:33	14:46 (4) 15:24 (4)	07:07 17:15	06:21 17:54	07:16 (3) 07:22 (3)	05:24 19:33	07:12 (1) 07:52 (1)	05:36 20:09	05:10 20:40
10	07:33 16:34	14:45 (4) 15:25 (4)	07:06 17:16	06:19 17:55	07:16 (3) 07:22 (3)	05:22 19:35	07:14 (1) 07:50 (1)	05:34 20:11	05:10 20:41
11	07:33 16:36	14:47 (4) 15:25 (4)	07:04 17:18	06:18 17:56	07:16 (3) 07:22 (3)	05:20 19:36	07:14 (1) 07:48 (1)	05:33 20:12	05:10 20:42
12	07:33 16:37	14:48 (4) 15:24 (4)	07:03 17:19	06:16 17:58	07:16 (3) 07:22 (3)	05:18 19:37	07:15 (1) 07:47 (1)	05:32 20:13	05:10 20:42
13	07:32 16:38	14:48 (4) 15:24 (4)	07:01 17:21	06:14 17:59	07:16 (3) 07:22 (3)	05:17 19:38	07:15 (1) 07:45 (1)	05:31 20:14	05:09 20:43
14	07:32 16:39	14:49 (4) 15:23 (4)	07:00 17:22	06:12 18:00	07:16 (3) 07:22 (3)	05:15 19:40	07:17 (1) 07:43 (1)	05:30 20:15	05:09 20:43
15	07:31 16:40	14:51 (4) 15:25 (4)	06:58 17:24	06:10 18:02	07:16 (3) 07:22 (3)	05:13 19:41	07:17 (1) 07:41 (1)	05:28 20:17	05:09 20:44
16	07:31 16:42	14:52 (4) 15:24 (4)	06:57 17:25	06:08 18:03	07:16 (3) 07:22 (3)	05:11 19:42	07:20 (1) 07:40 (1)	05:27 20:18	05:09 20:44
17	07:30 16:43	14:53 (4) 15:23 (4)	06:55 17:26	06:07 18:04	07:16 (3) 07:22 (3)	05:10 19:43	07:24 (1) 07:34 (1)	05:26 20:19	05:09 20:45
18	07:30 16:44	14:55 (4) 15:23 (4)	06:54 17:28	06:05 18:05	07:16 (3) 07:22 (3)	05:08 19:45	07:15 (1) 07:45 (1)	05:25 20:20	05:09 20:45
19	07:29 16:46	14:56 (4) 15:22 (4)	06:52 17:29	06:03 18:07	07:16 (3) 07:22 (3)	05:06 19:46	07:13 (1) 07:45 (1)	05:24 20:21	05:09 20:45
20	07:28 16:47	14:59 (4) 15:21 (4)	06:51 17:31	06:01 18:08	07:16 (3) 07:22 (3)	05:05 19:47	07:12 (1) 07:45 (1)	05:23 20:22	05:09 20:46
21	07:27 16:48	15:00 (4) 15:18 (4)	06:49 17:32	05:59 18:09	07:16 (3) 07:22 (3)	05:03 19:48	07:10 (1) 06:45 (1)	05:22 20:23	05:10 20:46
22	07:27 16:50	15:03 (4) 15:15 (4)	06:47 17:33	05:57 18:11	07:16 (3) 07:22 (3)	05:01 19:50	07:10 (1) 06:47 (1)	05:21 20:24	05:10 20:46
23	07:26 16:51	15:03 (4) 17:35	06:46 17:35	05:55 18:12	07:16 (3) 07:22 (3)	05:00 19:51	06:25 (1) 06:49 (1)	05:20 20:25	05:10 20:47
24	07:25 16:52	15:04 (4) 17:36	06:44 17:36	05:53 18:13	07:16 (3) 07:22 (3)	05:00 19:52	06:24 (1) 06:52 (1)	05:19 20:27	05:10 20:47
25	07:24 16:54	15:04 (4) 17:37	06:42 17:37	05:52 18:14	07:16 (3) 07:22 (3)	05:00 19:53	06:22 (1) 06:54 (1)	05:18 20:28	05:11 20:47
26	07:23 16:55	15:04 (4) 17:39	06:41 17:39	05:50 18:16	07:16 (3) 07:22 (3)	05:00 19:55	06:20 (1) 06:54 (1)	05:18 20:29	05:11 20:47
27	07:22 16:56	15:04 (4) 17:40	06:39 17:40	05:48 18:17	07:16 (3) 07:22 (3)	05:00 19:56	06:18 (1) 06:54 (1)	05:17 20:30	05:11 20:47
28	07:21 16:58	15:04 (4) 17:42	06:37 17:42	05:46 18:18	07:16 (3) 07:22 (3)	05:00 19:57	06:18 (1) 06:56 (1)	05:16 20:31	05:12 20:47
29	07:20 16:59	15:04 (4) 17:44	06:36 17:44	05:44 18:19	07:16 (3) 07:22 (3)	05:00 19:58	06:16 (1) 06:56 (1)	05:15 20:31	05:12 20:47
30	07:19 17:01	15:04 (4) 17:46	06:35 17:46	05:42 18:20	07:16 (3) 07:22 (3)	05:00 20:00	06:14 (1) 06:56 (1)	05:15 20:32	05:13 20:47
31	07:18 17:02	15:04 (4) 17:48	06:34 17:48	05:40 18:22	07:16 (3) 07:22 (3)	05:00 20:02	06:14 (1) 06:56 (1)	05:14 20:33	05:13 20:47
Potential sun hours	286	291	369	380	588	-285	-254		
Total, worst case	758	212	364	588					
Sun reduction	0.45	0.45	0.50	0.55					
Oper. time red.	0.91	0.91	0.91	0.91					
Wind dir. red.	0.62	0.61	0.62	0.62					
Total reduction	0.26	0.25	0.28	0.31					
Total, real	193	53	103	183					

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 258 - 258

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December	
1	05:13 20:47	05:41 20:25	06:17 19:35	07:13 (1) 18:38	06:53 16:46	07:13 16:17	14:29 (4) 15:07 (4)
2	05:14 20:47	05:42 20:24	06:19 19:33	07:13 (1) 18:36	06:55 16:44	07:14 16:16	14:28 (4) 15:08 (4)
3	05:14 20:46	05:43 20:22	06:20 19:31	07:10 (1) 18:35	06:56 16:43	07:16 16:16	14:29 (4) 15:07 (4)
4	05:15 20:46	05:44 20:21	06:21 19:29	07:09 (1) 18:33	06:57 16:42	07:17 16:16	14:29 (4) 15:09 (4)
5	05:16 20:46	05:46 20:20	06:22 19:27	07:08 (1) 18:31	06:58 16:40	07:18 16:16	14:30 (4) 15:10 (4)
6	05:16 20:46	05:47 20:19	06:23 19:26	07:07 (1) 18:29	07:00 16:39	07:19 16:15	14:29 (4) 15:11 (4)
7	05:17 20:45	05:48 20:17	06:25 19:24	07:08 (1) 18:27	07:01 16:38	07:20 16:15	14:30 (4) 15:12 (4)
8	05:18 20:45	05:49 20:16	06:26 19:22	07:07 (1) 18:25	07:02 16:36	07:21 16:15	14:29 (4) 15:11 (4)
9	05:18 20:45	05:50 20:14	06:27 19:20	07:07 (1) 18:24	07:03 16:35	07:22 16:15	14:30 (4) 15:12 (4)
10	05:19 20:44	05:51 20:13	06:28 19:18	07:06 (1) 18:22	07:05 16:34	07:23 16:15	14:31 (4) 15:13 (4)
11	05:20 20:44	05:53 20:11	06:29 19:16	07:07 (1) 18:20	07:06 16:33	07:24 16:15	14:30 (4) 15:14 (4)
12	05:21 20:43	05:54 20:10	06:31 19:14	07:06 (1) 18:18	07:07 (3) 16:32	06:49 16:15	14:31 (4) 15:15 (4)
13	05:22 20:42	05:55 20:08	06:32 19:12	07:07 (1) 18:16	07:08 16:31	06:50 16:15	14:31 (4) 15:13 (4)
14	05:23 20:42	05:56 20:07	06:33 19:11	07:06 (1) 18:15	07:43 (3) 16:29	06:52 16:15	14:32 (4) 15:14 (4)
15	05:23 20:41	05:57 20:05	06:34 19:09	07:07 (1) 18:13	07:43 (3) 16:28	06:53 16:15	14:31 (4) 15:15 (4)
16	05:24 20:41	05:58 20:04	06:35 19:07	07:07 (1) 18:11	07:42 (3) 16:27	06:54 16:16	14:32 (4) 15:16 (4)
17	05:25 20:40	06:00 20:02	06:36 19:05	07:08 (1) 18:09	07:41 (3) 16:26	06:56 16:16	14:32 (4) 15:16 (4)
18	05:26 20:39	06:01 20:01	06:38 19:03	07:09 (1) 18:08	07:41 (3) 16:25	06:57 16:16	14:33 (4) 15:17 (4)
19	05:27 20:38	06:02 19:57	06:39 19:01	07:10 (1) 18:06	07:40 (3) 16:25	06:58 16:17	14:34 (4) 15:18 (4)
20	05:28 20:37	06:03 19:56	06:40 18:59	07:11 (1) 18:04	07:40 (3) 16:24	07:00 16:17	14:34 (4) 15:18 (4)
21	05:29 20:37	06:04 19:54	06:41 18:57	07:13 (1) 18:03	07:41 (3) 16:23	07:01 16:18	14:35 (4) 15:19 (4)
22	05:30 20:36	06:06 19:52	06:42 18:55	07:16 (1) 18:01	07:42 (3) 16:22	07:02 16:18	14:35 (4) 15:19 (4)
23	05:31 20:35	06:07 19:51	06:44 18:53	07:22 17:59	07:44 (3) 16:21	07:03 16:18	14:36 (4) 15:20 (4)
24	05:32 20:34	06:08 19:49	06:45 18:51	07:23 17:58	07:45 (3) 16:21	07:05 16:19	14:36 (4) 15:20 (4)
25	05:33 20:33	06:09 19:47	06:46 18:50	06:24 16:56	06:47 (3) 16:20	07:06 16:20	14:36 (4) 15:20 (4)
26	05:34 20:32	06:10 19:45	07:27 (1) 07:39 (1)	06:47 18:48	06:26 16:55	07:07 16:19	14:37 (4) 15:21 (4)
27	05:35 20:31	06:12 19:44	07:22 (1) 07:42 (1)	06:49 18:46	06:27 16:53	07:09 16:19	14:37 (4) 15:21 (4)
28	05:37 20:30	06:13 19:42	07:19 (1) 07:43 (1)	06:50 18:44	06:28 16:52	07:10 16:18	14:37 (4) 15:21 (4)
29	05:38 20:28	06:14 19:40	07:18 (1) 07:44 (1)	06:51 18:42	06:30 16:50	07:11 16:18	14:37 (4) 15:21 (4)
30	05:39 20:27	06:15 19:38	07:15 (1) 07:45 (1)	06:52 18:40	06:31 16:49	07:12 16:17	14:39 (4) 15:21 (4)
31	05:40 20:26	06:16 19:37	07:14 (1) 07:46 (1)	06:53 16:47	06:32 16:47	07:13 16:24	14:39 (4) 15:23 (4)
Potential sun hours	-272	4	376	341	288	274	
Total, worst case		144	802	234	306	1324	
Sun reduction		0.55	0.55	0.45	0.35	0.35	
Oper. time red.		0.91	0.91	0.91	0.91	0.91	
Wind dir. red.		0.62	0.62	0.61	0.62	0.62	
Total reduction		0.31	0.31	0.25	0.20	0.20	
Total, real		45	249	59	61	263	

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)

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/23/06 17:18 / 53
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 266 - 266

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June					
1	07:34 16:25	07:17 17:03	06:35 17:43	05:38 18:23	17:06 (5) 17:22 (5)	05:47 20:00	06:08 (2) 20:34	05:13 20:00	06:05 (2) 20:34	38 38	06:43 (2) 06:06 (2)
2	07:34 16:26	07:16 17:05	06:34 17:44	05:37 18:24	17:13 (5) 17:17 (5)	05:45 20:01	06:07 (2) 20:35	05:13 20:00	06:06 (2) 20:35	36 36	06:42 (2) 06:06 (2)
3	07:34 16:27	07:14 17:06	07:36 (6) 07:44 (6)	06:32 17:46	05:35 18:26	05:44 20:02	06:05 (2) 20:36	05:12 20:00	06:06 (2) 20:36	36 36	06:42 (2) 06:08 (2)
4	07:34 16:28	07:13 17:08	07:35 (6) 07:49 (6)	06:30 17:47	05:33 18:27	05:42 20:03	06:04 (2) 20:37	05:12 20:00	06:08 (2) 20:37	34 34	06:42 (2) 06:07 (2)
5	07:34 16:29	07:12 17:09	07:34 (6) 07:52 (6)	06:28 17:48	06:31 19:28	05:41 20:04	06:02 (2) 20:37	05:11 20:00	06:07 (2) 20:37	34 34	06:41 (2) 06:09 (2)
6	07:34 16:30	07:11 17:11	07:32 (6) 07:52 (6)	06:27 17:50	06:29 19:29	05:40 20:06	06:01 (2) 20:38	05:11 20:00	06:09 (2) 20:38	32 32	06:41 (2) 06:09 (2)
7	07:34 16:31	07:09 17:12	07:31 (6) 07:55 (6)	06:25 17:51	06:27 19:31	05:38 20:07	06:00 (2) 20:39	05:11 20:00	06:10 (2) 20:39	32 32	06:41 (2) 06:10 (2)
8	07:34 16:32	07:08 17:13	07:30 (6) 07:56 (6)	06:23 17:52	06:26 19:32	05:37 20:08	06:01 (2) 20:40	05:10 20:00	06:10 (2) 20:40	30 30	06:40 (2) 06:12 (2)
9	07:34 16:33	07:07 17:15	07:28 (6) 07:56 (6)	06:21 17:54	06:24 19:33	05:36 20:09	05:59 (2) 20:40	05:10 20:00	06:10 (2) 20:40	30 30	06:40 (2) 06:12 (2)
10	07:33 16:34	07:05 17:16	07:27 (6) 07:57 (6)	06:19 17:55	17:14 (5) 17:28 (5)	06:22 19:34	05:34 20:11	06:00 (2) 20:41	06:12 (2) 20:41	28 28	06:40 (2) 06:12 (2)
11	07:33 16:35	07:04 17:18	07:25 (6) 07:57 (6)	06:18 17:56	17:10 (5) 17:30 (5)	06:20 19:36	05:33 20:12	05:59 (2) 20:42	06:12 (2) 20:42	28 28	06:40 (2) 06:12 (2)
12	07:33 16:37	07:03 17:19	07:24 (6) 07:58 (6)	06:16 17:57	17:08 (5) 17:32 (5)	06:18 19:37	05:32 20:13	06:00 (2) 20:42	06:12 (2) 20:42	28 28	06:40 (2) 06:14 (2)
13	07:32 16:38	07:01 17:21	07:24 (6) 07:58 (6)	06:14 17:59	17:06 (5) 17:34 (5)	06:17 19:38	05:31 20:14	05:59 (2) 20:43	06:14 (2) 20:43	26 26	06:40 (2) 06:13 (2)
14	07:32 16:39	07:00 17:22	07:25 (6) 07:59 (6)	06:12 18:00	17:04 (5) 17:34 (5)	06:15 19:39	05:29 20:15	05:59 (2) 20:43	06:13 (2) 20:43	26 26	06:39 (2) 06:13 (2)
15	07:31 16:40	06:58 17:23	07:23 (6) 07:59 (6)	06:10 18:01	17:02 (5) 17:34 (5)	06:13 19:41	05:28 20:16	05:58 (2) 20:44	06:13 (2) 20:44	26 26	06:39 (2) 06:13 (2)
16	07:31 16:42	06:57 17:25	07:24 (6) 08:00 (6)	06:08 18:03	17:03 (5) 17:37 (5)	06:11 19:42	05:27 20:18	05:59 (2) 20:44	06:13 (2) 20:44	26 26	06:39 (2) 06:16 (2)
17	07:30 16:43	06:55 17:26	07:24 (6) 08:00 (6)	06:06 18:04	17:01 (5) 17:37 (5)	06:10 19:43	05:26 20:19	05:58 (2) 20:45	06:16 (2) 20:45	24 24	06:40 (2) 06:16 (2)
18	07:29 16:44	06:54 17:28	07:25 (6) 07:59 (6)	06:05 18:05	17:01 (5) 17:37 (5)	06:08 19:45	05:25 20:20	05:59 (2) 20:45	06:16 (2) 20:45	24 24	06:40 (2) 06:16 (2)
19	07:29 16:45	06:52 17:29	07:23 (6) 07:59 (6)	06:03 18:07	16:59 (5) 17:37 (5)	06:06 19:46	05:24 20:21	06:00 (2) 20:45	06:16 (2) 20:45	24 24	06:40 (2) 06:16 (2)
20	07:28 16:47	06:50 17:30	07:23 (6) 07:57 (6)	06:01 18:08	16:59 (5) 17:37 (5)	06:04 19:47	05:23 20:22	05:59 (2) 20:46	06:16 (2) 20:46	24 24	06:40 (2) 06:16 (2)
21	07:27 16:48	06:49 17:32	07:24 (6) 07:58 (6)	05:59 18:09	16:59 (5) 17:37 (5)	06:03 19:48	05:22 20:23	06:01 (2) 20:46	06:16 (2) 20:46	24 24	06:40 (2) 06:16 (2)
22	07:27 16:49	06:47 17:33	07:26 (6) 07:56 (6)	05:57 18:10	16:59 (5) 17:35 (5)	06:01 19:50	05:21 20:24	06:00 (2) 20:46	06:16 (2) 20:46	24 24	06:40 (2) 06:17 (2)
23	07:26 16:51	06:46 17:35	07:26 (6) 07:56 (6)	05:55 18:12	16:57 (5) 17:35 (5)	05:59 19:51	05:20 20:25	06:01 (2) 20:46	06:17 (2) 20:46	24 24	06:41 (2) 06:17 (2)
24	07:25 16:52	06:44 17:36	07:27 (6) 07:55 (6)	05:53 18:13	16:57 (5) 17:35 (5)	05:58 19:52	06:18 (2) 20:26	05:19 20:00	06:17 (2) 20:47	24 24	06:41 (2) 06:17 (2)
25	07:24 16:54	06:42 17:37	07:29 (6) 07:53 (6)	05:51 18:14	17:00 (5) 17:34 (5)	05:56 19:53	06:17 (2) 20:27	05:18 20:00	06:17 (2) 20:47	24 24	06:41 (2) 06:16 (2)
26	07:23 16:55	06:41 17:39	07:29 (6) 07:51 (6)	05:50 18:15	17:00 (5) 17:34 (5)	05:55 19:55	06:15 (2) 20:28	05:18 20:00	06:16 (2) 20:47	26 26	06:42 (2) 06:16 (2)
27	07:22 16:56	06:39 17:40	07:32 (6) 07:48 (6)	05:48 18:17	17:00 (5) 17:32 (5)	05:53 19:56	06:14 (2) 20:29	05:17 20:00	06:16 (2) 20:47	26 26	06:42 (2) 06:16 (2)
28	07:21 16:58	06:37 17:41	07:38 (6) 07:42 (6)	05:46 18:18	17:00 (5) 17:30 (5)	05:51 19:57	06:12 (2) 20:30	05:16 20:00	06:16 (2) 20:47	26 26	06:42 (2) 06:17 (2)
29	07:20 16:59		05:44 18:19	05:40 18:19	17:02 (5) 17:30 (5)	05:50 19:58	06:11 (2) 20:31	05:15 20:00	06:17 (2) 20:47	26 26	06:43 (2) 06:15 (2)
30	07:19 17:01		05:42 18:21	05:38 18:21	17:02 (5) 17:28 (5)	05:48 20:00	06:09 (2) 20:32	05:13 20:00	06:15 (2) 20:47	28 28	06:43 (2) 06:43 (2)
31	07:18 17:02		05:40 18:22	05:36 17:24 (5)	17:04 (5) 17:24 (5)	05:46 19:59	05:14 20:33	06:05 (2) 20:33	06:15 (2) 20:47	38 38	06:43 (2) 06:43 (2)
Potential sun hours	286	291	369	380	380	380	-285		-254		
Total, worst case		702	684	194	1380	838					
Sun reduction		0.45	0.50	0.55	0.55	0.55					
Oper. time red.		0.91	0.91	0.91	0.91	0.91					
Wind dir. red.		0.61	0.60	0.57	0.56	0.56					
Total reduction		0.25	0.27	0.28	0.28	0.28					
Total, real		177	187	55	388	236					

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 17:18 / 54
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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 266 - 266

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	06:16 (2) 05:41 06:44 (2) 20:25	06:09 (2) 06:17 06:59 (2) 19:35	06:53 18:38	17:46 (5) 06:34 18:12 (5) 16:46	06:57 (6) 07:13 07:27 (6) 16:17
2	05:14 20:47	06:16 (2) 05:42 06:44 (2) 20:24	06:10 (2) 06:19 06:58 (2) 19:33	06:55 18:36	17:48 (5) 06:35 18:10 (5) 16:44	06:58 (6) 07:14 07:26 (6) 16:16
3	05:14 20:46	06:15 (2) 05:43 06:45 (2) 20:22	06:09 (2) 06:20 06:57 (2) 19:31	06:56 18:34	17:49 (5) 06:36 18:07 (5) 16:43	07:00 (6) 07:15 07:26 (6) 16:16
4	05:15 20:46	06:16 (2) 05:44 06:46 (2) 20:21	06:10 (2) 06:21 06:58 (2) 19:29	06:57 18:33	17:54 (5) 06:38 18:02 (5) 16:41	07:01 (6) 07:17 07:23 (6) 16:16
5	05:16 20:46	06:14 (2) 05:45 06:46 (2) 20:20	06:11 (2) 06:22 06:57 (2) 19:27	06:58 18:31	06:39 16:40	07:02 (6) 07:18 07:22 (6) 16:15
6	05:16 20:46	06:15 (2) 05:47 06:47 (2) 20:18	06:10 (2) 06:23 06:56 (2) 19:25	06:59 18:29	06:40 16:39	07:04 (6) 07:19 07:20 (6) 16:15
7	05:17 20:45	06:14 (2) 05:48 06:48 (2) 20:17	06:11 (2) 06:24 06:55 (2) 19:24	07:01 18:27	06:42 16:37	07:05 (6) 07:20 07:19 (6) 16:15
8	05:18 20:45	06:14 (2) 05:49 06:48 (2) 20:16	06:12 (2) 06:26 06:56 (2) 19:22	07:02 18:25	06:43 16:36	07:07 (6) 07:21 07:15 (6) 16:15
9	05:18 20:44	06:13 (2) 05:50 06:49 (2) 20:14	06:13 (2) 06:27 06:55 (2) 19:20	07:03 18:23	06:45 16:35	07:22 16:15
10	05:19 20:44	06:14 (2) 05:51 06:50 (2) 20:13	06:14 (2) 06:28 06:54 (2) 19:18	07:05 18:22	06:46 16:34	07:23 16:15
11	05:20 20:43	06:12 (2) 05:52 06:50 (2) 20:11	06:16 (2) 06:29 06:54 (2) 19:16	17:59 (5) 07:06 18:15 (5) 18:20	06:47 16:33	07:24 16:15
12	05:21 20:43	06:13 (2) 05:54 06:51 (2) 20:10	06:17 (2) 06:30 06:53 (2) 19:14	17:56 (5) 07:07 18:16 (5) 18:18	06:49 16:32	07:24 16:15
13	05:22 20:42	06:12 (2) 05:55 06:52 (2) 20:08	06:18 (2) 06:32 06:52 (2) 19:12	17:53 (5) 07:08 18:19 (5) 18:16	06:50 16:30	07:25 16:15
14	05:22 20:42	06:13 (2) 05:56 06:53 (2) 20:07	06:19 (2) 06:33 06:49 (2) 19:10	17:52 (5) 07:10 18:20 (5) 18:14	08:07 (6) 06:51 08:17 (6) 16:29	07:26 16:15
15	05:23 20:41	06:12 (2) 05:57 06:54 (2) 20:05	06:20 (2) 06:34 06:48 (2) 19:09	17:49 (5) 07:11 18:19 (5) 18:13	08:05 (6) 06:53 08:21 (6) 16:28	07:27 16:15
16	05:24 20:40	06:13 (2) 05:58 06:53 (2) 20:04	06:21 (2) 06:35 06:47 (2) 19:07	17:49 (5) 07:12 18:21 (5) 18:11	08:02 (6) 06:54 08:24 (6) 16:27	07:28 16:16
17	05:25 20:40	06:12 (2) 06:00 06:54 (2) 20:02	06:22 (2) 06:36 06:44 (2) 19:05	17:48 (5) 07:13 18:22 (5) 18:09	07:59 (6) 06:55 08:25 (6) 16:26	07:28 16:16
18	05:26 20:39	06:10 (2) 06:01 06:54 (2) 20:00	06:23 (2) 06:38 06:41 (2) 19:03	17:47 (5) 07:15 18:21 (5) 18:08	07:59 (6) 06:57 08:27 (6) 16:25	07:29 16:16
19	05:27 20:38	06:11 (2) 06:02 06:55 (2) 19:57	06:27 (2) 06:39 06:37 (2) 19:01	17:46 (5) 07:16 18:22 (5) 18:06	07:56 (6) 06:58 08:26 (6) 16:24	07:30 16:16
20	05:28 20:37	06:10 (2) 06:03 06:56 (2) 19:56	06:40 18:59	17:45 (5) 07:17 18:21 (5) 18:04	07:55 (6) 06:59 08:27 (6) 16:24	07:30 16:17
21	05:29 20:36	06:11 (2) 06:04 06:55 (2) 19:54	06:41 18:57	17:44 (5) 07:19 18:22 (5) 18:03	07:55 (6) 07:01 08:29 (6) 16:23	07:31 16:17
22	05:30 20:36	06:10 (2) 06:05 06:56 (2) 19:52	06:42 18:55	17:44 (5) 07:20 18:22 (5) 18:01	07:54 (6) 07:02 08:28 (6) 16:22	07:31 16:18
23	05:31 20:35	06:09 (2) 06:07 06:57 (2) 19:51	06:44 18:53	17:43 (5) 07:21 18:21 (5) 17:59	07:54 (6) 07:03 08:30 (6) 16:21	07:32 16:18
24	05:32 20:34	06:10 (2) 06:08 06:56 (2) 19:49	06:45 18:51	17:42 (5) 07:23 18:20 (5) 17:58	07:53 (6) 07:05 08:29 (6) 16:21	07:32 16:19
25	05:33 20:33	06:09 (2) 06:09 06:57 (2) 19:47	06:46 18:49	17:43 (5) 06:24 18:19 (5) 16:56	06:52 (6) 07:06 07:28 (6) 16:20	07:33 16:19
26	05:34 20:32	06:10 (2) 06:10 06:58 (2) 19:45	06:47 18:48	17:42 (5) 06:25 18:18 (5) 16:55	06:54 (6) 07:07 07:30 (6) 16:19	07:33 16:20
27	05:35 20:31	06:09 (2) 06:11 06:57 (2) 19:44	06:48 18:46	17:44 (5) 06:27 18:18 (5) 16:53	06:53 (6) 07:08 07:29 (6) 16:19	07:33 16:21
28	05:36 20:29	06:10 (2) 06:13 06:58 (2) 19:42	06:50 18:44	17:43 (5) 06:28 18:17 (5) 16:51	06:53 (6) 07:10 07:29 (6) 16:18	07:34 16:22
29	05:37 20:28	06:09 (2) 06:14 06:57 (2) 19:40	06:51 18:42	17:44 (5) 06:29 18:16 (5) 16:50	06:54 (6) 07:11 07:28 (6) 16:18	07:34 16:22
30	05:39 20:27	06:08 (2) 06:15 06:58 (2) 19:38	06:52 18:40	17:45 (5) 06:31 18:13 (5) 16:48	06:54 (6) 07:12 07:28 (6) 16:17	07:34 16:23
31	05:40 20:26	06:09 (2) 06:16 06:57 (2) 19:36	06:53 18:38	17:46 (5) 06:32 18:12 (5) 16:47	06:55 (6) 07:13 07:27 (6) 16:17	07:34 16:24
Potential sun hours	-272	4	376	341	288	274
Total, worst case	1256	698	644	622	164	
Sun reduction	0.58	0.55	0.55	0.45	0.35	
Oper. time red.	0.91	0.91	0.91	0.91	0.91	
Wind dir. red.	0.56	0.56	0.60	0.61	0.61	
Total reduction	0.30	0.28	0.30	0.25	0.20	
Total, real	372	196	194	156	32	

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: 060119 Marble River

Description: Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated: 01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 267 - 267

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Large data table with columns for months (January to December) and rows for each day of the month, showing sunrise/sunset times, shadow times, and reduction percentages. Includes a summary section at the bottom for Total, worst case, Sun reduction, Oper. time red., Wind dir. red., Total reduction, and Total, real.

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

Matrix table with columns: 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: 060119 Marble River

Description: Marble River Wind Project Shadow-Flicker, MidW part 2 27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)

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Calculated: 01/23/06 12:24/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area2 Shadow receptor: 330 - 330

Assumptions for shadow calculations

Maximum distance for influence 1,000 m Minimum sun height over horizon for influence 3 ° Day step for calculation 1 days Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time N NE E SE S SW W NW Sum 1,850 1,325 800 713 625 663 700 1,275 7,950

Table with 12 columns for months (January to December) and multiple rows of data representing time intervals, sun rise/set times, and shadow calculations. Includes a summary section at the bottom for 'Total, worst case' and 'Total, real'.

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

Matrix with 5 columns: 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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

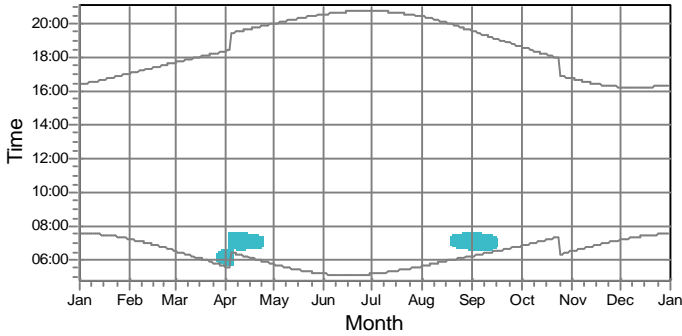
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01/23/06 17:18 / 59
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 12:24/2.4.0.67

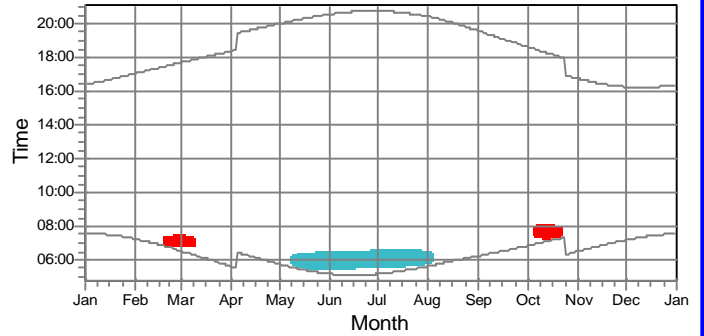
SHADOW - Calendar, graphical

Calculation: 060121 MidWest area2

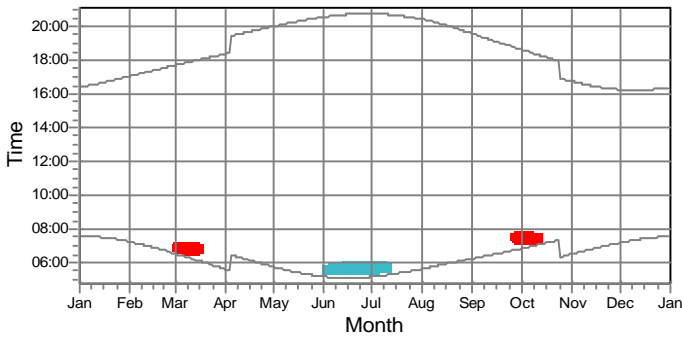
116: 116



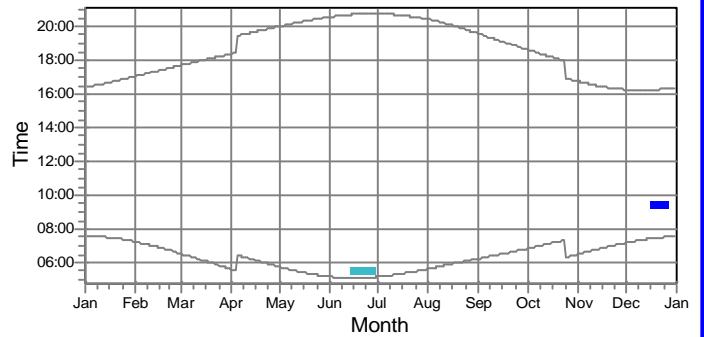
117: 117



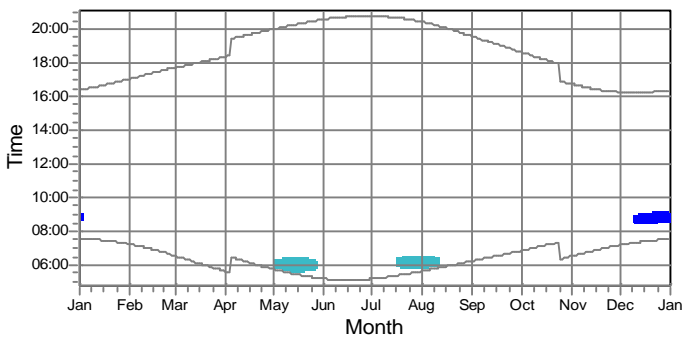
118: 118



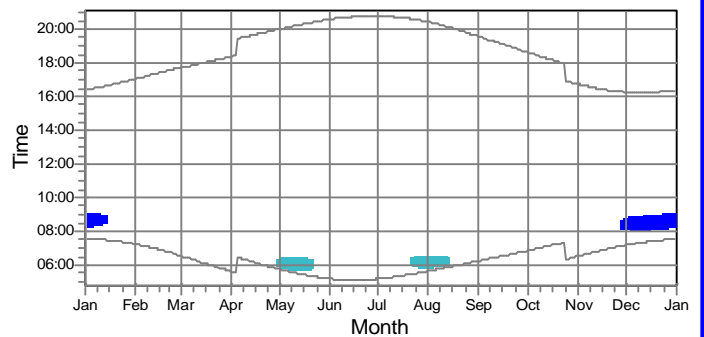
119: 119



120: 120



121: 121



WTGs



Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
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Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

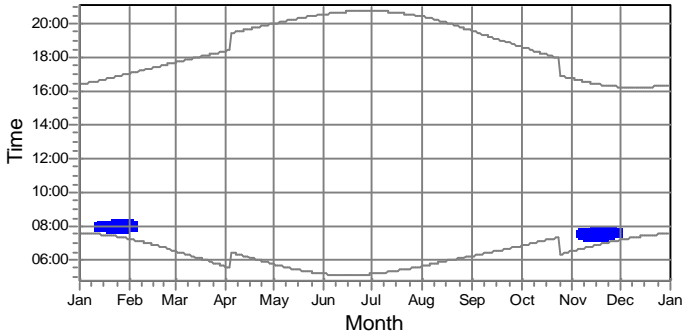
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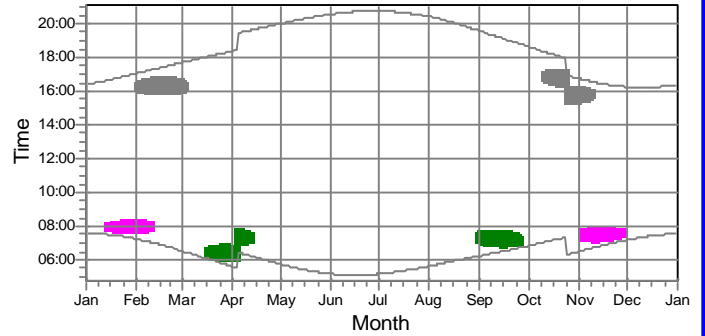
SHADOW - Calendar, graphical

Calculation: 060121 MidWest area2

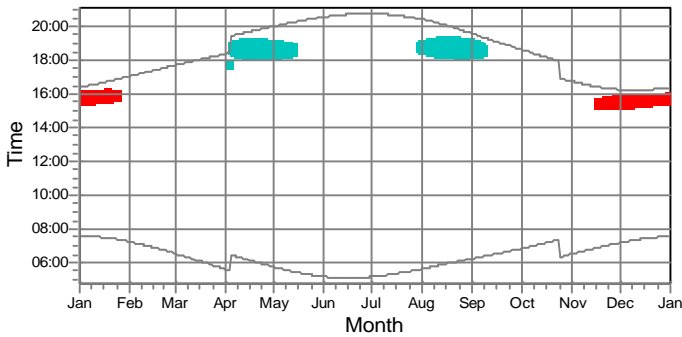
123: 123



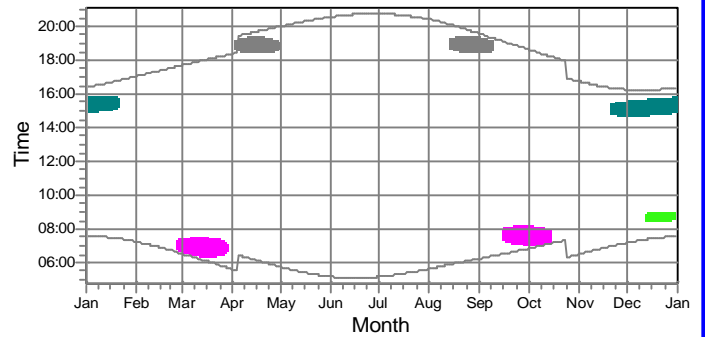
125: 125



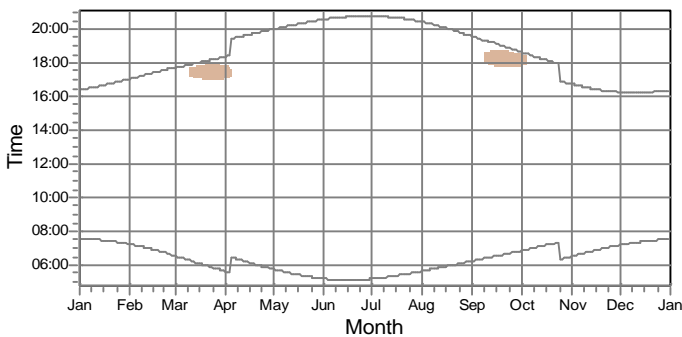
126: 126



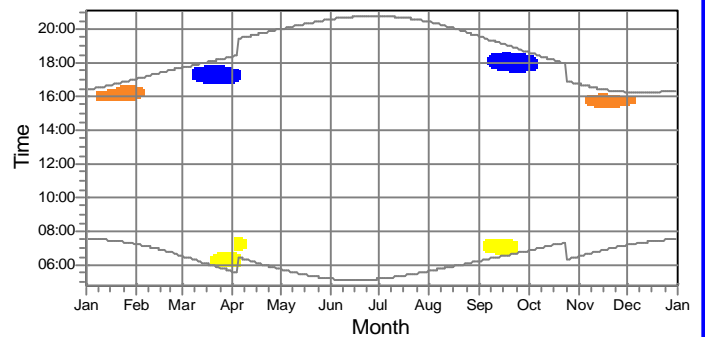
127: 127






128: 128



134: 134



WTGs

 042	 044	 046	 048-W	 081	 150-W
 043	 045	 047	 078	 085	

Project:
060119 Marble River

Description:
Marble River Wind Project
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27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
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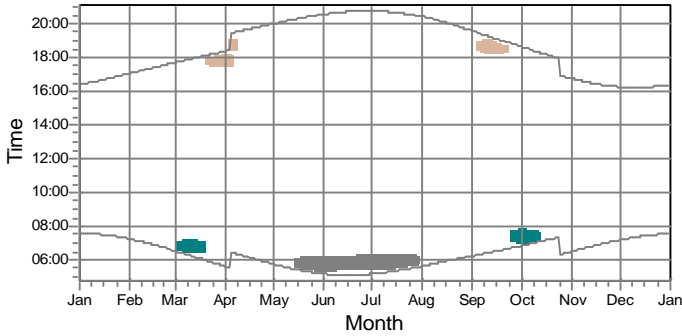
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Calculated:
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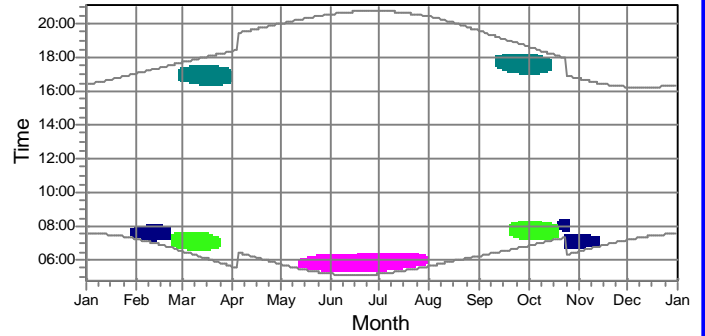
SHADOW - Calendar, graphical

Calculation: 060121 MidWest area2

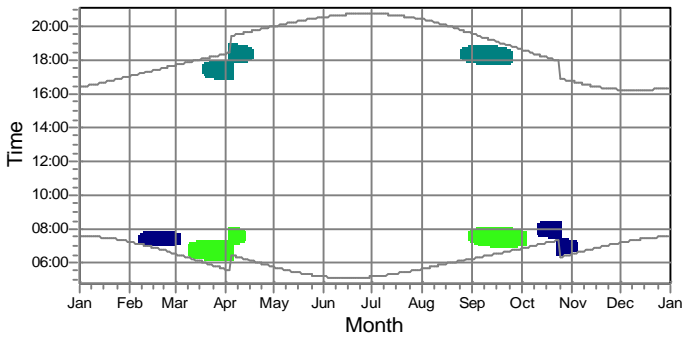
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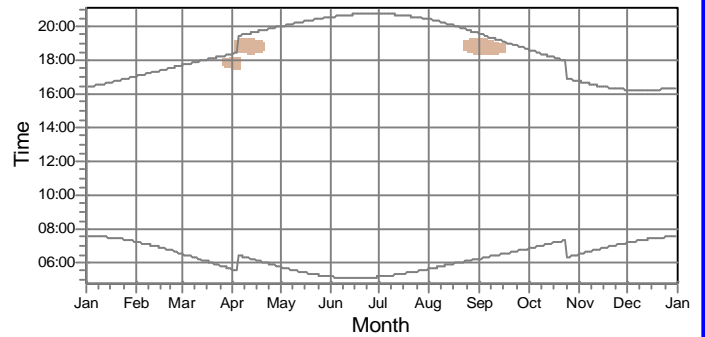
136: 136



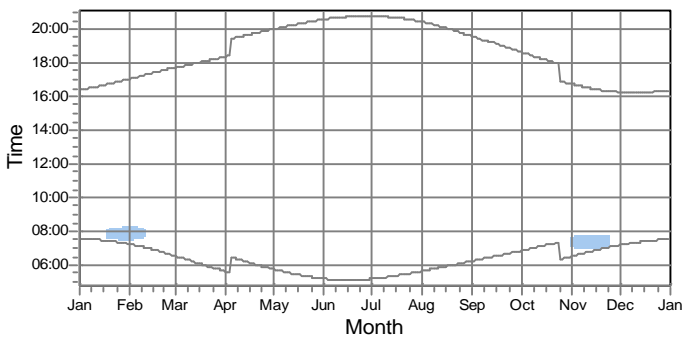
137: 137



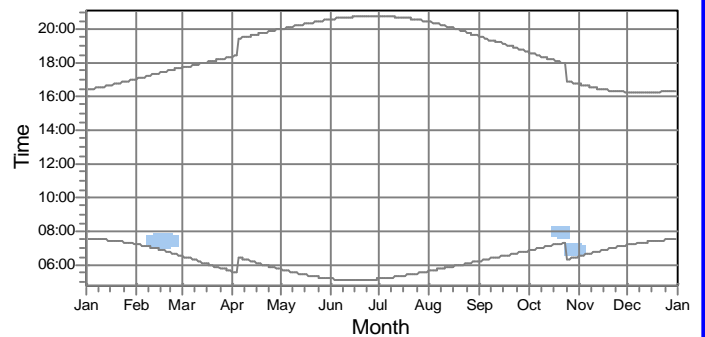
139: 139



140: 140



141: 141



WTGs



Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
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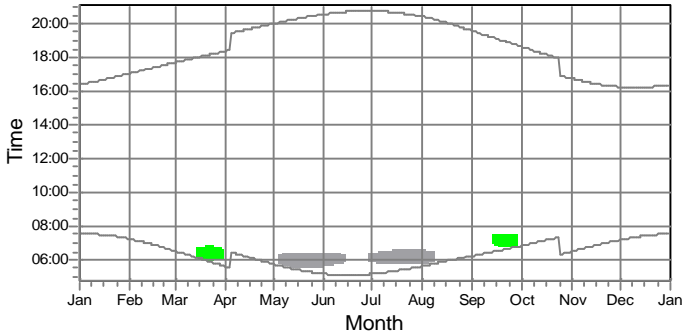
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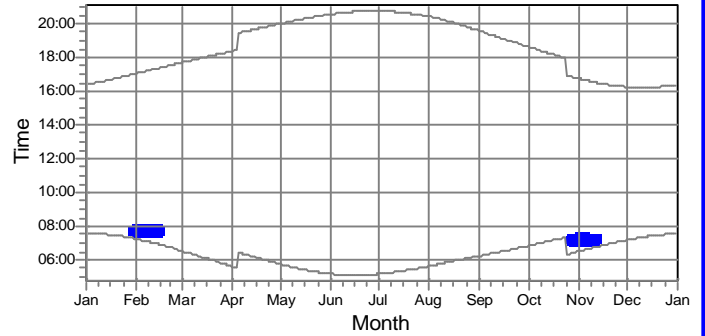
SHADOW - Calendar, graphical

Calculation: 060121 MidWest area2

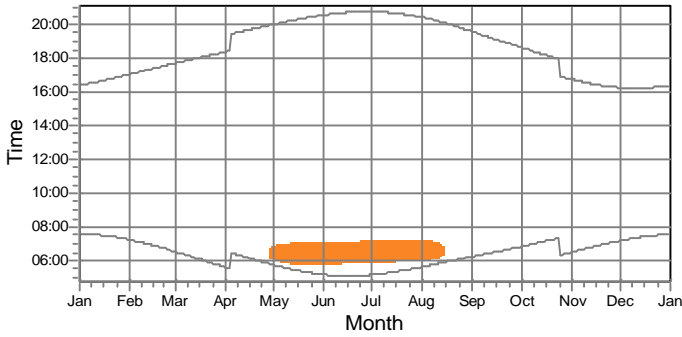
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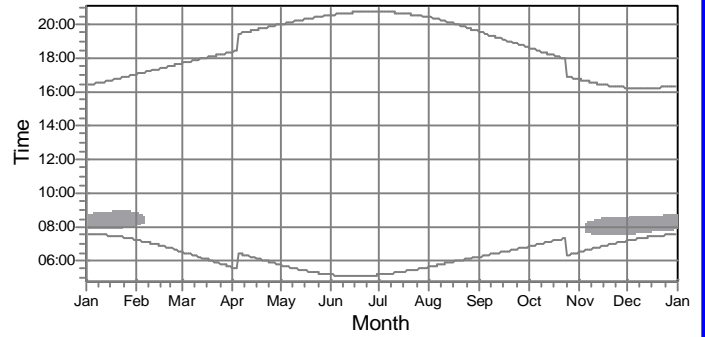
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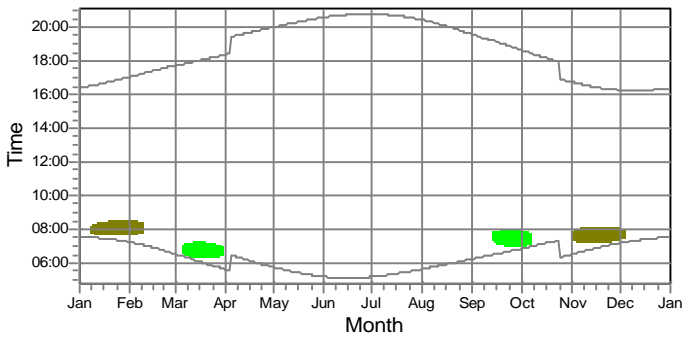
232: 232



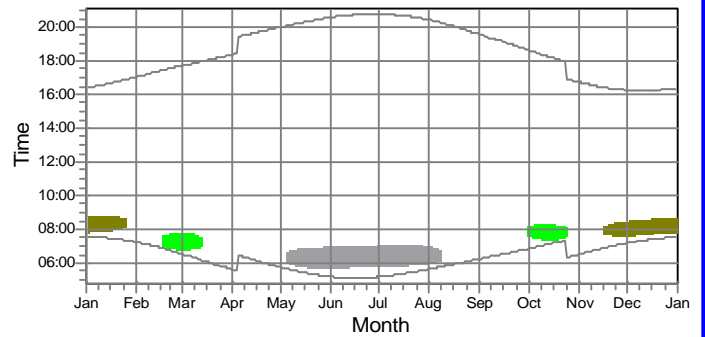
233: 233



234: 234



235: 235



WTGs



Project:
060119 Marble River

Description:
Marble River Wind Project
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27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
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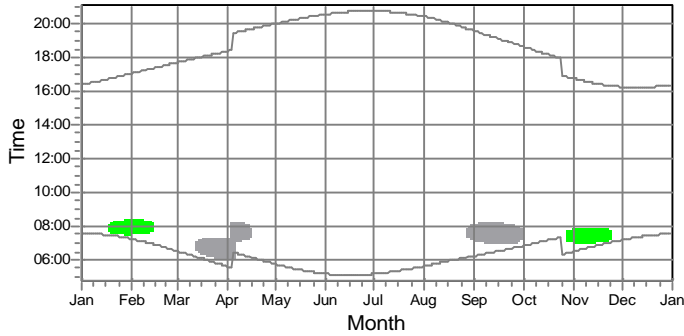
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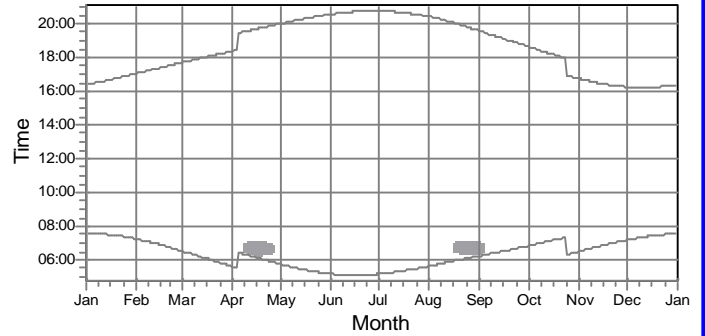
SHADOW - Calendar, graphical

Calculation: 060121 MidWest area2

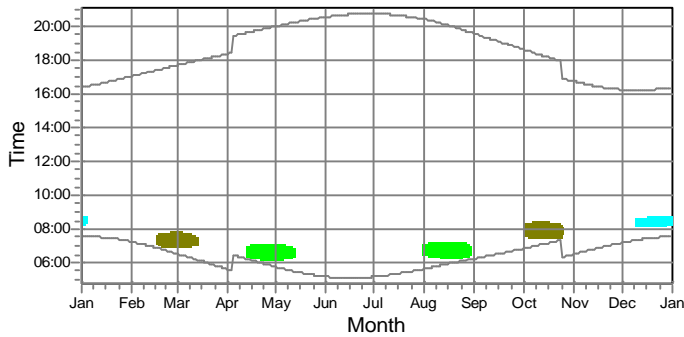
236: 236



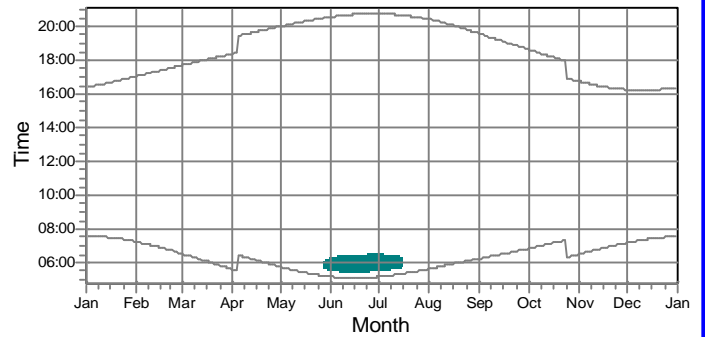
237: 237



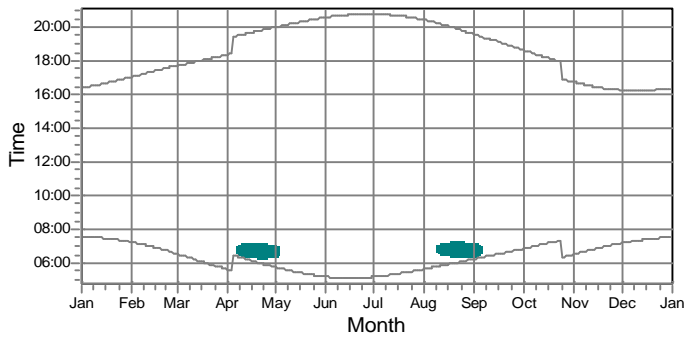
238: 238



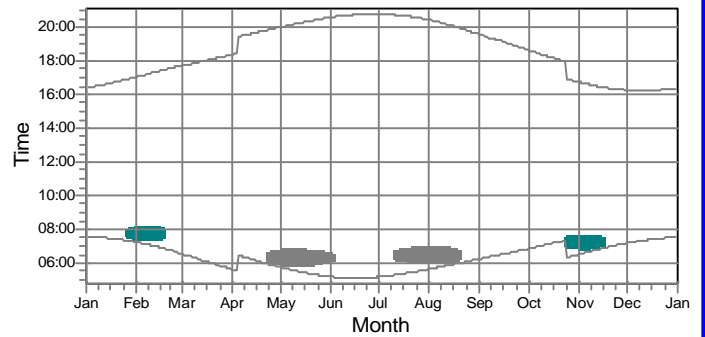
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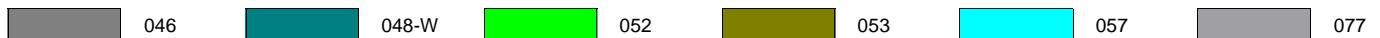
253: 253



254: 254



WTGs



Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
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Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

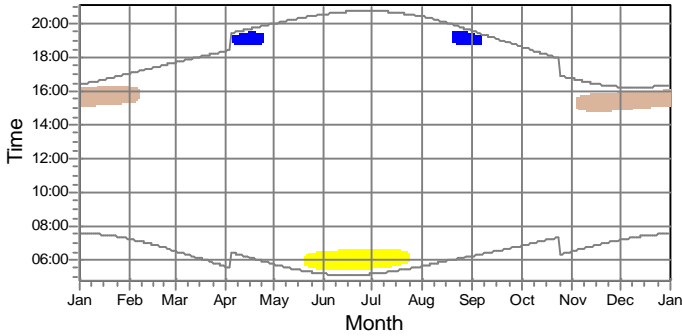
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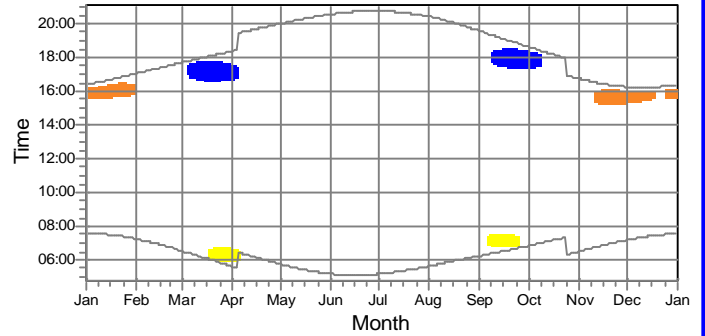
SHADOW - Calendar, graphical

Calculation: 060121 MidWest area2

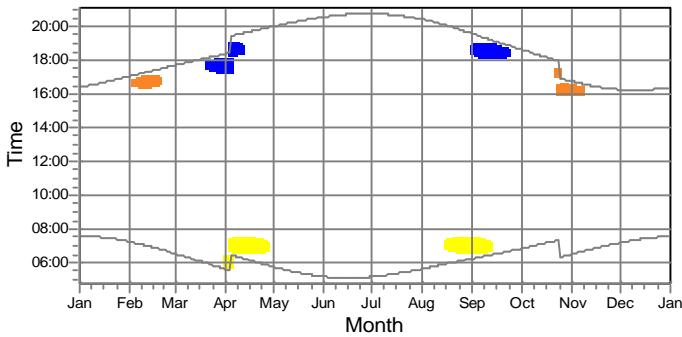
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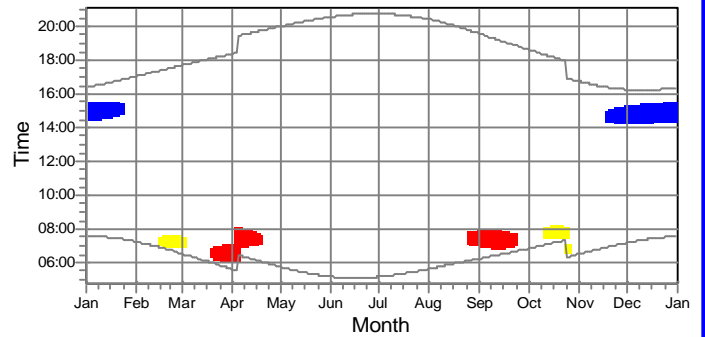
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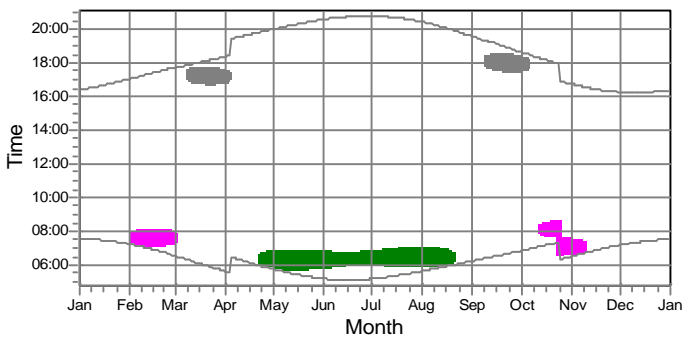
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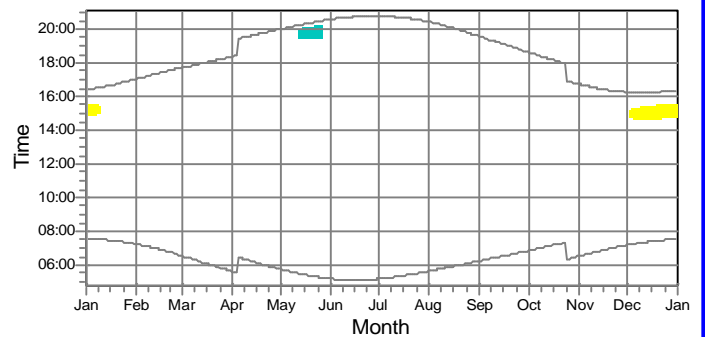
258: 258






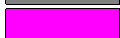

266: 266



267: 267



WTGs

 042	 044	 046	 078	 150-W
 043	 045	 047	 085	

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
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Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

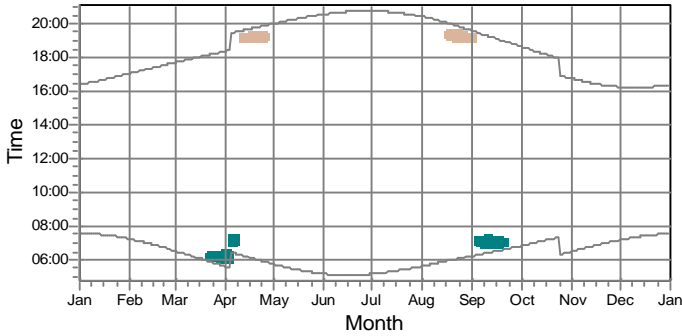
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US-RIVERSIDE, CA 92506

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01/23/06 12:24/2.4.0.67

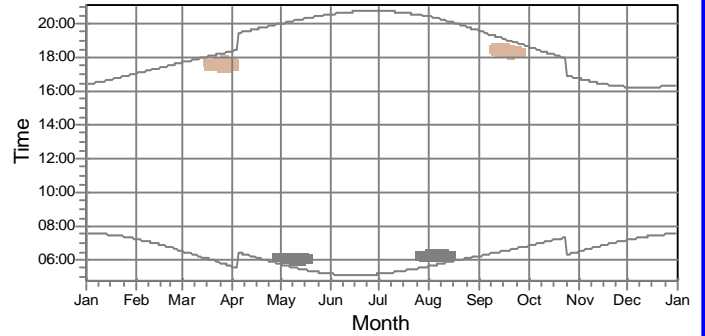
SHADOW - Calendar, graphical

Calculation: 060121 MidWest area2

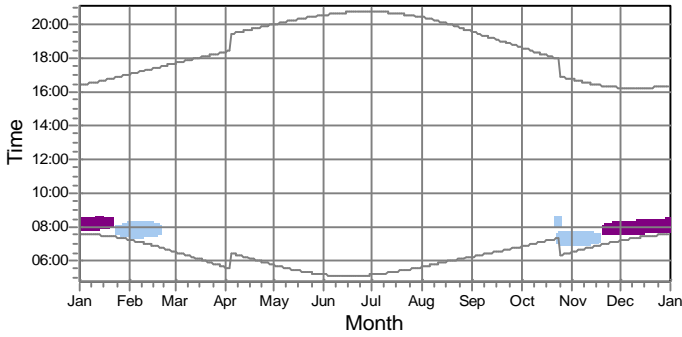
329: 329



330: 330



335: 335



WTGs



Project:
060119 Marble River

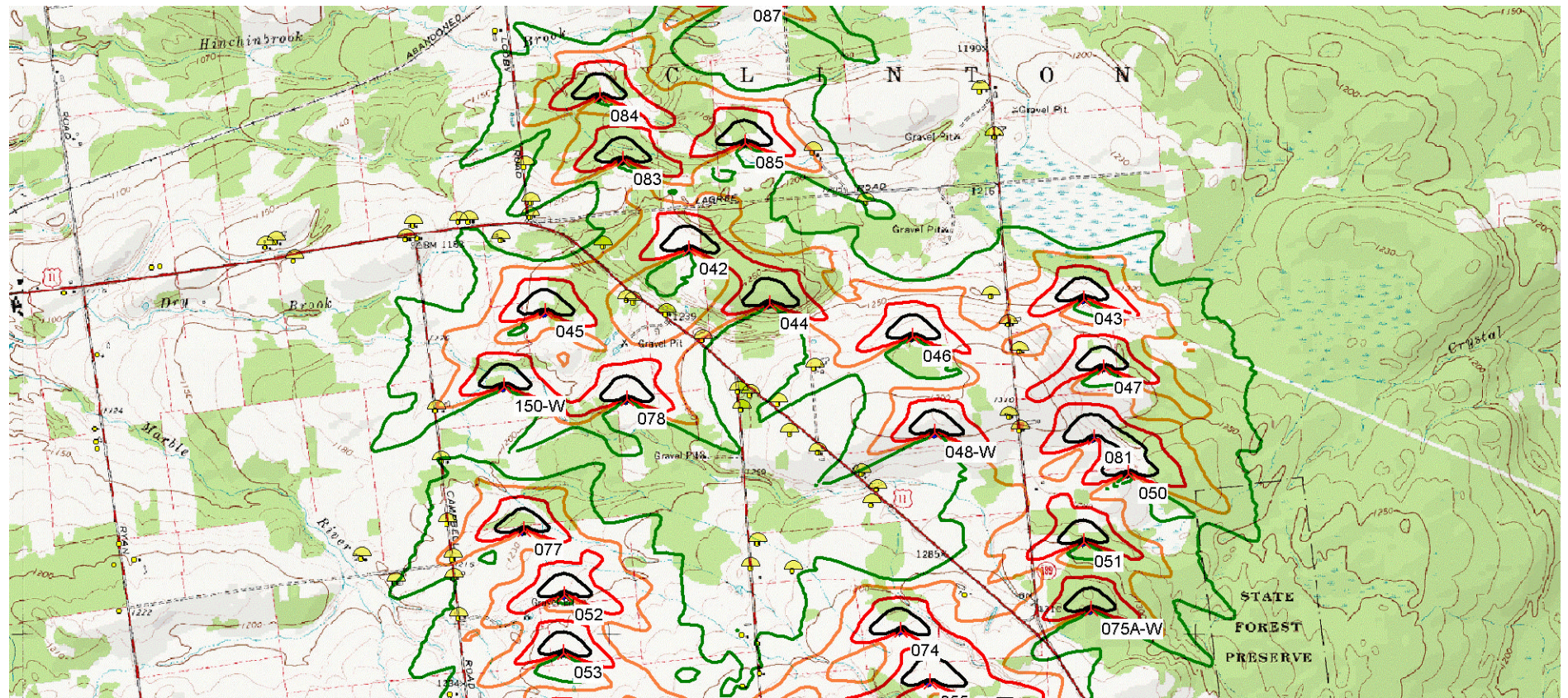
Description:
Marble River Wind Project
Shadow-Flicker, MidW part 2
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Bitmap map: 060106 Marble River USGS 50kz13.bmi

Calculation: 060121 MidWest area2 File: 060106 Marble River USGS 50kz13.bmi



Map: 060106 Marble River USGS 50kz13, Print scale 1:35,000, Map center UTM NAD27 Zone: 18 East: 583,150 North: 4,975,518

▲ New WTG
 ● Shadow receptor
— 10
 — 25
 — 50
 — 100
 Isolines showing shadow in Shadow hours/per year. Real value calculation.

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
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Window properties: 1m2 horizontal, 1m above ground
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Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/23/06 09:10/2.4.0.67

SHADOW - Main Result

Calculation: 060121 MidWest area

Assumptions for shadow calculations

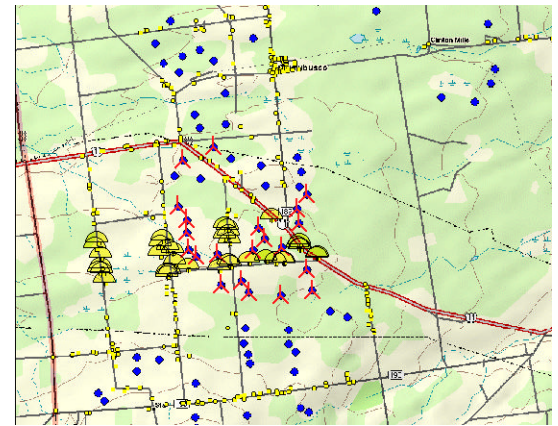
Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35

Operational time

N	NE	E	SE	S	SW	W	NW	Sum
1,850	1,325	800	713	625	663	700	1,275	7,950



Scale 1:200,000

▲ New WTG

● Shadow receptor

WTGs

UTM NAD27 Zone: 18			Row data/Description	WTG type		Power [kW]	Diam. [m]	Height [m]	RPM [RPM]
East	North	Z [m]		Valid	Manufact. Type				
1	582,640	4,976,154	373 042	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
2	581,837	4,975,789	368 045	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
3	585,126	4,974,929	389 050	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
4	584,883	4,974,543	394 051	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
5	581,967	4,974,207	379 052	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
6	581,965	4,973,881	382 053	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
7	584,027	4,973,748	404 055	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
8	584,494	4,973,518	408 056	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
9	582,025	4,973,435	385 057	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
10	582,792	4,973,326	396 058	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
11	582,225	4,973,245	389 059	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
12	585,159	4,972,933	402 060	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
13	583,438	4,972,609	404 062	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
14	582,893	4,972,499	404 063	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
15	585,312	4,972,397	392 064	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
16	583,632	4,972,311	400 066	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
17	584,482	4,972,239	396 073-W	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
18	583,858	4,974,035	399 074	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
19	584,928	4,974,166	400 075A-W	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
20	581,734	4,974,567	373 077	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
21	583,734	4,973,440	404 206	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7

Shadow receptor-Input

UTM NAD27 Zone: 18			Z [m]	Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	
No.	Name	East							North
138	138	584,217	4,974,246	401	1.0	1.0	1.0	0.0	0.0
142	142	582,971	4,974,010	392	1.0	1.0	1.0	0.0	0.0
143	143	583,057	4,973,958	394	1.0	1.0	1.0	0.0	0.0
144	144	583,073	4,973,791	397	1.0	1.0	1.0	0.0	0.0
145	145	582,977	4,973,721	397	1.0	1.0	1.0	0.0	0.0
146	146	583,110	4,973,610	400	1.0	1.0	1.0	0.0	0.0
147	147	583,093	4,973,038	401	1.0	1.0	1.0	0.0	0.0
148	148	583,623	4,973,091	406	1.0	1.0	1.0	0.0	0.0
151	151	579,556	4,973,420	375	1.0	1.0	1.0	0.0	0.0

Continued on next page...

Project:
060119 Marble River

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Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
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Window properties: 1m2 horizontal, 1m above ground
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Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Main Result

Calculation: 060121 MidWest area

...continued from previous page

UTM NAD27 Zone: 18

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window
		[m]	[m]	[m]	[m]	[m]	[m]	[°]	[°]
152	152	581,283	4,973,500	381	1.0	1.0	1.0	0.0	0.0
153	153	581,473	4,973,385	381	1.0	1.0	1.0	0.0	0.0
155	155	579,694	4,973,156	382	1.0	1.0	1.0	0.0	0.0
158	158	584,085	4,973,146	412	1.0	1.0	1.0	0.0	0.0
159	159	584,333	4,973,099	412	1.0	1.0	1.0	0.0	0.0
160	160	584,545	4,973,107	412	1.0	1.0	1.0	0.0	0.0
161	161	584,920	4,973,524	408	1.0	1.0	1.0	0.0	0.0
225	225	579,662	4,972,787	391	1.0	1.0	1.0	0.0	0.0
226	226	579,706	4,972,895	389	1.0	1.0	1.0	0.0	0.0
239	239	581,336	4,973,652	378	1.0	1.0	1.0	0.0	0.0
240	240	581,258	4,973,241	384	1.0	1.0	1.0	0.0	0.0
241	241	581,609	4,973,329	381	1.0	1.0	1.0	0.0	0.0
242	242	581,670	4,973,017	389	1.0	1.0	1.0	0.0	0.0
243	243	581,468	4,972,758	392	1.0	1.0	1.0	0.0	0.0
244	244	581,527	4,972,769	392	1.0	1.0	1.0	0.0	0.0
247	247	582,020	4,972,902	393	1.0	1.0	1.0	0.0	0.0
248	248	583,137	4,972,996	402	1.0	1.0	1.0	0.0	0.0
249	249	584,566	4,973,109	412	1.0	1.0	1.0	0.0	0.0
250	250	584,969	4,973,478	408	1.0	1.0	1.0	0.0	0.0
251	251	584,961	4,973,596	407	1.0	1.0	1.0	0.0	0.0
268	268	581,473	4,972,699	394	1.0	1.0	1.0	0.0	0.0
287	287	579,801	4,972,504	393	1.0	1.0	1.0	0.0	0.0
288	288	579,737	4,972,762	391	1.0	1.0	1.0	0.0	0.0
289	289	579,598	4,973,584	371	1.0	1.0	1.0	0.0	0.0
325	325	585,447	4,973,271	403	1.0	1.0	1.0	0.0	0.0
326	326	585,439	4,973,247	403	1.0	1.0	1.0	0.0	0.0
327	327	584,995	4,973,469	407	1.0	1.0	1.0	0.0	0.0
332	332	582,850	4,972,879	397	1.0	1.0	1.0	0.0	0.0

Calculation Results

No.	Name	Shadow, worst case			Shadow, expected values	
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]	
138	138	95:16	203	0:52	24:22	
142	142	30:36	102	0:24	7:51	
143	143	45:20	136	0:28	11:47	
144	144	38:20	118	0:30	10:16	
145	145	38:58	127	0:36	9:38	
146	146	126:02	256	0:52	30:23	
147	147	27:58	97	0:28	7:34	
148	148	51:12	181	0:24	13:30	
151	151	0:00	0	0:00	0:00	
152	152	41:58	121	0:30	12:06	
153	153	37:40	86	0:38	11:11	
155	155	0:00	0	0:00	0:00	
158	158	23:04	64	0:28	4:54	
159	159	21:14	77	0:24	6:25	
160	160	32:00	100	0:34	9:05	
161	161	49:20	87	0:48	15:08	
225	225	0:00	0	0:00	0:00	
226	226	0:00	0	0:00	0:00	
239	239	52:02	138	0:34	14:02	
240	240	20:56	69	0:28	6:08	
241	241	81:52	146	0:50	24:05	
242	242	48:50	96	0:38	13:29	
243	243	3:02	27	0:10	0:53	
244	244	0:00	0	0:00	0:00	

Continued on next page...

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, MidW part
 27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated:

01/23/06 09:10/2.4.0.67

SHADOW - Main Result

Calculation: 060121 MidWest area

...continued from previous page

No.	Name	Shadow, worst case		Shadow, expected values	
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
247	247	30:06	94	0:26	8:19
248	248	30:18	79	0:38	7:41
249	249	31:44	96	0:34	8:54
250	250	42:58	74	0:46	13:22
251	251	38:24	85	0:44	11:04
268	268	0:00	0	0:00	0:00
287	287	0:00	0	0:00	0:00
288	288	0:00	0	0:00	0:00
289	289	0:00	0	0:00	0:00
325	325	60:56	107	0:52	14:02
326	326	73:28	119	0:54	16:51
327	327	31:52	60	0:42	9:56
332	332	47:12	159	0:34	12:09

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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US-RIVERSIDE, CA 92506
Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 138 - 138

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June		
1 07:34	07:17	15:55 (18) 06:35	16:00 (18) 05:38	05:47	05:13	05:47 (4)		
16:25	17:03	36 16:31 (18) 17:43	28 16:28 (18) 18:23	20:00	20:34	26 06:13 (4)		
2 07:34	07:16	15:54 (18) 06:34	16:02 (18) 05:37	05:45	05:13	05:49 (4)		
16:26	17:05	38 16:32 (18) 17:44	22 16:24 (18) 18:24	20:01	20:35	26 06:15 (4)		
3 07:34	07:14	15:54 (18) 06:32	16:07 (18) 05:35	05:44	05:12	05:48 (4)		
16:27	17:06	38 16:32 (18) 17:46	14 16:21 (18) 18:26	20:02	20:36	26 06:14 (4)		
4 07:34	07:13	15:53 (18) 06:30	05:33	05:43	05:12	05:50 (4)		
16:28	17:08	40 16:33 (18) 17:47	18:27	20:03	20:37	24 06:14 (4)		
5 07:34	07:12	15:52 (18) 06:28	06:31	05:41	05:11	05:49 (4)		
16:29	17:09	44 16:36 (18) 17:48	19:28	20:04	20:37	24 06:13 (4)		
6 07:34	07:11	15:50 (18) 06:27	06:29	05:40	05:11	05:51 (4)		
16:30	17:11	46 16:36 (18) 17:50	19:29	20:06	20:38	22 06:13 (4)		
7 07:34	07:09	15:51 (18) 06:25	06:27	05:38	06:00 (4)	05:11	05:51 (4)	
16:31	17:12	46 16:37 (18) 17:51	19:31	20:07	4 06:04 (4)	20:39	22 06:13 (4)	
8 07:34	07:08	15:50 (18) 06:23	06:26	05:37	05:59 (4)	05:10	05:52 (4)	
16:32	17:13	48 16:38 (18) 17:52	19:32	20:08	8 06:07 (4)	20:40	20 06:12 (4)	
9 07:34	07:07	15:50 (18) 06:21	06:24	05:36	05:57 (4)	05:10	05:52 (4)	
16:33	17:15	48 16:38 (18) 17:54	19:33	20:09	12 06:09 (4)	20:40	20 06:12 (4)	
10 07:33	07:05	15:49 (18) 06:19	06:40 (19)	06:22	05:34	05:56 (4)	05:10	05:52 (4)
16:34	17:16	50 16:39 (18) 17:55	10 06:50 (19) 19:34	20:11	14 06:10 (4)	20:41	20 06:12 (4)	
11 07:33	07:04	15:49 (18) 06:18	06:38 (19)	06:20	05:33	05:55 (4)	05:10	05:54 (4)
16:36	17:18	50 16:39 (18) 17:56	14 06:52 (19) 19:36	20:12	16 06:11 (4)	20:42	18 06:12 (4)	
12 07:33	07:03	15:50 (18) 06:16	06:36 (19)	06:18	05:32	05:54 (4)	05:09	05:54 (4)
16:37	17:19	50 16:40 (18) 17:58	18 06:54 (19) 19:37	20:13	18 06:12 (4)	20:42	18 06:12 (4)	
13 07:32	07:01	15:48 (18) 06:14	06:34 (19)	06:17	05:31	05:53 (4)	05:09	05:54 (4)
16:38	17:21	50 16:38 (18) 17:59	20 06:54 (19) 19:38	20:14	20 06:13 (4)	20:43	18 06:12 (4)	
14 07:32	07:00	15:49 (18) 06:12	06:32 (19)	06:15	05:29	05:51 (4)	05:09	05:56 (4)
16:39	17:22	50 16:39 (18) 18:00	22 06:54 (19) 19:39	20:15	22 06:13 (4)	20:43	16 06:12 (4)	
15 07:31	06:58	15:49 (18) 06:10	06:30 (19)	06:13	05:28	05:50 (4)	05:09	05:56 (4)
16:40	17:23	50 16:39 (18) 18:01	26 06:56 (19) 19:41	20:16	24 06:14 (4)	20:44	16 06:12 (4)	
16 07:31	06:57	15:50 (18) 06:08	06:29 (19)	06:11	05:27	05:49 (4)	05:09	05:56 (4)
16:42	17:25	50 16:40 (18) 18:03	28 06:57 (19) 19:42	20:18	24 06:13 (4)	20:44	16 06:12 (4)	
17 07:30	06:55	15:50 (18) 06:06	06:27 (19)	06:10	05:26	05:48 (4)	05:09	05:56 (4)
16:43	17:26	48 16:38 (18) 18:04	30 06:57 (19) 19:43	20:19	26 06:14 (4)	20:45	16 06:12 (4)	
18 07:29	06:54	15:49 (18) 06:05	06:27 (19)	06:08	05:25	05:47 (4)	05:09	05:58 (4)
16:44	17:28	50 16:39 (18) 18:05	30 06:57 (19) 19:44	20:20	28 06:15 (4)	20:45	14 06:12 (4)	
19 07:29	06:52	15:49 (18) 06:03	06:27 (19)	06:06	05:24	05:46 (4)	05:09	05:58 (4)
16:45	17:29	50 16:39 (18) 18:07	28 06:55 (19) 19:46	20:21	28 06:14 (4)	20:45	14 06:12 (4)	
20 07:28	06:50	15:49 (18) 06:01	06:27 (19)	06:04	05:23	05:45 (4)	05:09	05:58 (4)
16:47	17:30	48 16:37 (18) 18:08	28 06:55 (19) 19:47	20:22	30 06:15 (4)	20:46	14 06:12 (4)	
21 07:27	06:49	15:52 (18) 05:59	06:27 (19)	06:03	05:22	05:45 (4)	05:10	05:58 (4)
16:48	17:32	46 16:38 (18) 18:09	28 06:55 (19) 19:48	20:23	30 06:15 (4)	20:46	14 06:12 (4)	
22 07:27	06:47	15:52 (18) 05:57	06:27 (19)	06:01	05:21	05:46 (4)	05:10	05:58 (4)
16:49	17:33	44 16:36 (18) 18:10	26 06:53 (19) 19:50	20:24	30 06:16 (4)	20:46	14 06:12 (4)	
23 07:26	06:46	15:52 (18) 05:55	06:27 (19)	05:59	05:20	05:45 (4)	05:10	05:59 (4)
16:51	17:35	44 16:36 (18) 18:12	24 06:51 (19) 19:51	20:25	30 06:15 (4)	20:46	14 06:13 (4)	
24 07:25	06:44	15:53 (18) 05:53	06:27 (19)	05:58	05:19	05:44 (4)	05:10	05:59 (4)
16:52	17:36	42 16:35 (18) 18:13	24 06:51 (19) 19:52	20:26	30 06:14 (4)	20:47	14 06:13 (4)	
25 07:24	06:42	15:55 (18) 05:51	06:30 (19)	05:56	05:18	05:45 (4)	05:11	05:57 (4)
16:54	17:37	40 16:35 (18) 18:14	20 06:50 (19) 19:53	20:27	30 06:15 (4)	20:47	16 06:13 (4)	
26 07:23	16:07 (18) 06:41	15:55 (18) 05:50	06:30 (19)	05:55	05:18	05:45 (4)	05:11	05:58 (4)
16:55	8 16:15 (18) 17:39	38 16:33 (18) 18:15	18 06:48 (19) 19:55	20:28	30 06:15 (4)	20:47	16 06:14 (4)	
27 07:22	16:04 (18) 06:39	15:58 (18) 05:48	06:34 (19)	05:53	05:17	05:46 (4)	05:11	05:58 (4)
16:56	16 16:20 (18) 17:40	34 16:32 (18) 18:17	10 06:44 (19) 19:56	20:29	28 06:14 (4)	20:47	16 06:14 (4)	
28 07:21	16:01 (18) 06:37	15:58 (18) 05:46	06:33 (19)	05:51	05:16	05:45 (4)	05:12	05:58 (4)
16:58	22 16:23 (18) 17:41	32 16:30 (18) 18:18	19:57	20:30	30 06:15 (4)	20:47	16 06:14 (4)	
29 07:20	15:58 (18)	05:44	06:32 (19)	05:50	05:15	05:47 (4)	05:12	05:59 (4)
16:59	26 16:24 (18)	18:19	19:58	20:31	28 06:15 (4)	20:47	16 06:15 (4)	
30 07:19	15:57 (18)	05:42	06:31 (19)	05:48	05:15	05:46 (4)	05:13	05:57 (4)
17:01	30 16:27 (18)	18:21	20:00	20:32	28 06:14 (4)	20:47	18 06:15 (4)	
31 07:18	15:56 (18)	05:40	06:30 (19)	05:46	05:14	05:48 (4)		
17:02	32 16:28 (18)	18:22	20:01	20:33	26 06:14 (4)			
Potential sun hours	286	291	369	380	-285	-254		
Total, worst case	134	1250	468		594	544		
Sun reduction	0.45	0.45	0.50		0.55	0.55		
Oper. time red.	0.91	0.91	0.91		0.91	0.91		
Wind dir. red.	0.58	0.58	0.62		0.55	0.55		
Total reduction	0.24	0.24	0.28		0.28	0.28		
Total, real	32	297	132		164	150		

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 138 - 138

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13	05:58 (4) 05:41	06:05 (4) 06:17	06:53	07:14 (19) 06:34	15:19 (18) 07:13
	20:47	18 06:16 (4) 20:25	18 06:23 (4) 19:35	18:38	18 07:32 (19) 16:46	50 16:09 (18) 16:17
2	05:14	05:58 (4) 05:42	06:06 (4) 06:19	06:55	07:16 (19) 06:35	15:20 (18) 07:14
	20:46	18 06:16 (4) 20:24	16 06:22 (4) 19:33	18:36	16 07:32 (19) 16:44	48 16:08 (18) 16:16
3	05:14	05:57 (4) 05:43	06:07 (4) 06:20	06:56	07:17 (19) 06:36	15:20 (18) 07:15
	20:46	20 06:17 (4) 20:22	12 06:19 (4) 19:31	18:34	12 07:29 (19) 16:43	48 16:08 (18) 16:16
4	05:15	05:58 (4) 05:44	06:08 (4) 06:21	06:57	07:18 (19) 06:38	15:21 (18) 07:17
	20:46	20 06:18 (4) 20:21	10 06:18 (4) 19:29	18:33	6 07:24 (19) 16:41	46 16:07 (18) 16:16
5	05:16	05:56 (4) 05:45	06:09 (4) 06:22	06:58	06:39	15:20 (18) 07:18
	20:46	22 06:18 (4) 20:20	6 06:15 (4) 19:27	18:31	16:40	46 16:06 (18) 16:15
6	05:16	05:57 (4) 05:47	06:23	06:59	06:40	15:22 (18) 07:19
	20:46	22 06:19 (4) 20:18	19:25	18:29	16:39	42 16:04 (18) 16:15
7	05:17	05:56 (4) 05:48	06:25	07:01	06:42	15:23 (18) 07:20
	20:45	24 06:20 (4) 20:17	19:24	18:27	16:38	40 16:03 (18) 16:15
8	05:18	05:56 (4) 05:49	06:26	07:02	06:43	15:25 (18) 07:21
	20:45	24 06:20 (4) 20:16	19:22	18:25	16:36	38 16:03 (18) 16:15
9	05:18	05:57 (4) 05:50	06:27	07:03	06:45	15:24 (18) 07:22
	20:44	24 06:21 (4) 20:14	19:20	18:23	16:35	38 16:02 (18) 16:15
10	05:19	05:56 (4) 05:51	06:28	07:05	16:46 (18) 06:46	15:26 (18) 07:23
	20:44	26 06:22 (4) 20:13	19:18	18:22	4 16:50 (18) 16:34	36 16:02 (18) 16:15
11	05:20	05:57 (4) 05:52	06:29	07:06	16:39 (18) 06:47	15:27 (18) 07:24
	20:43	26 06:23 (4) 20:11	19:16	18:20	18 16:57 (18) 16:33	32 15:59 (18) 16:15
12	05:21	05:55 (4) 05:54	06:30	07:07	16:35 (18) 06:49	15:29 (18) 07:24
	20:43	26 06:21 (4) 20:10	19:14	18:18	24 16:59 (18) 16:32	30 15:59 (18) 16:15
13	05:22	05:56 (4) 05:55	06:32	07:08	16:32 (18) 06:50	15:30 (18) 07:25
	20:42	26 06:22 (4) 20:08	19:12	18:16	30 17:02 (18) 16:30	26 15:56 (18) 16:15
14	05:23	05:55 (4) 05:56	06:33	07:10	16:31 (18) 06:51	15:34 (18) 07:26
	20:42	28 06:23 (4) 20:07	19:10	18:15	32 17:03 (18) 16:29	22 15:56 (18) 16:15
15	05:23	05:56 (4) 05:57	06:34	07:11	16:29 (18) 06:53	15:37 (18) 07:27
	20:41	28 06:24 (4) 20:05	19:09	18:13	36 17:05 (18) 16:28	16 15:53 (18) 16:15
16	05:24	05:55 (4) 05:58	06:35	07:12	16:26 (18) 06:54	15:41 (18) 07:28
	20:40	30 06:25 (4) 20:04	19:07	10 07:33 (19) 07:12	40 17:06 (18) 16:27	8 15:49 (18) 16:16
17	05:25	05:56 (4) 06:00	06:36	07:13	16:25 (18) 06:55	15:41 (18) 07:28
	20:40	28 06:24 (4) 20:02	19:05	14 07:34 (19) 18:09	40 17:05 (18) 16:26	16:16
18	05:26	05:54 (4) 06:01	06:38	07:15	16:25 (18) 06:57	15:41 (18) 07:29
	20:39	30 06:24 (4) 20:00	19:03	20 07:37 (19) 18:08	42 17:07 (18) 16:25	16:16
19	05:27	05:55 (4) 06:02	06:39	07:16	16:22 (18) 06:58	15:41 (18) 07:30
	20:38	30 06:25 (4) 19:57	19:01	22 07:38 (19) 18:06	46 17:08 (18) 16:25	16:17
20	05:28	05:54 (4) 06:03	06:40	07:17	16:21 (18) 06:59	15:41 (18) 07:30
	20:37	30 06:24 (4) 19:56	18:59	24 07:37 (19) 18:04	46 17:07 (18) 16:24	16:17
21	05:29	05:55 (4) 06:04	06:41	07:19	16:21 (18) 07:01	15:41 (18) 07:31
	20:36	30 06:25 (4) 19:54	18:57	26 07:38 (19) 18:03	48 17:09 (18) 16:23	16:17
22	05:30	05:54 (4) 06:05	06:42	07:20	16:20 (18) 07:02	15:41 (18) 07:31
	20:36	30 06:24 (4) 19:52	18:55	28 07:40 (19) 18:01	48 17:08 (18) 16:22	16:18
23	05:31	05:55 (4) 06:07	06:44	07:21	16:20 (18) 07:03	15:41 (18) 07:32
	20:35	30 06:25 (4) 19:51	18:53	28 07:39 (19) 17:59	50 17:10 (18) 16:21	16:18
24	05:32	05:56 (4) 06:08	06:45	07:23	16:19 (18) 07:05	15:41 (18) 07:32
	20:34	28 06:24 (4) 19:49	18:51	28 07:38 (19) 17:58	50 17:09 (18) 16:21	16:19
25	05:33	05:57 (4) 06:09	06:46	07:24	15:18 (18) 07:06	15:41 (18) 07:33
	20:33	28 06:25 (4) 19:47	18:49	30 07:39 (19) 18:56	50 16:08 (18) 16:20	16:20
26	05:34	05:58 (4) 06:10	06:47	07:25	15:18 (18) 07:07	15:41 (18) 07:33
	20:32	26 06:24 (4) 19:45	18:48	28 07:38 (19) 18:55	52 16:10 (18) 16:19	16:20
27	05:35	05:59 (4) 06:11	06:48	07:10 (19) 06:27	15:19 (18) 07:08	15:41 (18) 07:33
	20:31	26 06:25 (4) 19:44	18:46	28 07:38 (19) 16:53	50 16:09 (18) 16:19	16:21
28	05:36	06:00 (4) 06:13	06:50	07:11 (19) 06:28	15:19 (18) 07:10	15:41 (18) 07:34
	20:29	24 06:24 (4) 19:42	18:44	26 07:37 (19) 16:51	50 16:09 (18) 16:18	16:22
29	05:38	06:01 (4) 06:14	06:51	07:12 (19) 06:29	15:18 (18) 07:11	15:41 (18) 07:34
	20:28	22 06:23 (4) 19:40	18:42	24 07:36 (19) 16:50	50 16:08 (18) 16:18	16:22
30	05:39	06:02 (4) 06:15	06:52	07:13 (19) 06:31	15:18 (18) 07:12	15:41 (18) 07:34
	20:27	20 06:22 (4) 19:38	18:40	22 07:35 (19) 16:49	50 16:08 (18) 16:17	16:23
31	05:40	06:04 (4) 06:16		06:32	15:19 (18)	15:41 (18) 07:34
	20:26	20 06:24 (4) 19:36		16:47	48 16:07 (18)	16:24
Potential sun hours	-272	4	376	341	288	274
Total, worst case	784	62	358	956	566	
Sun reduction	0.58	0.55	0.55	0.45	0.35	
Oper. time red.	0.91	0.91	0.91	0.91	0.91	
Wind dir. red.	0.55	0.55	0.63	0.58	0.58	
Total reduction	0.29	0.28	0.31	0.24	0.18	
Total, real	228	17	112	228	104	

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/23/06 09:41 / 6
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 142 - 142

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shade)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December							
1	07:34	07:59 (21)	07:17	06:35	05:38	06:01 (18)	05:47	05:14	05:13	05:41	06:17	06:53	06:34	07:13	07:41 (21)				
16:25	16	08:15 (21)	17:04	17:43	18:23	24	06:25 (18)	20:00	20:34	20:47	20:25	19:35	18:38	16:46	24	08:05 (21)			
2	07:34	07:59 (21)	07:16	06:34	05:37	06:01 (18)	05:45	05:13	05:14	05:42	06:19	06:55	06:35	07:14	07:42 (21)				
16:26	18	08:17 (21)	17:05	17:44	18:24	24	06:25 (18)	20:01	20:35	20:47	20:24	19:33	18:36	16:44	22	08:04 (21)			
3	07:34	07:59 (21)	07:15	06:32	05:35	06:01 (18)	05:44	05:12	05:14	05:43	06:20	06:56	06:36	07:15	07:41 (21)				
16:27	18	08:18 (21)	17:06	17:45	18:26	22	06:23 (18)	20:02	20:36	20:48	20:22	19:31	18:35	16:43	24	08:05 (21)			
4	07:34	07:59 (21)	07:13	06:30	05:33	06:01 (18)	05:43	05:12	05:15	05:44	06:21	07:03 (18)	06:57	07:17	07:42 (21)				
16:28	18	08:17 (21)	17:08	17:47	18:27	22	06:23 (18)	20:03	20:37	20:46	20:21	19:29	8	07:11 (18)	18:33	16:42	22	08:04 (21)	
5	07:34	07:59 (21)	07:12	06:28	06:31	07:01 (18)	05:41	05:12	05:16	05:46	06:22	07:00 (18)	06:58	06:39	07:18	07:43 (21)			
16:29	20	08:19 (21)	17:09	17:48	18:28	20	07:21 (18)	20:05	20:37	20:46	20:20	19:27	14	07:14 (18)	18:31	16:40	22	08:05 (21)	
6	07:34	07:59 (21)	07:11	06:27	06:29	07:03 (18)	05:40	05:11	05:16	05:47	06:23	06:59 (18)	07:00	06:40	07:19	07:45 (21)			
16:30	20	08:19 (21)	17:11	17:50	18:29	16	07:19 (18)	20:06	20:38	20:46	20:18	19:26	16	07:15 (18)	18:29	16:39	20	08:05 (21)	
7	07:34	07:58 (21)	07:09	06:25	06:27	07:04 (18)	05:38	05:11	05:17	05:48	06:25	06:56 (18)	07:01	06:42	07:20	07:46 (21)			
16:31	22	08:20 (21)	17:12	17:51	19:31	14	07:18 (18)	20:07	20:39	20:45	20:17	19:24	20	07:16 (18)	18:27	16:38	20	08:06 (21)	
8	07:34	07:58 (21)	07:08	06:23	06:26	07:06 (18)	05:37	05:10	05:18	05:49	06:26	06:55 (18)	07:02	06:43	07:21	07:47 (21)			
16:32	22	08:20 (21)	17:14	17:52	19:32	8	07:14 (18)	20:08	20:40	20:45	20:16	19:22	22	07:17 (18)	18:25	16:36	16:15	18	08:05 (21)
9	07:34	07:58 (21)	07:07	06:21	06:24	07:06 (18)	05:37	05:10	05:19	05:50	06:27	06:55 (18)	07:03	06:45	07:22	07:48 (21)			
16:33	24	08:22 (21)	17:15	17:54	19:33	20:09	20:40	20:44	20:14	19:20	22	07:17 (18)	18:23	16:35	16:15	18	08:06 (21)		
10	07:34	07:59 (21)	07:05	06:19	06:22	07:05 (18)	05:34	05:10	05:19	05:51	06:28	06:54 (18)	07:05	06:46	07:23	07:49 (21)			
16:34	22	08:21 (21)	17:16	17:55	19:34	20:11	20:41	20:44	20:13	19:18	24	07:18 (18)	18:22	16:34	16:15	18	08:07 (21)		
11	07:34	07:59 (21)	07:04	06:18	06:20	07:05 (18)	05:33	05:10	05:20	05:53	06:29	06:53 (18)	07:06	06:47	07:24	07:50 (21)			
16:36	24	08:23 (21)	17:18	17:56	19:36	20:12	20:42	20:43	20:11	19:16	24	07:17 (18)	18:20	16:33	16:15	16	08:06 (21)		
12	07:34	07:58 (21)	07:03	06:18	06:18	07:05 (18)	05:32	05:10	05:21	05:54	06:31	06:54 (18)	07:07	06:49	07:24	07:50 (21)			
16:37	24	08:22 (21)	17:19	17:58	19:37	20:13	20:42	20:43	20:10	19:14	22	07:16 (18)	18:18	16:32	16:15	16	08:06 (21)		
13	07:34	08:00 (21)	07:01	06:14	06:17	07:06 (18)	05:31	05:09	05:22	05:55	06:32	06:53 (18)	07:08	06:50	07:25	07:51 (21)			
16:38	24	08:24 (21)	17:21	17:59	19:38	20:14	20:43	20:42	20:08	19:12	22	07:15 (18)	18:16	16:31	16:15	16	08:07 (21)		
14	07:34	07:59 (21)	07:00	06:12	06:15	07:07 (18)	05:30	05:09	05:23	05:56	06:33	06:54 (18)	07:10	06:51	07:26	07:52 (21)			
16:39	22	08:23 (21)	17:22	18:00	19:40	20:16	20:45	20:42	20:07	19:10	20	07:14 (18)	18:15	16:34	16:15	14	08:06 (21)		
15	07:34	08:01 (21)	06:58	06:10	06:13	07:08 (18)	05:28	05:09	05:23	05:57	06:34	06:55 (18)	07:11	06:53	07:27	07:53 (21)			
16:40	22	08:23 (21)	17:24	18:01	19:41	20:16	20:44	20:41	20:05	19:09	18	07:13 (18)	18:13	16:28	16:15	14	08:07 (21)		
16	07:34	08:00 (21)	06:57	06:08	06:11	07:09 (18)	05:27	05:09	05:24	05:58	06:35	06:57 (18)	07:12	06:54	07:28	07:54 (21)			
16:42	24	08:24 (21)	17:25	18:03	19:42	20:18	20:44	20:40	20:04	19:07	16	07:13 (18)	18:11	16:27	6	07:51 (21)	16:16	14	08:08 (21)
17	07:34	08:01 (21)	06:55	06:07	06:10	07:10 (18)	05:26	05:09	05:25	06:00	06:36	06:58 (18)	07:14	06:55	07:24	07:51 (21)			
16:43	22	08:23 (21)	17:26	18:04	19:43	20:19	20:45	20:40	20:02	19:05	12	07:10 (18)	18:09	16:26	12	07:54 (21)	16:16	14	08:08 (21)
18	07:29	08:03 (21)	06:54	06:05	06:08	07:12 (18)	05:25	05:09	05:26	06:01	06:38	06:59 (18)	07:15	06:57	07:42 (21)	07:29	07:55 (21)		
16:44	22	08:25 (21)	17:28	18:05	19:45	20:20	20:45	20:39	20:01	19:03	10	07:09 (18)	18:08	16:26	14	07:56 (21)	16:16	12	08:07 (21)
19	07:29	08:02 (21)	06:52	06:06	06:09	07:14 (18)	05:24	05:09	05:27	06:02	06:39	06:58 (18)	07:11	06:54	07:41 (21)	07:30	07:55 (21)		
16:46	22	08:24 (21)	17:29	18:07	19:46	20:21	20:45	20:38	19:57	19:01	10	07:08 (18)	18:06	16:25	16	07:57 (21)	16:17	12	08:07 (21)
20	07:28	08:03 (21)	06:50	06:01	06:05	07:15 (18)	05:23	05:10	05:28	06:03	06:40	06:59 (18)	07:17	06:57	07:40 (21)	07:30	07:56 (21)		
16:47	20	08:23 (21)	17:31	18:08	19:47	20:22	20:46	20:37	19:56	18:59	18	07:12 (18)	18:04	16:24	18	07:58 (21)	16:17	12	08:08 (21)
21	07:27	08:04 (21)	06:49	06:03	06:03	07:16 (18)	05:22	05:10	05:29	06:04	06:41	06:59 (18)	07:19	07:01	07:40 (21)	07:31	07:57 (21)		
16:48	20	08:24 (21)	17:32	18:09	19:48	20:23	20:46	20:36	19:54	18:57	18	07:11 (18)	18:03	16:23	20	08:00 (21)	16:17	12	08:09 (21)
22	07:27	08:05 (21)	06:47	06:01	06:01	07:17 (18)	05:21	05:10	05:30	06:06	06:42	07:20	07:02	07:39 (21)	07:31	07:57 (21)			
16:50	18	08:23 (21)	17:33	18:10	19:50	20:24	20:46	20:36	19:52	18:55	18	07:10 (18)	18:01	16:22	20	07:59 (21)	16:18	12	08:09 (21)
23	07:26	08:06 (21)	06:46	06:05	06:00	07:19 (18)	05:20	05:10	05:31	06:07	06:44	07:21	07:03	07:39 (21)	07:32	07:57 (21)			
16:51	16	08:22 (21)	17:35	18:12	19:51	20:25	20:46	20:35	19:51	18:53	18	07:09 (18)	18:01	16:21	22	08:01 (21)	16:18	12	08:09 (21)
24	07:25	08:08 (21)	06:44	06:03	06:05	07:20 (18)	05:19	05:10	05:32	06:08	06:45	07:23	07:05	07:40 (21)	07:32	07:58 (21)			
16:52	14	08:22 (21)	17:36	18:13	19:52	20:26	20:47	20:34	19:49	18:51	17	07:08 (18)	18:01	16:21	22	08:02 (21)	16:19	12	08:10 (21)
25	07:24	08:09 (21)	06:42	06:02	06:05	07:21 (18)	05:18	05:11	05:33	06:09	06:46	07:24	07:06	07:39 (21)	07:33	07:58 (21)			
16:54	12	08:21 (21)	17:39	18:14	19:53	20:27	20:47	20:33	19:47	18:50	16	07:07 (18)	18:00	16:20	22	08:01 (21)	16:20	12	08:10 (21)
26	07:23	08:12 (21)	06:41	06:00	06:03	07:22 (18)	05:18	05:11	05:34	06:10	06:47	07:25	07:07	07:39 (21)	07:33	07:58 (21)			
16:55	6	08:18 (21)	17:39	18:16	12	06:22 (18)	19:55	20:28	20:47	20:32	19:45	18:48	16:55	16:19	24	08:03 (21)	16:20	12	08:10 (21)
27	07:22	08:07 (21)	06:40	06:01	06:04	07:23 (18)	05:17	05:11	05:35	06:12	06:48	07:27	07:08	07:40 (21)	07:33	07:59 (21)			
16:56	18	08:19 (21)	17:40	18:17	16	06:24 (18)	19:56	20:29	20:47	20:31	19:44	18:46	16:53	16:19	22	08:02 (21)	16:21	14	08:13 (21)
28	07:21	08:06 (21)	06:37	06:02	06:05	07:24 (18)	05:16	05:12	05:37	06:13	06:50	07:28	07:10	07:39 (21)	07:34	07:59 (21)			
16:58	18	08:19 (21)	17:42	18:18	18	06:24 (18)	19:57	20:30	20:47	20:30	19:42	18:44	16:52	16:18	24	08:03 (21)	16:22	14	08:13 (21)
29	07:20	08:04 (21)	06:35	06:00	06:03	07:25 (18)	05:15	05:12	05:38	06:14	06:51	07:30	07:11	07:40 (21)	07:34	07:59 (21)			
16:59	18	08:19 (21)	17:43	18:19	20	06:24 (18)	19:58	20:31	20:47	20:28	19:40	18:42	16:50	16:18	24	08:04 (21)	16:22	14	08:13 (21)
30	07:19	08:02 (21)	06:33	06:00	06:03	07:26 (18)	05:15	05:13	05:39	06:15	06:52	07:32	07:12	07:40 (21)	07:34	07:59 (21)			
17:01	18	08:19 (21)	17:44	18:21	22	06:24 (18)	20:00	20:32	20:47	20:27	19:38	18:40	16:49	16:					

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/23/06 09:41 / 7
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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 143 - 143

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34	07:59 (21)	07:17	06:35	06:56 (7)	05:38
	16:25	22 08:21 (21)	17:04	17:43	10 07:06 (7)	18:23
2	07:34	07:59 (21)	07:16	06:34	06:54 (7)	05:37
	16:26	22 08:21 (21)	17:05	17:44	12 07:06 (7)	18:24
3	07:34	07:59 (21)	07:14	06:32	06:53 (7)	05:35
	16:27	24 08:23 (21)	17:06	17:46	16 07:09 (7)	18:26
4	07:34	07:59 (21)	07:13	06:30	06:51 (7)	05:33
	16:28	24 08:23 (21)	17:08	17:47	18 07:09 (7)	18:27
5	07:34	08:01 (21)	07:12	06:28	06:49 (7)	06:31
	16:29	22 08:23 (21)	17:09	17:48	20 07:09 (7)	19:28
6	07:34	08:01 (21)	07:11	06:27	06:47 (7)	06:29
	16:30	24 08:25 (21)	17:11	17:50	22 07:09 (7)	19:29
7	07:34	08:00 (21)	07:09	06:25	06:47 (7)	06:27
	16:31	24 08:24 (21)	17:12	17:51	22 07:09 (7)	19:31
8	07:34	08:00 (21)	07:08	06:23	06:48 (7)	06:26
	16:32	26 08:26 (21)	17:14	17:52	20 07:08 (7)	19:32
9	07:34	08:02 (21)	07:07	06:21	06:48 (7)	06:24
	16:33	24 08:26 (21)	17:15	17:54	20 07:08 (7)	19:33
10	07:33	08:01 (21)	07:05	06:19	06:48 (7)	06:22
	16:34	26 08:27 (21)	17:16	17:55	18 07:06 (7)	19:34
11	07:33	08:01 (21)	07:04	06:18	06:50 (7)	06:20
	16:36	26 08:27 (21)	17:18	17:56	14 07:04 (7)	19:36
12	07:33	08:02 (21)	07:03	06:16	06:50 (7)	06:18
	16:37	26 08:28 (21)	17:19	17:58	12 07:02 (7)	19:37
13	07:32	08:02 (21)	07:01	06:14	06:56 (7)	06:17
	16:38	26 08:28 (21)	17:21	17:59	4 07:00 (7)	19:38
14	07:32	08:01 (21)	07:00	06:12	06:15	06:49 (18)
	16:39	26 08:27 (21)	17:22	18:00	20 07:09 (18)	20:15
15	07:31	08:03 (21)	06:58	06:10	06:13	06:49 (18)
	16:40	26 08:29 (21)	17:24	18:01	19:41	18 07:07 (18)
16	07:31	08:02 (21)	06:57	06:08	06:11	06:52 (18)
	16:42	26 08:28 (21)	17:25	18:03	19:42	14 07:06 (18)
17	07:30	08:03 (21)	06:55	06:07	06:10	06:54 (18)
	16:43	26 08:29 (21)	17:26	18:04	19:43	8 07:02 (18)
18	07:29	08:05 (21)	06:54	06:05	06:08	05:25
	16:44	24 08:29 (21)	17:28	18:05	19:45	20:20
19	07:29	08:04 (21)	06:52	06:03	06:06	05:24
	16:46	26 08:30 (21)	17:29	18:07	19:46	20:21
20	07:28	08:05 (21)	06:50	06:01	06:05	05:23
	16:47	24 08:29 (21)	17:31	18:08	19:47	20:22
21	07:27	08:06 (21)	06:49	05:59	06:03	05:22
	16:48	22 08:28 (21)	17:32	18:09	19:48	20:23
22	07:27	08:07 (21)	06:47	05:57	06:01	05:21
	16:50	22 08:29 (21)	17:33	18:10	19:50	20:24
23	07:26	08:08 (21)	06:46	05:55	06:00	05:20
	16:51	20 08:28 (21)	17:35	18:12	19:51	20:25
24	07:25	08:10 (21)	06:44	05:53	05:58	05:19
	16:52	18 08:28 (21)	17:36	18:13	19:52	20:26
25	07:24	08:11 (21)	06:42	05:52	05:56	05:18
	16:54	16 08:27 (21)	17:37	18:14	19:53	20:27
26	07:23	08:12 (21)	06:41	05:50	05:55	05:18
	16:55	14 08:26 (21)	17:39	18:16	19:55	20:28
27	07:22	08:15 (21)	06:39	05:48	05:53	05:17
	16:56	8 08:23 (21)	17:40	18:17	19:56	20:29
28	07:21	06:37	06:58 (7)	05:46	05:52	05:16
	16:58	17:42	6 07:04 (7)	18:18	19:57	20:30
29	07:20			05:44	05:50	05:15
	16:59			18:19	19:58	20:31
30	07:19			05:42	05:48	05:15
	17:01			18:21	20:00	20:32
31	07:18			05:40		05:14
	17:02			18:22		20:33
Potential sun hours	286	291	369	380	-285	-254
Total, worst case	614	6	208	340		
Sun reduction	0.45	0.45	0.50	0.55		
Oper. time red.	0.91	0.91	0.91	0.91		
Wind dir. red.	0.67	0.62	0.62	0.61		
Total reduction	0.28	0.26	0.28	0.31		
Total, real	169	2	59	104		

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	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)
	Sun set (hh:mm)	Minutes with flicker			

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, MidW part
 27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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01/23/06 09:41 / 8

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Wind Engineers, Inc.
 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated:

01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 143 - 143

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	06:17 19:35	06:45 (18) 07:11 (18)	06:53 18:38	07:31 (7) 16:46
2	05:14 20:47	05:42 20:24	06:19 19:33	06:47 (18) 07:11 (18)	06:55 18:36	07:28 (7) 16:44
3	05:14 20:46	05:43 20:22	06:20 19:31	06:46 (18) 07:12 (18)	06:56 18:35	07:27 (7) 16:43
4	05:15 20:46	05:44 20:21	06:21 19:29	06:45 (18) 07:11 (18)	06:57 18:33	07:26 (7) 16:42
5	05:16 20:46	05:46 20:20	06:22 19:27	06:44 (18) 07:10 (18)	06:58 18:31	07:26 (7) 16:40
6	05:16 20:46	05:47 20:18	06:23 19:25	06:45 (18) 07:09 (18)	07:00 18:29	07:25 (7) 16:39
7	05:17 20:45	05:48 20:17	06:25 19:24	06:46 (18) 07:08 (18)	07:01 18:27	07:24 (7) 16:38
8	05:18 20:45	05:49 20:16	06:26 19:22	06:47 (18) 07:07 (18)	07:02 18:25	07:23 (7) 16:36
9	05:19 20:44	05:50 20:14	06:27 19:20	06:49 (18) 07:07 (18)	07:03 18:23	07:25 (7) 16:35
10	05:19 20:44	05:51 20:13	06:28 19:18	06:50 (18) 07:04 (18)	07:05 18:22	07:26 (7) 16:34
11	05:20 20:43	05:53 20:11	06:29 19:16	06:51 (18) 07:01 (18)	07:06 18:20	07:27 (7) 16:33
12	05:21 20:43	05:54 20:10	06:31 19:14	07:07 18:18	07:07 18:18	07:29 (7) 16:32
13	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:16	07:30 (7) 07:38 (7)	06:50 16:31
14	05:23 20:42	05:56 20:07	06:33 19:10	07:10 18:15	07:31 (7) 07:35 (7)	06:51 16:29
15	05:23 20:41	05:57 20:05	06:34 19:09	07:11 18:13	06:53 16:28	07:47 (21) 07:55 (21)
16	05:24 20:40	05:58 20:04	06:35 19:07	07:12 18:11	06:54 16:27	07:45 (21) 07:59 (21)
17	05:25 20:40	06:00 20:02	06:36 19:05	07:14 18:09	06:55 16:26	07:44 (21) 08:00 (21)
18	05:26 20:39	06:01 20:01	06:38 19:03	07:15 18:08	06:57 16:25	07:44 (21) 08:02 (21)
19	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:25	07:43 (21) 08:03 (21)
20	05:28 20:37	06:03 19:56	06:40 18:59	07:17 18:04	06:59 16:24	07:42 (21) 08:04 (21)
21	05:29 20:36	06:04 19:54	06:41 18:57	07:19 18:03	07:01 16:23	07:42 (21) 08:04 (21)
22	05:30 20:36	06:06 19:52	06:42 18:55	07:20 18:01	07:02 16:22	07:41 (21) 08:05 (21)
23	05:31 20:35	06:07 19:51	06:44 18:53	07:21 17:59	07:03 16:21	07:41 (21) 08:07 (21)
24	05:32 20:34	06:08 19:49	06:45 18:51	07:23 17:58	07:05 16:21	07:42 (21) 08:06 (21)
25	05:33 20:33	06:09 19:47	06:46 18:50	06:24 16:56	07:06 16:20	07:41 (21) 08:07 (21)
26	05:34 20:32	06:10 19:45	06:55 (18) 07:07 (18)	06:47 18:48	06:25 16:19	07:41 (21) 08:07 (21)
27	05:35 20:31	06:12 19:44	06:52 (18) 07:08 (18)	06:48 18:46	06:27 16:19	07:42 (21) 08:08 (21)
28	05:37 20:30	06:13 19:42	06:51 (18) 07:09 (18)	06:50 18:44	06:28 16:18	07:41 (21) 08:09 (21)
29	05:38 20:28	06:14 19:40	06:50 (18) 07:10 (18)	06:51 18:42	06:30 16:18	07:42 (21) 08:08 (21)
30	05:39 20:27	06:15 19:38	06:47 (18) 07:11 (18)	06:52 18:40	06:31 16:17	07:44 (21) 08:10 (21)
31	05:40 20:26	06:16 19:36	06:46 (18) 07:10 (18)	06:52 18:40	06:32 16:17	07:44 (21) 08:10 (21)
Potential sun hours	-272	4	376	341	288	274
Total, worst case		114	236	208	352	642
Sun reduction		0.55	0.55	0.45	0.35	0.35
Oper. time red.		0.91	0.91	0.91	0.91	0.91
Wind dir. red.		0.61	0.61	0.62	0.67	0.67
Total reduction		0.31	0.31	0.26	0.21	0.21
Total, real		35	72	53	75	138

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 144 - 144

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34 16:25	07:17 17:04	07:39 (21) 08:03 (21)	06:35 17:43	05:38 18:23	05:47 20:00
2	07:34 16:26	07:16 17:05	07:38 (21) 08:04 (21)	06:34 17:44	05:37 18:24	05:45 20:01
3	07:34 16:27	07:14 17:06	07:38 (21) 08:04 (21)	06:32 17:46	05:35 18:26	05:44 20:02
4	07:34 16:28	07:13 17:08	07:37 (21) 08:05 (21)	06:30 17:47	05:33 18:27	05:43 20:03
5	07:34 16:29	07:12 17:09	07:38 (21) 08:06 (21)	06:28 17:48	05:31 19:28	05:41 20:05
6	07:34 16:30	07:11 17:11	07:36 (21) 08:04 (21)	06:27 17:50	05:29 19:29	05:40 20:06
7	07:34 16:31	07:09 17:12	07:37 (21) 08:05 (21)	06:25 17:51	05:27 19:31	05:38 20:07
8	07:34 16:32	07:08 17:14	07:38 (21) 08:06 (21)	06:23 17:52	05:26 19:32	05:37 20:08
9	07:34 16:33	07:07 17:15	07:36 (21) 08:06 (21)	06:21 17:54	05:24 19:33	05:36 20:09
10	07:33 16:34	07:05 17:16	07:37 (21) 08:05 (21)	06:19 17:55	05:22 19:34	05:34 20:11
11	07:33 16:36	07:04 17:18	07:37 (21) 08:05 (21)	06:18 17:56	05:20 19:36	05:33 20:12
12	07:33 16:37	07:03 17:19	07:38 (21) 08:04 (21)	06:16 17:58	05:18 19:37	05:32 20:13
13	07:32 16:38	07:01 17:21	07:38 (21) 08:04 (21)	06:14 17:59	05:16 19:38	05:31 20:14
14	07:32 16:39	07:00 17:22	07:39 (21) 08:03 (21)	06:12 18:00	05:15 19:40	05:30 20:15
15	07:31 16:40	06:58 17:24	07:41 (21) 08:01 (21)	06:10 18:01	05:13 19:41	05:28 20:16
16	07:31 16:42	06:57 17:25	07:42 (21) 08:00 (21)	06:08 18:03	05:11 19:42	05:27 20:18
17	07:30 16:43	06:55 17:26	07:44 (21) 07:58 (21)	06:07 18:04	05:10 19:43	05:26 20:19
18	07:29 16:44	06:54 17:28	07:49 (21) 07:53 (21)	06:05 18:05	05:09 19:45	05:25 20:20
19	07:29 16:46	06:52 17:29	06:52 18:07	06:03 18:08	05:08 19:46	05:24 20:21
20	07:28 16:47	06:50 17:31	06:51 18:08	06:01 18:09	05:06 19:47	05:23 20:22
21	07:27 16:48	06:49 17:32	06:50 18:09	06:00 18:10	05:05 19:48	05:22 20:23
22	07:27 16:50	06:47 17:33	06:50 18:10	06:00 19:50	05:04 20:24	05:21 20:24
23	07:26 16:51	06:46 17:35	06:50 18:12	06:00 19:51	05:03 20:25	05:20 20:25
24	07:25 16:52	06:44 17:36	06:50 18:13	06:00 19:52	05:02 20:26	05:19 20:26
25	07:24 16:54	06:42 17:37	06:50 18:14	06:00 19:53	05:01 20:27	05:18 20:27
26	07:23 16:55	06:41 17:39	06:50 18:16	06:00 19:55	05:01 20:28	05:18 20:28
27	07:22 16:56	06:39 17:40	06:50 18:17	06:00 19:56	05:00 20:29	05:17 20:29
28	07:21 16:58	06:37 17:42	06:50 18:18	06:00 19:57	05:00 20:30	05:16 20:30
29	07:20 16:59	06:37 17:42	06:50 18:19	06:00 19:58	05:00 20:31	05:15 20:31
30	07:19 17:01	06:37 17:41	06:50 18:21	06:00 20:00	05:00 20:32	05:15 20:32
31	07:18 17:02	06:37 17:40	06:50 18:22	06:00 20:00	05:00 20:33	05:15 20:33
Potential sun hours	286	291	369	380	285	254
Total, worst case	70	434	218	130	294	
Sun reduction	0.45	0.45	0.50	0.55	0.55	
Oper. time red.	0.91	0.91	0.91	0.91	0.91	
Wind dir. red.	0.63	0.63	0.62	0.57	0.57	
Total reduction	0.26	0.26	0.28	0.29	0.29	
Total, real	18	113	62	37	84	

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 144 - 144

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December		
1	05:13 20:47	05:41 20:25	06:23 (18) 06:39 (18)	06:17 19:35	06:53 18:38	06:34 16:46	07:07 (21) 07:35 (21)	07:13 16:17
2	05:14 20:47	05:42 20:24	06:22 (18) 06:40 (18)	06:19 19:33	06:55 18:36	06:35 16:44	07:06 (21) 07:36 (21)	07:14 16:16
3	05:14 20:46	05:43 20:22	06:21 (18) 06:41 (18)	06:20 19:31	06:56 18:35	06:36 16:43	07:08 (21) 07:36 (21)	07:15 16:16
4	05:15 20:46	05:44 20:21	06:20 (18) 06:42 (18)	06:21 19:29	06:57 18:33	06:38 16:42	07:07 (21) 07:35 (21)	07:17 16:16
5	05:16 20:46	05:46 20:20	06:19 (18) 06:41 (18)	06:22 19:27	06:58 18:31	06:39 16:40	07:06 (21) 07:34 (21)	07:18 16:16
6	05:16 20:46	05:47 20:18	06:18 (18) 06:42 (18)	06:23 19:25	07:00 18:29	06:40 16:39	07:08 (21) 07:36 (21)	07:19 16:15
7	05:17 20:45	05:48 20:17	06:17 (18) 06:43 (18)	06:25 19:24	07:01 18:27	06:42 16:38	07:07 (21) 07:35 (21)	07:20 16:15
8	05:18 20:45	05:49 20:16	06:16 (18) 06:42 (18)	06:26 19:22	07:02 18:25	06:43 16:36	07:09 (21) 07:35 (21)	07:21 16:15
9	05:19 20:44	05:50 20:14	06:17 (18) 06:43 (18)	06:27 19:20	07:03 18:23	06:45 16:35	07:08 (21) 07:34 (21)	07:22 16:15
10	05:19 20:44	05:51 20:13	06:17 (18) 06:43 (18)	06:28 19:18	07:05 18:22	06:46 16:34	07:10 (21) 07:34 (21)	07:23 16:15
11	05:20 20:43	05:53 20:11	06:16 (18) 06:42 (18)	06:29 19:16	07:06 18:20	06:47 16:33	07:11 (21) 07:31 (21)	07:24 16:15
12	05:21 20:43	05:54 20:10	06:17 (18) 06:43 (18)	06:31 19:14	07:07 18:18	06:49 16:32	07:13 (21) 07:31 (21)	07:24 16:15
13	05:22 20:42	05:55 20:08	06:18 (18) 06:42 (18)	06:32 19:12	07:11 (7) 07:17 (7)	06:50 16:31	07:14 (21) 07:30 (21)	07:25 16:15
14	05:23 20:42	05:56 20:07	06:19 (18) 06:41 (18)	06:33 19:10	07:08 (7) 07:20 (7)	06:51 16:29	07:18 (21) 07:28 (21)	07:26 16:15
15	05:23 20:41	05:57 20:05	06:20 (18) 06:40 (18)	06:34 19:09	07:05 (7) 07:21 (7)	06:53 16:28	07:21 (21) 07:25 (21)	07:27 16:15
16	05:24 20:40	05:58 20:04	06:21 (18) 06:39 (18)	06:35 19:07	07:05 (7) 07:23 (7)	06:54 16:27	07:22 (21) 07:31 (21)	07:28 16:16
17	05:25 20:40	06:00 20:02	06:22 (18) 06:38 (18)	06:36 19:05	07:04 (7) 07:24 (7)	06:55 16:26	07:23 (21) 07:32 (21)	07:29 16:16
18	05:26 20:39	06:01 20:01	06:24 (18) 06:36 (18)	06:38 19:03	07:03 (7) 07:23 (7)	06:57 16:26	07:15 (21) 07:31 (21)	07:29 16:16
19	05:27 20:38	06:02 19:57	06:25 (18) 06:35 (18)	06:39 19:01	07:02 (7) 07:24 (7)	06:58 16:25	07:16 (21) 07:30 (21)	07:30 16:17
20	05:28 20:37	06:03 19:56	06:26 (18) 06:30 (18)	06:40 18:59	07:01 (7) 07:23 (7)	06:59 16:24	07:17 (21) 07:31 (21)	07:30 16:17
21	05:29 20:36	06:04 19:54	06:27 (18) 18:57	06:41 18:57	07:02 (7) 07:22 (7)	07:01 16:23	07:19 (21) 07:31 (21)	07:31 16:17
22	05:30 20:36	06:06 19:52	06:28 (18) 18:55	06:42 18:55	07:04 (7) 07:22 (7)	07:02 16:22	07:20 (21) 07:31 (21)	07:31 16:18
23	05:31 20:35	06:07 19:51	06:29 (18) 18:53	06:44 18:53	07:05 (7) 07:21 (7)	07:03 16:21	07:21 (21) 07:32 (21)	07:32 16:18
24	05:32 20:34	06:08 19:49	06:29 (18) 18:51	06:45 18:51	07:06 (7) 07:20 (7)	07:05 16:21	07:23 (21) 08:17 (21)	07:32 16:19
25	05:33 20:33	06:09 19:47	06:30 (18) 18:50	06:46 18:50	07:07 (7) 07:17 (7)	07:06 16:20	07:14 (21) 07:28 (21)	07:33 16:20
26	05:34 20:32	06:10 19:45	06:31 (18) 18:48	06:47 18:48	07:08 (7) 07:14 (7)	07:07 16:19	07:12 (21) 07:30 (21)	07:33 16:20
27	05:35 20:31	06:12 19:44	06:32 (18) 18:46	06:48 18:46	07:09 (7) 16:53	07:08 16:19	07:13 (21) 07:31 (21)	07:33 16:21
28	05:37 20:29	06:13 19:42	06:33 (18) 18:44	06:50 18:44	07:10 (7) 16:52	07:09 16:18	07:14 (21) 07:33 (21)	07:34 16:22
29	05:38 20:28	06:14 19:40	06:34 (18) 18:42	06:51 18:42	07:11 (7) 16:50	07:10 16:18	07:15 (21) 07:34 (21)	07:34 16:22
30	05:39 20:27	06:15 19:38	06:35 (18) 18:40	06:52 18:40	07:12 (7) 16:49	07:11 16:17	07:16 (21) 07:34 (21)	07:34 16:23
31	05:40 20:26	06:16 19:36	06:36 (18) 19:36	06:53 18:40	07:13 (7) 16:47	07:12 16:17	07:17 (21) 07:35 (21)	07:34 16:24
Potential sun hours	-272	4	376	341	288	274		
Total, worst case	22	404	220	166	342			
Sun reduction	0.58	0.55	0.55	0.45	0.35			
Oper. time red.	0.91	0.91	0.91	0.91	0.91			
Wind dir. red.	0.57	0.57	0.62	0.63	0.63			
Total reduction	0.30	0.29	0.31	0.26	0.20			
Total, real	7	115	69	43	69			

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/23/06 09:41 / 11
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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 145 - 145

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34 16:25	07:17 17:04	16:11 (11) 16:33 (11)	06:35 17:43	07:20 (21) 18:23	05:38 18:23
2	07:34 16:26	07:16 17:05	16:14 (11) 16:34 (11)	06:34 17:44	17:02 (9) 18:24	05:37 18:24
3	07:34 16:27	07:14 17:06	16:14 (11) 16:32 (11)	06:32 17:46	17:05 (9) 18:26	05:35 18:26
4	07:34 16:28	07:13 17:08	16:15 (11) 16:31 (11)	06:30 17:47	17:05 (9) 18:27	05:33 18:27
5	07:34 16:29	07:12 17:09	16:18 (11) 16:30 (11)	06:28 17:48	17:09 (9) 19:28	06:31 19:28
6	07:34 16:30	07:11 17:11	16:20 (11) 16:27 (11)	06:27 17:50	17:15 (9) 19:29	06:29 19:29
7	07:34 16:31	07:09 17:12	16:26 (11) 17:50	06:25 17:51	19:29	06:27 19:31
8	07:34 16:32	07:08 17:14	06:23 17:52	06:26 19:32	06:27 19:32	06:26 19:32
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:59 (18) 06:21 (18)
10	07:33 16:34	07:05 17:16	06:19 17:55	06:22 19:34	05:34 20:11	06:00 (18) 06:22 (18)
11	07:33 16:36	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	06:01 (18) 06:21 (18)
12	07:33 16:37	07:03 17:19	06:16 17:58	06:18 19:37	05:32 20:13	06:02 (18) 06:22 (18)
13	07:32 16:38	07:01 17:21	07:22 (21) 06:14 17:59	06:17 19:38	05:31 20:14	06:01 (18) 06:21 (18)
14	07:32 16:39	07:00 17:22	07:21 (21) 06:12 18:00	06:15 19:40	05:30 20:15	06:02 (18) 06:20 (18)
15	07:31 16:40	06:58 17:24	07:19 (21) 06:10 18:01	06:13 19:41	05:28 20:16	06:02 (18) 06:18 (18)
16	07:31 16:42	06:57 17:25	07:18 (21) 06:08 18:03	06:11 19:42	05:27 20:18	06:05 (18) 06:17 (18)
17	07:30 16:43	06:55 17:26	07:16 (21) 06:07 18:04	06:10 19:43	05:26 20:19	06:06 (18) 06:14 (18)
18	07:29 16:44	06:54 17:28	07:15 (21) 06:05 18:05	06:08 19:45	05:25 20:20	05:09 20:45
19	07:29 16:46	06:52 17:29	07:15 (21) 06:03 18:07	06:06 19:46	05:24 20:21	05:09 20:45
20	07:28 16:47	06:50 17:31	07:13 (21) 06:01 18:08	06:05 19:47	05:23 20:22	05:10 20:46
21	07:27 16:48	06:49 17:32	07:14 (21) 05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46
22	07:27 16:50	06:47 17:33	17:10 (9) 05:57 18:10	06:01 19:50	05:21 20:24	05:10 20:46
23	07:26 16:51	06:46 17:35	07:14 (21) 05:55 18:12	06:00 19:51	05:20 20:25	05:10 20:46
24	07:25 16:52	06:44 17:36	07:15 (21) 05:53 18:13	05:58 19:52	05:19 20:26	05:10 20:47
25	07:24 16:54	06:42 17:37	07:15 (21) 05:52 18:14	05:56 19:53	05:18 20:27	05:11 20:47
26	07:23 16:55	06:41 17:39	07:15 (21) 05:50 18:16	05:55 19:55	05:18 20:28	05:11 20:47
27	07:22 16:56	06:39 17:40	17:15 (9) 05:48 18:17	05:53 19:56	05:17 20:29	05:11 20:47
28	07:21 16:58	06:37 17:42	07:18 (21) 05:46 18:18	05:52 19:57	05:16 (18) 20:30	05:12 20:47
29	07:20 16:59	16:10 (11) 16:32 (11)	05:44 18:19	05:50 19:58	06:11 (18) 06:19 (18)	05:15 20:31
30	07:19 17:01	16:11 (11) 16:33 (11)	05:42 18:21	05:48 20:00	06:09 (18) 06:19 (18)	05:15 20:32
31	07:18 17:02	16:10 (11) 16:34 (11)	05:40 18:22	05:46 18:22	05:14 20:33	05:13 20:47
Potential sun hours	286	291	369	380	-285	-254
Total, worst case	232	510	84	22	310	
Sun reduction	0.45	0.45	0.50	0.55	0.55	
Oper. time red.	0.91	0.91	0.91	0.91	0.91	
Wind dir. red.	0.59	0.60	0.58	0.56	0.56	
Total reduction	0.24	0.25	0.26	0.28	0.28	
Total, real	56	125	22	6	86	

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 145 - 145

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	06:11 (18) 06:31 (18)	06:17 19:35	06:53 18:38	06:34 16:46
2	05:14 20:47	05:42 20:24	06:10 (18) 06:32 (18)	06:19 19:33	06:55 18:36	06:35 16:44
3	05:14 20:46	05:43 20:22	06:11 (18) 06:33 (18)	06:20 19:31	06:56 18:35	06:36 16:43
4	05:15 20:46	05:44 20:21	06:10 (18) 06:32 (18)	06:21 19:29	06:57 18:33	06:38 16:42
5	05:16 20:46	05:46 20:20	06:09 (18) 06:33 (18)	06:22 19:27	06:58 18:31	06:39 16:40
6	05:16 20:46	05:47 20:18	06:10 (18) 06:32 (18)	06:23 19:25	07:00 18:29	8 16:00 (11)
7	05:17 20:45	05:48 20:17	06:11 (18) 06:33 (18)	06:25 19:24	07:01 18:27	14 16:01 (11)
8	05:18 20:45	05:49 20:16	06:12 (18) 06:32 (18)	06:26 19:22	07:02 18:25	16 16:03 (11)
9	05:19 20:44	05:50 20:14	06:13 (18) 06:31 (18)	06:27 19:20	07:03 18:23	18 16:04 (11)
10	05:19 20:44	05:51 20:13	06:15 (18) 06:31 (18)	06:28 19:18	07:05 18:22	22 16:04 (11)
11	05:20 20:43	05:53 20:11	06:16 (18) 06:30 (18)	06:29 19:16	07:06 18:20	24 16:05 (11)
12	05:21 20:43	05:54 20:10	06:17 (18) 06:29 (18)	06:31 19:14	07:07 18:18	24 16:05 (11)
13	05:22 20:42	05:55 20:08	06:18 (18) 06:28 (18)	06:32 19:12	07:08 18:16	30 16:04 (11)
14	05:23 20:42	05:56 20:07	06:19 (18) 06:27 (18)	06:33 19:10	07:10 18:15	32 16:04 (11)
15	05:23 20:41	05:57 20:05	06:20 (18) 06:24 (18)	06:34 19:09	07:11 18:13	34 16:01 (11)
16	05:24 20:40	05:58 20:04	06:21 (18) 19:07	06:35 18:11	07:12 18:11	36 16:01 (11)
17	05:25 20:40	06:00 20:02	06:22 (18) 19:05	06:36 18:09	07:14 18:09	36 16:00 (11)
18	05:26 20:39	06:01 20:01	06:23 (18) 19:03	06:38 18:08	07:15 18:08	34 16:00 (11)
19	05:27 20:38	06:02 19:57	06:24 (18) 19:01	06:39 18:06	07:16 18:06	34 16:00 (11)
20	05:28 20:37	06:03 19:56	06:25 (18) 18:59	06:40 18:04	07:17 18:04	30 16:00 (11)
21	05:29 20:36	06:04 19:54	06:26 (18) 18:57	06:41 18:03	07:19 18:03	26 16:00 (11)
22	05:30 20:36	06:06 19:52	06:27 (18) 18:55	06:42 18:01	07:20 18:01	26 16:00 (11)
23	05:31 20:35	06:07 19:51	06:28 (18) 18:53	06:44 17:59	07:21 17:59	26 16:00 (11)
24	05:32 20:34	06:08 19:49	06:29 (18) 18:51	06:45 17:58	07:23 17:58	24 16:00 (11)
25	05:33 20:33	06:09 19:47	06:30 (18) 18:50	06:46 16:56	06:24 16:56	22 16:00 (11)
26	05:34 20:32	06:10 19:45	06:31 (18) 18:48	06:47 16:55	06:25 16:55	22 16:00 (11)
27	05:35 20:31	06:11 (18) 19:44	06:32 (18) 18:46	06:48 16:53	06:26 16:53	16 16:00 (11)
28	05:37 20:29	06:14 (18) 19:42	06:33 (18) 18:44	06:50 16:52	06:27 16:52	12 16:00 (11)
29	05:38 20:28	06:13 (18) 19:40	06:34 (18) 18:42	06:51 16:50	06:28 16:50	8 16:00 (11)
30	05:39 20:27	06:13 (18) 19:38	06:35 (18) 18:40	06:52 16:49	06:29 16:49	8 16:00 (11)
31	05:40 20:26	06:12 (18) 19:36	06:36 (18) 19:36	06:53 16:47	06:30 16:47	8 16:00 (11)
Potential sun hours	-272	4	376	341	288	274
Total, worst case	82	256	510	332		
Sun reduction	0.58	0.55	0.45	0.35		
Oper. time red.	0.91	0.91	0.91	0.91		
Wind dir. red.	0.56	0.56	0.60	0.59		
Total reduction	0.29	0.28	0.25	0.19		
Total, real	24	71	125	62		

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 146 - 146

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34 16:25	15:05 (10) 17:04	07:17 16:01 (10)	06:35 17:43	05:38 18:23	05:14 16:34
2	07:34 16:26	15:05 (10) 17:05	07:16 16:00 (10)	06:34 17:44	05:37 18:24	05:13 16:35
3	07:34 16:27	15:05 (10) 17:06	07:14 15:58 (10)	06:32 17:46	05:35 18:26	05:12 16:36
4	07:34 16:28	15:05 (10) 17:07	07:13 15:59 (10)	06:30 17:47	05:33 18:27	05:12 16:37
5	07:34 16:29	15:07 (10) 17:09	07:12 15:58 (10)	06:28 17:48	06:31 19:28	05:12 16:38
6	07:34 16:30	15:07 (10) 17:11	07:11 15:56 (10)	06:27 17:50	06:29 19:29	05:11 16:39
7	07:34 16:31	15:06 (10) 17:12	07:09 15:55 (10)	06:25 17:51	06:27 19:31	05:11 16:40
8	07:34 16:32	15:06 (10) 17:14	07:08 15:54 (10)	06:23 17:52	06:26 19:32	05:10 16:41
9	07:34 16:33	15:06 (10) 17:15	07:07 15:54 (10)	06:21 17:54	06:24 19:33	05:10 16:42
10	07:33 16:34	15:07 (10) 17:16	07:05 15:53 (11)	06:19 17:55	06:22 19:34	05:10 16:43
11	07:33 16:36	15:07 (10) 17:18	07:04 15:53 (11)	06:18 17:56	06:20 19:36	05:10 16:44
12	07:33 16:37	15:06 (10) 17:19	07:03 15:52 (11)	06:16 17:58	06:18 19:37	05:10 16:45
13	07:32 16:38	15:08 (10) 17:21	07:01 15:51 (11)	06:14 17:59	06:17 19:38	05:09 16:46
14	07:32 16:39	15:07 (10) 17:22	07:00 15:50 (11)	06:12 18:00	06:15 19:40	05:09 16:47
15	07:31 16:40	15:09 (10) 17:24	06:58 15:49 (11)	06:10 18:01	06:13 19:41	05:09 16:48
16	07:31 16:42	15:08 (10) 17:25	06:57 15:48 (11)	06:08 18:03	06:11 19:42	05:09 16:49
17	07:30 16:43	15:07 (10) 17:26	06:55 15:47 (11)	06:07 18:04	06:10 19:43	05:09 16:50
18	07:29 16:44	15:09 (10) 17:28	06:54 15:46 (11)	06:05 18:05	06:08 19:45	05:09 16:51
19	07:29 16:46	15:08 (10) 17:29	06:52 15:45 (11)	06:03 18:07	06:06 19:46	05:09 16:52
20	07:28 16:47	15:09 (10) 17:31	06:50 15:44 (11)	06:01 18:08	06:05 19:47	05:10 16:53
21	07:27 16:48	15:10 (10) 17:32	06:49 15:43 (11)	05:59 18:09	06:03 19:48	05:10 16:54
22	07:27 16:50	15:09 (10) 17:33	06:47 15:42 (11)	05:57 18:10	06:01 19:50	05:10 16:55
23	07:26 16:51	15:10 (10) 17:35	06:46 15:41 (11)	05:55 18:12	06:00 19:51	05:10 16:56
24	07:25 16:52	15:10 (10) 17:36	06:44 15:40 (11)	05:53 18:13	05:58 19:52	05:19 16:57
25	07:24 16:54	15:11 (10) 17:37	06:42 15:39 (11)	05:52 18:14	05:56 19:53	4 05:46 (18) 16:58
26	07:23 16:55	15:12 (10) 17:39	06:41 15:38 (11)	05:50 18:16	05:55 19:55	05:18 16:59
27	07:22 16:56	15:12 (10) 17:40	06:39 15:37 (11)	05:48 18:17	05:53 19:56	05:17 17:00
28	07:21 16:58	15:13 (10) 17:42	06:37 15:36 (11)	05:46 18:18	05:52 19:57	10 05:40 (18) 17:01
29	07:20 16:59	15:12 (10) 17:44	06:35 15:35 (11)	05:44 18:19	05:50 19:58	12 05:39 (18) 17:02
30	07:19 17:01	15:13 (10) 17:46	06:33 15:34 (11)	05:42 18:21	05:48 20:00	14 05:38 (18) 17:03
31	07:18 17:02	15:14 (10) 17:48	06:31 15:33 (11)	05:40 18:22	05:46 20:03	14 05:37 (18) 17:04
Potential sun hours	286	291	369	380	285	254
Total, worst case	1506	672	390	246	76	674
Sun reduction	0.45	0.45	0.50	0.55	0.55	0.55
Oper. time red.	0.91	0.91	0.91	0.91	0.91	0.91
Wind dir. red.	0.61	0.60	0.62	0.60	0.58	0.58
Total reduction	0.25	0.24	0.28	0.30	0.29	0.29
Total, real	379	164	110	74	22	195

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

Day in month	Sun rise (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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 146 - 146

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13	05:38 (18) 05:41	06:17	06:39 (7) 06:53	07:39 (21) 06:34	14:59 (10) 07:13 14:49 (10)
	20:47	24 06:02 (18) 20:25	19:35	20 06:59 (7) 18:38	22 08:01 (21) 16:46	24 16:23 (11) 16:17 48 15:37 (10)
2	05:14	05:39 (18) 05:42	06:19	06:41 (7) 06:55	07:38 (21) 06:35	14:56 (10) 07:14 14:50 (10)
	20:46	22 06:01 (18) 20:24	19:33	18 06:59 (7) 18:36	24 08:02 (21) 16:44	26 15:22 (10) 16:16 48 15:38 (10)
3	05:14	05:39 (18) 05:43	06:20	06:42 (7) 06:56	07:37 (21) 06:36	14:54 (10) 07:15 14:49 (10)
	20:46	22 06:01 (18) 20:22	19:31	14 06:56 (7) 18:35	26 08:03 (21) 16:43	30 15:24 (10) 16:16 48 15:37 (10)
4	05:15	05:40 (18) 05:44	06:21	06:43 (7) 06:57	07:34 (21) 06:38	14:53 (10) 07:17 14:50 (10)
	20:46	22 06:02 (18) 20:21	19:29	12 06:55 (7) 18:33	30 08:04 (21) 16:42	32 15:25 (10) 16:16 48 15:38 (10)
5	05:16	05:40 (18) 05:46	06:22	06:44 (7) 06:58	07:34 (21) 06:39	14:50 (10) 07:18 14:51 (10)
	20:46	22 06:02 (18) 20:20	19:27	10 06:54 (7) 18:31	30 08:04 (21) 16:40	36 15:26 (10) 16:16 46 15:37 (10)
6	05:16	05:41 (18) 05:47	06:23	06:45 (7) 07:00	07:33 (21) 06:40	14:50 (10) 07:19 14:53 (10)
	20:46	20 06:01 (18) 20:18	19:25	6 06:51 (7) 18:29	32 08:05 (21) 16:39	38 15:28 (10) 16:15 46 15:39 (10)
7	05:17	05:42 (18) 05:48	06:25	07:01	07:32 (21) 06:42	14:49 (10) 07:20 14:54 (10)
	20:45	20 06:02 (18) 20:17	19:24	18:27	32 08:04 (21) 16:38	40 15:29 (10) 16:15 46 15:40 (10)
8	05:18	05:42 (18) 05:49	06:26	07:02	07:31 (21) 06:43	14:47 (10) 07:21 14:53 (10)
	20:45	20 06:02 (18) 20:16	19:22	18:25	32 08:03 (21) 16:36	42 15:29 (10) 16:15 46 15:39 (10)
9	05:19	05:43 (18) 05:50	06:27	07:03	07:33 (21) 06:45	14:46 (10) 07:22 14:54 (10)
	20:44	18 06:01 (18) 20:14	19:20	18:23	32 08:05 (21) 16:35	44 15:30 (10) 16:15 46 15:40 (10)
10	05:19	05:44 (18) 05:51	06:28	07:05	07:32 (21) 06:46	14:46 (10) 07:23 14:55 (10)
	20:44	18 06:02 (18) 20:13	19:18	18:22	32 08:04 (21) 16:34	46 15:32 (10) 16:15 44 15:39 (10)
11	05:20	05:45 (18) 05:53	06:29	07:06	07:31 (21) 06:47	14:45 (10) 07:24 14:55 (10)
	20:43	16 06:01 (18) 20:11	19:16	18:20	32 08:03 (21) 16:33	46 15:31 (10) 16:15 44 15:39 (10)
12	05:21	05:45 (18) 05:54	06:31	07:07	07:33 (21) 06:49	14:45 (10) 07:24 14:56 (10)
	20:43	16 06:01 (18) 20:10	19:14	18:18	30 08:03 (21) 16:32	48 15:33 (10) 16:15 44 15:40 (10)
13	05:22	05:46 (18) 05:55	06:32	07:08	07:32 (21) 06:50	14:44 (10) 07:25 14:57 (10)
	20:42	14 06:00 (18) 20:08	19:12	18:16	30 08:02 (21) 16:31	48 15:32 (10) 16:15 42 15:39 (10)
14	05:23	05:47 (18) 05:56	06:33	07:10	07:33 (21) 06:51	14:44 (10) 07:26 14:58 (10)
	20:42	14 06:01 (18) 20:07	19:10	18:15	28 08:01 (21) 16:29	50 15:34 (10) 16:15 42 15:40 (10)
15	05:23	05:48 (18) 05:57	06:34	07:11	07:35 (21) 06:53	14:45 (10) 07:27 14:59 (10)
	20:41	12 06:00 (18) 20:05	19:09	18:13	24 07:59 (21) 16:28	48 15:33 (10) 16:15 42 15:41 (10)
16	05:24	05:49 (18) 05:58	06:35	07:12	07:34 (21) 06:54	14:45 (10) 07:28 14:58 (10)
	20:40	10 05:59 (18) 20:04	19:07	18:11	24 07:58 (21) 16:27	50 15:35 (10) 16:16 44 15:42 (10)
17	05:25	05:50 (18) 06:00	06:36	07:14	07:35 (21) 06:55	14:44 (10) 07:28 14:58 (10)
	20:40	8 05:58 (18) 20:02	19:05	18:09	20 07:55 (21) 16:26	50 15:34 (10) 16:16 42 15:40 (10)
18	05:26	05:51 (18) 06:01	06:38	07:15	07:39 (21) 06:57	14:44 (10) 07:29 14:59 (10)
	20:39	6 05:57 (18) 20:01	19:03	18:08	18 17:31 (11) 16:26	52 15:36 (10) 16:16 42 15:41 (10)
19	05:27	05:51 (18) 06:02	06:39	07:16	07:42 (21) 06:58	14:45 (10) 07:30 14:59 (10)
	20:38	4 05:55 (18) 19:57	19:01	18:06	18 17:32 (11) 16:25	50 15:35 (10) 16:17 42 15:41 (10)
20	05:28	06:03	06:40	07:17	17:19 (11) 06:59	14:44 (10) 07:30 15:00 (10)
	20:37	19:56	18:59	18:04	14 17:33 (11) 16:24	52 15:36 (10) 16:17 42 15:42 (10)
21	05:29	06:04	06:41	07:19	17:17 (11) 07:01	14:46 (10) 07:31 15:01 (10)
	20:36	19:54	18:57	18:03	18 17:35 (11) 16:23	50 15:36 (10) 16:17 42 15:43 (10)
22	05:30	06:06	06:48 (7) 06:42	07:20	17:16 (11) 07:02	14:45 (10) 07:31 15:01 (10)
	20:36	19:52	4 06:52 (7) 18:55	18:01	20 17:36 (11) 16:22	52 15:37 (10) 16:18 42 15:43 (10)
23	05:31	06:07	06:45 (7) 06:44	07:21	17:16 (11) 07:03	14:45 (10) 07:32 15:01 (10)
	20:35	19:51	10 06:55 (7) 18:53	17:59	18 17:34 (11) 16:21	52 15:37 (10) 16:18 42 15:43 (10)
24	05:32	06:08	06:42 (7) 06:45	07:23	17:15 (11) 07:05	14:46 (10) 07:32 15:02 (10)
	20:34	19:49	16 06:58 (7) 18:51	17:58	18 17:33 (11) 16:21	50 15:36 (10) 16:19 42 15:44 (10)
25	05:33	06:09	06:42 (7) 06:46	06:24	16:14 (11) 07:06	14:45 (10) 07:33 15:02 (10)
	20:33	19:47	18 07:00 (7) 18:50	16:56	16 16:30 (11) 16:20	52 15:37 (10) 16:20 42 15:44 (10)
26	05:34	06:10	06:41 (7) 06:47	06:25	16:14 (11) 07:07	14:47 (10) 07:33 15:02 (10)
	20:32	19:45	18 06:59 (7) 18:48	16:55	16 16:30 (11) 16:19	50 15:37 (10) 16:20 42 15:44 (10)
27	05:35	06:12	06:38 (7) 06:48	06:27	16:15 (11) 07:08	14:48 (10) 07:33 15:03 (10)
	20:31	19:44	22 07:00 (7) 18:46	16:53	12 16:27 (11) 16:19	50 15:38 (10) 16:21 44 15:47 (10)
28	05:37	06:13	06:39 (7) 06:50	06:28	16:15 (11) 07:10	14:47 (10) 07:34 15:03 (10)
	20:29	19:42	20 06:59 (7) 18:44	16:52	12 16:27 (11) 16:18	50 15:37 (10) 16:22 44 15:47 (10)
29	05:38	06:14	06:38 (7) 06:51	07:44 (21) 06:30	16:16 (11) 07:11	14:48 (10) 07:34 15:05 (10)
	20:28	19:40	22 07:00 (7) 18:42	12 07:56 (21) 16:50	8 16:24 (11) 16:18	50 15:38 (10) 16:22 42 15:47 (10)
30	05:39	06:15	06:37 (7) 06:52	07:41 (21) 06:31	16:16 (11) 07:12	14:48 (10) 07:34 15:05 (10)
	20:27	19:38	22 06:59 (7) 18:40	18 07:59 (21) 16:49	8 16:24 (11) 16:17	50 15:38 (10) 16:23 42 15:47 (10)
31	05:40	06:16	06:38 (7) 06:53	06:32	15:03 (10) 07:34	15:05 (10)
	20:26	19:36	20 06:58 (7) 18:47	16:47	16 16:21 (11) 16:24	42 15:47 (10)
Potential sun hours	-272	4	376	341	288	274
Total, worst case	308	172	110	692	1358	1358
Sun reduction	0.58	0.55	0.55	0.45	0.35	0.35
Oper. time red.	0.91	0.91	0.91	0.91	0.91	0.91
Wind dir. red.	0.58	0.60	0.61	0.60	0.61	0.61
Total reduction	0.30	0.30	0.30	0.25	0.20	0.20
Total, real	94	52	33	170	266	266

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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: **060119 Marble River**

Description: Marble River Wind Project
 Shadow-Flicker, MidW part
 27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

Printed/Page: 01/23/06 09:41 / 15
 Licensed user: **Wind Engineers, Inc.**
 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated: 01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 147 - 147

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
 N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34 16:25	08:53 (13) 09:17 (13)	07:17 17:04	06:35 17:43	05:38 18:23	05:47 20:00
2	07:34 16:26	08:55 (13) 09:17 (13)	07:16 17:05	06:34 17:44	05:37 18:24	05:46 20:01
3	07:34 16:27	08:55 (13) 09:17 (13)	07:14 17:06	06:32 17:46	05:35 18:26	05:44 20:02
4	07:34 16:28	08:57 (13) 09:17 (13)	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03
5	07:34 16:29	08:59 (13) 09:17 (13)	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:04
6	07:34 16:30	08:58 (13) 09:14 (13)	07:11 17:11	06:27 17:50	06:29 19:29	05:40 20:06
7	07:34 16:31	08:58 (13) 09:14 (13)	07:11 17:11	06:27 17:50	06:29 19:29	05:40 20:06
8	07:34 16:32	09:04 (13) 09:12 (13)	07:08 17:14	06:23 17:52	06:26 19:32	05:37 20:08
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40
10	07:33 16:34	07:05 17:16	06:19 17:55	06:22 19:34	05:34 20:11	05:10 20:41
11	07:33 16:36	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:10 20:42
12	07:33 16:37	07:03 17:19	06:16 17:58	06:18 19:37	05:32 20:13	05:10 20:42
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	05:09 20:43
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	05:30 20:15	05:09 20:43
15	07:31 16:40	06:58 17:24	06:10 18:01	06:13 19:41	05:28 20:16	05:09 20:44
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	05:09 20:44
17	07:30 16:43	06:55 17:26	06:07 18:04	06:10 19:43	05:26 19:18 (11) 20:19	05:09 20:45
18	07:29 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 19:14 (11) 20:20	05:09 20:45
19	07:29 16:46	06:52 17:29	06:03 18:07	06:06 19:46	05:24 19:13 (11) 20:21	05:09 20:45
20	07:28 16:47	06:50 17:31	06:01 18:08	06:05 19:47	05:23 19:13 (11) 20:22	05:10 20:46
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 19:11 (11) 20:23	05:10 20:46
22	07:27 16:50	06:47 17:33	05:57 18:10	06:01 19:50	05:21 19:12 (11) 20:24	05:10 20:46
23	07:26 16:51	06:46 17:35	05:55 18:12	06:00 19:51	05:20 19:10 (11) 20:25	05:10 20:46
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 19:11 (11) 20:26	05:10 20:47
25	07:24 16:54	06:42 17:37	05:52 18:14	05:56 19:53	05:19 19:09 (11) 20:27	05:11 20:47
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	05:18 19:09 (11) 20:28	05:11 20:47
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 19:10 (11) 20:29	05:11 20:47
28	07:21 16:58	06:37 17:42	05:46 18:18	05:52 19:57	05:16 19:10 (11) 20:30	05:12 20:47
29	07:20 16:59		05:44 18:19	05:50 19:58	05:15 19:11 (11) 20:31	05:12 20:47
30	07:19 17:01		05:42 18:21	05:48 20:00	05:15 19:11 (11) 20:32	05:13 20:47
31	07:18 17:02		05:40 18:22		05:14 19:29 (11) 20:33	05:13 20:47
Potential sun hours	286	291	369	380	-285	-254
Total, worst case	144			206	36	324
Sun reduction	0.45			0.55	0.55	0.55
Oper. time red.	0.91			0.91	0.91	0.91
Wind dir. red.	0.69			0.62	0.62	0.59
Total reduction	0.29			0.31	0.31	0.30
Total, real	41			65	11	96

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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US-RIVERSIDE, CA 92506
Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 147 - 147

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes
Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December	
1	05:13	05:38 (21)	05:41	06:17	06:53	06:34	07:13
	20:47	12 05:50 (21)	20:25	19:35	18:38	16:46	16:17
2	05:14	05:39 (21)	05:42	06:19	06:55	06:35	07:14
	20:46	12 05:51 (21)	20:24	19:33	18:36	16:44	16:16
3	05:14	05:39 (21)	05:43	06:20	06:56	06:36	07:15
	20:46	10 05:49 (21)	20:22	19:31	18:35	16:43	16:16
4	05:15	05:40 (21)	05:44	06:21	06:57	06:38	07:17
	20:46	8 05:48 (21)	20:21	19:29	18:33	16:42	16:16
5	05:16	05:42 (21)	05:46	06:22	06:58	06:39	07:18
	20:46	4 05:46 (21)	20:20	19:27	18:31	16:40	16:16
6	05:16	05:47	05:47	06:23	07:00	06:40	07:19
	20:46	20:18	19:25	18:29	16:39	16:15	16
7	05:17	05:48	05:48	06:25	07:01	06:42	07:20
	20:45	20:17	19:24	18:27	16:38	16:15	18
8	05:18	05:49	05:49	06:26	07:02	06:43	07:21
	20:45	20:16	19:22	18:25	16:36	16:15	20
9	05:19	05:50	05:50	06:27	07:03	06:45	07:22
	20:44	20:14	19:20	18:23	16:35	16:15	22
10	05:19	05:51	19:25 (11)	06:28	07:05	06:46	07:23
	20:44	20:13	10 19:35 (11)	19:18	18:22	16:34	16:15
11	05:20	05:53	19:22 (11)	06:29	07:06	06:47	07:24
	20:43	20:11	14 19:36 (11)	19:16	18:20	16:33	16:15
12	05:21	05:54	19:21 (11)	06:31	07:07	06:49	07:24
	20:43	20:10	16 19:37 (11)	19:14	18:18	16:32	16:15
13	05:22	05:55	19:20 (11)	06:32	07:08	06:50	07:25
	20:42	20:08	18 19:38 (11)	19:12	18:16	16:31	16:15
14	05:23	05:56	19:19 (11)	06:33	07:10	06:51	07:26
	20:42	20:07	20 19:39 (11)	19:10	18:15	16:29	16:15
15	05:24	05:57	19:18 (11)	06:34	07:11	06:53	07:27
	20:41	20:05	20 19:38 (11)	19:09	18:13	16:28	16:15
16	05:24	05:58	19:17 (11)	06:35	07:12	06:54	07:28
	20:40	20:04	20 19:37 (11)	19:07	18:11	16:27	16:16
17	05:25	06:00	19:16 (11)	06:36	07:14	06:55	07:28
	20:40	20:02	20 19:36 (11)	19:05	18:09	16:26	16:16
18	05:26	06:01	19:16 (11)	06:38	07:15	06:57	07:29
	20:39	20:01	18 19:34 (11)	19:03	18:08	16:26	16:16
19	05:27	06:02	19:17 (11)	06:39	07:16	06:58	07:30
	20:38	19:57	16 19:33 (11)	19:01	18:06	16:25	16:17
20	05:28	06:03	19:16 (11)	06:40	07:17	06:59	07:30
	20:37	19:56	16 19:32 (11)	18:59	18:04	16:24	16:17
21	05:29	06:04	19:15 (11)	06:41	07:19	07:01	07:31
	20:36	19:54	14 19:29 (11)	18:57	18:03	16:23	16:17
22	05:30	06:06	19:16 (11)	06:42	07:20	07:02	07:31
	20:36	19:52	12 19:28 (11)	18:55	18:01	16:22	16:18
23	05:31	06:07	19:17 (11)	06:44	07:21	07:03	07:32
	20:35	19:51	10 19:27 (11)	18:53	17:59	16:21	16:18
24	05:32	06:08	19:16 (11)	06:45	07:23	07:05	07:32
	20:34	19:49	8 19:24 (11)	18:51	17:58	16:21	16:19
25	05:33	06:09	19:18 (11)	06:46	06:24	07:06	07:33
	20:33	19:47	6 19:24 (11)	18:50	16:56	16:20	16:20
26	05:34	06:10	06:47	06:25	07:07	07:33	08:48 (13)
	20:32	19:45	18:48	16:55	16:19	16:20	28
27	05:35	06:12	06:48	06:27	07:08	07:33	08:49 (13)
	20:31	19:44	18:46	16:53	16:19	16:21	28
28	05:37	06:13	06:50	06:28	07:10	07:34	08:51 (13)
	20:29	19:42	18:44	16:52	16:18	16:22	26
29	05:38	06:14	06:51	06:30	07:11	07:34	08:51 (13)
	20:28	19:40	18:42	16:50	16:18	16:22	26
30	05:39	06:15	06:52	06:31	07:12	07:34	08:51 (13)
	20:27	19:38	18:40	16:49	16:17	16:23	26
31	05:40	06:16	06:52	06:32	07:13	07:34	08:51 (13)
	20:26	19:36	18:38	16:47	16:17	16:24	26
Potential sun hours	-272	4	376	341	288	274	
Total, worst case	46	238				684	
Sun reduction	0.58	0.55				0.35	
Oper. time red.	0.91	0.91				0.91	
Wind dir. red.	0.59	0.62				0.69	
Total reduction	0.31	0.31				0.22	
Total, real	14	75				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)	Last time (hh:mm) with flicker	(WTG causing flicker last time)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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US-RIVERSIDE, CA 92506
Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 148 - 148

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34	15:37 (14)	07:17	06:35	05:38	05:47
	16:25	20 15:57 (14)	17:03	17:43	18:23	22 19:14 (10)
2	07:34	15:37 (14)	07:16	06:34	05:37	05:14 (8)
	16:26	20 15:57 (14)	17:05	17:44	18:24	22 19:37 (10)
3	07:34	15:39 (14)	07:14	06:32	05:35	05:12 (8)
	16:27	20 15:59 (14)	17:06	17:46	18:26	22 19:37 (10)
4	07:34	15:39 (14)	07:13	06:30	05:33	05:12 (8)
	16:28	20 15:59 (14)	17:08	17:47	18:27	22 19:38 (10)
5	07:34	15:39 (14)	07:12	06:28	06:31	05:41
	16:29	22 16:01 (14)	17:09	17:48	19:28	22 19:36 (10)
6	07:34	15:40 (14)	07:11	06:27	06:29	05:40
	16:30	20 16:00 (14)	17:11	17:50	19:29	22 19:37 (10)
7	07:34	15:40 (14)	07:09	06:25	06:27	05:38
	16:31	22 16:02 (14)	17:12	17:51	19:31	18 19:36 (10)
8	07:34	15:40 (14)	07:08	06:23	06:26	05:37
	16:32	24 16:04 (14)	17:14	17:52	19:32	16 19:35 (10)
9	07:34	15:42 (14)	07:07	06:21	06:24	05:36
	16:33	24 16:06 (14)	17:15	17:54	19:33	14 19:19 (10)
10	07:33	15:41 (14)	07:05	06:19	06:22	05:34
	16:34	24 16:05 (14)	17:16	17:55	19:34	8 19:30 (10)
11	07:33	15:43 (14)	07:04	06:18	06:20	05:33
	16:36	22 16:05 (14)	17:18	17:56	19:36	20:12
12	07:33	15:42 (14)	07:03	06:16	06:18	05:32
	16:37	24 16:06 (14)	17:19	17:58	19:37	20:13
13	07:32	15:44 (14)	07:01	06:14	06:17	05:31
	16:38	22 16:06 (14)	17:21	17:59	19:38	20:14
14	07:32	15:43 (14)	07:00	06:12	06:15	05:30
	16:39	22 16:05 (14)	17:22	18:00	19:39	4 05:52 (8)
15	07:31	15:45 (14)	06:58	06:10	06:13	05:28
	16:40	22 16:07 (14)	17:23	18:01	19:41	6 05:50 (8)
16	07:31	15:46 (14)	06:57	06:08	06:11	05:27
	16:42	20 16:06 (14)	17:25	18:03	19:42	8 05:49 (8)
17	07:30	15:47 (14)	06:55	06:06	06:10	05:26
	16:43	18 16:05 (14)	17:26	18:04	19:43	10 05:48 (8)
18	07:29	15:49 (14)	06:54	06:05	06:08	05:25
	16:44	16 16:05 (14)	17:28	18:05	19:45	12 05:58 (8)
19	07:29	15:50 (14)	06:52	06:03	06:06	05:24
	16:46	14 16:04 (14)	17:29	18:07	19:46	14 06:00 (8)
20	07:28	15:51 (14)	06:50	06:01	06:05	05:23
	16:47	12 16:03 (14)	17:31	18:08	19:47	16 06:02 (8)
21	07:27	15:52 (14)	06:49	05:59	06:03	05:22
	16:48	10 16:02 (14)	17:32	18:09	19:48	18 06:03 (8)
22	07:27	15:55 (14)	06:47	05:57	06:01	19:22 (10)
	16:50	4 15:59 (14)	17:33	18:10	19:50	4 05:21
23	07:26	06:46	05:55	06:00	05:20	18 06:02 (8)
	16:51	06:46	18:12	19:51	6 19:26 (10)	20 06:02 (8)
24	07:25	06:44	05:53	05:58	19:19 (10)	05:19
	16:52	06:44	18:13	19:52	8 19:27 (10)	20 06:02 (8)
25	07:24	06:42	05:52	05:56	19:17 (10)	05:18
	16:54	06:42	18:14	19:53	12 19:29 (10)	20 06:03 (8)
26	07:23	06:41	05:50	05:55	19:15 (10)	05:18
	16:55	06:41	18:16	19:55	14 19:29 (10)	20 06:03 (8)
27	07:22	06:39	05:48	05:53	19:16 (10)	05:17
	16:56	06:39	18:17	19:56	14 19:30 (10)	20 06:02 (8)
28	07:21	06:37	05:46	05:52	19:14 (10)	05:16
	16:58	06:37	18:18	19:57	18 19:32 (10)	20 06:03 (8)
29	07:20	06:35	05:44	05:50	19:13 (10)	05:15
	16:59	06:35	18:19	19:58	18 19:33 (10)	20 06:03 (8)
30	07:19	06:33	05:42	05:48	19:12 (10)	05:14
	17:01	06:33	18:21	20:00	18 19:33 (10)	20 06:02 (8)
31	07:18	06:31	05:40	05:46	19:11 (10)	05:13
	17:02	06:31	18:22	20:01	18 19:33 (10)	20 06:02 (8)
Potential sun hours	286	291	369	380	-285	-254
Total, worst case	422			112	490	456
Sun reduction	0.45			0.55	0.55	0.55
Oper. time red.	0.91			0.91	0.91	0.91
Wind dir. red.	0.61			0.62	0.58	0.56
Total reduction	0.25			0.31	0.29	0.28
Total, real	105			35	143	128

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 09:41 / 18
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 148 - 148

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13	05:50 (8) 05:41		06:17	06:53	06:34
	20:47	16 06:06 (8) 20:25		19:35	18:38	16:46
2	05:14	05:51 (8) 05:42	19:34 (10)	06:19	06:55	06:35
	20:46	16 06:07 (8) 20:24	6 19:40 (10)	19:33	18:36	16:44
3	05:14	05:51 (8) 05:43	19:31 (10)	06:20	06:56	06:36
	20:46	16 06:07 (8) 20:22	12 19:43 (10)	19:31	18:34	16:43
4	05:15	05:50 (8) 05:44	19:30 (10)	06:21	06:57	06:38
	20:46	18 06:08 (8) 20:21	14 19:44 (10)	19:29	18:33	16:42
5	05:16	05:50 (8) 05:46	19:27 (10)	06:22	06:58	06:39
	20:46	18 06:08 (8) 20:20	18 19:45 (10)	19:27	18:31	16:40
6	05:16	05:49 (8) 05:47	19:26 (10)	06:23	07:00	06:40
	20:45	20 06:09 (8) 20:18	20 19:46 (10)	19:25	18:29	16:39
7	05:17	05:50 (8) 05:48	19:25 (10)	06:25	07:01	06:42
	20:45	20 06:10 (8) 20:17	22 19:47 (10)	19:24	18:27	16:38
8	05:18	05:50 (8) 05:49	19:24 (10)	06:26	07:02	06:43
	20:45	18 06:08 (8) 20:16	22 19:46 (10)	19:22	18:25	16:36
9	05:19	05:49 (8) 05:50	19:23 (10)	06:27	07:03	06:45
	20:44	20 06:09 (8) 20:14	24 19:47 (10)	19:20	18:23	16:35
10	05:19	05:50 (8) 05:51	19:23 (10)	06:28	07:05	06:46
	20:44	20 06:10 (8) 20:13	24 19:47 (10)	19:18	18:22	16:34
11	05:20	05:49 (8) 05:53	19:24 (10)	06:29	07:06	06:47
	20:43	22 06:11 (8) 20:11	22 19:46 (10)	19:16	18:20	16:33
12	05:21	05:49 (8) 05:54	19:23 (10)	06:30	07:07	06:49
	20:43	22 06:11 (8) 20:10	20 19:43 (10)	19:14	18:18	16:32
13	05:22	05:48 (8) 05:55	19:22 (10)	06:32	07:08	06:50
	20:42	24 06:12 (8) 20:08	20 19:42 (10)	19:12	18:16	16:31
14	05:23	05:49 (8) 05:56	19:23 (10)	06:33	07:10	06:51
	20:42	22 06:11 (8) 20:07	18 19:41 (10)	19:10	18:15	16:29
15	05:23	05:50 (8) 05:57	19:22 (10)	06:34	07:11	06:53
	20:41	22 06:12 (8) 20:05	16 19:38 (10)	19:09	18:13	16:28
16	05:24	05:49 (8) 05:58	19:23 (10)	06:35	07:12	06:54
	20:40	24 06:13 (8) 20:04	14 19:37 (10)	19:07	18:11	16:27
17	05:25	05:50 (8) 06:00	19:22 (10)	06:36	07:14	06:55
	20:40	22 06:12 (8) 20:02	14 19:36 (10)	19:05	18:09	16:26
18	05:26	05:51 (8) 06:01	19:24 (10)	06:38	07:15	06:57
	20:39	22 06:13 (8) 20:00	10 19:34 (10)	19:03	18:08	16:25
19	05:27	05:51 (8) 06:02	19:25 (10)	06:39	07:16	06:58
	20:38	20 06:11 (8) 19:57	8 19:33 (10)	19:01	18:06	16:25
20	05:28	05:52 (8) 06:03	19:26 (10)	06:40	07:17	06:59
	20:37	20 06:12 (8) 19:56	6 19:32 (10)	18:59	18:04	16:24
21	05:29	05:53 (8) 06:04	19:27 (10)	06:41	07:19	07:01
	20:36	18 06:11 (8) 19:54	4 19:31 (10)	18:57	18:03	16:23
22	05:30	05:54 (8) 06:06		06:42	07:20	07:02
	20:36	18 06:12 (8) 19:52		18:55	18:01	16:22
23	05:31	05:55 (8) 06:07		06:44	07:21	07:03
	20:35	16 06:11 (8) 19:51		18:53	17:59	16:21
24	05:32	05:56 (8) 06:08		06:45	07:23	07:05
	20:34	16 06:12 (8) 19:49		18:51	17:58	16:21
25	05:33	05:57 (8) 06:09		06:46	06:24	07:06
	20:33	14 06:11 (8) 19:47		18:50	18:56	16:20
26	05:34	05:58 (8) 06:10		06:47	06:25	07:07
	20:32	12 06:10 (8) 19:45		18:48	18:55	16:19
27	05:35	05:59 (8) 06:11		06:48	06:27	07:08
	20:31	10 06:09 (8) 19:44		18:46	16:53	16:19
28	05:37	06:00 (8) 06:13		06:50	06:28	07:10
	20:29	8 06:08 (8) 19:42		18:44	16:52	16:18
29	05:38	06:01 (8) 06:14		06:51	06:29	07:11
	20:28	6 06:07 (8) 19:40		18:42	16:50	16:18
30	05:39	06:03 (8) 06:15		06:52	06:31	07:12
	20:27	4 06:07 (8) 19:38		18:40	16:49	16:17
31	05:40	06:16		06:53		07:13
	20:26	19:36		16:47		16:24
Potential sun hours	-272	4	376	341	288	274
Total, worst case	524	314			184	570
Sun reduction	0.58	0.55			0.35	0.35
Oper. time red.	0.91	0.91			0.91	0.91
Wind dir. red.	0.56	0.62			0.61	0.61
Total reduction	0.30	0.31			0.19	0.19
Total, real	155	97			36	111

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 09:41 / 19
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 152 - 152

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:04	06:36 17:43	05:56 (11) 17:18 (11)	05:39 18:23	05:47 20:00	05:14 20:34	05:37 (6) 20:47	05:13 28	05:38 (6) 20:25	06:18 19:35	06:53 18:38	
2	07:35 16:26	07:18 17:05	06:37 17:44	05:57 (11) 17:19 (11)	05:35 18:24	05:44 20:01	05:15 20:35	05:38 (6) 20:47	05:15 28	05:39 (6) 20:24	06:19 19:33	06:54 18:36	
3	07:35 16:27	07:18 17:06	06:37 17:45	05:57 (11) 17:20 (11)	05:35 18:25	05:44 20:02	05:15 20:36	05:38 (6) 20:48	05:15 26	05:39 (6) 20:22	06:20 19:31	06:56 18:35	
4	07:35 16:28	07:18 17:07	06:37 17:46	05:57 (11) 17:21 (11)	05:35 18:26	05:44 20:03	05:15 20:37	05:38 (6) 20:49	05:15 26	05:40 (6) 20:21	06:21 19:29	06:57 18:33	
5	07:34 16:29	07:12 17:09	06:29 17:48	06:57 (11) 17:22 (11)	06:31 18:27	05:41 20:04	05:41 20:37	05:35 (6) 20:46	05:16 26	05:40 (6) 20:20	06:22 19:27	06:58 18:31	
6	07:34 16:30	07:11 17:10	06:27 17:50	06:59 (11) 17:23 (11)	06:29 18:28	05:40 20:05	05:40 20:38	05:35 (6) 20:46	05:16 24	05:41 (6) 20:18	06:23 19:26	07:00 18:29	
7	07:34 16:31	07:11 17:11	06:27 17:51	06:59 (11) 17:24 (11)	06:29 18:29	05:40 20:06	05:40 20:39	05:35 (6) 20:45	05:16 24	05:41 (6) 20:17	06:22 19:24	07:00 18:27	
8	07:34 16:32	07:11 17:12	06:27 17:52	06:59 (11) 17:25 (11)	06:29 18:30	05:40 20:07	05:40 20:40	05:35 (6) 20:45	05:16 24	05:41 (6) 20:16	06:22 19:22	07:00 18:25	
9	07:34 16:33	07:11 17:13	06:27 17:53	06:59 (11) 17:26 (11)	06:29 18:31	05:40 20:08	05:40 20:41	05:35 (6) 20:44	05:16 22	05:41 (6) 20:14	06:22 19:20	07:00 18:24	
10	07:33 16:34	07:10 17:14	06:26 17:54	06:58 (11) 17:27 (11)	06:28 18:32	05:39 20:09	05:39 20:42	05:34 (6) 20:44	05:17 22	05:42 (6) 20:12	06:23 19:19	07:01 18:23	
11	07:33 16:35	07:10 17:15	06:26 17:55	06:58 (11) 17:28 (11)	06:28 18:33	05:39 20:10	05:39 20:43	05:34 (6) 20:44	05:17 22	05:42 (6) 20:11	06:23 19:18	07:01 18:22	
12	07:33 16:36	07:10 17:16	06:26 17:56	06:58 (11) 17:29 (11)	06:28 18:34	05:39 20:11	05:39 20:44	05:34 (6) 20:45	05:17 22	05:42 (6) 20:11	06:23 19:17	07:01 18:21	
13	07:32 16:37	07:09 17:17	06:25 17:57	06:57 (11) 17:30 (11)	06:27 18:35	05:38 20:12	05:38 20:45	05:33 (6) 20:46	05:18 20	05:41 (6) 20:10	06:23 19:16	07:00 18:20	
14	07:32 16:38	07:09 17:18	06:25 17:58	06:57 (11) 17:31 (11)	06:27 18:36	05:38 20:13	05:38 20:46	05:33 (6) 20:47	05:18 20	05:41 (6) 20:09	06:23 19:15	07:00 18:19	
15	07:31 16:39	07:08 17:19	06:24 17:59	06:56 (11) 17:32 (11)	06:26 18:37	05:37 20:14	05:37 20:47	05:32 (6) 20:48	05:19 18	05:40 (6) 20:08	06:24 19:14	07:00 18:18	
16	07:31 16:40	07:08 17:20	06:24 18:00	06:56 (11) 17:33 (11)	06:26 18:38	05:37 20:15	05:37 20:48	05:32 (6) 20:49	05:19 18	05:40 (6) 20:07	06:24 19:13	07:00 18:17	
17	07:31 16:41	07:08 17:21	06:24 18:01	06:56 (11) 17:34 (11)	06:26 18:39	05:37 20:16	05:37 20:49	05:32 (6) 20:50	05:19 18	05:40 (6) 20:06	06:24 19:12	07:00 18:16	
18	07:30 16:42	07:07 17:22	06:23 18:02	06:55 (11) 17:35 (11)	06:25 18:40	05:36 20:17	05:36 20:50	05:31 (6) 20:51	05:20 16	05:39 (6) 20:05	06:25 19:11	07:00 18:15	
19	07:29 16:43	07:06 17:23	06:22 18:03	06:54 (11) 17:36 (11)	06:24 18:41	05:35 20:18	05:35 20:51	05:30 (6) 20:52	05:21 16	05:38 (6) 20:04	06:25 19:10	07:00 18:14	
20	07:28 16:44	07:05 17:24	06:21 18:04	06:53 (11) 17:37 (11)	06:23 18:42	05:34 20:19	05:34 20:52	05:30 (6) 20:53	05:21 16	05:38 (6) 20:03	06:25 19:09	07:00 18:13	
21	07:28 16:45	07:05 17:25	06:21 18:05	06:53 (11) 17:38 (11)	06:23 18:43	05:34 20:20	05:34 20:53	05:30 (6) 20:54	05:21 16	05:38 (6) 20:02	06:25 19:08	07:00 18:12	
22	07:27 16:46	07:04 17:26	06:20 18:06	06:52 (11) 17:39 (11)	06:22 18:44	05:33 20:21	05:33 20:54	05:29 (6) 20:55	05:22 16	05:37 (6) 20:01	06:26 19:07	07:00 18:11	
23	07:26 16:47	07:03 17:27	06:19 18:07	06:51 (11) 17:40 (11)	06:21 18:45	05:32 20:22	05:32 20:55	05:28 (6) 20:56	05:22 16	05:36 (6) 20:00	06:26 19:06	07:00 18:10	
24	07:25 16:48	07:02 17:28	06:18 18:08	06:50 (11) 17:41 (11)	06:20 18:46	05:31 20:23	05:31 20:56	05:27 (6) 20:57	05:22 16	05:35 (6) 20:00	06:26 19:05	07:00 18:09	
25	07:24 16:49	07:01 17:29	06:17 18:09	06:49 (11) 17:42 (11)	06:19 18:47	05:30 20:24	05:30 20:57	05:26 (6) 20:58	05:22 16	05:34 (6) 20:00	06:26 19:04	07:00 18:08	
26	07:23 16:50	07:00 17:30	06:16 18:10	06:48 (11) 17:43 (11)	06:18 18:48	05:29 20:25	05:29 20:58	05:25 (6) 20:59	05:22 16	05:33 (6) 20:00	06:26 19:03	07:00 18:07	
27	07:22 16:51	06:59 17:31	06:15 18:11	06:47 (11) 17:44 (11)	06:17 18:49	05:28 20:26	05:28 20:59	05:24 (6) 21:00	05:22 16	05:32 (6) 20:00	06:26 19:02	07:00 18:06	
28	07:21 16:52	06:58 17:32	06:14 18:12	06:46 (11) 17:45 (11)	06:16 18:50	05:27 20:27	05:27 21:00	05:23 (6) 21:01	05:22 16	05:31 (6) 20:00	06:26 19:01	07:00 18:05	
29	07:20 16:53	06:57 17:33	06:13 18:13	06:45 (11) 17:46 (11)	06:15 18:51	05:26 20:28	05:26 21:01	05:22 (6) 21:02	05:22 16	05:30 (6) 20:00	06:26 19:00	07:00 18:04	
30	07:19 17:01	06:56 17:34	06:12 18:14	06:44 (11) 17:47 (11)	06:14 18:52	05:25 20:29	05:25 21:02	05:21 (6) 21:03	05:22 16	05:29 (6) 20:00	06:26 18:59	07:00 18:03	
31	07:18 17:02	06:55 17:35	06:11 18:15	06:43 (11) 17:48 (11)	06:13 18:53	05:24 20:30	05:24 21:03	05:20 (6) 21:04	05:22 16	05:28 (6) 20:00	06:26 18:58	07:00 18:02	
Potential sun hours	286	291	369	380	380	285	254	272	4	376	341	288	274
Total, worst case			92	506		112	818	390		382		218	
Sun reduction			0.45	0.50		0.55	0.55	0.58		0.55		0.45	
Oper. time red.			0.91	0.91		0.91	0.91	0.91		0.91		0.91	
Wind dir. red.			0.62	0.62		0.57	0.57	0.57		0.62		0.62	
Total reduction			0.25	0.28		0.29	0.29	0.30		0.31		0.25	
Total, real			23	143		32	235	118		119		55	

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: 060119 Marble River	Description: Marble River Wind Project Shadow-Flicker, MidW part 27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)	Printed/Page: 01/23/06 09:41 / 20 Licensed user: Wind Engineers, Inc. 7660 Whitegate Avenue US-RIVERSIDE, CA 92506 Calculated: 01/23/06 09:10/2.4.0.67
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SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 153 - 153

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35

Operational time											
N	NE	E	SE	S	SW	W	NW	Sum			
1,850	1,325	800	713	625	663	700	1,275	7,950			

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:04	06:36 17:43		05:39 18:23	06:07 (9) 20:00	05:14 20:34	05:13 20:47	05:41 20:25	06:18 19:35	06:50 (9) 18:38	06:53 28 07:49 (11) 16:46	07:13 16:17
2	07:35 16:26	07:15 17:05	06:34 17:44		05:37 18:24	06:03 (9) 20:01	05:13 20:35	05:14 20:47	05:42 20:24	06:19 19:33	06:49 (9) 18:36	06:55 28 07:48 (11) 16:44	07:14 16:17
3	07:35 16:27	07:15 17:06	06:32 17:46		05:35 18:26	05:59 (9) 20:02	05:13 20:36	05:15 20:46	05:43 20:22	06:20 19:31	06:48 (9) 18:35	06:56 26 07:47 (11) 16:43	07:16 16:16
4	07:34 16:28	07:13 17:08	06:30 17:47	06:51 (11) 12 07:03 (11)	05:33 18:27	05:57 (9) 20:03	05:12 20:37	05:15 20:46	05:44 20:21	06:21 19:29	06:49 (9) 18:33	06:57 26 07:46 (11) 16:42	07:17 16:16
5	07:34 16:29	07:12 17:09	06:29 17:48	06:49 (11) 16 07:05 (11)	06:31 19:28	06:55 (9) 20:05	05:12 20:37	05:16 20:46	05:46 20:20	06:22 19:27	06:50 (9) 18:31	06:58 24 07:45 (11) 16:40	07:18 16:16
6	07:34 16:30	07:11 17:10	06:27 17:50	06:47 (11) 20 07:07 (11)	06:29 19:30	06:53 (9) 20:06	05:11 20:38	05:16 20:46	05:47 20:18	06:23 19:26	06:49 (9) 18:29	07:00 24 07:44 (11) 16:39	07:19 16:15
7	07:34 16:31	07:10 17:12	06:25 17:51	06:45 (11) 22 07:07 (11)	06:28 19:31	06:54 (9) 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:25 19:24	06:50 (9) 18:27	07:01 22 07:42 (11) 16:38	07:20 16:15
8	07:34 16:32	07:08 17:14	06:23 17:52	06:44 (11) 26 07:10 (11)	06:26 19:32	06:52 (9) 20:08	05:11 20:40	05:18 20:45	05:49 20:16	06:26 19:22	06:52 (9) 18:25	07:02 18 07:41 (11) 16:36	07:21 16:15
9	07:34 16:33	07:07 17:15	06:21 17:54	06:44 (11) 26 07:10 (11)	06:24 19:33	06:50 (9) 20:09	05:10 20:40	05:19 20:44	05:50 20:14	06:27 19:20	06:53 (9) 18:24	07:03 16 07:41 (11) 16:35	07:22 16:15
10	07:33 16:35	07:06 17:16	06:20 17:55	06:42 (11) 28 07:10 (11)	06:22 19:35	06:50 (9) 20:11	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	06:56 (9) 18:22	07:05 8 07:36 (11) 16:34	07:23 16:15
11	07:33 16:36	07:04 17:18	06:18 17:56	06:42 (11) 28 07:10 (11)	06:20 19:36	06:50 (9) 20:12	05:10 20:42	05:20 20:44	05:53 20:11	06:29 19:16	06:59 (9) 18:20	07:06 10 07:09 (9) 16:20	07:24 16:33
12	07:33 16:37	07:03 17:19	06:16 17:58	06:42 (11) 26 07:08 (11)	06:19 19:37	06:49 (9) 20:13	05:10 20:42	05:21 20:43	05:54 20:10	06:31 19:14	07:07 (9) 18:18	07:07 16:32	07:25 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	06:42 (11) 26 07:08 (11)	06:17 19:38	06:49 (9) 20:14	05:10 20:43	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:16	07:08 16:31	07:25 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	06:42 (11) 26 07:08 (11)	06:15 19:40	06:49 (9) 20:15	05:09 20:43	05:23 20:42	05:56 20:07	06:33 19:11	07:10 18:15	07:10 16:30	07:26 16:15
15	07:31 16:41	06:58 17:24	06:10 18:02	06:43 (11) 24 07:07 (11)	06:13 19:41	06:47 (9) 20:17	05:09 20:44	05:24 20:05	05:57 20:05	06:34 19:09	07:11 18:13	07:11 16:29	07:27 16:16
16	07:31 16:42	06:57 17:25	06:08 18:03	06:43 (11) 24 07:07 (11)	06:11 19:42	06:48 (9) 20:18	05:09 20:44	05:24 20:04	05:59 20:04	06:35 19:07	07:12 18:11	07:12 16:27	07:28 16:16
17	07:30 16:43	06:55 17:26	06:07 18:04	06:43 (11) 22 07:05 (11)	06:10 19:43	06:48 (9) 20:19	05:09 20:45	05:25 20:02	06:00 19:05	06:37 18:09	07:14 17:15	07:14 16:27	07:28 16:16
18	07:30 16:44	06:54 17:28	06:05 18:05	06:45 (11) 18 07:03 (11)	06:08 19:45	06:48 (9) 20:20	05:09 20:45	05:25 20:01	06:01 18 07:20 (9)	06:38 19:03	07:15 18:08	07:15 16:26	07:29 16:16
19	07:29 16:46	06:52 17:29	06:03 18:07	06:47 (11) 14 07:01 (11)	06:06 19:46	06:49 (9) 20:21	05:09 20:45	05:27 20:02	06:02 19:01	06:39 18:06	07:16 18:06	07:16 16:25	07:30 16:17
20	07:28 16:47	06:51 17:31	06:01 18:08	06:49 (11) 6 06:55 (11)	06:05 19:47	06:49 (9) 20:22	05:10 20:46	06:03 20:37	06:58 (9) 24 07:22 (9)	06:40 18:59	07:18 18:04	07:18 16:24	07:30 16:17
21	07:27 16:48	06:49 17:32	05:59 18:09	06:49 (9) 19:48	06:03 19:48	06:49 (9) 20:23	05:10 20:46	06:04 20:37	06:41 19:54	06:39 18:57	07:19 18:03	07:19 16:23	07:31 16:18
22	07:27 16:50	06:47 17:33	05:57 18:11	06:47 (9) 19:50	06:01 19:50	06:52 (9) 20:24	05:10 20:46	06:06 20:36	06:42 19:52	06:39 18:55	07:20 18:01	07:20 16:22	07:31 16:18
23	07:26 16:51	06:46 17:35	05:55 18:12	06:46 (9) 19:51	06:00 19:51	06:52 (9) 20:25	05:10 20:46	06:07 20:35	06:53 (9) 19:51	06:44 18:53	07:22 17:59	07:22 16:21	07:32 16:19
24	07:25 16:52	06:44 17:36	05:54 18:13	06:45 (11) 19:52	05:58 19:52	06:55 (9) 20:26	05:11 20:47	06:08 20:34	06:52 (9) 19:49	06:45 18:52	07:23 (11) 17:58	07:23 16:21	07:32 16:19
25	07:24 16:54	06:42 17:38	05:52 18:14	06:44 (9) 18 07:13 (9)	05:56 19:53	06:55 (9) 20:27	05:11 20:47	06:09 20:33	06:46 19:47	06:38 18:50	07:27 (11) 17:56	07:27 16:20	07:33 16:20
26	07:23 16:55	06:41 17:39	05:50 18:16	06:43 (9) 19:55	05:55 19:55	07:00 (9) 20:28	05:11 20:47	06:10 20:32	06:47 (9) 19:45	06:39 18:48	07:26 (11) 17:55	07:26 16:19	07:33 16:20
27	07:22 16:57	06:39 17:40	05:48 18:17	06:42 (9) 19:56	05:53 19:56	07:08 (9) 20:29	05:12 20:47	06:12 20:31	06:50 (9) 19:44	06:49 (9) 18:46	07:24 (11) 17:53	07:24 16:19	07:33 16:21
28	07:21 16:58	06:37 17:42	05:46 18:18	06:41 (9) 19:57	05:52 19:57	07:00 (9) 20:30	05:12 20:47	06:13 20:37	06:47 (9) 19:42	06:50 (9) 18:44	07:23 (11) 17:52	07:23 16:18	07:34 16:22
29	07:20 16:59	06:36 17:43	05:44 18:19	06:40 (9) 19:58	05:50 19:58	07:00 (9) 20:31	05:12 20:47	06:14 20:28	06:46 (9) 19:40	06:51 (9) 18:42	07:22 (11) 17:50	07:22 16:18	07:34 16:23
30	07:19 17:01	06:35 17:44	05:42 18:20	06:39 (9) 20:00	05:49 20:00	07:00 (9) 20:32	05:13 20:47	06:15 20:27	06:49 (9) 19:38	06:52 (9) 18:40	07:21 (11) 17:49	07:21 16:17	07:34 16:23
31	07:18 17:02	06:34 17:45	05:40 18:22	06:38 (9) 20:00	05:48 20:00	07:00 (9) 20:33	05:14 20:48	06:16 20:26	06:48 (9) 19:37	06:53 (9) 18:40	07:20 (11) 17:48	06:32 16:47	07:34 16:24
Potential sun hours	286	291	369	380	758	-285	-254	-272	4	376	341	288	274
Total, worst case			364		758				454	464	220		
Sun reduction			0.50		0.55				0.55	0.55	0.45		
Oper. time red.			0.91		0.91				0.91	0.91	0.91		
Wind dir. red.			0.62		0.61				0.61	0.61	0.62		
Total reduction			0.28		0.30				0.30	0.31	0.26		
Total, real			103		231				138	142	56		

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

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

Project: 060119 Marble River

Description: Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 158 - 158

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes
Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Table with 12 columns for months (January to December) and rows for each day of the month. Columns contain sun rise and set times, and potential sun hours. Summary rows at the bottom show total sun hours and reductions.

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

Matrix with 5 columns: 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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 159 - 159

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34 16:25	07:17 17:03	06:35 17:43	06:56 (12) 07:04 (12)	05:38 18:23	05:47 20:01
2	07:34 16:26	07:16 17:05	06:34 17:44	06:54 (12) 07:04 (12)	05:37 18:24	05:45 20:01
3	07:34 16:27	07:14 17:06	06:32 17:46	06:52 (12) 07:06 (12)	05:35 18:26	05:44 20:02
4	07:34 16:28	07:13 17:08	06:30 17:47	06:51 (12) 07:07 (12)	05:33 18:27	05:43 20:03
5	07:34 16:29	07:12 17:09	06:28 17:48	06:49 (12) 07:07 (12)	06:31 19:28	05:41 20:04
6	07:34 16:30	07:11 17:11	06:27 17:50	06:47 (12) 07:07 (12)	06:29 19:29	05:40 20:06
7	07:34 16:31	07:09 17:12	06:25 17:51	06:45 (12) 07:07 (12)	06:27 19:31	05:38 20:07
8	07:34 16:32	07:08 17:13	06:23 17:52	06:43 (12) 07:05 (12)	06:26 19:32	05:37 20:08
9	07:34 16:33	07:07 17:15	06:21 17:54	06:42 (12) 07:06 (12)	06:24 19:33	05:36 20:09
10	07:33 16:34	07:05 17:16	06:19 17:55	06:42 (12) 07:06 (12)	06:22 19:34	05:34 20:11
11	07:33 16:36	07:04 17:18	06:18 17:56	06:42 (12) 07:04 (12)	06:20 19:36	05:33 20:12
12	07:33 16:37	07:03 17:19	06:16 17:58	06:44 (12) 07:02 (12)	06:18 19:37	05:32 20:13
13	07:32 16:38	07:01 17:21	06:14 17:59	06:44 (12) 07:00 (12)	06:17 19:38	05:31 20:14
14	07:32 16:39	07:00 17:22	06:12 18:00	06:46 (12) 06:58 (12)	06:15 19:39	05:29 20:15
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:16	05:09 20:44
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	05:09 20:44
17	07:30 16:43	06:55 17:26	06:06 18:04	06:10 19:43	05:26 20:19	05:09 20:45
18	07:29 16:44	06:54 17:28	06:05 18:05	06:08 19:44	05:25 20:20	05:09 20:45
19	07:29 16:46	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:09 20:45
20	07:28 16:47	06:50 17:30	06:01 18:08	06:04 19:47	05:23 20:22	05:09 20:46
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46
22	07:26 16:50	06:47 17:33	05:57 18:10	06:01 19:49	05:21 20:24	05:10 20:46
23	07:26 16:51	06:46 17:35	05:55 18:12	05:59 19:51	05:20 20:25	05:10 20:46
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:26	05:10 20:46
25	07:24 16:54	06:42 17:37	05:51 18:14	05:56 19:53	05:18 20:27	05:11 20:47
26	07:23 16:55	06:41 17:39	05:50 18:15	05:55 19:54	05:18 20:28	05:11 20:47
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	05:11 20:47
28	07:21 16:58	06:37 17:41	05:46 06:58 (12) 07:02 (12)	05:51 18:18	05:16 20:30	05:12 20:47
29	07:20 16:59		05:44 18:19	05:50 19:58	05:15 20:31	20:03 (21) 20:07 (21)
30	07:19 17:01		05:42 18:21	05:48 19:59	05:15 20:32	20:00 (21) 20:06 (21)
31	07:18 17:02		05:40 18:22	05:46 20:33	05:14 20:33	20:00 (21) 20:06 (21)
Potential sun hours	286	291	369	404	-285	-254
Total, worst case		4	246		16	580
Sun reduction		0.45	0.50		0.55	0.55
Oper. time red.		0.91	0.91		0.91	0.91
Wind dir. red.		0.62	0.62		0.64	0.64
Total reduction		0.25	0.28		0.32	0.32
Total, real		1	70		5	185

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 159 - 159

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes
Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December	
1	05:13 20:47	19:58 (21) 20:18 (21)	05:41 20:25	06:17 19:35	06:53 18:38	07:22 (12) 16:46	07:13 16:17
2	05:14 20:46	19:58 (21) 20:18 (21)	05:42 20:24	06:19 19:33	06:55 18:36	07:22 (12) 07:42 (12)	06:35 16:16
3	05:14 20:46	19:58 (21) 20:18 (21)	05:43 20:22	06:20 19:31	06:56 18:34	07:21 (12) 07:43 (12)	06:36 16:16
4	05:15 20:46	20:00 (21) 20:18 (21)	05:44 20:21	06:21 19:29	06:57 18:33	07:20 (12) 07:42 (12)	06:38 16:16
5	05:16 20:46	20:00 (21) 20:18 (21)	05:45 20:20	06:22 19:27	06:58 18:31	07:19 (12) 07:43 (12)	06:39 16:16
6	05:16 20:45	20:01 (21) 20:17 (21)	05:47 20:18	06:23 19:25	06:59 18:29	07:21 (12) 07:43 (12)	06:40 16:15
7	05:17 20:45	20:02 (21) 20:18 (21)	05:48 20:17	06:25 19:24	07:01 18:27	07:22 (12) 07:42 (12)	06:42 16:15
8	05:18 20:45	20:02 (21) 20:16 (21)	05:49 20:16	06:26 19:22	07:02 18:25	07:23 (12) 07:41 (12)	06:43 16:15
9	05:18 20:44	20:03 (21) 20:17 (21)	05:50 20:14	06:27 19:20	07:03 18:23	07:25 (12) 07:41 (12)	06:45 16:15
10	05:19 20:44	20:04 (21) 20:16 (21)	05:51 20:13	06:28 19:18	07:04 18:22	07:26 (12) 07:40 (12)	06:46 16:15
11	05:20 20:43	20:05 (21) 20:15 (21)	05:52 20:11	06:29 19:16	07:06 18:20	07:27 (12) 07:39 (12)	06:47 16:15
12	05:21 20:43	20:05 (21) 20:15 (21)	05:54 20:10	06:30 19:14	07:07 18:18	07:29 (12) 07:39 (12)	06:49 16:15
13	05:22 20:42	20:08 (21) 20:14 (21)	05:55 20:08	06:32 19:12	07:08 18:16	07:30 (12) 07:36 (12)	06:50 16:15
14	05:23 20:42	20:09 (21) 20:13 (21)	05:56 20:07	06:33 19:10	07:10 18:15	07:31 (12) 07:35 (12)	06:51 16:15
15	05:23 20:41	05:57 20:05	06:34 19:08	07:11 18:13	06:53 16:28	07:27 16:15	07:27 16:15
16	05:24 20:40	05:58 20:04	06:35 19:07	07:12 18:11	06:54 16:27	07:28 16:16	07:28 16:16
17	05:25 20:40	06:00 20:02	06:36 19:05	07:13 18:09	06:55 16:26	07:28 16:16	07:28 16:16
18	05:26 20:39	06:01 20:00	06:38 19:03	07:15 18:08	06:57 16:25	07:29 16:16	07:29 16:16
19	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:25	07:30 16:17	07:30 16:17
20	05:28 20:37	06:03 19:56	06:40 18:59	07:17 18:04	06:59 16:24	07:30 16:17	07:30 16:17
21	05:29 20:36	06:04 19:54	06:41 18:57	07:19 18:03	07:01 16:23	07:31 16:17	07:31 16:17
22	05:30 20:35	06:06 19:52	06:42 18:55	07:20 18:01	07:02 16:22	07:31 16:18	07:31 16:18
23	05:31 20:35	06:07 19:50	06:44 18:53	07:21 17:59	07:03 16:21	07:32 16:18	07:32 16:18
24	05:32 20:34	06:08 19:49	06:45 18:51	07:23 17:58	07:05 16:21	07:32 16:19	07:32 16:19
25	05:33 20:33	06:09 19:47	06:46 18:49	06:24 16:56	07:06 16:20	07:33 16:20	07:33 16:20
26	05:34 20:32	06:10 19:45	06:47 18:48	06:25 16:55	07:07 16:19	07:33 16:20	07:33 16:20
27	05:35 20:31	06:11 19:44	06:48 18:46	06:27 16:53	07:08 16:19	07:33 16:21	07:33 16:21
28	05:36 20:29	06:13 19:42	06:50 18:44	06:28 16:52	07:10 16:18	07:34 16:22	07:34 16:22
29	05:38 20:28	06:14 19:40	06:51 18:42	07:28 (12) 07:36 (12)	06:29 16:50	07:11 16:18	07:34 16:22
30	05:39 20:27	06:15 19:38	06:52 18:40	07:25 (12) 07:39 (12)	06:31 16:49	07:12 16:17	07:34 16:23
31	05:40 20:26	06:16 19:36	06:53 18:40	06:32 16:47	06:32 16:47	07:34 16:24	07:34 16:24
Potential sun hours	-272	4	376	341	288	274	
Total, worst case	178		22	228			
Sun reduction	0.58		0.55	0.45			
Oper. time red.	0.91		0.91	0.91			
Wind dir. red.	0.64		0.62	0.62			
Total reduction	0.34		0.31	0.25			
Total, real	60		7	58			

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 160 - 160

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June		
1	07:34 16:25	07:17 17:03	06:35 17:43	06:56 (12) 18:23	05:38 20:01	05:47 20:34		19:41 (21)
2	07:34 16:26	07:16 17:05	06:34 17:44	06:56 (12) 18:24	05:37 20:01	05:45 20:35	12	19:53 (21)
3	07:34 16:27	07:14 17:06	06:32 17:46	06:56 (12) 18:26	05:35 20:02	05:44 20:36	8	19:51 (21)
4	07:34 16:28	07:13 17:08	06:30 17:47	06:57 (12) 18:27	05:33 20:03	05:43 20:37	6	19:50 (21)
5	07:34 16:29	07:12 17:09	06:28 17:48	06:57 (12) 18:28	06:31 20:04	05:41 20:37		05:12
6	07:34 16:30	07:11 17:11	06:27 17:50	06:57 (12) 18:29	06:29 20:06	05:40 20:38		05:11
7	07:34 16:31	07:09 17:12	06:25 17:51	06:57 (12) 18:31	06:27 20:07	05:38 20:39	4	19:40 (21) 19:44 (21)
8	07:34 16:32	07:08 17:13	06:23 17:52	06:57 (12) 18:32	06:26 20:08	05:37 20:40	4	19:39 (21) 19:43 (21)
9	07:34 16:33	07:07 17:15	06:21 17:54	07:00 (12) 18:33	06:24 20:09	05:36 20:41	8	19:37 (21) 19:45 (21)
10	07:33 16:34	07:05 17:16	06:19 17:55	07:00 (12) 18:34	06:22 20:10	05:34 20:42	10	19:36 (21) 19:46 (21)
11	07:33 16:36	07:04 17:18	06:18 17:56	07:02 (12) 18:36	06:20 20:12	05:33 20:43	12	19:35 (21) 19:47 (21)
12	07:33 16:37	07:03 17:19	06:16 17:57	07:06 (12) 18:37	06:18 20:13	05:32 20:44	14	19:34 (21) 19:48 (21)
13	07:32 16:38	07:01 17:21	06:14 17:59	07:12 (12) 18:38	06:17 20:14	05:31 20:45	16	19:33 (21) 19:49 (21)
14	07:32 16:39	07:00 17:22	06:12 18:00	07:18 (12) 18:39	06:15 20:15	05:29 20:46	16	19:32 (21) 19:50 (21)
15	07:31 16:40	06:58 17:23	06:10 18:01	07:24 (12) 18:40	06:13 20:16	05:28 20:47	18	19:32 (21) 19:51 (21)
16	07:31 16:42	06:57 17:25	06:08 18:03	07:30 (12) 18:41	06:11 20:18	05:27 20:48	18	19:33 (21) 19:52 (21)
17	07:30 16:43	06:55 17:26	06:06 18:04	07:36 (12) 18:42	06:10 20:19	05:26 20:49	20	19:32 (21) 19:52 (21)
18	07:29 16:44	06:54 17:28	06:05 18:05	07:42 (12) 18:43	06:08 20:20	05:25 20:50	20	19:33 (21) 19:53 (21)
19	07:29 16:46	06:52 17:29	06:03 18:07	07:48 (12) 18:44	06:06 20:21	05:24 20:51	22	19:32 (21) 19:54 (21)
20	07:28 16:47	06:50 17:30	06:01 18:08	07:54 (12) 18:45	06:04 20:22	05:23 20:52	22	19:34 (21) 19:56 (21)
21	07:27 16:48	06:49 17:32	05:59 18:09	08:00 (12) 18:46	06:03 20:23	05:22 20:53	24	19:33 (21) 19:57 (21)
22	07:26 16:50	06:47 17:33	05:57 18:10	08:06 (12) 18:47	06:01 20:24	05:21 20:54	24	19:34 (21) 19:58 (21)
23	07:26 16:51	06:46 17:35	05:55 18:12	08:12 (12) 18:48	05:59 20:25	05:20 20:55	22	19:35 (21) 19:57 (21)
24	07:25 16:52	06:44 17:36	05:53 18:13	08:18 (12) 18:49	05:58 20:26	05:19 20:56	22	19:34 (21) 19:56 (21)
25	07:24 16:54	06:42 17:37	05:51 18:14	08:24 (12) 18:50	05:56 20:27	05:18 20:57	22	19:35 (21) 19:57 (21)
26	07:23 16:55	06:41 17:39	05:50 18:15	08:30 (12) 18:51	05:55 20:28	05:18 20:58	20	19:37 (21) 19:57 (21)
27	07:22 16:56	06:39 17:40	05:48 18:17	08:36 (12) 18:52	05:53 20:29	05:17 20:59	20	19:36 (21) 19:56 (21)
28	07:21 16:58	06:37 17:41	05:46 18:18	08:42 (12) 18:53	05:51 20:30	05:16 21:00	18	19:37 (21) 19:55 (21)
29	07:20 16:59		05:44 18:19	08:48 (12) 18:54	05:50 20:31	05:15 21:01	16	19:39 (21) 19:55 (21)
30	07:19 17:01		05:42 18:21	08:54 (12) 18:55	05:48 20:32	05:15 21:02	16	19:38 (21) 19:54 (21)
31	07:18 17:02		05:40 18:22	09:00 (12) 18:56	05:46 20:33	05:14 21:03	14	19:40 (21) 19:54 (21)
Potential sun hours	286	291	369	404	-285	-254		
Total, worst case		196	304		422			26
Sun reduction		0.45	0.50		0.55			0.55
Oper. time red.		0.91	0.91		0.91			0.91
Wind dir. red.		0.62	0.62		0.60			0.60
Total reduction		0.25	0.28		0.30			0.30
Total, real		50	85		127			8

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

Day in month	Sun rise (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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 160 - 160

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes
Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	14 19:45 (21) 19:59 (21)	06:17 19:35	06:53 18:38	06:34 16:46
2	05:14 20:46	05:42 20:24	19:46 (21) 19:58 (21)	06:19 19:33	06:54 18:36	07:42 (12) 16:44
3	05:14 20:46	05:43 20:22	19:47 (21) 19:55 (21)	06:20 19:31	06:56 18:34	07:39 (12) 16:43
4	05:15 20:46	05:44 20:21	19:48 (21) 19:54 (21)	06:21 19:29	06:57 18:33	07:36 (12) 16:41
5	05:16 20:46	05:45 20:20	19:49 (21) 19:53 (21)	06:22 19:27	06:58 18:31	07:35 (12) 16:40
6	05:16 20:45	05:47 20:18	19:50 (21) 19:54 (21)	06:23 19:25	06:59 18:29	07:33 (12) 16:39
7	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27	07:32 (12) 16:38	06:42 16:15
8	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	07:31 (12) 16:36	06:43 16:15
9	05:18 20:44	19:53 (21) 19:57 (21)	05:50 20:14	06:27 19:20	07:03 18:23	07:31 (12) 16:35
10	05:19 20:44	19:52 (21) 19:58 (21)	05:51 20:13	06:28 19:18	07:04 18:22	07:30 (12) 16:34
11	05:20 20:43	19:49 (21) 20:01 (21)	05:52 20:11	06:29 19:16	07:06 18:20	07:29 (12) 16:33
12	05:21 20:43	19:49 (21) 20:01 (21)	05:54 20:10	06:30 19:14	07:07 18:18	07:29 (12) 16:32
13	05:22 20:42	19:48 (21) 20:02 (21)	05:55 20:08	06:32 19:12	07:08 18:16	07:30 (12) 16:30
14	05:23 20:42	19:47 (21) 20:03 (21)	05:56 20:07	06:33 19:10	07:10 18:15	07:31 (12) 16:29
15	05:23 20:41	19:46 (21) 20:04 (21)	05:57 20:05	06:34 19:08	07:11 18:13	07:33 (12) 16:28
16	05:24 20:40	19:47 (21) 20:05 (21)	05:58 20:04	06:35 19:07	07:12 18:11	07:34 (12) 16:27
17	05:25 20:40	19:46 (21) 20:06 (21)	06:00 20:02	06:36 19:05	07:13 18:09	07:35 (12) 16:26
18	05:26 20:39	19:44 (21) 20:06 (21)	06:01 20:00	06:38 19:03	07:15 18:08	07:37 (12) 16:25
19	05:27 20:38	19:45 (21) 20:07 (21)	06:02 19:57	06:39 19:01	07:16 18:06	07:38 (12) 16:25
20	05:28 20:37	19:44 (21) 20:06 (21)	06:03 19:56	06:40 18:59	07:17 18:04	07:39 (12) 16:24
21	05:29 20:36	19:43 (21) 20:07 (21)	06:04 19:54	06:41 18:57	07:19 18:03	07:41 (12) 16:23
22	05:30 20:35	19:44 (21) 20:08 (21)	06:05 19:52	06:42 18:55	07:20 18:01	07:42 (12) 16:22
23	05:31 20:35	19:43 (21) 20:07 (21)	06:07 19:50	06:44 18:53	07:21 17:59	07:03 16:21
24	05:32 20:34	19:44 (21) 20:06 (21)	06:08 19:49	06:45 18:51	07:23 17:58	07:05 16:21
25	05:33 20:33	19:43 (21) 20:05 (21)	06:09 19:47	06:46 18:49	06:24 16:56	07:06 16:20
26	05:34 20:32	19:42 (21) 20:04 (21)	06:10 19:45	06:47 18:48	06:25 16:55	07:07 16:19
27	05:35 20:30	19:43 (21) 20:03 (21)	06:11 19:44	06:48 18:46	06:27 16:53	07:08 16:19
28	05:36 20:29	19:44 (21) 20:02 (21)	06:13 19:42	06:50 18:44	06:28 16:51	07:10 16:18
29	05:38 20:28	19:43 (21) 20:01 (21)	06:14 19:40	06:51 18:42	06:29 16:50	07:11 16:18
30	05:39 20:27	19:44 (21) 20:00 (21)	06:15 19:38	06:52 18:40	06:31 16:49	07:12 16:17
31	05:40 20:26	19:44 (21) 20:00 (21)	06:16 19:36	06:53 18:47	06:32 16:47	07:34 16:24
Potential sun hours	-272	4	376	341	288	274
Total, worst case	412	48	512			
Sun reduction	0.58	0.55	0.45			
Oper. time red.	0.91	0.91	0.91			
Wind dir. red.	0.60	0.60	0.62			
Total reduction	0.32	0.30	0.25			
Total, real	131	14	129			

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)

Project:

060119 Marble River

Description:

Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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Calculated:

01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 161 - 161

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Table with columns for months (January to December) and rows for each day (1-31) showing sun rise/set times and shadow reduction percentages. Includes a summary section at the bottom for 'Potential sun hours' and 'Total, real'.

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

Matrix defining table layout: 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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 239 - 239

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34 16:25	07:17 17:04	06:36 17:43	07:04 (9) 05:39 07:34 (9) 18:23	05:47 20:00	06:10 (6) 05:14 14 06:24 (6) 20:34 12 06:23 (6)
2	07:35 16:26	07:16 17:05	06:34 17:44	07:04 (9) 05:37 28 07:32 (9) 18:24	05:46 20:01	06:07 (6) 05:13 20 06:27 (6) 20:35 8 06:21 (6)
3	07:35 16:27	07:15 17:06	06:32 17:46	07:05 (9) 05:35 28 07:33 (9) 18:26	05:44 20:02	06:05 (6) 05:13 22 06:27 (6) 20:36 4 06:20 (6)
4	07:35 16:28	07:13 17:08	06:30 17:47	07:05 (9) 05:33 6 07:31 (9) 18:27	05:43 20:03	06:04 (6) 05:12 24 06:28 (6) 20:37
5	07:34 16:29	07:12 17:09	06:29 17:48	07:05 (9) 06:31 26 07:31 (9) 19:28	05:41 20:05	06:03 (6) 05:12 28 06:31 (6) 20:37
6	07:34 16:30	07:11 17:11	06:27 17:50	07:07 (9) 06:29 22 07:29 (9) 19:30	05:40 20:06	06:03 (6) 05:11 28 06:31 (6) 20:38
7	07:34 16:31	07:10 17:12	06:25 17:51	07:07 (9) 06:28 20 07:27 (9) 19:31	05:39 20:07	06:02 (6) 05:11 28 06:30 (6) 20:39
8	07:34 16:32	07:08 17:14	06:23 17:52	07:10 (9) 06:26 16 07:26 (9) 19:32	05:37 20:08	06:01 (6) 05:11 30 06:31 (6) 20:40
9	07:34 16:33	07:07 17:15	06:21 17:54	07:14 (9) 06:24 6 07:20 (9) 19:33	05:36 20:09	06:01 (6) 05:10 30 06:31 (6) 20:40
10	07:33 16:35	07:06 17:16	06:20 17:55	06:22 19:35	05:35 20:11	06:00 (6) 05:10 32 06:32 (6) 20:41
11	07:33 16:36	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:59 (6) 05:10 32 06:31 (6) 20:42
12	07:33 16:37	07:03 17:19	06:16 17:58	06:19 19:37	05:32 20:13	06:00 (6) 05:10 32 06:32 (6) 20:42
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	05:59 (6) 05:10 34 06:33 (6) 20:43
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	05:30 20:15	06:00 (6) 05:09 32 06:32 (6) 20:43
15	07:31 16:41	06:58 17:24	06:10 18:02	06:13 19:41	05:28 20:17	06:01 (6) 05:09 32 06:33 (6) 20:44
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	06:00 (6) 05:09 32 06:32 (6) 20:44
17	07:30 16:43	06:55 17:26	06:07 18:04	06:10 19:43	05:26 20:19	06:01 (6) 05:09 32 06:33 (6) 20:45
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	06:00 (6) 05:09 32 06:32 (6) 20:45
19	07:29 16:46	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	06:01 (6) 05:09 30 06:31 (6) 20:45
20	07:28 16:47	06:51 17:31	06:01 18:08	06:05 19:47	05:23 20:22	06:02 (6) 05:10 30 06:32 (6) 20:46
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	06:01 (6) 05:10 30 06:31 (6) 20:46
22	07:27 16:50	06:47 17:33	05:57 18:11	06:01 19:50	05:21 20:24	06:02 (6) 05:10 28 06:30 (6) 20:46
23	07:26 16:51	06:46 17:35	05:55 18:12	06:00 19:51	05:20 20:25	06:03 (6) 05:10 26 06:29 (6) 20:46
24	07:25 16:52	06:44 17:36	05:54 18:13	05:58 19:52	05:19 20:26	06:02 (6) 05:11 26 06:28 (6) 20:47
25	07:24 16:54	06:42 17:38	05:52 18:14	05:56 19:53	05:19 20:27	06:04 (6) 05:11 26 06:30 (6) 20:47
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	05:18 20:29	06:05 (6) 05:11 24 06:29 (6) 20:47
27	07:22 16:57	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:30	06:06 (6) 05:12 22 06:28 (6) 20:47
28	07:21 16:58	06:37 17:42	05:46 18:18	05:52 19:57	05:16 20:30	06:05 (6) 05:12 22 06:27 (6) 20:47
29	07:20 16:59		05:44 18:19	05:50 19:58	05:16 20:31	06:07 (6) 05:12 20 06:27 (6) 20:47
30	07:19 17:01		05:42 18:21	05:49 20:00	05:15 20:32	06:08 (6) 05:13 8 06:22 (6) 20:47
31	07:18 17:02		05:40 18:22		05:14 20:33	06:10 (6) 14 06:24 (6)
Potential sun hours	286	291	369	380	-285	-254
Total, worst case		492	202	8	828	24
Sun reduction		0.45	0.50	0.55	0.55	0.55
Oper. time red.		0.91	0.91	0.91	0.91	0.91
Wind dir. red.		0.62	0.62	0.56	0.56	0.56
Total reduction		0.25	0.28	0.28	0.28	0.28
Total, real		124	57	2	231	7

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 09:41 / 28
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 239 - 239

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	06:11 (6) 06:43 (6)	06:18 19:35	06:53 18:38	06:34 16:46
2	05:14 20:47	05:42 20:24	06:10 (6) 06:42 (6)	06:19 19:33	06:55 18:36	22 07:19 (11) 06:58 (11)
3	05:15 20:46	05:43 20:22	06:11 (6) 06:43 (6)	06:20 19:31	06:56 18:35	20 07:18 (11) 07:00 (11)
4	05:15 20:46	05:44 20:21	06:10 (6) 06:42 (6)	06:21 19:29	06:57 18:33	18 07:18 (11) 06:38
5	05:16 20:46	05:46 20:20	06:11 (6) 06:41 (6)	06:22 19:27	06:58 18:31	14 07:15 (11) 07:03 (11)
6	05:16 20:46	05:47 20:18	06:12 (6) 06:40 (6)	06:23 19:26	07:00 18:29	12 07:15 (11) 07:45 (9)
7	05:17 20:45	05:48 20:17	06:13 (6) 06:39 (6)	06:25 19:24	07:01 18:27	10 07:14 (11) 07:44 (9)
8	05:18 20:45	05:49 20:16	06:12 (6) 06:38 (6)	06:26 19:22	07:02 18:25	6 07:12 (11) 07:41 (9)
9	05:19 20:44	05:50 20:14	06:14 (6) 06:38 (6)	06:27 19:20	07:03 18:24	08:05 (9) 07:41 (9)
10	05:19 20:44	06:22 (6) 06:28 (6)	05:51 20:13	06:28 19:18	07:05 18:22	08:06 (9) 07:40 (9)
11	05:20 20:44	06:19 (6) 06:31 (6)	05:53 20:11	06:29 19:16	07:06 18:20	07:39 (9) 08:07 (9)
12	05:21 20:43	06:17 (6) 06:31 (6)	05:54 20:10	06:31 19:14	07:07 18:18	07:39 (9) 08:07 (9)
13	05:22 20:42	06:16 (6) 06:32 (6)	05:55 20:08	06:32 19:12	07:08 18:16	07:38 (9) 08:06 (9)
14	05:23 20:42	06:17 (6) 06:33 (6)	05:56 20:07	06:33 19:11	07:10 18:15	07:37 (9) 08:07 (9)
15	05:24 20:41	06:16 (6) 06:36 (6)	05:57 20:05	06:34 19:09	07:11 18:13	07:37 (9) 08:07 (9)
16	05:24 20:40	06:15 (6) 06:37 (6)	05:59 20:04	06:35 19:07	07:12 18:11	07:38 (9) 08:06 (9)
17	05:25 20:40	06:14 (6) 06:38 (6)	06:00 20:02	06:37 19:05	07:14 18:09	07:37 (9) 08:05 (9)
18	05:26 20:39	06:13 (6) 06:39 (6)	06:01 20:01	06:38 19:03	07:15 18:08	07:39 (9) 08:05 (9)
19	05:27 20:38	06:14 (6) 06:38 (6)	06:02 19:57	06:39 19:01	07:16 18:06	07:38 (9) 08:02 (9)
20	05:28 20:37	06:13 (6) 06:39 (6)	06:03 19:56	06:40 18:59	07:18 18:04	07:40 (9) 08:02 (9)
21	05:29 20:37	06:11 (6) 06:39 (6)	06:04 19:54	06:41 18:57	07:19 18:03	07:41 (9) 08:01 (9)
22	05:30 20:36	06:12 (6) 06:40 (6)	06:06 19:52	06:43 18:55	07:20 18:01	07:44 (9) 07:58 (9)
23	05:31 20:35	06:11 (6) 06:41 (6)	06:07 19:51	06:44 18:53	07:22 17:59	07:46 (9) 08:12 (11)
24	05:32 20:34	06:10 (6) 06:40 (6)	06:08 19:49	06:45 18:52	07:23 17:58	08:01 (11) 08:13 (11)
25	05:33 20:33	06:11 (6) 06:41 (6)	06:09 19:47	06:46 18:50	06:24 16:56	06:59 (11) 07:15 (11)
26	05:34 20:32	06:10 (6) 06:42 (6)	06:10 19:45	06:47 18:48	06:26 16:55	06:58 (11) 07:16 (11)
27	05:36 20:31	06:09 (6) 06:41 (6)	06:12 19:44	06:49 18:46	06:27 16:53	06:57 (11) 07:17 (11)
28	05:37 20:30	06:10 (6) 06:42 (6)	06:13 19:42	06:50 18:44	06:28 16:52	06:57 (11) 07:17 (11)
29	05:38 20:28	06:10 (6) 06:44 (6)	06:14 19:40	06:51 18:42	06:30 16:50	06:56 (11) 07:18 (11)
30	05:39 20:27	06:11 (6) 06:43 (6)	06:15 19:38	06:52 18:40	06:31 16:49	06:56 (11) 07:18 (11)
31	05:40 20:26	06:10 (6) 06:42 (6)	06:16 19:37	06:52 18:40	06:32 16:47	06:55 (11) 07:17 (11)
Potential sun hours	-272	4	376	341	288	274
Total, worst case	546	322	598	102		
Sun reduction	0.58	0.55	0.45	0.35		
Oper. time red.	0.91	0.91	0.91	0.91		
Wind dir. red.	0.56	0.56	0.62	0.62		
Total reduction	0.29	0.28	0.25	0.20		
Total, real	160	90	151	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)
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Project: **060119 Marble River**

Description: Marble River Wind Project
 Shadow-Flicker, MidW part
 27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

Printed/Page: 01/23/06 09:41 / 29
 Licensed user: **Wind Engineers, Inc.**
 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated: 01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 240 - 240

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
 N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:34 16:25	07:17 17:04	06:36 17:43	05:39 18:23	06:07 (11) 20:00	05:47 24	06:18 (9) 20:34	05:13 20:47	05:41 20:25	06:18 19:35	06:34 18:38	07:13 16:17
2	07:35 16:26	07:15 17:05	06:34 17:44	05:37 18:24	06:07 (11) 20:01	05:46 22	06:19 (9) 20:35	05:14 20:47	05:42 20:24	06:19 19:33	06:35 18:36	07:14 16:17
3	07:35 16:27	07:15 17:06	06:32 17:46	05:35 18:26	06:09 (11) 20:02	05:44 20	06:19 (9) 20:36	05:15 20:46	05:43 20:22	06:20 19:31	06:36 18:35	07:16 16:16
4	07:35 16:28	07:13 17:08	06:30 17:47	05:33 18:27	06:11 (11) 20:03	05:43 18	06:20 (9) 20:37	05:15 20:46	05:44 20:21	06:21 19:29	06:38 18:33	07:17 16:16
5	07:34 16:29	07:12 17:09	06:29 17:48	06:31 19:28	05:41 20:05	14	06:23 (9) 20:37	05:16 20:46	05:46 20:20	06:22 19:27	06:39 18:31	07:18 16:16
6	07:34 16:30	07:11 17:11	06:27 17:50	06:29 19:30	05:40 20:06	12	06:23 (9) 20:38	05:16 20:46	05:47 20:18	06:23 (9) 19:26	07:00 18:29	07:19 16:15
7	07:34 16:31	07:10 17:12	06:25 17:51	06:28 19:31	05:39 20:07		05:11 20:39	05:17 20:45	05:48 20:17	06:33 (9) 19:24	07:01 18:27	07:20 16:15
8	07:34 16:32	07:08 17:14	06:23 17:52	06:26 19:32	05:37 20:08		05:11 20:40	05:18 20:45	05:49 20:16	06:30 (9) 19:22	07:08 (11) 18:25	07:21 16:15
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09		05:10 20:40	05:19 20:44	05:50 20:14	06:30 (9) 19:20	07:03 (11) 18:24	07:22 16:15
10	07:33 16:35	07:06 17:16	06:20 17:55	06:22 19:35	05:35 20:11		05:10 20:41	05:19 20:44	05:51 20:13	06:29 (9) 19:18	07:00 (11) 18:22	07:23 16:15
11	07:33 16:36	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12		05:10 20:42	05:20 20:44	05:53 20:11	06:28 (9) 19:16	06:59 (11) 18:20	07:24 16:15
12	07:33 16:37	07:03 17:19	06:16 17:58	06:19 19:37	05:32 20:13		05:10 20:42	05:21 20:43	05:54 20:10	06:27 (9) 19:14	06:58 (11) 18:18	07:25 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14		05:10 20:43	05:22 20:42	05:55 20:08	06:26 (9) 19:12	06:55 (11) 18:16	07:26 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	05:30 20:15		05:09 20:43	05:23 20:42	05:56 20:07	06:25 (9) 19:11	06:56 (11) 18:15	07:27 16:15
15	07:31 16:41	06:58 17:24	06:10 18:02	06:13 19:41	05:28 20:17		05:09 20:44	05:24 20:41	05:57 20:05	06:24 (9) 19:09	06:56 (11) 18:13	07:28 16:16
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18		05:09 20:44	05:25 20:40	05:59 20:04	06:25 (9) 19:07	06:57 (11) 18:11	07:29 16:16
17	07:30 16:43	06:55 17:26	06:07 18:04	06:10 19:43	05:26 20:19	8	05:09 20:45	05:25 20:40	06:00 20:02	06:25 (9) 19:05	06:58 (11) 18:09	07:30 16:16
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	12	05:09 20:45	05:26 20:39	06:01 20:01	06:24 (9) 19:03	06:59 (11) 18:08	07:31 16:16
19	07:29 16:46	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	16	05:10 20:46	05:27 20:38	06:02 19:57	06:25 (9) 19:01	07:00 (11) 18:06	07:32 16:17
20	07:28 16:47	06:51 17:31	06:01 18:08	06:05 19:47	05:23 20:22	18	05:10 20:46	05:28 20:37	06:03 19:56	06:26 (9) 18:59	07:01 (11) 18:04	07:33 16:17
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	20	05:10 20:46	05:29 20:37	06:04 19:54	06:27 (9) 18:57	07:03 (11) 18:03	07:34 16:18
22	07:27 16:50	06:47 17:33	05:57 18:11	06:01 19:50	05:21 20:24	22	05:10 20:46	05:30 20:36	06:06 19:52	06:28 (9) 18:55	07:09 (11) 18:01	07:35 16:18
23	07:26 16:51	06:46 17:35	05:55 18:12	06:00 19:51	05:20 20:25	24	05:10 20:46	05:31 20:35	06:07 19:51	06:29 (9) 18:53	07:11 (11) 18:00	07:36 16:19
24	07:25 16:52	06:44 17:36	05:54 18:13	06:14 (11) 19:52	05:58 20:26	26	05:11 20:47	05:32 20:34	06:08 19:49	06:30 (9) 18:52	07:23 (11) 18:00	07:37 16:19
25	07:24 16:54	06:42 17:38	05:52 18:14	06:12 (11) 19:53	05:56 20:27	28	05:11 20:47	05:33 20:33	06:09 19:47	06:32 (9) 18:50	06:24 (11) 18:00	07:38 16:20
26	07:23 16:55	06:41 17:39	05:50 18:16	06:10 (11) 19:55	05:55 20:28	30	05:11 20:47	05:34 20:32	06:10 19:45	06:33 (9) 18:48	06:26 (11) 18:00	07:39 16:20
27	07:22 16:57	06:39 17:40	05:48 18:17	06:08 (11) 19:56	05:53 20:29	26	05:12 20:47	05:36 20:31	06:12 19:44	06:41 (9) 18:46	06:27 (11) 18:00	07:40 16:21
28	07:21 16:58	06:37 17:42	05:46 18:18	06:06 (11) 19:57	05:52 20:30	28	05:12 20:47	05:37 20:30	06:13 19:42	06:50 18:44	06:28 (11) 18:00	07:41 16:22
29	07:20 16:59		05:44 18:19	06:04 (11) 19:58	05:50 20:31	26	05:12 20:47	05:38 20:28	06:14 19:40	06:51 18:42	06:30 (11) 18:00	07:42 16:23
30	07:19 17:01		05:42 18:21	06:04 (11) 20:00	05:49 20:32	26	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	06:31 (11) 18:00	07:43 16:23
31	07:18 17:02		05:40 18:22	06:05 (11) 20:05	05:48 20:33		05:14 20:33	05:40 20:26	06:16 19:37		06:32 (11) 18:00	07:44 16:24
Potential sun hours	286	291	369	380	285	-254	-272	4	376	341	288	274
Total, worst case			162	354	110			420	210			
Sun reduction			0.50	0.55	0.55			0.55	0.55			
Oper. time red.			0.91	0.91	0.91			0.91	0.91			
Wind dir. red.			0.62	0.59	0.58			0.58	0.62			
Total reduction			0.28	0.29	0.29			0.29	0.31			
Total, real			46	104	32			122	65			

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 09:41 / 30
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 241 - 241

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34 16:25	07:17 17:04	06:36 17:43	05:39 18:23	05:47 20:00	06:22 (9) 05:14 26 06:57 (9)
2	07:35 16:26	07:16 17:05	06:34 17:44	05:37 18:24	05:46 20:01	46 07:08 (9) 20:34 26 06:57 (9)
3	07:35 16:27	07:15 17:06	06:32 17:46	05:35 18:26	05:44 20:02	48 07:09 (9) 20:35 24 06:57 (9)
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	48 07:09 (9) 20:36 24 06:56 (9)
5	07:34 16:29	07:12 17:09	06:29 17:48	06:31 19:28	05:41 20:05	48 07:09 (9) 20:37 20 06:55 (9)
6	07:34 16:30	07:11 17:11	06:27 17:50	06:29 19:30	05:40 20:06	50 07:09 (9) 20:38 16 06:53 (9)
7	07:34 16:31	07:10 17:12	06:25 17:51	06:28 19:31	05:39 20:07	48 07:08 (9) 20:39 16 06:53 (9)
8	07:34 16:32	07:08 17:14	06:23 17:52	06:26 19:32	05:37 20:08	50 07:09 (9) 20:40 12 06:51 (9)
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	50 07:09 (9) 20:40 10 06:50 (9)
10	07:33 16:35	07:06 17:16	06:20 17:55	06:44 (11) 06:22 16 07:00 (11) 19:35	05:35 20:11	48 07:08 (9) 20:41 4 06:48 (9)
11	07:33 16:36	07:04 17:18	06:18 17:56	06:42 (11) 06:20 20 07:02 (11) 19:36	05:33 20:12	50 07:09 (9) 20:42
12	07:33 16:37	07:03 17:19	06:16 17:58	06:40 (11) 06:19 24 07:04 (11) 19:37	05:32 20:13	48 07:08 (9) 20:42
13	07:32 16:38	07:01 17:21	06:14 17:59	06:38 (11) 06:17 26 07:04 (11) 19:38	05:31 20:14	50 07:09 (9) 20:43
14	07:32 16:39	07:00 17:22	06:12 18:00	06:36 (11) 06:15 30 07:06 (11) 19:40	05:30 20:15	48 07:08 (9) 20:43
15	07:31 16:41	06:58 17:24	06:10 18:02	06:37 (11) 06:13 30 07:07 (11) 19:41	05:28 20:17	46 07:07 (9) 20:44
16	07:31 16:42	06:57 17:25	06:08 18:03	06:35 (11) 06:11 32 07:07 (11) 19:42	05:27 20:18	48 07:08 (9) 20:44
17	07:30 16:43	06:55 17:26	06:07 18:04	06:35 (11) 06:10 32 07:07 (11) 19:43	05:26 20:19	46 07:07 (9) 20:45
18	07:30 16:44	06:54 17:28	06:05 18:05	06:33 (11) 06:08 34 07:07 (11) 19:45	05:25 20:20	44 07:06 (9) 20:45
19	07:29 16:46	06:52 17:29	06:03 18:07	06:33 (11) 06:06 34 07:07 (11) 19:46	05:24 20:21	44 07:05 (9) 20:45
20	07:28 16:47	06:51 17:31	06:01 18:08	06:33 (11) 06:05 32 07:05 (11) 19:47	05:23 20:22	44 07:06 (9) 20:46
21	07:27 16:48	06:49 17:32	05:59 18:09	06:33 (11) 06:03 32 07:05 (11) 19:48	05:22 20:23	42 07:05 (9) 20:46
22	07:27 16:50	06:47 17:33	05:57 18:11	06:33 (11) 06:01 32 07:05 (11) 19:50	05:21 20:24	40 07:04 (9) 20:46
23	07:26 16:51	06:46 17:35	05:55 18:12	06:34 (11) 06:00 30 07:04 (11) 19:51	05:20 20:25	40 07:03 (9) 20:46
24	07:25 16:52	06:44 17:36	05:54 18:13	06:34 (11) 05:58 28 07:02 (11) 19:52	05:19 20:26	38 07:02 (9) 20:47
25	07:24 16:54	06:42 17:38	05:52 18:14	06:34 (11) 05:56 28 07:02 (11) 19:53	05:19 20:27	36 07:02 (9) 20:47
26	07:23 16:55	06:41 17:39	05:50 18:16	06:34 (11) 05:55 26 07:00 (11) 19:55	05:18 20:28	38 07:03 (9) 20:47
27	07:22 16:57	06:39 17:40	05:48 18:17	06:36 (11) 05:53 22 06:58 (11) 19:56	05:17 20:29	36 07:02 (9) 20:47
28	07:21 16:58	06:37 17:42	05:46 18:18	06:38 (11) 05:52 18 06:56 (11) 19:57	05:16 20:30	34 07:01 (9) 20:47
29	07:20 16:59	06:35 17:43	05:44 18:19	06:40 (11) 05:50 12 06:52 (11) 19:58	05:16 20:31	32 07:01 (9) 20:47
30	07:19 17:01	06:33 17:44	05:42 18:20	06:42 (11) 05:49 46 07:08 (9) 20:00	05:15 20:32	32 07:00 (9) 20:47
31	07:18 17:02	06:31 17:45	05:40 18:22	06:44 (11) 05:47 46 07:08 (9) 20:01	05:14 20:33	28 06:58 (9) 20:47
Potential sun hours	286	291	369	380	-285	-254
Total, worst case			544	380	1348	174
Sun reduction			0.50	0.55	0.55	0.55
Oper. time red.			0.91	0.91	0.91	0.91
Wind dir. red.			0.63	0.58	0.58	0.58
Total reduction			0.28	0.29	0.29	0.29
Total, real			154	110	391	51

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 09:41 / 31
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 241 - 241

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	06:31 (9) 07:19 (9)	06:18 19:35	06:53 18:38	07:19 (11) 16:46
2	05:14 20:47	05:42 20:24	06:30 (9) 07:18 (9)	06:19 19:33	06:55 18:36	07:20 (11) 16:44
3	05:15 20:46	06:47 (9) 06:53 (9)	05:43 20:22	06:20 19:31	06:56 18:35	07:21 (11) 16:43
4	05:15 20:46	06:46 (9) 06:56 (9)	05:44 20:21	06:21 19:29	06:57 18:33	07:24 (11) 16:42
5	05:16 20:46	06:44 (9) 06:58 (9)	05:46 20:20	06:22 19:27	06:58 18:31	06:39 16:40
6	05:16 20:46	06:43 (9) 06:59 (9)	05:48 20:18	06:23 19:26	07:00 18:29	06:41 16:39
7	05:17 20:45	06:42 (9) 07:00 (9)	05:48 20:17	06:25 19:24	07:01 18:27	06:42 16:38
8	05:18 20:45	06:40 (9) 07:02 (9)	05:49 20:16	06:26 19:22	07:02 18:25	06:43 16:36
9	05:19 20:44	06:41 (9) 07:03 (9)	05:50 20:14	06:27 19:20	07:03 18:24	06:45 16:35
10	05:19 20:44	06:40 (9) 07:04 (9)	05:51 20:13	06:28 19:18	07:05 18:22	06:46 16:34
11	05:20 20:44	06:39 (9) 07:05 (9)	05:53 20:11	06:29 19:16	07:06 18:20	06:47 16:33
12	05:21 20:43	06:37 (9) 07:05 (9)	05:54 20:10	06:31 19:14	07:07 18:18	06:49 16:32
13	05:22 20:42	06:38 (9) 07:06 (9)	05:55 20:08	06:32 19:12	07:08 18:16	06:50 16:31
14	05:23 20:42	06:37 (9) 07:09 (9)	05:56 20:07	06:33 19:11	07:10 18:15	06:51 16:30
15	05:24 20:41	06:36 (9) 07:10 (9)	05:57 20:05	06:34 19:09	07:11 18:13	06:53 16:28
16	05:24 20:40	06:37 (9) 07:11 (9)	05:59 20:04	06:35 19:07	07:12 18:11	06:54 16:27
17	05:25 20:40	06:36 (9) 07:12 (9)	06:00 20:02	06:37 19:05	07:14 18:09	06:56 16:27
18	05:26 20:39	06:35 (9) 07:11 (9)	06:01 20:01	06:38 19:03	07:15 18:08	06:57 16:26
19	05:27 20:38	06:34 (9) 07:12 (9)	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:25
20	05:28 20:37	06:35 (9) 07:13 (9)	06:03 19:56	06:40 18:59	07:18 18:04	07:00 16:24
21	05:29 20:37	06:33 (9) 07:13 (9)	06:04 19:54	06:41 18:57	07:19 (11) 18:03	07:01 16:23
22	05:30 20:36	06:32 (9) 07:14 (9)	06:06 19:52	06:42 18:55	07:18 (11) 18:01	07:02 16:22
23	05:31 20:35	06:33 (9) 07:15 (9)	06:07 19:51	06:43 18:53	07:17 (11) 17:59	07:03 16:21
24	05:32 20:34	06:32 (9) 07:16 (9)	06:08 19:49	06:45 18:52	07:16 (11) 17:58	07:05 16:21
25	05:33 20:33	06:31 (9) 07:15 (9)	06:09 19:47	06:46 18:50	07:17 (11) 17:56	07:06 16:20
26	05:34 20:32	06:30 (9) 07:16 (9)	06:10 19:45	06:47 18:48	07:16 (11) 17:55	07:07 16:19
27	05:36 20:31	06:31 (9) 07:17 (9)	06:12 19:44	06:49 18:46	07:16 (11) 17:53	07:08 16:19
28	05:37 20:30	06:30 (9) 07:16 (9)	06:13 19:42	06:50 18:44	07:17 (11) 17:52	07:10 16:18
29	05:38 20:28	06:30 (9) 07:18 (9)	06:14 19:40	06:51 18:42	07:16 (11) 17:50	07:11 16:18
30	05:39 20:27	06:31 (9) 07:19 (9)	06:15 19:38	06:52 18:40	07:17 (11) 17:49	07:12 16:17
31	05:40 20:26	06:30 (9) 07:18 (9)	06:16 19:37	06:53 18:40	07:18 (11) 17:48	07:13 16:17
Potential sun hours	-272	4	376	341	288	274
Total, worst case	956	956	478	76		
Sun reduction	0.58	0.55	0.55	0.45		
Oper. time red.	0.91	0.91	0.91	0.91		
Wind dir. red.	0.58	0.58	0.63	0.63		
Total reduction	0.31	0.29	0.31	0.26		
Total, real	293	278	149	19		

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:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, MidW part
 27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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01/23/06 09:41 / 32

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Wind Engineers, Inc.
 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated:

01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 242 - 242

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35

Operational time										
N	NE	E	SE	S	SW	W	NW	Sum		
1,850	1,325	800	713	625	663	700	1,275	7,950		

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:04	06:36 17:43	05:39 18:23	05:47 20:00	05:14 20:34	05:55 (11) 06:29 (11)	05:13 20:47	06:04 (11) 20:25	06:05 (11) 19:35	06:18 18:38	06:53 16:46	06:34 16:17
2	07:34 16:26	07:16 17:05	06:34 17:44	05:37 18:24	05:46 20:01	05:13 20:35	05:55 (11) 06:29 (11)	05:14 20:47	06:03 (11) 20:24	06:06 (11) 19:33	06:19 18:36	06:55 16:44	06:35 16:17
3	07:35 16:27	07:15 17:06	06:32 17:46	05:35 18:26	05:44 20:02	05:13 20:36	05:54 (11) 06:28 (11)	05:15 20:46	06:03 (11) 20:22	06:07 (11) 19:31	06:20 18:35	06:56 16:43	06:36 16:16
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	05:12 20:37	05:56 (11) 06:28 (11)	05:15 20:46	06:04 (11) 20:21	06:08 (11) 19:29	06:21 18:33	06:57 16:42	06:38 16:16
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:05	06:07 (11) 06:17 (11)	05:12 20:37	05:16 20:46	06:02 (11) 20:20	06:09 (11) 19:27	06:22 18:31	06:58 16:40	06:39 16:16
6	07:34 16:30	07:11 17:11	06:27 17:50	06:29 19:30	05:40 20:06	06:03 (11) 06:19 (11)	05:11 20:38	05:16 20:46	06:03 (11) 20:18	06:10 (11) 19:26	06:23 18:29	07:00 16:39	06:41 16:15
7	07:34 16:31	07:10 17:12	06:25 17:51	06:28 19:31	05:39 20:07	06:00 (11) 06:20 (11)	05:11 20:39	05:17 20:45	06:02 (11) 20:17	06:13 (11) 19:24	06:25 18:27	07:01 16:38	06:42 16:15
8	07:34 16:32	07:08 17:14	06:23 17:52	06:26 19:32	05:37 20:08	05:59 (11) 06:23 (11)	05:11 20:40	05:18 20:45	06:02 (11) 20:16	06:16 (11) 19:22	06:26 18:25	07:02 16:36	06:43 16:15
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:57 (11) 06:23 (11)	05:10 20:40	05:19 20:44	06:03 (11) 20:14	06:27 19:20	07:03 18:24	06:45 16:35	06:45 16:15
10	07:33 16:35	07:06 17:16	06:19 17:55	06:22 19:35	05:35 20:11	05:56 (11) 06:24 (11)	05:10 20:41	05:19 20:44	06:02 (11) 20:13	06:28 19:18	07:05 18:22	06:46 16:34	06:46 16:15
11	07:33 16:36	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:55 (11) 06:25 (11)	05:10 20:42	05:20 20:44	06:03 (11) 20:11	06:29 19:16	07:06 18:20	06:47 16:33	06:47 16:15
12	07:33 16:37	07:03 17:19	06:16 17:58	06:19 19:37	05:32 20:13	05:56 (11) 06:26 (11)	05:10 20:43	05:21 20:43	06:01 (11) 20:10	06:31 19:14	07:07 18:18	06:49 16:32	06:49 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	05:55 (11) 06:27 (11)	05:10 20:43	05:22 20:42	06:02 (11) 20:08	06:32 19:12	07:08 18:16	06:50 16:31	06:49 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	05:30 20:15	05:54 (11) 06:28 (11)	05:09 20:43	05:23 20:42	06:03 (11) 20:07	06:33 19:11	07:10 18:15	06:51 16:30	06:49 16:15
15	07:31 16:41	06:58 17:24	06:10 18:02	06:13 19:41	05:28 20:17	05:53 (11) 06:27 (11)	05:09 20:44	05:24 20:41	06:02 (11) 20:05	06:34 19:09	07:11 18:13	06:53 16:28	06:49 16:15
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	05:54 (11) 06:28 (11)	05:09 20:44	05:24 20:40	06:03 (11) 20:04	06:35 19:07	07:12 18:11	06:54 16:27	06:48 16:16
17	07:30 16:43	06:55 17:26	06:07 18:04	06:10 19:43	05:26 20:19	05:53 (11) 06:29 (11)	05:09 20:45	05:25 20:40	06:02 (11) 20:02	06:37 19:05	07:14 18:09	06:56 16:27	06:48 16:16
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	05:52 (11) 06:28 (11)	05:09 20:45	05:26 20:39	06:03 (11) 20:01	06:38 19:03	07:15 18:08	06:57 16:26	06:48 16:16
19	07:29 16:46	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:53 (11) 06:29 (11)	05:09 20:45	05:27 20:38	06:02 (11) 19:57	06:39 19:01	07:16 18:06	06:58 16:25	06:30 16:17
20	07:28 16:47	06:51 17:31	06:01 18:08	06:05 19:47	05:23 20:22	05:52 (11) 06:28 (11)	05:10 20:46	05:28 20:37	06:03 (11) 19:56	06:40 18:59	07:18 18:04	07:00 16:24	06:30 16:17
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:53 (11) 06:29 (11)	05:10 20:46	05:29 20:36	06:01 (11) 19:54	06:41 18:57	07:19 18:03	07:01 16:23	06:31 16:18
22	07:27 16:50	06:47 17:33	05:57 18:11	06:01 19:50	05:21 20:24	05:52 (11) 06:28 (11)	05:10 20:46	05:30 20:36	06:02 (11) 19:52	06:42 18:55	07:20 18:01	07:02 16:22	06:31 16:18
23	07:26 16:51	06:46 17:35	05:55 18:12	06:00 19:51	05:20 20:25	05:53 (11) 06:29 (11)	05:10 20:46	05:31 20:35	06:01 (11) 19:51	06:44 18:53	07:22 17:59	07:03 16:21	06:32 16:19
24	07:25 16:52	06:44 17:36	05:54 18:13	05:58 19:52	05:19 20:26	05:52 (11) 06:28 (11)	05:11 20:47	05:32 20:34	06:02 (11) 19:49	06:45 18:52	07:23 17:58	07:05 16:21	06:32 16:19
25	07:24 16:54	06:42 17:38	05:52 18:14	05:56 19:53	05:19 20:27	05:52 (11) 06:30 (11)	05:11 20:47	05:33 20:33	06:03 (11) 19:47	06:46 18:50	07:24 17:56	07:06 16:20	06:33 16:20
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	05:18 20:28	05:53 (11) 06:29 (11)	05:11 20:47	05:34 20:32	06:02 (11) 19:45	06:47 18:48	07:25 17:55	07:07 16:19	06:34 16:20
27	07:22 16:57	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	05:52 (11) 06:28 (11)	05:12 20:47	05:36 20:31	06:03 (11) 19:44	06:49 18:46	07:27 17:53	07:08 16:19	06:35 16:21
28	07:21 16:58	06:37 17:42	05:46 18:18	05:52 19:57	05:16 20:30	05:53 (11) 06:29 (11)	05:12 20:47	05:37 20:30	06:04 (11) 19:42	06:50 18:44	07:28 17:52	07:10 16:18	06:36 16:22
29	07:20 16:59	06:35 18:19	05:44 18:19	05:50 19:58	05:16 20:31	05:53 (11) 06:29 (11)	05:12 20:47	05:38 20:28	06:05 (11) 19:40	06:51 18:42	07:30 17:50	07:11 16:18	06:37 16:23
30	07:19 17:01	06:32 18:21	05:42 18:21	05:49 20:00	05:15 20:32	05:54 (11) 06:28 (11)	05:13 20:47	05:39 20:27	06:06 (11) 19:38	06:52 18:40	07:31 17:49	07:12 16:17	06:38 16:23
31	07:18 17:02	06:30 18:22	05:40 18:22	05:47 20:00	05:14 20:33	05:54 (11) 06:28 (11)	05:13 20:47	05:40 20:26	06:07 (11) 19:37	06:53 18:40	07:32 17:47	07:13 16:16	06:39 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	274	
Total, worst case					856	856	1040	178					
Sun reduction					0.55	0.55	0.58	0.55					
Oper. time red.					0.91	0.91	0.91	0.91					
Wind dir. red.					0.54	0.54	0.54	0.54					
Total reduction					0.27	0.27	0.29	0.27					
Total, real					232	232	297	48					

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/23/06 09:41 / 33
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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 243 - 243

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:34 16:25	07:17 17:04	06:36 17:43	05:39 18:23	05:47 20:00	05:14 20:34	05:13 20:47	05:38 (11) 20:25	05:41 19:35	06:18 18:38	06:53 16:46	07:13 16:17
2	07:35 16:26	07:16 17:05	06:34 17:44	05:37 18:24	05:46 20:01	05:13 20:35	05:14 20:47	05:39 (11) 20:24	05:42 19:33	06:19 18:36	06:55 16:44	07:14 16:17
3	07:35 16:27	07:15 17:06	06:32 17:46	05:35 18:26	05:44 20:02	05:13 20:36	05:15 20:46	05:39 (11) 20:22	05:43 19:31	06:20 18:35	06:56 16:43	07:16 16:16
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	05:12 20:37	05:15 20:46	05:40 (11) 20:21	05:44 19:29	06:21 18:33	06:57 16:42	07:17 16:16
5	07:34 16:29	07:12 17:09	06:29 17:48	06:31 19:28	05:41 20:05	05:12 20:37	05:16 20:46	05:46 20:20	05:46 19:27	06:22 18:31	06:58 16:40	07:18 16:16
6	07:34 16:30	07:11 17:10	06:27 17:48	06:29 19:28	05:40 20:06	05:11 20:38	05:16 20:46	05:47 20:18	06:23 19:26	07:00 18:29	06:41 16:39	07:19 16:15
7	07:34 16:31	07:10 17:12	06:25 17:51	06:28 19:31	05:39 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27	06:42 16:38	07:20 16:15
8	07:34 16:32	07:08 17:14	06:23 17:52	06:26 19:32	05:37 20:08	05:11 20:40	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	06:43 16:36	07:21 16:15
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40	05:19 20:44	05:50 20:14	06:27 19:20	07:03 18:24	06:45 16:35	07:22 16:15
10	07:33 16:35	07:06 17:16	06:20 17:55	06:22 19:35	05:35 20:11	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	06:46 16:34	07:23 16:15
11	07:33 16:36	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:10 20:42	05:20 20:44	05:53 20:11	06:29 19:16	07:06 18:20	06:47 16:33	07:24 16:15
12	07:33 16:37	07:03 17:19	06:16 17:58	06:19 19:37	05:32 20:13	05:10 20:42	05:21 20:43	05:54 20:10	06:31 19:14	07:07 18:18	06:49 16:32	07:24 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	05:10 20:43	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:16	06:50 16:31	07:25 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	05:30 20:15	05:09 20:43	05:23 20:42	05:56 20:07	06:33 19:11	07:10 18:15	06:51 16:30	07:26 16:15
15	07:31 16:41	06:58 17:24	06:10 18:02	06:13 19:41	05:28 20:17	05:09 20:44	05:24 20:41	05:57 20:05	06:34 19:09	07:11 18:13	06:53 16:29	07:27 16:16
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	05:09 20:44	05:25 20:40	05:59 20:04	06:35 19:07	07:12 18:11	06:54 16:28	07:28 16:16
17	07:30 16:43	06:55 17:26	06:07 18:04	06:10 19:43	05:26 20:19	05:09 20:45	05:25 20:40	06:00 20:02	06:37 19:05	07:14 18:09	06:56 16:27	07:28 16:16
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:01	06:38 19:03	07:15 18:08	06:57 16:26	07:29 16:16
19	07:29 16:46	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:10 20:45	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:25	07:30 16:17
20	07:28 16:47	06:51 17:31	06:01 18:08	06:05 19:47	05:23 20:22	05:10 20:46	05:28 20:37	06:03 19:56	06:40 18:59	07:18 18:04	07:00 16:24	07:30 16:17
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46	05:29 20:37	06:04 19:54	06:41 18:57	07:19 18:03	07:01 16:23	07:31 16:18
22	07:27 16:50	06:47 17:33	05:57 18:11	06:01 19:50	05:21 20:24	05:10 20:46	05:30 20:36	06:06 19:52	06:43 18:55	07:20 18:01	07:02 16:22	07:31 16:18
23	07:26 16:51	06:46 17:35	05:55 18:12	06:00 19:51	05:20 20:25	05:10 20:46	05:31 20:35	06:07 19:51	06:44 18:53	07:22 17:59	07:03 16:21	07:32 16:19
24	07:25 16:52	06:44 17:36	05:54 18:13	05:58 19:52	05:19 20:26	05:11 20:47	05:32 20:34	06:08 19:49	06:45 18:52	07:23 17:58	07:05 16:21	07:32 16:19
25	07:24 16:54	06:42 17:38	05:52 18:14	05:56 19:53	05:19 20:27	05:11 20:47	05:33 20:33	06:09 19:47	06:46 18:50	07:24 18:56	07:06 16:20	07:33 16:20
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	05:18 20:28	05:11 20:47	05:34 20:32	06:10 19:45	06:47 18:48	07:26 18:55	07:07 16:19	07:33 16:20
27	07:22 16:57	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	05:12 20:47	05:36 20:31	06:12 19:44	06:49 18:46	07:27 18:53	07:08 16:19	07:33 16:21
28	07:21 16:58	06:37 17:42	05:46 18:18	05:52 19:57	05:16 20:30	05:12 20:47	05:37 20:30	06:13 19:42	06:50 18:44	07:28 18:52	07:10 16:18	07:34 16:22
29	07:20 16:59	06:36 18:19	05:44 18:19	05:50 19:58	05:16 20:31	05:12 20:47	05:38 20:28	06:14 19:40	06:51 18:42	07:29 18:50	07:11 16:18	07:34 16:23
30	07:19 17:01	06:35 18:21	05:42 18:21	05:49 20:00	05:15 20:32	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	07:30 18:49	07:12 16:17	07:34 16:23
31	07:18 17:02	06:34 18:22	05:40 18:22	05:47 20:00	05:14 20:33	05:14 20:47	05:40 20:26	06:16 19:37	06:53 18:40	07:31 18:49	07:13 16:17	07:34 16:24
Potential sun hours	286	291	369	380	285	254	272	4	376	341	288	274
Total, worst case						164	18					
Sun reduction						0.55	0.58					
Oper. time red.						0.91	0.91					
Wind dir. red.						0.59	0.59					
Total reduction						0.29	0.31					
Total, real						48	6					

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:

060119 Marble River

Description:

Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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Calculated:

01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 247 - 247

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Table with columns for months (January-December) and rows for days of the month, showing sun rise and set times. Includes summary rows for Total worst case, Sun reduction, Oper. time red., Wind dir. red., Total reduction, and 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 (WTG causing flicker first time) Last time (hh:mm) with flicker (WTG causing flicker last time)

Project: 060119 Marble River

Description: Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 248 - 248

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Large table with columns for months (January to December) and rows for days (1 to 31), showing sun rise/set times and shadow reduction percentages.

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: 060119 Marble River

Description: Marble River Wind Project Shadow-Flicker, MidW part 27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 249 - 249

Assumptions for shadow calculations

Maximum distance for influence 1,000 m Minimum sun height over horizon for influence 3 ° Day step for calculation 1 days Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time N NE E SE S SW W NW Sum 1,850 1,325 800 713 625 663 700 1,275 7,950

Table with columns for months (January to December) and rows for each day (1 to 31) showing sun rise and set times and shadow reduction percentages.

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

Matrix with columns: 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: 060119 Marble River Description: Marble River Wind Project Shadow-Flicker, MidW part
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Licensed user: Wind Engineers, Inc. 7660 Whitegate Avenue US-RIVERSIDE, CA 92506
Calculation: 01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 250 - 250

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes
Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Table with columns for months (January to December) and rows for each day of the month. Each row contains two columns of times (e.g., 07:34, 16:25) representing sunrise and sunset, followed by a series of data points in parentheses representing shadow probabilities for different directions (N, NE, E, SE, S, SW, W, NW, Sum). Summary rows at the bottom show total sun hours and reduction factors.

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

Matrix with columns: 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:

060119 Marble River

Description:

Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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Calculated:

01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 251 - 251

Assumptions for shadow calculations

Maximum distance for influence

1,000 m

Minimum sun height over horizon for influence

3 °

Day step for calculation

1 days

Time step for calculation

2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Table with columns for months (January to December) and rows for each day of the month, showing sun rise and set times and shadow reduction factors.

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: **060119 Marble River**

Description: Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 325 - 325

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Table with columns for months (January to December) and rows for each day of the month, showing sun rise and set times, shadow times, and reduction factors. Includes a summary row at the bottom: Total, worst case | 1074 | 291 | 369 | 404 | 150 | 86 | -254 | -272 | 4 | 252 | 376 | 341 | 288 | 540 | 1542 | 0.35 | 0.91 | 0.62 | 0.26 | 274 | 46 | 30 | 78 | 107 | 306

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)

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/23/06 09:41 / 40
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US-RIVERSIDE, CA 92506

Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 326 - 326

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34 16:25	14:37 (12) 17:03	07:17 15:09 (12)	06:35 17:43	05:38 18:23	05:13 20:01
2	07:34 16:26	14:37 (12) 17:05	07:16 15:21 (12)	06:34 17:44	05:37 18:24	05:13 20:01
3	07:34 16:27	14:37 (12) 17:06	07:14 15:31 (12)	06:32 17:46	05:35 18:26	05:12 20:02
4	07:34 16:28	14:39 (12) 17:08	07:13 15:31 (12)	06:30 17:47	05:33 18:27	05:12 20:03
5	07:34 16:29	14:39 (12) 17:09	07:12 15:31 (12)	06:28 17:48	06:31 19:28	05:11 20:04
6	07:34 16:30	14:38 (12) 17:11	07:11 15:32 (12)	06:27 17:50	06:29 19:29	05:11 20:06
7	07:34 16:31	14:40 (12) 17:12	07:09 15:32 (12)	06:25 17:51	06:27 19:31	05:11 20:07
8	07:34 16:32	14:40 (12) 17:13	07:08 15:32 (12)	06:23 17:52	06:26 19:32	05:10 20:08
9	07:33 16:33	14:39 (12) 17:15	07:07 15:33 (12)	06:21 17:54	06:24 19:33	05:10 20:09
10	07:33 16:34	14:41 (12) 17:16	07:05 15:33 (12)	06:19 17:55	06:22 19:34	05:10 20:10
11	07:33 16:35	14:41 (12) 17:18	07:04 15:33 (12)	06:17 17:56	06:20 19:36	05:10 20:12
12	07:32 16:37	14:42 (12) 17:19	07:02 15:34 (12)	06:16 17:57	06:18 19:37	05:09 20:13
13	07:32 16:38	14:44 (12) 17:21	07:01 15:34 (12)	06:14 17:59	06:17 19:38	05:09 20:14
14	07:32 16:39	14:43 (12) 17:22	07:00 15:33 (12)	06:12 18:00	06:15 19:39	05:09 20:15
15	07:31 16:40	14:44 (12) 17:23	06:58 15:34 (12)	06:10 18:01	06:13 19:41	05:09 20:16
16	07:31 16:42	14:44 (12) 17:25	06:57 15:34 (12)	06:08 18:03	06:11 19:42	05:09 20:17
17	07:30 16:43	14:45 (12) 17:26	06:55 15:33 (12)	06:06 18:04	06:10 19:43	05:09 20:19
18	07:29 16:44	14:46 (12) 17:28	06:54 15:34 (12)	06:05 18:05	06:08 19:44	05:09 20:20
19	07:29 16:45	14:48 (12) 17:29	06:52 15:34 (12)	06:03 18:07	06:06 19:46	05:09 20:21
20	07:28 16:47	14:47 (12) 17:30	06:50 15:33 (12)	06:01 18:08	06:04 19:47	05:09 20:22
21	07:27 16:48	14:48 (12) 17:32	06:49 15:34 (12)	05:59 18:09	06:03 19:48	05:10 20:23
22	07:26 16:49	14:49 (12) 17:33	06:47 15:33 (12)	05:57 18:10	06:01 19:49	05:10 20:24
23	07:26 16:51	14:50 (12) 17:35	06:45 15:32 (12)	05:55 18:12	05:59 19:51	05:10 20:25
24	07:25 16:52	14:51 (12) 17:36	06:44 15:33 (12)	05:53 18:13	05:58 19:52	05:10 20:26
25	07:24 16:54	14:52 (12) 17:37	06:42 15:32 (12)	05:51 18:14	05:56 19:53	05:11 20:27
26	07:23 16:55	14:55 (12) 17:39	06:40 15:31 (12)	05:50 18:15	05:55 19:54	05:11 20:28
27	07:22 16:56	14:56 (12) 17:40	06:39 15:30 (12)	05:48 18:17	05:53 19:56	05:11 20:29
28	07:21 16:58	14:57 (12) 17:41	06:37 15:29 (12)	05:46 18:18	05:51 19:57	05:12 20:30
29	07:20 16:59	15:00 (12) 17:41	06:37 15:28 (12)	05:44 18:19	05:50 19:58	05:12 20:31
30	07:19 17:01	15:01 (12) 17:41	06:37 15:25 (12)	05:42 18:20	05:48 19:59	05:13 20:32
31	07:18 17:02	15:06 (12) 17:41	06:37 15:24 (12)	05:40 18:22	05:46 19:59	05:13 20:33
Potential sun hours	286	291	369	404	285	-254
Total, worst case	1404	12		84	172	
Sun reduction	0.45	0.45		0.55	0.55	
Oper. time red.	0.91	0.91		0.91	0.91	
Wind dir. red.	0.62	0.62		0.62	0.62	
Total reduction	0.25	0.25		0.31	0.31	
Total, real	358	3		26	53	

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/23/06 09:41 / 41
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 326 - 326

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December	
1	05:13 20:47	05:41 20:25		06:17 19:35	06:53 18:38	06:33 16:46	07:13 16:17
2	05:14 20:46	05:42 20:23	4 19:34 (8)	06:19 19:33	06:54 18:36	06:35 16:44	52 15:16 (12)
3	05:14 20:46	05:43 20:22	10 19:41 (8)	06:20 19:31	06:56 18:34	06:36 16:43	54 15:17 (12)
4	05:15 20:46	05:44 20:21	14 19:44 (8)	06:21 19:29	06:57 18:33	06:38 16:41	52 15:16 (12)
5	05:16 20:46	05:45 20:20	16 19:45 (8)	06:22 19:27	06:58 18:31	06:39 16:40	52 15:17 (12)
6	05:16 20:45	05:47 20:18	18 19:46 (8)	06:23 19:25	06:59 18:29	06:40 16:39	54 15:18 (12)
7	05:17 20:45	05:48 20:17	20 19:45 (8)	06:24 19:24	07:01 18:27	06:42 16:37	52 15:17 (12)
8	05:18 20:45	05:49 20:16	20 19:46 (8)	06:26 19:22	07:02 18:25	06:43 16:36	52 15:18 (12)
9	05:18 20:44	05:50 20:14	20 19:45 (8)	06:27 19:20	07:03 18:23	06:44 16:35	54 15:19 (12)
10	05:19 20:44	05:51 20:13	22 19:46 (8)	06:28 19:18	07:04 18:22	06:46 16:34	12 14:40 (12)
11	05:20 20:43	05:52 20:11	22 19:46 (8)	06:29 19:16	07:06 18:20	06:47 16:33	20 14:35 (12)
12	05:21 20:43	05:54 20:10	18 19:45 (8)	06:30 19:14	07:07 18:18	06:49 16:32	24 14:57 (12)
13	05:22 20:42	05:55 20:08	18 19:42 (8)	06:32 19:12	07:08 18:16	06:50 16:30	28 15:00 (12)
14	05:23 20:42	05:56 20:07	16 19:41 (8)	06:33 19:10	07:10 18:14	06:51 16:29	32 15:02 (12)
15	05:23 20:41	05:57 20:05	14 19:38 (8)	06:34 19:08	07:11 18:13	06:53 16:28	34 15:03 (12)
16	05:24 20:40	05:58 20:04	12 19:37 (8)	06:35 19:07	07:12 18:11	06:54 16:27	36 15:05 (12)
17	05:25 20:40	06:00 20:02	10 19:36 (8)	06:36 19:05	07:13 18:09	06:55 16:26	40 15:06 (12)
18	05:26 20:39	06:01 20:00	6 19:33 (8)	06:38 19:03	07:15 18:08	06:57 16:25	42 15:07 (12)
19	05:27 20:38	06:02 19:57	4 19:33 (8)	06:39 19:01	07:16 18:06	06:58 16:24	42 15:07 (12)
20	05:28 20:37	06:03 19:55		06:40 18:59	07:17 18:04	06:59 16:24	44 15:08 (12)
21	05:29 20:36	06:04 19:54		06:41 18:57	07:19 18:03	07:01 16:23	46 15:10 (12)
22	05:30 20:35	06:05 19:52		06:42 18:55	07:20 18:01	07:02 16:22	46 15:09 (12)
23	05:31 20:34	06:07 19:50		06:44 18:53	07:21 17:59	07:03 16:21	46 15:10 (12)
24	05:32 20:34	06:08 19:49		06:45 18:51	07:23 17:58	07:05 16:21	48 15:12 (12)
25	05:33 20:33	06:09 19:47		06:46 18:49	07:24 17:56	07:06 16:20	48 15:11 (12)
26	05:34 20:32	06:10 19:45		06:47 18:48	07:25 17:55	07:07 16:19	50 15:12 (12)
27	05:35 20:30	06:11 19:43		06:48 18:46	07:27 17:53	07:08 16:19	50 15:14 (12)
28	05:36 20:29	06:13 19:42		06:50 18:44	07:28 17:51	07:10 16:18	50 15:13 (12)
29	05:38 20:28	06:14 19:40		06:51 18:42	07:29 17:50	07:11 16:18	50 15:14 (12)
30	05:39 20:27	06:15 19:38		06:52 18:40	07:31 17:48	07:12 16:17	52 15:16 (12)
31	05:40 20:26	06:16 19:36		06:52 18:40	07:32 17:47	07:13 16:17	52 15:16 (12)
Potential sun hours	-272	4	376	341	288		274
Total, worst case		264			840		1632
Sun reduction		0.55			0.35		0.35
Oper. time red.		0.91			0.91		0.91
Wind dir. red.		0.62			0.62		0.62
Total reduction		0.31			0.20		0.20
Total, real		81			166		323

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: 060119 Marble River **Description:** Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page: 01/23/06 09:41 / 42
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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated: 01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area **Shadow receptor:** 327 - 327

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35
------	------	------	------	------	------	------	------	------	------	------	------

Operational time

N	NE	E	SE	S	SW	W	NW	Sum
1,850	1,325	800	713	625	663	700	1,275	7,950

	January	February	March	April	May	June	July	August	September	October	November	December		
1	07:34 16:25	07:17 17:03	06:35 17:43	05:38 18:23	05:47 20:01	18:36 (8) 20:34	05:13 20:47	05:13 20:25	05:41 20:25	06:17 19:35	18:29 (8) 19:07 (8)	06:53 18:38	06:34 16:46	07:13 16:17
2	07:34 16:26	07:16 17:05	06:34 17:44	05:37 18:24	05:45 20:01	18:39 (8) 20:35	05:13 20:46	05:14 20:24	05:42 20:24	06:19 19:33	18:30 (8) 19:04 (8)	06:54 18:36	06:35 16:44	07:14 16:16
3	07:34 16:27	07:14 17:06	06:32 17:46	05:35 18:26	05:44 20:02	18:41 (8) 20:36	05:12 20:46	05:14 20:22	05:43 20:22	06:20 19:31	18:32 (8) 19:04 (8)	06:56 18:34	06:36 16:43	07:15 16:16
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	17:47 (8) 17:55 (8)	05:43 20:03	05:12 20:37	05:44 20:21	06:21 19:29	18:33 (8) 19:03 (8)	06:57 18:33	06:38 16:41	07:16 16:16
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:04	18:41 (8) 18:59 (8)	05:41 20:04	05:11 20:37	05:45 20:20	06:22 19:27	18:34 (8) 19:00 (8)	06:58 18:31	06:39 16:40	07:18 16:15
6	07:34 16:30	07:11 17:11	06:27 17:50	06:29 19:29	05:40 20:06	18:39 (8) 19:01 (8)	05:40 20:06	05:11 20:38	05:47 20:18	06:23 19:25	18:35 (8) 18:59 (8)	06:59 18:29	06:40 16:39	07:19 16:15
7	07:34 16:31	07:09 17:12	06:25 17:51	06:27 19:31	05:38 20:07	18:37 (8) 19:03 (8)	05:38 20:07	05:11 20:39	05:48 20:17	06:24 19:24	18:36 (8) 18:54 (8)	07:01 18:27	06:42 16:38	07:20 16:15
8	07:34 16:32	07:08 17:13	06:23 17:52	06:26 19:32	05:37 20:08	18:36 (8) 19:06 (8)	05:37 20:08	05:10 20:40	05:49 20:16	06:26 19:22	18:41 (8) 18:51 (8)	07:02 18:25	06:43 16:36	07:21 16:15
9	07:33 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	18:34 (8) 19:06 (8)	05:36 20:09	05:10 20:40	05:50 20:14	06:27 19:20	07:03 18:23	06:44 16:35	07:22 16:15	
10	07:33 16:34	07:05 17:16	06:19 17:55	06:22 19:34	05:34 20:10	18:32 (8) 19:06 (8)	05:34 20:10	05:10 20:41	05:51 20:13	06:28 19:18	18:48 (8) 19:00 (8)	07:04 18:22	06:46 16:34	07:23 16:15
11	07:33 16:36	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	18:30 (8) 19:08 (8)	05:33 20:12	05:10 20:41	05:52 20:11	06:29 19:16	18:46 (8) 19:04 (8)	07:06 18:20	06:47 16:33	07:23 16:15
12	07:32 16:37	07:03 17:19	06:16 17:57	06:18 19:37	05:32 20:13	18:31 (8) 19:09 (8)	05:32 20:13	05:09 20:42	05:54 20:10	06:30 19:14	18:43 (8) 19:05 (8)	07:07 18:18	06:49 16:32	07:24 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	18:29 (8) 19:09 (8)	05:31 20:14	05:09 20:43	05:55 20:08	06:32 19:12	18:42 (8) 19:06 (8)	07:08 18:16	06:50 16:30	07:25 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:39	05:29 20:15	18:29 (8) 19:09 (8)	05:29 20:15	05:09 20:43	05:56 20:07	06:33 19:10	18:39 (8) 19:07 (8)	07:10 18:14	06:51 16:29	07:26 16:15
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:16	18:27 (8) 19:09 (8)	05:28 20:16	05:09 20:44	05:57 20:05	06:34 19:08	18:38 (8) 19:08 (8)	07:11 18:13	06:53 16:28	07:27 16:15
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	18:28 (8) 19:08 (8)	05:27 20:18	05:09 20:44	05:58 20:04	06:35 19:07	18:37 (8) 19:09 (8)	07:12 18:11	06:54 16:27	07:28 16:16
17	07:30 16:43	06:55 17:26	06:06 18:04	06:10 19:43	05:26 20:19	18:28 (8) 19:08 (8)	05:26 20:19	05:09 20:45	06:00 20:02	06:36 19:05	18:36 (8) 19:10 (8)	07:13 18:09	06:55 16:26	07:28 16:16
18	07:29 16:44	06:54 17:28	06:05 18:05	06:08 19:44	05:25 20:20	18:26 (8) 19:08 (8)	05:25 20:20	05:09 20:45	06:01 20:00	06:38 19:03	18:35 (8) 19:11 (8)	07:15 18:08	06:57 16:25	07:29 16:16
19	07:29 16:45	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	18:27 (8) 19:09 (8)	05:24 20:21	05:09 20:45	06:02 19:57	06:39 19:01	18:35 (8) 19:11 (8)	07:16 18:06	06:58 16:25	07:30 16:17
20	07:28 16:47	06:50 17:30	06:01 18:08	06:04 19:47	05:23 20:22	18:27 (8) 19:07 (8)	05:23 20:22	05:09 20:46	06:03 19:56	06:40 18:59	18:34 (8) 19:12 (8)	07:17 18:04	06:59 16:24	07:30 16:17
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	18:27 (8) 19:07 (8)	05:22 20:23	05:10 20:46	06:04 19:54	06:41 18:57	18:33 (8) 19:11 (8)	07:19 18:03	07:01 16:23	07:31 16:17
22	07:26 16:49	06:47 17:33	05:57 18:10	06:01 19:49	05:21 20:24	18:28 (8) 19:06 (8)	05:21 20:24	05:10 20:46	06:05 19:52	06:42 18:55	18:32 (8) 19:12 (8)	07:20 18:01	07:02 16:22	07:31 16:18
23	07:26 16:51	06:46 17:35	05:55 18:12	05:59 19:51	05:20 20:25	18:28 (8) 19:06 (8)	05:20 20:25	05:10 20:46	06:07 19:50	06:44 18:53	18:31 (8) 19:11 (8)	07:21 17:59	07:03 16:21	07:32 16:18
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:26	18:28 (8) 19:04 (8)	05:19 20:26	05:10 20:46	06:08 19:49	06:45 18:51	18:30 (8) 19:12 (8)	07:23 17:58	07:05 16:21	07:32 16:19
25	07:24 16:54	06:42 17:37	05:51 18:14	05:56 19:53	05:18 20:27	18:29 (8) 19:05 (8)	05:18 20:27	05:11 20:47	06:09 19:47	06:46 18:49	18:29 (8) 19:11 (8)	07:24 17:58	07:06 16:20	07:33 16:20
26	07:23 16:55	06:40 17:39	05:50 18:15	05:55 19:54	05:18 20:28	18:29 (8) 19:03 (8)	05:18 20:28	05:11 20:47	06:10 19:45	06:47 18:48	18:31 (8) 19:11 (8)	07:25 17:58	07:07 16:19	07:33 16:20
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	18:30 (8) 19:02 (8)	05:17 20:29	05:11 20:47	06:11 19:44	06:48 18:46	18:30 (8) 19:10 (8)	07:26 17:58	07:08 16:18	07:33 16:21
28	07:21 16:58	06:37 17:41	05:46 18:18	05:51 19:57	05:16 20:30	18:30 (8) 19:00 (8)	05:16 20:30	05:12 20:47	06:13 19:42	06:50 18:44	18:29 (8) 19:11 (8)	07:27 17:58	07:10 16:18	07:34 16:22
29	07:20 16:59		05:44 18:19	05:50 19:58	05:15 20:31	18:33 (8) 18:59 (8)	05:15 20:31	05:12 20:47	06:14 19:40	06:51 18:42	18:30 (8) 19:10 (8)	07:28 17:58	07:11 16:18	07:34 16:22
30	07:19 17:01		05:42 18:21	05:48 19:59	05:14 20:32	18:33 (8) 18:57 (8)	05:14 20:32	05:13 20:47	06:15 19:38	06:52 18:40	18:29 (8) 19:09 (8)	07:29 17:58	07:12 16:17	07:34 16:23
31	07:18 17:02		05:40 18:22		05:14 20:33		05:14 20:33		06:16 19:36	06:52 18:38	18:30 (8) 19:08 (8)	07:30 17:58		07:34 16:24
Potential sun hours	286	291	369	404	285	-254	-272	4	376	341	288	274		
Total, worst case				906	42				752	212				
Sun reduction				0.55	0.55				0.55	0.55				
Oper. time red.				0.91	0.91				0.91	0.91				
Wind dir. red.				0.62	0.62				0.62	0.62				
Total reduction				0.31	0.31				0.31	0.31				
Total, real				283	13				235	66				

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/23/06 09:41 / 43
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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 09:10/2.4.0.67

SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 332 - 332

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	
1	07:34	07:59 (16) 07:17	06:35	05:39	05:47	05:14	20:05 (11)
	16:25	12 08:11 (16) 17:04	17:43	18:23	20:00	20:34	4 20:09 (11)
2	07:34	07:59 (16) 07:16	06:34	05:37	05:46	05:13	20:05 (11)
	16:26	12 08:11 (16) 17:05	17:44	18:24	20:01	20:35	4 20:09 (11)
3	07:34	07:59 (16) 07:14	06:32	05:35	05:44	05:13	20:02 (11)
	16:27	14 08:13 (16) 17:06	17:46	18:26	20:02	20:36	6 20:08 (11)
4	07:34	07:59 (16) 07:13	06:30	05:33	05:43	05:12	20:02 (11)
	16:28	14 08:13 (16) 17:08	17:47	18:27	20:03	20:37	8 20:10 (11)
5	07:34	07:59 (16) 07:12	07:38 (13) 06:28	06:31	05:41	05:12	20:01 (11)
	16:29	16 08:15 (16) 17:09	10 07:48 (13) 17:48	19:28	20:04	20:37	8 20:09 (11)
6	07:34	07:59 (16) 07:11	07:36 (13) 06:27	06:29	05:40	05:11	20:01 (11)
	16:30	16 08:15 (16) 17:11	16 07:52 (13) 17:50	19:29	20:06	20:38	10 20:11 (11)
7	07:34	07:58 (16) 07:09	07:33 (13) 06:25	06:27	05:38	05:11	20:01 (11)
	16:31	18 08:16 (16) 17:12	20 07:53 (13) 17:51	19:31	20:07	20:39	10 20:11 (11)
8	07:34	07:58 (16) 07:08	07:32 (13) 06:23	06:26	05:37	05:11	20:00 (11)
	16:32	18 08:16 (16) 17:14	24 07:56 (13) 17:52	19:32	20:08	20:40	12 20:12 (11)
9	07:34	07:58 (16) 07:07	07:32 (13) 06:21	06:24	05:36	05:10	20:00 (11)
	16:33	20 08:18 (16) 17:15	24 07:56 (13) 17:54	19:33	20:09	20:40	12 20:12 (11)
10	07:33	07:57 (16) 07:05	07:31 (13) 06:19	06:22	05:34	05:10	20:00 (11)
	16:34	20 08:17 (16) 17:16	26 07:57 (13) 17:55	19:34	20:11	20:41	14 20:14 (11)
11	07:33	07:57 (16) 07:04	07:29 (13) 06:18	06:20	05:33	05:10	20:00 (11)
	16:36	20 08:17 (16) 17:18	30 07:59 (13) 17:56	19:36	20:12	20:42	14 20:14 (11)
12	07:33	07:56 (16) 07:03	07:30 (13) 06:16	06:18	05:32	05:10	20:00 (11)
	16:37	22 08:18 (16) 17:19	30 08:00 (13) 17:58	19:37	20:13	20:42	14 20:14 (11)
13	07:32	07:56 (16) 07:01	07:28 (13) 06:14	06:17	05:31	05:09	20:00 (11)
	16:38	22 08:18 (16) 17:21	32 08:00 (13) 17:59	19:38	20:14	20:43	16 20:16 (11)
14	07:32	07:55 (16) 07:00	07:29 (13) 06:12	06:15	05:30	05:09	20:00 (11)
	16:39	24 08:19 (16) 17:22	32 08:01 (13) 18:00	19:40	20:15	20:43	16 20:16 (11)
15	07:31	07:57 (16) 06:58	07:27 (13) 06:10	06:13	05:28	05:09	20:00 (11)
	16:40	22 08:19 (16) 17:24	32 07:59 (13) 18:01	19:41	20:16	20:44	16 20:16 (11)
16	07:31	07:56 (16) 06:57	07:28 (13) 06:08	06:11	05:27	05:09	20:00 (11)
	16:42	24 08:20 (16) 17:25	32 08:00 (13) 18:03	19:42	20:18	20:44	16 20:16 (11)
17	07:30	07:57 (16) 06:55	07:28 (13) 06:07	06:10	05:26	05:09	20:00 (11)
	16:43	22 08:19 (16) 17:26	32 08:00 (13) 18:04	19:43	20:19	20:45	18 20:18 (11)
18	07:29	07:59 (16) 06:54	07:29 (13) 06:05	06:08	05:25	05:09	20:00 (11)
	16:44	22 08:21 (16) 17:28	32 08:01 (13) 18:05	19:45	20:20	20:45	18 20:18 (11)
19	07:29	07:58 (16) 06:52	07:27 (13) 06:03	06:06	05:24	05:09	20:00 (11)
	16:46	22 08:20 (16) 17:29	32 07:59 (13) 18:07	19:46	20:21	20:45	18 20:18 (11)
20	07:28	07:59 (16) 06:50	07:27 (13) 06:01	06:05	05:23	05:10	20:00 (11)
	16:47	20 08:19 (16) 17:31	32 07:59 (13) 18:08	19:47	20:22	20:46	18 20:18 (11)
21	07:27	08:00 (16) 06:49	07:28 (13) 05:59	06:03	05:22	05:10	20:00 (11)
	16:48	20 08:20 (16) 17:32	30 07:58 (13) 18:09	19:48	20:23	20:46	18 20:18 (11)
22	07:27	08:01 (16) 06:47	07:30 (13) 05:57	06:01	05:21	05:10	20:01 (11)
	16:50	18 08:19 (16) 17:33	28 07:58 (13) 18:10	19:50	20:24	20:46	18 20:19 (11)
23	07:26	08:02 (16) 06:46	07:30 (13) 05:55	06:00	05:20	05:10	20:01 (11)
	16:51	16 08:18 (16) 17:35	26 07:56 (13) 18:12	19:51	20:25	20:46	18 20:19 (11)
24	07:25	08:03 (16) 06:44	07:31 (13) 05:53	05:58	05:19	05:10	20:01 (11)
	16:52	14 08:17 (16) 17:36	24 07:55 (13) 18:13	19:52	20:26	20:47	18 20:19 (11)
25	07:24	08:05 (16) 06:42	07:33 (13) 05:52	05:56	05:19	05:11	20:01 (11)
	16:54	12 08:17 (16) 17:37	20 07:53 (13) 18:14	19:53	20:27	20:47	18 20:19 (11)
26	07:23	08:08 (16) 06:41	07:35 (13) 05:50	05:55	05:18	05:11	20:02 (11)
	16:55	6 08:14 (16) 17:39	16 07:51 (13) 18:16	19:55	20:28	20:47	16 20:18 (11)
27	07:22	06:39	07:38 (13) 05:48	05:53	05:17	05:12	20:02 (11)
	16:56	17:40	10 07:48 (13) 18:17	19:56	20:29	20:47	16 20:18 (11)
28	07:21	06:37	05:46	05:52	05:16	05:12	20:03 (11)
	16:58	17:42	18:18	19:57	20:30	20:47	16 20:19 (11)
29	07:20		05:44	05:50	05:15	05:12	20:03 (11)
	16:59		18:19	19:58	20:31	20:47	16 20:19 (11)
30	07:19		05:42	05:49	05:15	05:13	20:04 (11)
	17:01		18:21	20:00	20:32	20:47	16 20:20 (11)
31	07:18		05:40		05:14		
	17:02		18:22		20:33		
Potential sun hours	286	291	369	380	-285	-254	
Total, worst case	466	590				422	
Sun reduction	0.45	0.45				0.55	
Oper. time red.	0.91	0.91				0.91	
Wind dir. red.	0.67	0.62				0.64	
Total reduction	0.27	0.25				0.32	
Total, real	127	149				136	

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060121 MidWest area Shadow receptor: 332 - 332

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13	20:04 (11)	05:41	06:17	06:53	06:34
	20:47	14 20:18 (11)	20:25	19:35	18:38	16:46
2	05:14	20:05 (11)	05:42	06:19	06:55	06:35
	20:46	14 20:19 (11)	20:24	19:33	18:36	16:44
3	05:14	20:05 (11)	05:43	06:20	06:56	06:36
	20:46	14 20:19 (11)	20:22	19:31	18:35	16:43
4	05:15	20:06 (11)	05:44	06:21	06:57	06:38
	20:46	12 20:18 (11)	20:21	19:29	18:33	16:42
5	05:16	20:06 (11)	05:46	06:22	06:58	06:39
	20:46	12 20:18 (11)	20:20	19:27	18:31	16:40
6	05:16	20:07 (11)	05:47	06:23	07:00	06:40
	20:46	10 20:17 (11)	20:18	19:25	18:29	16:39
7	05:17	20:08 (11)	05:48	06:25	07:01	06:42
	20:45	10 20:18 (11)	20:17	19:24	18:27	16:38
8	05:18	20:08 (11)	05:49	06:26	07:02	06:43
	20:45	8 20:16 (11)	20:16	19:22	18:25	16:36
9	05:19	20:09 (11)	05:50	06:27	07:03	06:45
	20:44	8 20:17 (11)	20:14	19:20	18:24	16:35
10	05:19	20:10 (11)	05:51	06:28	07:05	06:46
	20:44	6 20:16 (11)	20:13	19:18	18:22	16:34
11	05:20	20:13 (11)	05:53	06:29	07:06	06:47
	20:43	4 20:17 (11)	20:11	19:16	18:20	16:33
12	05:21	20:14 (11)	05:54	06:31	07:07	06:49
	20:43	20:10	19:14	18:18	16:32	16:15
13	05:22	20:15 (11)	05:55	06:32	07:08	06:50
	20:42	20:08	19:12	18:16	16:31	16:15
14	05:23	20:16 (11)	05:56	06:33	07:10	06:51
	20:42	20:07	19:10	18:15	16:29	16:15
15	05:24	20:17 (11)	05:57	06:34	07:11	06:53
	20:41	20:05	19:09	18:13	16:28	16:15
16	05:24	20:18 (11)	05:58	06:35	07:12	06:54
	20:40	20:04	19:07	18:11	16:27	16:16
17	05:25	20:19 (11)	05:59	06:36	07:13	06:55
	20:40	20:02	19:05	18:09	16:26	16:16
18	05:26	20:20 (11)	06:01	06:38	07:15	06:57
	20:39	20:01	19:03	18:08	16:26	16:16
19	05:27	20:21 (11)	06:02	06:39	07:16	06:58
	20:38	19:57	19:01	18:06	16:25	16:17
20	05:28	20:22 (11)	06:03	06:40	07:17	06:59
	20:37	19:56	18:59	18:04	16:24	16:17
21	05:29	20:23 (11)	06:04	06:41	07:19	07:01
	20:36	19:54	18:57	18:03	16:23	16:17
22	05:30	20:24 (11)	06:06	06:42	07:20	07:02
	20:36	19:52	18:55	18:01	16:22	16:18
23	05:31	20:25 (11)	06:07	06:44	07:21	07:03
	20:35	19:51	18:53	17:59	16:21	16:18
24	05:32	20:26 (11)	06:08	06:45	07:23	07:05
	20:34	19:49	18:51	17:58	16:21	16:19
25	05:33	20:27 (11)	06:09	06:46	07:24	07:06
	20:33	19:47	18:50	18:56	16:20	16:20
26	05:34	20:28 (11)	06:10	06:47	07:25	07:07
	20:32	19:45	18:48	18:55	16:19	16:20
27	05:35	20:29 (11)	06:12	06:48	07:26	07:08
	20:31	19:44	18:46	18:53	16:19	16:21
28	05:37	20:30 (11)	06:13	06:50	07:27	07:10
	20:29	19:42	18:44	18:52	16:18	16:22
29	05:38	20:31 (11)	06:14	06:51	07:28	07:11
	20:28	19:40	18:42	18:50	16:18	16:22
30	05:39	20:32 (11)	06:15	06:52	07:29	07:12
	20:27	19:38	18:40	18:49	16:17	16:23
31	05:40	20:33 (11)	06:16	06:53	07:30	07:13
	20:26	19:36	18:38	18:47	16:17	16:24
Potential sun hours	-272	4	376	341	288	274
Total, worst case	112			478	400	364
Sun reduction	0.58			0.45	0.35	0.35
Oper. time red.	0.91			0.91	0.91	0.91
Wind dir. red.	0.64			0.62	0.65	0.67
Total reduction	0.34			0.25	0.21	0.21
Total, real	38			120	83	77

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

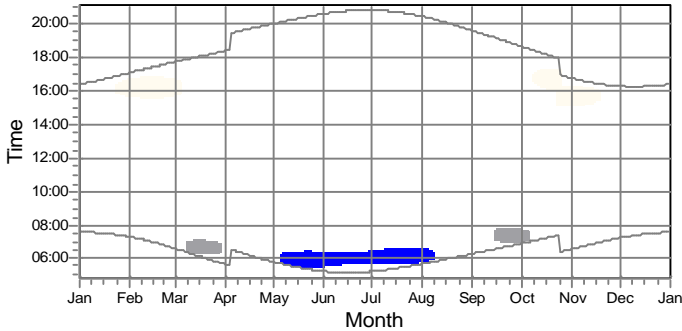
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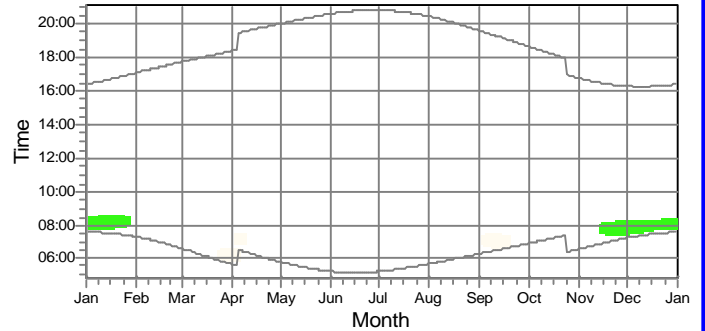
SHADOW - Calendar, graphical

Calculation: 060121 MidWest area

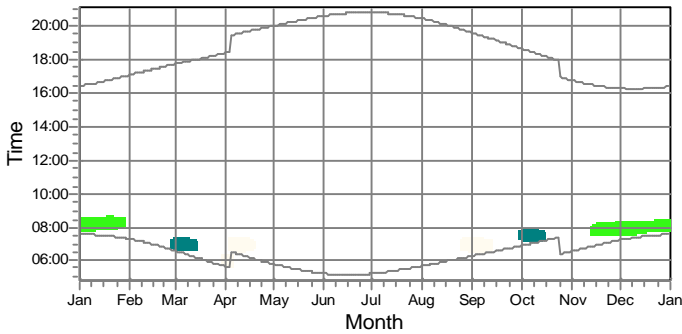
138: 138



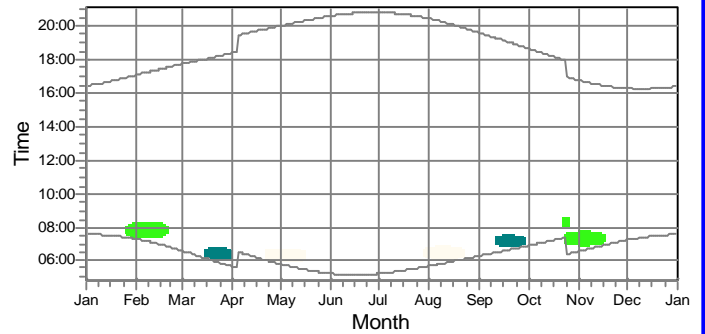
142: 142



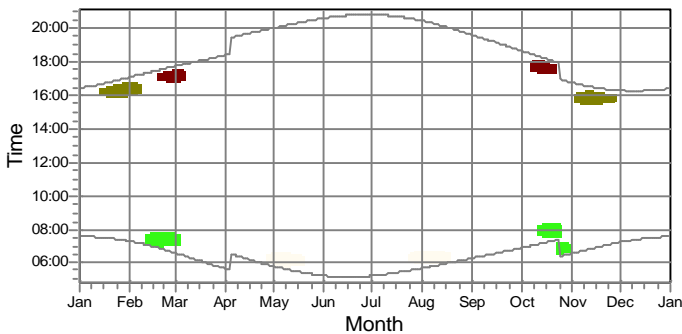
143: 143



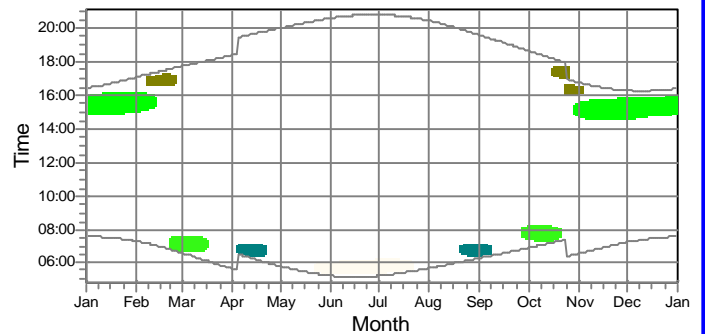
144: 144



145: 145



146: 146



WTGs

 051	 057	 059	 075A-W
 055	 058	 074	 206

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, MidW part
 27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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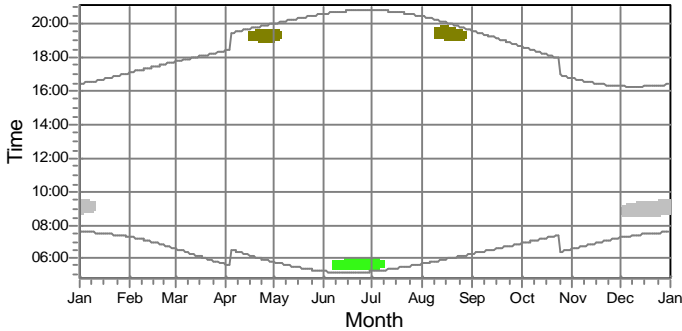
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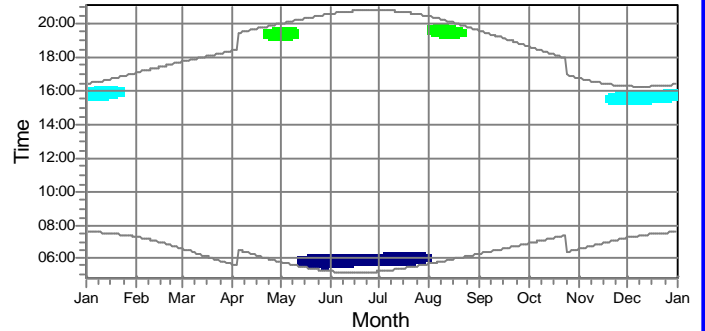
SHADOW - Calendar, graphical

Calculation: 060121 MidWest area

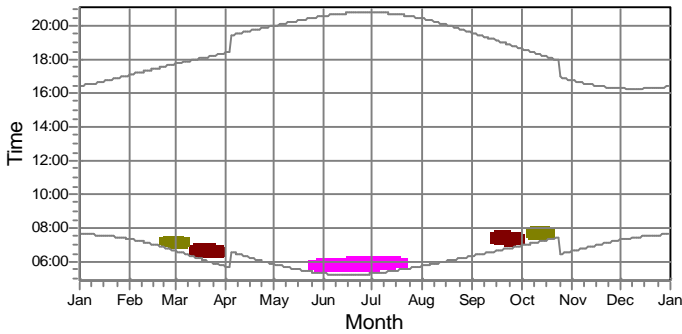
147: 147



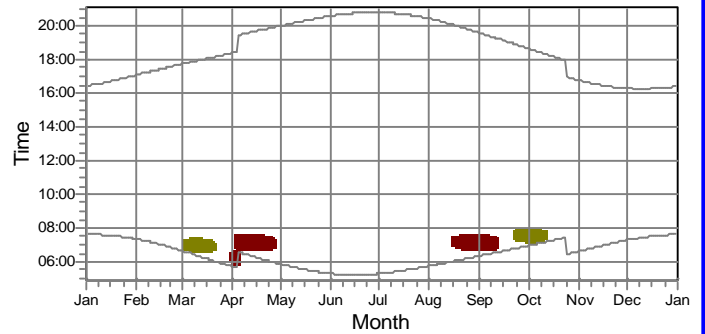
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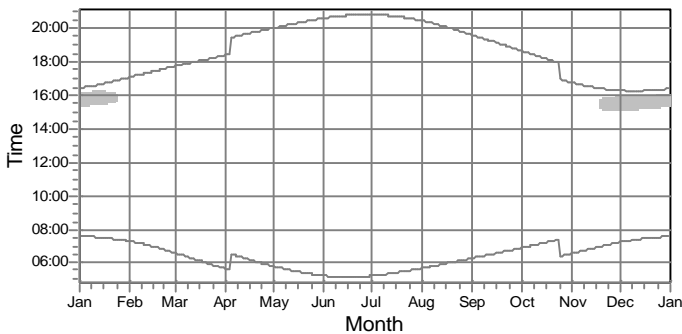
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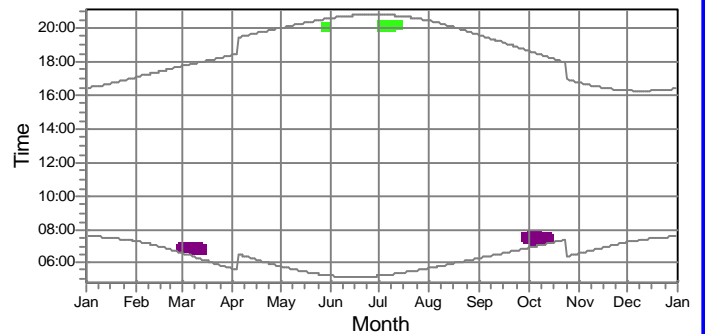
153: 153



158: 158



159: 159



WTGs

 053	 057	 059	 062	 206
 056	 058	 060	 063	

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
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Window properties: 1m2 horizontal, 1m above ground
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Directional run-hours applied (91% of time)

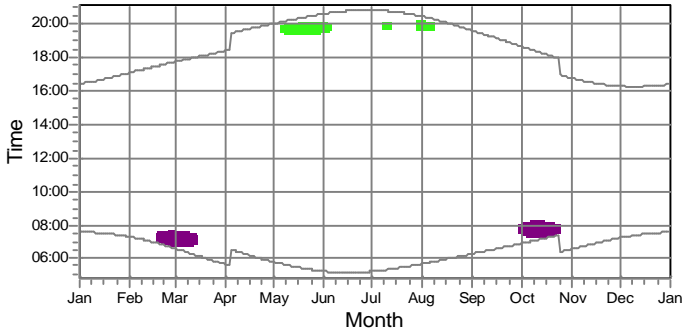
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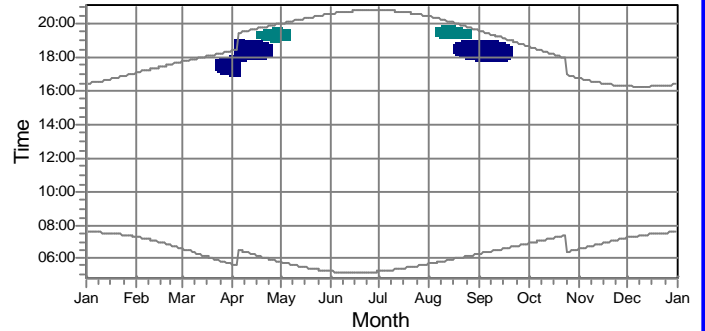
SHADOW - Calendar, graphical

Calculation: 060121 MidWest area

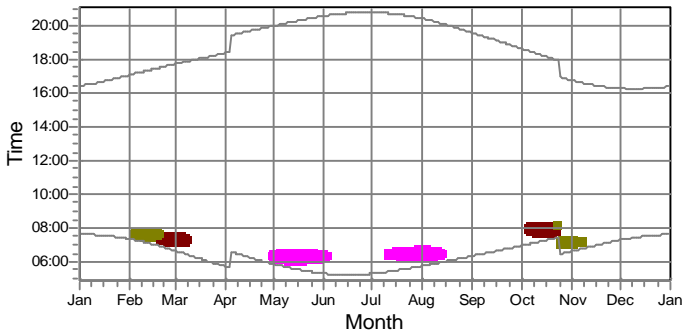
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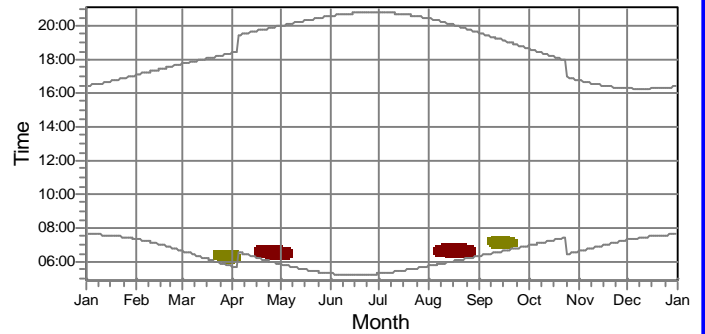
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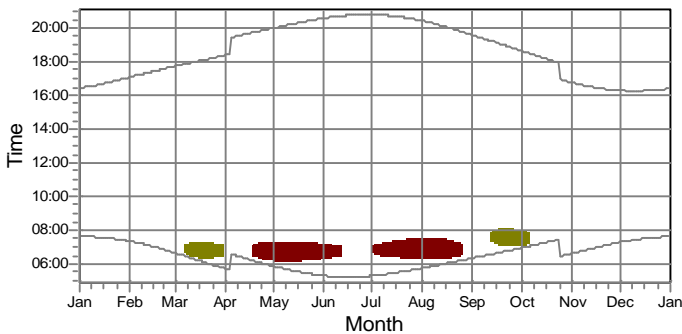
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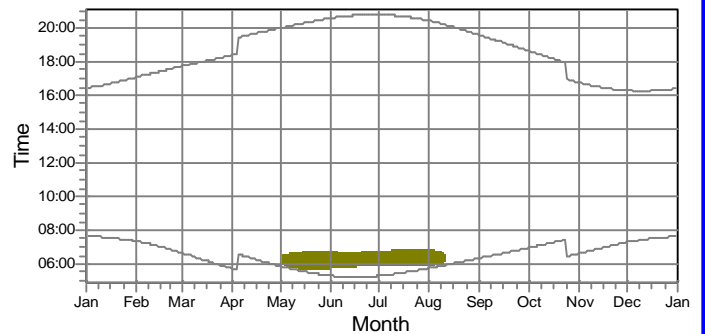
240: 240




241: 241



242: 242



WTGs

- | | | | |
|---|---|---|---|
|  053 |  056 |  059 |  206 |
|  055 |  057 |  060 | |

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

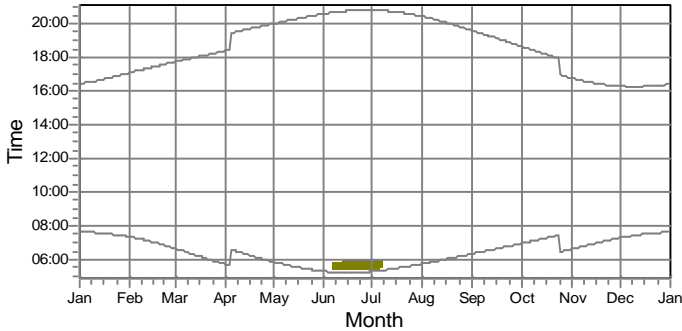
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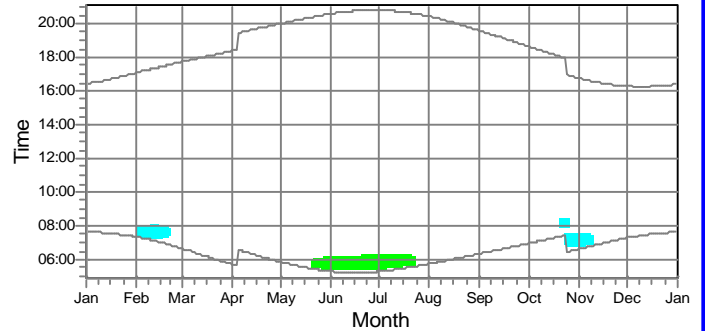
SHADOW - Calendar, graphical

Calculation: 060121 MidWest area

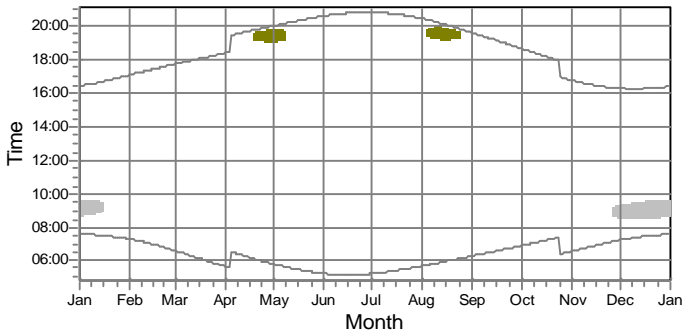
243: 243



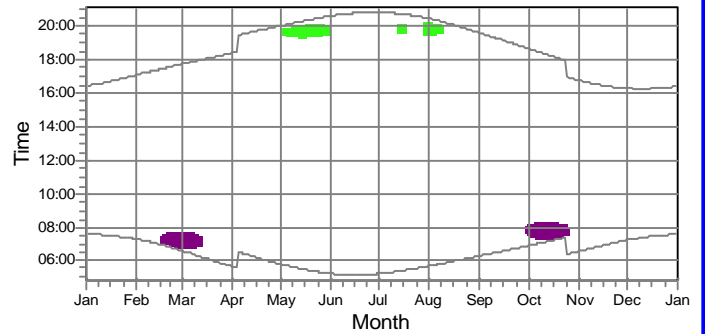
247: 247



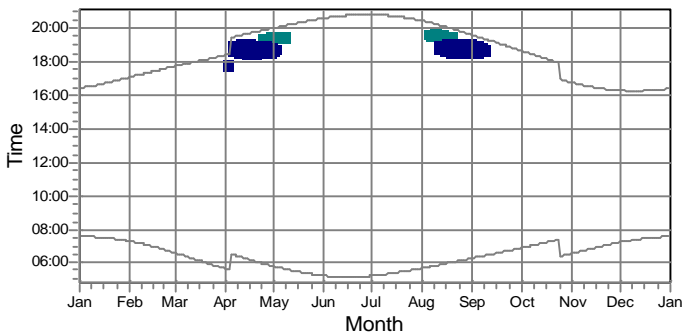
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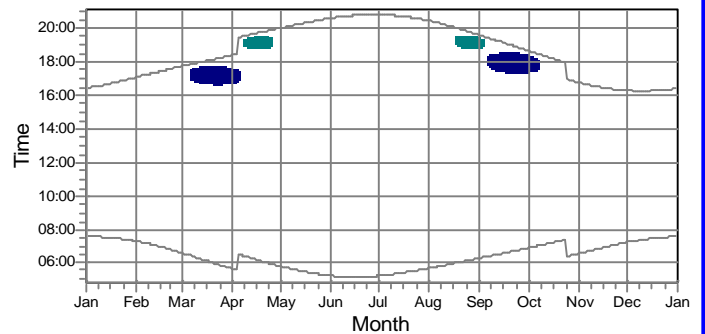
249: 249




250: 250



251: 251



WTGs

	055		058		060		063
	056		059		062		206

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

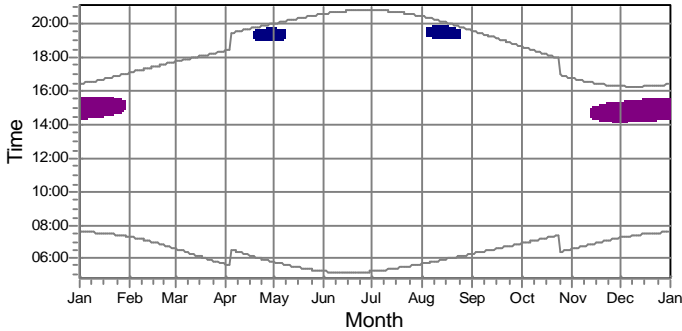
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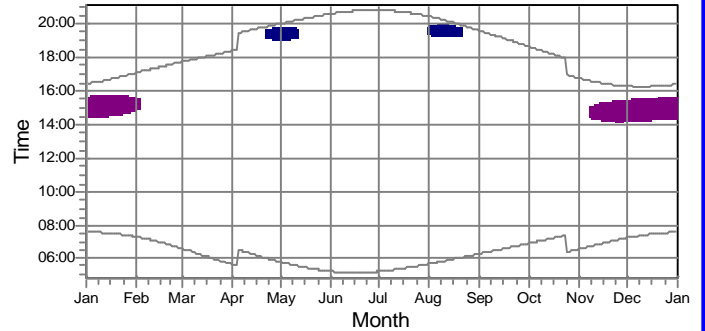
SHADOW - Calendar, graphical

Calculation: 060121 MidWest area

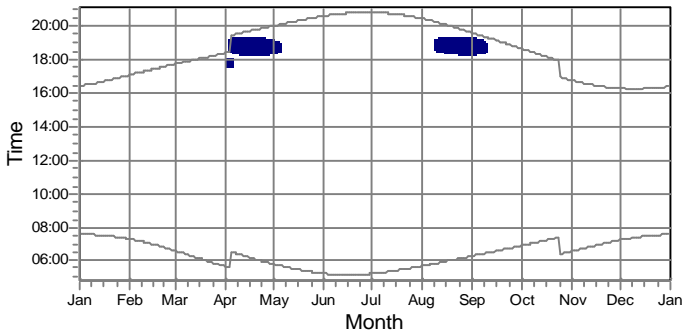
325: 325



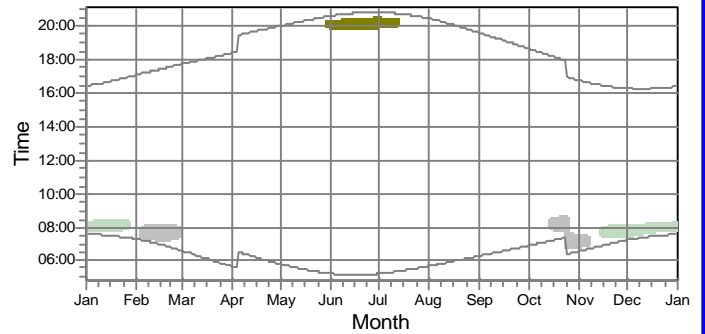
326: 326



327: 327



332: 332



WTGs



Project:
060119 Marble River

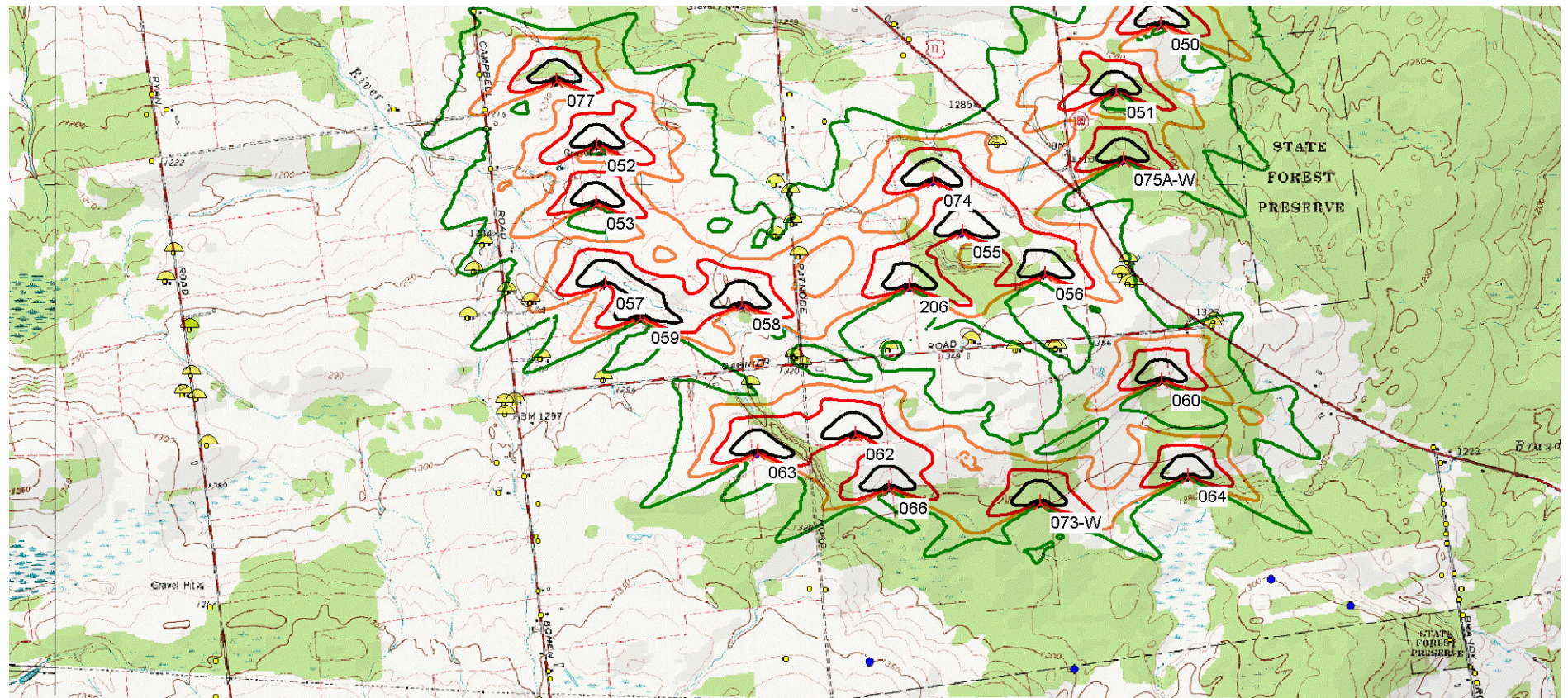
Description:
Marble River Wind Project
Shadow-Flicker, MidW part
27 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Bitmap map: 060106 Marble River USGS 50kz13.bmi

Calculation: 060121 MidWest area File: 060106 Marble River USGS 50kz13.bmi



Map: 060106 Marble River USGS 50kz13, Print scale 1:35,000, Map center UTM NAD27 Zone: 18 East: 583,000 North: 4,973,000

▲ New WTG ● Shadow receptor

— 10 — 25 — 50 — 100

Isolines showing shadow in Shadow hours/per year. Real value calculation.

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Main Result

Calculation: 060119 Northern area

Assumptions for shadow calculations

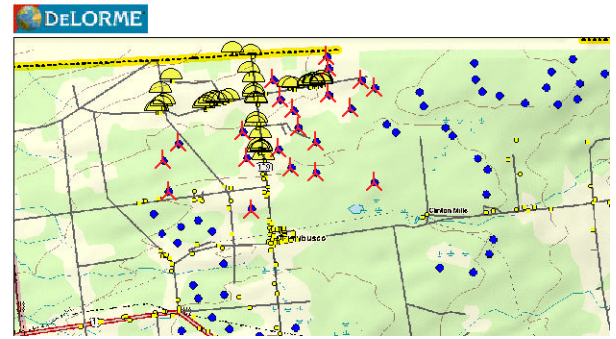
Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35

Operational time

N	NE	E	SE	S	SW	W	NW	Sum
1,850	1,325	800	713	625	663	700	1,275	7,950



▲ New WTG

● Shadow receptor

WTGs

UTM NAD27 Zone: 18			Row data/Description	WTG type		Power [kW]	Diam. [m]	Height [m]	RPM [RPM]
East	North	Z		Valid	Manufact. Type				
1	585,602	4,983,100	310 001-A	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
2	585,651	4,982,803	314 002-A	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
3	584,192	4,982,477	288 003	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
4	586,531	4,982,484	324 004-A	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
5	585,668	4,982,101	308 005-A	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
6	584,381	4,981,964	297 006	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
7	584,870	4,981,221	317 009A	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
8	585,348	4,980,842	328 010A	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
9	583,400	4,981,092	309 011	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
10	581,703	4,980,749	305 013	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
11	583,517	4,980,388	327 015	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
12	581,310	4,980,287	313 019	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
13	584,694	4,980,148	335 021	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
14	583,653	4,979,018	351 028	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
15	586,901	4,979,788	351 136	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
16	584,358	4,980,639	326 148	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
17	585,354	4,980,026	337 153	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
18	581,455	4,979,460	334 172	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
19	586,878	4,982,289	328 173	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
20	586,264	4,981,741	325 174	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
21	584,737	4,981,678	309 175	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7

Shadow receptor-Input

UTM NAD27 Zone: 18			Z	Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	
No.	Name	East							North
001	001	585,296	4,982,380	305	1.0	1.0	1.0	0.0	0.0
002	002	585,313	4,982,326	305	1.0	1.0	1.0	0.0	0.0
003	003	585,497	4,982,365	309	1.0	1.0	1.0	0.0	0.0
004	004	585,509	4,982,432	310	1.0	1.0	1.0	0.0	0.0
026	026	581,516	4,982,418	266	1.0	1.0	1.0	0.0	0.0
027	027	582,391	4,981,689	291	1.0	1.0	1.0	0.0	0.0
028	028	582,536	4,981,812	287	1.0	1.0	1.0	0.0	0.0
029	029	582,740	4,981,842	290	1.0	1.0	1.0	0.0	0.0
030	030	583,123	4,983,164	256	1.0	1.0	1.0	0.0	0.0

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Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Main Result

Calculation: 060119 Northern area

...continued from previous page

UTM NAD27 Zone: 18

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window
		[m]	[m]	[m]	[m]	[m]	[m]	[°]	[°]
031	031	583,622	4,983,086	270	1.0	1.0	1.0	0.0	0.0
032	032	585,474	4,982,368	309	1.0	1.0	1.0	0.0	0.0
033	033	585,276	4,982,381	305	1.0	1.0	1.0	0.0	0.0
034	034	585,487	4,982,431	309	1.0	1.0	1.0	0.0	0.0
035	035	584,613	4,982,261	297	1.0	1.0	1.0	0.0	0.0
037	037	583,692	4,982,077	295	1.0	1.0	1.0	0.0	0.0
038	038	583,706	4,981,992	297	1.0	1.0	1.0	0.0	0.0
039	039	583,764	4,981,852	297	1.0	1.0	1.0	0.0	0.0
040	040	583,773	4,981,832	297	1.0	1.0	1.0	0.0	0.0
041	041	583,696	4,982,393	290	1.0	1.0	1.0	0.0	0.0
042	042	583,043	4,981,911	290	1.0	1.0	1.0	0.0	0.0
043	043	582,888	4,981,865	290	1.0	1.0	1.0	0.0	0.0
044	044	581,103	4,981,575	291	1.0	1.0	1.0	0.0	0.0
045	045	581,162	4,981,578	290	1.0	1.0	1.0	0.0	0.0
046	046	581,252	4,981,703	290	1.0	1.0	1.0	0.0	0.0
047	047	583,761	4,981,219	308	1.0	1.0	1.0	0.0	0.0
048	048	583,791	4,981,314	305	1.0	1.0	1.0	0.0	0.0
049	049	583,857	4,980,636	325	1.0	1.0	1.0	0.0	0.0
263	263	581,240	4,982,066	282	1.0	1.0	1.0	0.0	0.0
354	354	583,966	4,980,332	329	1.0	1.0	1.0	0.0	0.0
355	355	583,833	4,980,546	327	1.0	1.0	1.0	0.0	0.0
356	356	583,931	4,980,554	328	1.0	1.0	1.0	0.0	0.0
357	357	583,929	4,980,574	327	1.0	1.0	1.0	0.0	0.0
358	358	583,889	4,980,918	317	1.0	1.0	1.0	0.0	0.0
359	359	584,735	4,982,238	297	1.0	1.0	1.0	0.0	0.0
360	360	585,149	4,982,307	301	1.0	1.0	1.0	0.0	0.0
361	361	585,162	4,982,322	302	1.0	1.0	1.0	0.0	0.0
362	362	583,578	4,982,649	276	1.0	1.0	1.0	0.0	0.0
363	363	582,662	4,981,860	289	1.0	1.0	1.0	0.0	0.0
364	364	582,438	4,981,725	290	1.0	1.0	1.0	0.0	0.0
365	365	581,334	4,981,767	290	1.0	1.0	1.0	0.0	0.0

Calculation Results

No.	Name	Shadow, worst case		Max shadow hours per day [h/day]	Shadow, expected values	
		Shadow hours per year [h/year]	Shadow days per year [days/year]		Shadow hours per year [h/year]	Shadow hours per year [h/year]
001	001	56:02	100	0:46	13:41	
002	002	56:40	80	1:00	14:00	
003	003	102:14	84	1:34	24:28	
004	004	13:32	32	0:32	3:00	
026	026	0:00	0	0:00	0:00	
027	027	0:00	0	0:00	0:00	
028	028	0:00	0	0:00	0:00	
029	029	0:00	0	0:00	0:00	
030	030	0:00	0	0:00	0:00	
031	031	4:10	22	0:14	0:54	
032	032	83:34	88	1:08	20:14	
033	033	54:30	90	0:52	13:10	
034	034	23:14	42	0:42	5:20	
035	035	110:30	149	1:00	28:08	
037	037	14:32	38	0:30	4:09	
038	038	15:32	40	0:32	4:39	
039	039	28:06	74	0:34	8:13	
040	040	30:08	79	0:34	8:47	
041	041	51:02	113	0:42	14:14	
042	042	0:00	0	0:00	0:00	
043	043	0:00	0	0:00	0:00	

Continued on next page...

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, N part
 17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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Calculated:

01/20/06 13:20/2.4.0.67

SHADOW - Main Result

Calculation: 060119 Northern area

...continued from previous page

No.	Name	Shadow, worst case		Shadow, expected values	
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
044	044	0:00	0	0:00	0:00
045	045	0:00	0	0:00	0:00
046	046	0:00	0	0:00	0:00
047	047	63:00	113	0:54	15:26
048	048	40:24	67	0:48	9:12
049	049	95:56	142	1:12	24:00
263	263	0:00	0	0:00	0:00
354	354	54:38	105	0:46	16:26
355	355	98:24	144	1:10	24:58
356	356	98:36	176	0:50	26:01
357	357	95:28	167	0:48	25:07
358	358	90:26	167	0:42	26:09
359	359	111:22	212	0:48	29:15
360	360	40:10	88	0:58	10:07
361	361	40:42	84	1:00	10:11
362	362	17:44	42	0:34	4:43
363	363	0:00	0	0:00	0:00
364	364	0:00	0	0:00	0:00
365	365	0:00	0	0:00	0:00

Project: 060119 Marble River

Description: Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 002 - 002

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Table with 13 columns for months (January to December) and multiple rows for time intervals (e.g., 07:35, 16:25). Includes summary rows for 'Potential sun hours', 'Total, worst case', and 'Total, real'.

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

Matrix with 5 columns: Day in month, Sun rise (hh:mm), Sun set (hh:mm), First time (hh:mm) with flicker, Last time (hh:mm) with flicker, and two columns for (WTG causing flicker first/last time).

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, N part
 17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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Calculated:

01/20/06 13:20/2.4.0.67

SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 003 - 003

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
 N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:35 16:25	08:03 (20) 10:13 (5) 17:03	09:39 (5) 17:43	06:35 18:23	05:38 20:00	05:47 20:34	05:13 20:47	05:13 20:25	05:41 19:35	06:17 18:38	06:53 16:45	06:34 16:16	07:13 84 09:57 (5)
2	07:35 16:26	08:03 (20) 10:13 (5) 17:05	09:53 (5) 17:44	06:34 18:24	05:36 20:01	05:45 20:35	05:13 20:47	05:42 20:24	06:18 19:33	06:54 18:36	06:35 16:44	07:14 16:16	88 09:58 (5)
3	07:35 16:27	08:03 (20) 10:13 (5) 17:05	09:53 (5) 17:44	06:32 18:26	05:35 20:02	05:44 20:36	05:12 20:46	05:14 20:22	06:20 19:31	06:56 18:34	06:36 16:43	07:16 16:16	88 09:59 (5)
4	07:35 16:28	08:05 (20) 10:15 (5) 17:07	09:53 (5) 17:47	06:30 18:27	05:33 20:03	05:42 20:37	05:12 20:46	05:15 20:21	06:21 19:29	06:57 18:32	06:38 16:41	07:17 16:15	90 10:01 (5)
5	07:34 16:29	08:05 (20) 10:15 (5) 17:09	09:53 (5) 17:48	06:28 18:28	06:31 20:05	05:41 20:38	05:11 20:46	05:15 20:20	06:22 19:27	06:58 18:31	06:39 16:40	07:18 16:15	88 10:00 (5)
6	07:34 16:30	08:05 (20) 10:15 (5) 17:11	09:53 (5) 17:49	06:27 18:29	06:29 20:06	05:39 20:38	05:11 20:46	05:16 20:18	06:23 19:25	06:59 18:29	06:41 16:39	07:19 16:15	92 10:01 (5)
7	07:34 16:31	08:06 (20) 10:16 (5) 17:10	09:53 (5) 17:51	06:25 18:31	06:27 20:07	05:38 20:39	05:10 20:45	05:17 20:17	06:24 19:24	07:01 18:27	06:42 16:37	07:20 16:15	90 10:02 (5)
8	07:34 16:32	08:06 (20) 10:16 (5) 17:12	09:53 (5) 17:52	06:23 18:32	06:25 20:08	05:37 20:40	05:10 20:45	05:49 20:16	06:26 19:22	07:02 18:25	06:43 16:36	07:21 16:15	90 10:03 (5)
9	07:34 16:33	08:08 (20) 10:16 (5) 17:15	09:53 (5) 17:53	06:21 18:33	06:24 20:09	05:35 20:40	05:10 20:45	05:50 20:14	06:27 19:20	07:03 18:23	06:45 16:35	07:22 16:15	92 10:02 (5)
10	07:33 16:34	08:07 (20) 10:15 (5) 17:16	09:53 (5) 17:55	06:19 18:34	06:22 20:11	05:34 20:41	05:10 20:44	05:51 20:13	06:28 19:18	07:04 18:21	06:46 16:34	16 09:10 (5) 09:26 (5)	92 10:03 (5)
11	07:33 16:35	08:09 (20) 10:15 (5) 17:18	09:53 (5) 17:56	06:18 18:36	06:20 20:12	05:33 20:42	05:09 20:44	05:52 20:11	06:29 19:16	07:06 18:20	06:47 16:32	24 09:29 (5) 09:05 (5)	90 10:04 (5)
12	07:33 16:36	08:08 (20) 10:16 (5) 17:19	09:53 (5) 17:57	06:16 18:37	06:18 20:13	05:32 20:42	05:09 20:43	05:53 20:10	06:30 19:14	07:07 18:18	06:49 16:31	30 09:33 (5) 09:03 (5)	92 10:05 (5)
13	07:32 16:38	08:10 (20) 10:16 (5) 17:20	09:53 (5) 17:59	06:14 18:38	06:16 20:14	05:30 20:43	05:09 20:43	05:55 20:08	06:32 19:12	07:08 18:16	06:50 16:30	34 09:36 (5) 09:02 (5)	92 10:05 (5)
14	07:32 16:39	08:09 (20) 10:15 (5) 17:22	09:53 (5) 18:00	06:12 19:40	06:15 20:15	05:29 20:43	05:09 20:42	05:56 20:07	06:33 19:10	07:10 18:14	06:52 16:29	38 09:38 (5) 09:00 (5)	94 10:06 (5)
15	07:31 16:40	08:11 (20) 10:15 (5) 17:23	09:53 (5) 18:01	06:10 19:41	06:13 20:17	05:28 20:44	05:09 20:41	05:57 20:05	06:34 19:08	07:11 18:13	06:53 16:28	40 09:39 (5) 08:59 (5)	90 10:05 (5)
16	07:31 16:41	08:12 (20) 10:14 (5) 17:25	09:53 (5) 18:03	06:08 19:42	06:11 20:18	05:27 20:44	05:09 20:41	05:58 20:04	06:35 19:07	07:12 18:11	06:54 16:27	46 09:43 (5) 08:57 (5)	90 10:06 (5)
17	07:30 16:43	08:13 (20) 10:15 (5) 17:26	09:53 (5) 18:04	06:06 19:43	06:09 20:19	05:26 20:45	05:09 20:40	05:59 20:02	06:36 19:05	07:14 18:09	06:56 16:26	48 09:44 (5) 09:16 (5)	92 10:06 (5)
18	07:30 16:44	08:15 (20) 10:15 (5) 17:27	09:53 (5) 18:05	06:05 19:45	06:08 20:20	05:25 20:45	05:09 20:39	06:01 20:01	06:37 19:03	07:15 18:07	06:57 16:25	50 09:46 (5) 08:56 (5)	92 10:07 (5)
19	07:29 16:45	08:16 (20) 10:14 (5) 17:29	09:53 (5) 18:06	06:03 19:46	06:06 20:21	05:24 20:46	05:09 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:24	52 09:47 (5) 08:55 (5)	92 10:08 (5)
20	07:28 16:47	08:19 (20) 10:13 (5) 17:30	09:53 (5) 18:08	06:01 19:47	06:04 20:22	05:23 20:46	05:09 20:37	06:03 19:56	06:40 18:59	07:17 18:04	07:00 16:23	54 09:49 (5) 08:55 (5)	92 10:08 (5)
21	07:27 16:48	09:18 (5) 10:12 (5) 17:32	09:53 (5) 18:09	05:59 19:48	06:03 20:23	05:22 20:46	05:09 20:37	06:04 19:54	06:41 18:57	07:19 18:02	07:01 16:23	54 09:48 (5) 08:54 (5)	92 10:09 (5)
22	07:27 16:49	09:19 (5) 10:13 (5) 17:33	09:53 (5) 18:10	05:57 19:50	06:01 20:24	05:21 20:46	05:09 20:36	06:05 19:52	06:42 18:55	07:20 18:01	07:02 16:22	60 09:49 (5) 07:55 (20)	92 10:09 (5)
23	07:26 16:51	09:21 (5) 10:13 (5) 17:34	09:53 (5) 18:12	05:55 19:51	05:59 20:25	05:20 20:47	05:10 20:35	06:06 19:51	06:43 18:53	07:21 17:59	07:03 16:21	68 09:51 (5) 07:53 (20)	92 10:10 (5)
24	07:25 16:52	09:22 (5) 10:12 (5) 17:36	09:53 (5) 18:13	05:53 19:52	05:58 20:27	05:19 20:47	05:10 20:34	06:08 19:49	06:45 18:51	07:23 17:58	07:05 16:20	72 09:52 (5) 07:52 (20)	92 10:10 (5)
25	07:24 16:53	09:23 (5) 10:11 (5) 17:37	09:53 (5) 18:14	05:51 19:53	05:56 20:28	05:18 20:47	05:10 20:33	06:09 19:47	06:46 18:49	07:24 17:56	07:06 16:20	74 09:53 (5) 07:51 (20)	92 10:10 (5)
26	07:23 16:55	09:24 (5) 10:10 (5) 17:39	09:53 (5) 18:15	05:50 19:55	05:54 20:29	05:17 20:47	05:11 20:32	06:10 19:45	06:47 18:48	07:25 17:54	07:07 16:19	76 09:53 (5) 07:50 (20)	92 10:11 (5)
27	07:22 16:56	09:27 (5) 10:07 (5) 17:40	09:53 (5) 18:17	05:48 19:56	05:53 20:30	05:16 20:47	05:11 20:31	06:11 19:44	06:48 18:46	07:27 17:53	07:09 16:18	80 09:54 (5) 07:50 (20)	90 10:11 (5)
28	07:21 16:58	09:28 (5) 10:06 (5) 17:41	09:53 (5) 18:18	05:46 19:57	05:51 20:31	05:16 20:47	05:11 20:30	06:12 19:42	06:50 18:44	07:28 17:51	07:10 16:18	82 09:55 (5) 07:49 (20)	90 10:11 (5)
29	07:20 16:59	09:30 (5) 10:04 (5) 17:42	09:53 (5) 18:19	05:44 19:58	05:50 20:31	05:15 20:47	05:12 20:28	06:14 19:40	06:51 18:42	07:30 17:50	07:11 16:17	84 09:56 (5) 07:51 (20)	94 10:13 (5)
30	07:19 17:00	09:33 (5) 10:01 (5) 17:43	09:53 (5) 18:21	05:42 20:00	05:48 20:32	05:14 20:47	05:12 20:27	06:15 19:38	06:52 18:40	07:31 17:48	07:12 16:17	86 09:58 (5) 07:50 (20)	92 10:13 (5)
31	07:18 17:02	09:36 (5) 09:58 (5) 17:44	09:53 (5) 18:22	05:40 20:33	05:47 20:33	05:14 20:47	05:11 20:26	06:16 19:36	06:53 18:36	07:32 17:47	07:13 16:17	88 09:59 (5) 07:51 (20)	92 10:13 (5)
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	340	288	274	
Total, worst case	2132	14									1168	2820	
Sun reduction	0.45	0.45									0.35	0.35	
Oper. time red.	0.91	0.91									0.91	0.91	
Wind dir. red.	0.69	0.69									0.69	0.68	
Total reduction	0.28	0.28									0.22	0.22	
Total, real	597	4									255	613	

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/20/06 13:37 / 7
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/20/06 13:20/2.4.0.67

SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 004 - 004

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1 07:35	09:51 (5)	07:17	06:35	05:38	05:47	05:13	05:13	05:41	06:17	06:53	06:34	07:13
16:25	26 10:17 (5)	17:03	17:43	18:23	20:00	20:34	20:47	20:25	19:35	18:38	16:45	16:16
2 07:35	09:53 (5)	07:16	06:34	05:36	05:45	05:13	05:13	05:42	06:18	06:54	06:35	07:14
16:26	22 10:15 (5)	17:05	17:44	18:24	20:01	20:35	20:47	20:24	19:33	18:36	16:44	16:16
3 07:35	09:55 (5)	07:15	06:32	05:35	05:44	05:12	05:14	05:43	06:20	06:56	06:36	07:16
16:27	20 10:15 (5)	17:06	17:45	18:26	20:02	20:36	20:46	20:22	19:31	18:34	16:43	16:16
4 07:35	09:57 (5)	07:13	06:30	05:33	05:42	05:12	05:15	05:44	06:21	06:57	06:38	07:17
16:28	16 10:13 (5)	17:07	17:47	18:27	20:03	20:37	20:46	20:21	19:29	18:32	16:41	16:15
5 07:34	09:59 (5)	07:12	06:28	06:31	05:41	05:11	05:15	05:45	06:22	06:58	06:39	07:18
16:29	14 10:13 (5)	17:09	17:48	19:28	20:05	20:38	20:46	20:20	19:27	18:31	16:40	16:15
6 07:34	10:03 (5)	07:11	06:27	06:29	05:39	05:11	05:16	05:46	06:23	06:59	06:41	07:19
16:30	6 10:09 (5)	17:10	17:49	19:29	20:06	20:38	20:46	20:18	19:25	18:29	16:39	16:15
7 07:34		07:10	06:25	06:27	05:38	05:10	05:17	05:48	06:24	07:01	06:42	07:20
16:31		17:12	17:51	19:31	20:07	20:39	20:45	20:17	19:24	18:27	16:37	16:15
8 07:34		07:08	06:23	06:25	05:37	05:10	05:17	05:49	06:26	07:02	06:43	07:21
16:32		17:13	17:52	19:32	20:08	20:40	20:45	20:16	19:22	18:25	16:36	16:15
9 07:34		07:07	06:21	06:24	05:35	05:10	05:18	05:50	06:27	07:03	06:45	07:22
16:33		17:15	17:53	19:33	20:09	20:40	20:45	20:14	19:20	18:23	16:35	16:15
10 07:33		07:05	06:19	06:22	05:34	05:10	05:19	05:51	06:28	07:04	06:46	07:23
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11 07:33		07:04	06:18	06:20	05:33	05:09	05:20	05:52	06:29	07:06	06:47	07:24
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12 07:33		07:03	06:16	06:18	05:32	05:09	05:20	05:53	06:30	07:07	06:49	07:25
16:36		17:19	17:57	19:37	20:13	20:42	20:43	20:10	19:14	18:18	16:31	16:15
13 07:32		07:01	06:14	06:16	05:30	05:09	05:21	05:55	06:32	07:08	06:50	07:25
16:38		17:20	17:59	19:38	20:14	20:43	20:43	20:08	19:12	18:16	16:30	16:15
14 07:32		07:00	06:12	06:15	05:29	05:09	05:22	05:56	06:33	07:10	06:52	07:26
16:39		17:22	18:00	19:40	20:15	20:43	20:42	20:07	19:10	18:14	16:29	16:15
15 07:31		06:58	06:10	06:13	05:28	05:09	05:23	05:57	06:34	07:11	06:53	07:27
16:40		17:23	18:01	19:41	20:17	20:44	20:41	20:05	19:08	18:13	16:28	16:15
16 07:31		06:57	06:08	06:11	05:27	05:09	05:24	05:58	06:35	07:12	06:54	07:28
16:41		17:25	18:03	19:42	20:18	20:44	20:41	20:04	19:07	18:11	16:27	16:15
17 07:30		06:55	06:06	06:09	05:26	05:09	05:25	05:59	06:36	07:14	06:56	07:28
16:43		17:26	18:04	19:43	20:19	20:45	20:40	20:02	19:05	18:09	16:26	16:16
18 07:30		06:54	06:05	06:08	05:25	05:09	05:26	06:01	06:37	07:15	06:57	07:29
16:44		17:27	18:05	19:45	20:20	20:45	20:39	20:01	19:03	18:07	16:25	16:16
19 07:29		06:52	06:03	06:06	05:24	05:09	05:27	06:02	06:39	07:16	06:58	07:30
16:45		17:29	18:06	19:46	20:21	20:46	20:38	19:57	19:01	18:06	16:24	16:16
20 07:28		06:50	06:01	06:04	05:23	05:09	05:28	06:03	06:40	07:17	07:00	07:30
16:47		17:30	18:08	19:47	20:22	20:46	20:37	19:56	18:59	18:04	16:23	16:17
21 07:27		06:49	05:59	06:03	05:22	05:09	05:29	06:04	06:41	07:19	07:01	07:31
16:48		17:32	18:09	19:48	20:23	20:46	20:37	19:54	18:57	18:02	16:23	16:17
22 07:27		06:47	05:57	06:01	05:21	05:09	05:30	06:05	06:42	07:20	07:02	07:32
16:49		17:33	18:10	19:50	20:24	20:46	20:36	19:52	18:55	18:01	16:22	16:18
23 07:26		06:46	05:55	05:59	05:20	05:10	05:31	06:06	06:43	07:21	07:03	07:32
16:51		17:34	18:12	19:51	20:25	20:47	20:35	19:51	18:53	17:59	16:21	16:18
24 07:25		06:44	05:53	05:58	05:19	05:10	05:32	06:08	06:45	07:23	07:05	07:32
16:52		17:36	18:13	19:52	20:27	20:47	20:34	19:49	18:51	17:58	16:20	16:19
25 07:24		06:42	05:51	05:56	05:18	05:10	05:33	06:09	06:46	06:24	07:06	07:33
16:53		17:37	18:14	19:53	20:28	20:47	20:33	19:47	18:49	18:56	16:20	16:19
26 07:23		06:41	05:50	05:54	05:17	05:11	05:34	06:10	06:47	06:25	07:07	07:33
16:55		17:39	18:15	19:55	20:29	20:47	20:32	19:45	18:48	18:54	16:19	16:20
27 07:22		06:39	05:48	05:53	05:16	05:11	05:35	06:11	06:48	06:27	07:09	07:34
16:56		17:40	18:17	19:56	20:30	20:47	20:31	19:44	18:46	18:53	16:18	16:21
28 07:21		06:37	05:46	05:51	05:16	05:11	05:36	06:12	06:50	06:28	07:10	07:34
16:58		17:41	18:18	19:57	20:31	20:47	20:30	19:42	18:44	18:51	16:18	16:21
29 07:20			05:44	05:50	05:15	05:12	05:37	06:14	06:51	06:30	07:11	07:34
16:59			18:19	19:58	20:31	20:47	20:28	19:40	18:42	18:50	16:17	16:22
30 07:19			05:42	05:48	05:14	05:12	05:38	06:15	06:52	06:31	07:12	07:34
17:00			18:21	20:00	20:32	20:47	20:27	19:38	18:40	18:48	16:17	16:23
31 07:18			05:40		05:14		05:39	06:16		06:32		07:34
17:02			18:22		20:33		20:26	19:36		16:47		16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	340	288	274
Total, worst case	104											708
Sun reduction	0.45											0.35
Oper. time red.	0.91											0.91
Wind dir. red.	0.67											0.67
Total reduction	0.28											0.21
Total, real	29											152

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/20/06 13:37 / 8
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/20/06 13:20/2.4.0.67

SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 031 - 031

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:35 16:25	08:43 (3) 08:47 (3)	07:17 06:36	05:38 18:23	05:47 20:00	05:13 20:34	05:13 20:47	05:41 20:25	06:17 19:35	06:53 18:38	06:34 16:45	07:13 16:17	
2	07:35 16:26	07:16 17:05	06:34 17:44	05:37 18:24	05:45 20:01	05:13 20:35	05:14 20:47	05:42 20:24	06:19 19:33	06:55 18:36	06:35 16:44	07:15 16:16	
3	07:35 16:27	07:15 17:06	06:32 17:46	05:35 18:26	05:44 20:02	05:12 20:36	05:14 20:47	05:43 20:23	06:20 19:31	06:56 18:34	06:36 16:43	07:16 16:16	
4	07:35 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:42 20:03	05:12 20:37	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:33	06:38 16:41	07:17 16:15	
5	07:35 16:29	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:05	05:11 20:38	05:15 20:46	05:45 20:20	06:22 19:27	06:58 18:31	06:39 16:40	07:18 16:15	
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7	07:34 16:31	07:10 17:12	06:25 17:51	06:27 19:31	05:38 20:07	05:10 20:39	05:17 20:45	05:48 20:17	06:24 19:24	07:01 18:27	06:42 16:37	07:20 16:15	
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9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:35 20:10	05:10 20:41	05:18 20:45	05:50 20:14	06:27 19:20	07:03 18:23	06:45 16:35	07:22 16:15	
10	07:34 16:34	07:06 17:16	06:19 17:55	06:22 19:35	05:34 20:11	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	06:46 16:34	07:23 16:15	
11	07:33 16:35	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:09 20:42	05:20 20:44	05:52 20:12	06:29 19:16	07:06 18:20	06:48 16:33	07:24 16:15	08:34 (3) 08:38 (3)
12	07:33 16:36	07:03 17:19	06:16 17:57	06:18 19:37	05:32 20:13	05:09 20:42	05:21 20:43	05:53 20:10	06:30 19:14	07:07 18:18	06:49 16:31	07:25 16:15	08:33 (3) 08:39 (3)
13	07:32 16:38	07:01 17:20	06:14 17:59	06:16 19:38	05:30 20:14	05:09 20:43	05:21 20:43	05:55 20:09	06:32 19:12	07:08 18:16	06:50 16:30	07:26 16:15	08:32 (3) 08:42 (3)
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	05:29 20:16	05:09 20:44	05:22 20:42	05:56 20:07	06:33 19:10	07:10 18:14	06:52 16:29	07:26 16:15	08:32 (3) 08:42 (3)
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17	07:30 16:43	06:55 17:26	06:07 18:04	06:09 19:43	05:26 20:19	05:09 20:45	05:25 20:40	05:59 20:02	06:36 19:05	07:14 18:09	06:56 16:26	07:29 16:16	08:33 (3) 08:45 (3)
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19	07:29 16:45	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:09 20:46	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:24	07:30 16:16	08:30 (3) 08:46 (3)
20	07:28 16:47	06:51 17:30	06:01 18:08	06:04 19:47	05:23 20:22	05:09 20:46	05:28 20:38	06:03 19:56	06:40 18:59	07:18 18:04	07:00 16:23	07:31 16:17	08:32 (3) 08:46 (3)
21	07:28 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:09 20:46	05:29 20:37	06:04 19:54	06:41 18:57	07:19 18:02	07:01 16:23	07:31 16:17	08:33 (3) 08:47 (3)
22	07:27 16:49	06:47 17:33	05:57 18:10	06:01 19:50	05:21 20:25	05:10 20:46	05:30 20:36	06:05 19:52	06:42 18:55	07:20 18:01	07:02 16:22	07:32 16:18	08:33 (3) 08:47 (3)
23	07:26 16:51	06:46 17:35	05:55 18:12	05:59 19:51	05:20 20:26	05:10 20:47	05:31 20:35	06:07 19:51	06:44 18:53	07:22 17:59	07:04 16:21	07:32 16:18	08:34 (3) 08:48 (3)
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26	07:23 16:55	06:41 17:39	05:50 18:16	05:54 19:55	05:17 20:29	05:11 20:47	05:34 20:32	06:10 19:45	06:47 18:48	06:26 18:54	07:07 16:19	07:33 16:20	08:35 (3) 08:49 (3)
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:30	05:11 20:47	05:35 20:31	06:11 19:44	06:48 18:46	06:27 16:53	07:09 16:18	07:34 16:21	08:37 (3) 08:49 (3)
28	07:21 16:58	06:37 17:41	05:46 18:18	05:51 19:57	05:16 20:31	05:12 20:47	05:36 20:30	06:13 19:42	06:50 18:44	06:28 16:51	07:10 16:18	07:34 16:21	08:37 (3) 08:49 (3)
29	07:20 16:59		05:44 18:19	05:50 19:58	05:15 20:32	05:12 20:47	05:37 20:29	06:14 19:40	06:51 18:42	06:30 16:50	07:11 16:17	07:34 16:22	08:37 (3) 08:49 (3)
30	07:19 17:00		05:42 18:21	05:48 20:00	05:14 20:33	05:12 20:47	05:38 20:27	06:15 19:38	06:52 18:40	06:31 16:48	07:12 16:17	07:34 16:23	08:40 (3) 08:50 (3)
31	07:18 17:02		05:40 18:22	05:40 20:00	05:14 20:33	05:14 20:47	05:40 20:26	06:16 19:37	06:32 16:47			07:34 16:24	08:42 (3) 08:50 (3)
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	340	288	274	
Total, worst case	4											246	
Sun reduction	0.45											0.35	
Oper. time red.	0.91											0.91	
Wind dir. red.	0.69											0.69	
Total reduction	0.28											0.22	
Total, real	1											54	

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/20/06 13:37 / 11
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/20/06 13:20/2.4.0.67

SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 034 - 034

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:35 16:25	09:33 (5) 10:09 (5)	07:17 17:03	06:35 17:43	05:38 18:23	05:47 20:00	05:13 20:34	05:13 20:47	05:41 20:25	06:17 19:35	06:53 18:38	07:13 16:16
2	07:35 16:26	09:33 (5) 10:09 (5)	07:16 17:05	06:34 17:44	05:36 18:24	05:45 20:01	05:13 20:35	05:13 20:47	05:42 20:24	06:18 19:33	06:54 18:36	07:14 16:16
3	07:35 16:27	09:35 (5) 10:09 (5)	07:15 17:06	06:32 17:45	05:35 18:26	05:44 20:02	05:12 20:36	05:14 20:46	05:43 20:22	06:20 19:31	06:56 18:34	07:16 16:16
4	07:35 16:28	09:35 (5) 10:09 (5)	07:13 17:07	06:30 17:47	05:33 18:27	05:42 20:03	05:12 20:37	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:32	07:17 16:15
5	07:34 16:29	09:37 (5) 10:09 (5)	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:05	05:11 20:38	05:15 20:46	05:45 20:20	06:22 19:27	06:58 18:31	07:18 16:15
6	07:34 16:30	09:39 (5) 10:07 (5)	07:11 17:10	06:27 17:49	06:29 19:29	05:39 20:06	05:11 20:38	05:16 20:46	05:46 20:18	06:23 19:25	06:59 18:29	07:19 16:15
7	07:34 16:31	09:40 (5) 10:06 (5)	07:10 17:12	06:25 17:51	06:27 19:31	05:38 20:07	05:10 20:39	05:17 20:45	05:48 20:17	06:24 19:24	07:01 18:27	06:42 16:15
8	07:34 16:32	09:42 (5) 10:06 (5)	07:08 17:13	06:23 17:52	06:25 19:32	05:37 20:08	05:10 20:40	05:17 20:45	05:49 20:16	06:26 19:22	07:02 18:25	06:43 16:15
9	07:34 16:33	09:44 (5) 10:04 (5)	07:07 17:15	06:21 17:53	06:24 19:33	05:35 20:09	05:10 20:40	05:18 20:45	05:50 20:14	06:27 19:20	07:03 18:23	06:45 16:15
10	07:33 16:34	09:45 (5) 10:03 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:34 20:11	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:04 18:21	06:46 16:15
11	07:33 16:35	09:49 (5) 10:01 (5)	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:09 20:42	05:20 20:44	05:52 20:11	06:29 19:16	07:06 18:20	06:47 16:15
12	07:33 16:36	07:03 17:19	06:16 17:57	06:18 19:37	05:32 20:13	05:09 20:42	05:20 20:43	05:53 20:10	06:30 19:14	07:07 18:18	06:49 16:31	07:25 16:15
13	07:32 16:38	07:01 17:20	06:14 17:59	06:16 19:38	05:30 20:14	05:09 20:43	05:21 20:43	05:55 20:08	06:32 19:12	07:08 18:16	06:50 16:30	07:25 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	05:29 20:15	05:09 20:43	05:22 20:42	05:56 20:07	06:33 19:10	07:10 18:14	06:52 16:29	07:26 16:15
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:17	05:09 20:44	05:23 20:41	05:57 20:05	06:34 19:08	07:11 18:13	06:53 16:28	07:27 16:15
16	07:31 16:41	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	05:09 20:44	05:24 20:41	05:58 20:04	06:35 19:07	07:12 18:11	06:54 16:27	07:28 16:15
17	07:30 16:43	06:55 17:26	06:06 18:04	06:09 19:43	05:26 20:19	05:09 20:45	05:25 20:40	05:59 20:02	06:36 19:05	07:14 18:09	06:56 16:26	07:28 16:16
18	07:30 16:44	06:54 17:27	06:05 18:05	06:08 19:45	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:01	06:37 19:03	07:15 18:07	06:57 16:25	07:29 16:16
19	07:29 16:45	06:52 17:29	06:03 18:06	06:06 19:46	05:24 20:21	05:09 20:46	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:24	07:30 16:16
20	07:28 16:47	06:50 17:30	06:01 18:08	06:04 19:47	05:23 20:22	05:09 20:46	05:28 20:37	06:03 19:56	06:40 18:59	07:17 18:04	07:00 16:23	07:30 16:17
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:09 20:46	05:29 20:37	06:04 19:54	06:41 18:57	07:19 18:02	07:01 16:23	07:31 16:17
22	07:27 16:49	06:47 17:33	05:57 18:10	06:01 19:50	05:21 20:24	05:09 20:46	05:30 20:36	06:05 19:52	06:42 18:55	07:20 18:01	07:02 16:22	07:32 16:18
23	07:26 16:51	06:46 17:34	05:55 18:12	05:59 19:51	05:20 20:25	05:10 20:47	05:31 20:35	06:06 19:51	06:43 18:53	07:21 17:59	07:03 16:21	07:32 16:18
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:27	05:10 20:47	05:32 20:34	06:08 19:49	06:45 18:51	07:23 17:58	07:05 16:20	07:32 16:19
25	07:24 16:53	06:42 17:37	05:51 18:14	05:56 19:53	05:18 20:28	05:10 20:47	05:33 20:33	06:09 19:47	06:46 18:49	06:24 18:56	07:06 16:20	07:33 16:19
26	07:23 16:55	06:41 17:39	05:50 18:15	05:54 19:55	05:17 20:29	05:11 20:47	05:34 20:32	06:10 19:45	06:47 18:48	06:25 16:54	07:07 16:19	07:33 16:20
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:16 20:30	05:11 20:47	05:35 20:31	06:11 19:44	06:48 18:46	06:27 16:53	07:09 16:18	07:34 16:21
28	07:21 16:58	06:37 17:41	05:46 18:18	05:51 19:57	05:16 20:31	05:11 20:47	05:36 20:30	06:12 19:42	06:50 18:44	06:28 16:51	07:10 16:18	07:34 16:21
29	07:20 16:59	06:35 18:19	05:44 18:19	05:50 19:58	05:15 20:31	05:12 20:47	05:37 20:28	06:14 19:40	06:51 18:42	06:30 16:50	07:11 16:17	07:34 16:22
30	07:19 17:00	06:33 18:21	05:42 18:21	05:48 20:00	05:14 20:32	05:12 20:47	05:38 20:27	06:15 19:38	06:52 18:40	06:31 16:48	07:12 16:17	07:34 16:23
31	07:18 17:02	06:31 18:22	05:40 18:22	05:40 20:00	05:14 20:33	05:14 20:47	05:39 20:26	06:16 19:36	06:52 16:47	06:32 16:47	07:13 16:24	07:34 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	340	288	274
Total, worst case	300											1094
Sun reduction	0.45											0.35
Oper. time red.	0.91											0.91
Wind dir. red.	0.68											0.68
Total reduction	0.28											0.22
Total, real	83											237

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/20/06 13:37 / 12
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/20/06 13:20/2.4.0.67

SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 035 - 035

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:35	14:17 (6) 07:17	14:53 (6) 06:35	05:38	05:47	05:13	19:33 (3) 05:13	19:36 (3) 05:41	06:17	06:53	06:34	07:13
2	07:35	14:17 (6) 07:16	15:05 (6) 06:34	05:36	05:45	05:13	19:32 (3) 05:13	19:36 (3) 05:42	06:18	06:55	06:35	07:15
3	07:35	14:17 (6) 07:15	14:44	18:24	20:01	05:13	20:08 (3) 20:47	20:18 (3) 20:24	19:33	18:36	16:44	16:16
4	07:35	14:19 (6) 07:13	06:30	05:33	05:42	05:12	19:31 (3) 05:15	19:35 (3) 05:44	06:21	06:57	06:38	07:17
5	07:35	14:19 (6) 07:12	17:47	18:27	20:03	05:11	20:09 (3) 20:46	20:17 (3) 20:21	19:29	18:33	16:41	16:15
6	07:34	14:19 (6) 07:11	06:28	06:31	05:41	05:11	19:31 (3) 05:16	19:37 (3) 05:46	06:22	06:58	06:39	07:18
7	07:34	14:20 (6) 07:10	17:48	19:28	20:05	05:10	20:11 (3) 20:46	20:18 (3) 20:20	19:27	18:31	16:40	16:15
8	07:34	14:20 (6) 07:08	06:27	06:29	05:40	05:11	19:31 (3) 05:16	19:37 (3) 05:46	06:23	06:59	06:40	07:19
9	07:34	14:22 (6) 07:07	17:50	19:29	20:06	05:10	20:11 (3) 20:46	20:17 (3) 20:19	19:25	18:29	16:39	16:15
10	07:33	14:21 (6) 07:06	06:25	06:27	05:38	05:10	19:30 (3) 05:17	19:37 (3) 05:46	06:24	07:01	06:42	07:20
11	07:33	14:23 (6) 07:04	17:51	19:31	20:07	05:09	20:12 (3) 20:45	20:17 (3) 20:17	19:24	18:27	16:37	16:15
12	07:33	14:23 (6) 07:03	06:23	06:25	05:37	05:10	19:32 (3) 05:17	19:38 (3) 05:49	06:26	07:02	06:43	07:21
13	07:32	14:24 (6) 07:01	17:52	19:32	20:08	05:10	20:12 (3) 20:45	20:16 (3) 20:16	19:22	18:25	16:36	16:15
14	07:32	14:26 (6) 07:00	06:21	06:24	05:35	05:10	19:30 (3) 05:18	19:39 (3) 05:50	06:27	07:03	06:45	07:22
15	07:31	14:25 (6) 06:58	17:53	19:33	20:10	05:10	20:14 (3) 20:45	20:17 (3) 20:14	19:20	18:23	16:35	16:15
16	07:31	14:26 (6) 06:57	06:19	06:22	05:34	05:10	19:32 (3) 05:19	19:40 (3) 05:51	06:28	07:05	06:46	07:23
17	07:30	14:28 (6) 06:55	17:55	19:34	20:11	05:09	20:14 (3) 20:44	20:16 (3) 20:13	19:18	18:22	16:34	14:22 (6)
18	07:30	14:28 (6) 06:54	06:18	06:20	05:33	05:09	19:32 (3) 05:20	19:40 (3) 05:52	06:29	07:06	06:47	16:15
19	07:29	14:28 (6) 06:52	17:56	19:36	20:12	05:09	20:14 (3) 20:44	20:16 (3) 20:11	19:16	18:20	16:32	16:15
20	07:28	14:29 (6) 06:51	06:16	06:18	05:32	05:09	19:31 (3) 05:21	19:39 (3) 05:53	06:30	07:07	06:49	14:15 (6)
21	07:27	14:30 (6) 06:49	17:57	19:37	20:13	05:09	20:15 (3) 20:43	20:15 (3) 20:10	19:14	18:18	16:31	14:15 (6)
22	07:27	14:32 (6) 06:47	06:14	06:16	05:30	05:09	19:31 (3) 05:21	19:40 (3) 05:55	06:32	07:08	06:50	14:14 (6)
23	07:26	14:33 (6) 06:46	17:59	19:38	20:14	05:09	20:15 (3) 20:43	20:14 (3) 20:08	19:12	18:16	16:30	16:15
24	07:25	14:34 (6) 06:44	06:12	06:15	05:29	05:09	19:31 (3) 05:22	19:41 (3) 05:56	06:33	07:10	06:52	14:12 (6)
25	07:24	14:35 (6) 06:42	17:59	19:40	20:15	05:09	20:16 (3) 20:42	20:15 (3) 20:07	19:08	18:22	16:34	14:12 (6)
26	07:23	14:36 (6) 06:41	06:10	06:13	05:28	05:09	19:31 (3) 05:23	19:42 (3) 05:57	06:34	07:11	06:53	14:11 (6)
27	07:22	14:36 (6) 06:40	18:01	19:41	20:17	05:09	20:15 (3) 20:41	20:14 (3) 20:05	19:09	18:13	16:28	14:11 (6)
28	07:21	14:37 (6) 06:39	06:08	06:11	05:27	05:09	19:31 (3) 05:24	19:42 (3) 05:58	06:35	07:12	06:54	14:10 (6)
29	07:20	14:42 (6) 06:37	18:03	19:42	20:18	05:09	20:16 (3) 20:41	20:12 (3) 20:04	19:07	18:11	16:27	14:10 (6)
30	07:19	14:45 (6) 06:35	06:06	06:09	05:26	05:09	19:31 (3) 05:25	19:43 (3) 05:59	06:36	07:14	06:56	14:10 (6)
31	07:18	14:48 (6) 06:33	18:04	19:43	20:19	05:09	20:15 (3) 20:40	20:11 (3) 20:02	19:05	18:09	16:26	14:10 (6)
Potential sun hours	286	291	369	380	285	254	220	200	180	160	140	120
Total, worst case	1530	12				304	1290	762			910	1822
Sun reduction	0.45	0.45				0.55	0.55	0.58			0.35	0.35
Oper. time red.	0.91	0.91				0.91	0.91	0.91			0.91	0.91
Wind dir. red.	0.63	0.63				0.63	0.63	0.63			0.63	0.63
Total reduction	0.26	0.26				0.31	0.31	0.33			0.20	0.20
Total, real	390	3				95	405	252			181	362

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)
	Minutes with flicker		

Project: 060119 Marble River	Description: Marble River Wind Project Shadow-Flicker, N part 17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)	Printed/Page: 01/20/06 13:37 / 13 Licensed user: Wind Engineers, Inc. 7660 Whitegate Avenue US-RIVERSIDE, CA 92506 Calculated: 01/20/06 13:20/2.4.0.67
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SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 037 - 037

Assumptions for shadow calculations

Maximum distance for influence	1,000 m	Sun shine probabilities (part of time from sun rise to sun set with sun shine)											
Minimum sun height over horizon for influence	3 °	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Day step for calculation	1 days	0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35
Time step for calculation	2 minutes	Operational time											
		N	NE	E	SE	S	SW	W	NW	Sum			
		1,850	1,325	800	713	625	663	700	1,275	7,950			

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:35 16:25	07:17 17:03	06:35 17:43		05:38 18:23	05:47 20:00	05:13 20:34	05:13 20:47	05:41 20:25	06:17 19:35		06:34 16:17	
2	07:35 16:26	07:16 17:05	06:34 17:44		05:37 18:24	05:45 20:01	05:13 20:35	05:14 20:47	05:42 20:24	06:19 19:33	30	07:47 (6) 16:45 06:35 16:16	
3	07:35 16:27	07:15 17:06	06:32 17:46		05:35 18:26	05:44 20:02	05:12 20:36	05:14 20:47	05:43 20:23	06:20 19:31	28	07:46 (6) 16:44 06:36 16:16	
4	07:35 16:28	07:13 17:08	06:30 17:47		05:33 18:27	05:42 20:03	05:12 20:37	05:15 20:46	05:44 20:21	06:21 19:29	28	07:45 (6) 16:43 06:38 16:16	
5	07:35 16:29	07:12 17:09	06:28 17:48		06:51 (6) 06:57 (6)	06:31 19:28	05:41 20:05	05:15 20:38	05:45 20:20	06:22 19:27	26	07:44 (6) 16:41 06:39 16:15	
6	07:34 16:30	07:11 17:10	06:27 17:50	6	06:47 (6) 07:01 (6)	06:29 19:29	05:40 20:06	05:11 20:38	05:46 20:19	06:23 19:26	22	07:42 (6) 16:40 06:41 16:15	
7	07:34 16:31	07:10 17:12	06:25 17:51	14	06:45 (6) 07:03 (6)	06:27 19:31	05:38 20:07	05:10 20:39	05:48 20:17	06:24 19:24	20	07:41 (6) 16:39 06:42 16:15	
8	07:34 16:32	07:08 17:13	06:23 17:52	18	06:44 (6) 07:06 (6)	06:26 19:32	05:37 20:08	05:10 20:40	05:49 20:16	06:26 19:22	16	07:38 (6) 16:37 06:43 16:15	
9	07:34 16:33	07:07 17:15	06:21 17:54	24	06:42 (6) 07:06 (6)	06:24 19:33	05:36 20:10	05:10 20:41	05:50 20:14	06:27 19:20	12	07:35 (6) 16:36 06:45 16:15	
10	07:34 16:34	07:06 17:16	06:19 17:55	26	06:40 (6) 07:06 (6)	06:22 19:35	05:34 20:11	05:10 20:41	05:51 20:13	06:28 19:18		07:05 16:22 06:46 16:15	
11	07:33 16:35	07:04 17:18	06:18 17:56	28	06:38 (6) 07:06 (6)	06:20 19:36	05:33 20:12	05:09 20:42	05:52 20:11	06:29 19:16		07:06 16:20 06:47 16:15	
12	07:33 16:36	07:03 17:19	06:16 17:57	28	06:38 (6) 07:06 (6)	06:18 19:37	05:32 20:13	05:09 20:42	05:53 20:10	06:30 19:14		07:07 16:18 06:49 16:15	
13	07:32 16:38	07:01 17:20	06:14 17:59	28	06:38 (6) 07:06 (6)	06:17 19:38	05:30 20:14	05:09 20:43	05:55 20:08	06:32 19:12		07:08 16:16 06:50 16:15	
14	07:32 16:39	07:00 17:22	06:12 18:00	30	06:36 (6) 07:06 (6)	06:15 19:40	05:29 20:16	05:09 20:44	05:56 20:07	06:33 19:10		07:10 16:14 06:52 16:15	
15	07:31 16:40	06:58 17:23	06:10 18:01	30	06:37 (6) 07:07 (6)	06:13 19:41	05:28 20:17	05:09 20:44	05:57 20:05	06:34 19:09		07:11 16:13 06:53 16:15	
16	07:31 16:41	06:57 17:25	06:08 18:03	30	06:37 (6) 07:07 (6)	06:11 19:42	05:27 20:18	05:09 20:44	05:58 20:04	06:35 19:07		07:12 16:11 06:54 16:15	
17	07:30 16:43	06:55 17:26	06:06 18:04	28	06:37 (6) 07:05 (6)	06:09 19:43	05:26 20:19	05:09 20:45	05:59 20:02	06:36 19:05		07:14 16:09 06:56 16:16	
18	07:30 16:44	06:54 17:28	06:05 18:05	28	06:37 (6) 07:05 (6)	06:08 19:45	05:25 20:20	05:09 20:45	06:01 20:01	06:38 19:03		07:15 16:08 06:57 16:16	
19	07:29 16:45	06:52 17:29	06:03 18:07	26	06:37 (6) 07:03 (6)	06:06 19:46	05:24 20:21	05:09 20:46	06:02 19:57	06:39 19:01		07:16 16:06 06:58 16:16	
20	07:28 16:47	06:51 17:30	06:01 18:08	22	06:39 (6) 07:01 (6)	06:04 19:47	05:23 20:22	05:09 20:46	06:03 19:56	06:40 18:59	8	07:31 (6) 18:04 07:39 (6) 16:23 07:28 (6) 16:17	
21	07:28 16:48	06:49 17:32	05:59 18:09	20	06:39 (6) 06:59 (6)	06:03 19:48	05:22 20:23	05:09 20:46	06:04 19:54	06:41 18:57	14	07:28 (6) 18:03 07:42 (6) 16:23 07:26 (6) 16:17	
22	07:27 16:49	06:47 17:33	05:57 18:10	16	06:41 (6) 06:57 (6)	06:01 19:50	05:21 20:24	05:10 20:46	06:05 19:52	06:42 18:55	18	07:26 (6) 18:01 07:44 (6) 16:22 07:23 (6) 16:18	
23	07:26 16:51	06:46 17:35	05:55 18:12	10	06:43 (6) 06:53 (6)	05:59 19:51	05:20 20:26	05:10 20:47	06:07 19:51	06:44 18:53	22	07:22 (6) 17:59 07:45 (6) 16:21 07:22 (6) 16:18	
24	07:25 16:52	06:44 17:36	05:53 18:13		05:58 19:52	05:19 20:27	05:10 20:47	05:32 20:34	06:08 19:49	06:45 18:51	24	07:22 (6) 17:58 07:46 (6) 16:20 07:22 (6) 16:19	
25	07:24 16:53	06:42 17:37	05:51 18:14		05:56 19:53	05:18 20:28	05:10 20:47	05:33 20:33	06:09 19:47	06:46 18:50	26	07:21 (6) 16:56 07:47 (6) 16:20 07:18 (6) 16:19	
26	07:23 16:55	06:41 17:39	05:50 18:16		05:54 19:55	05:17 20:29	05:11 20:47	05:34 20:32	06:10 19:45	06:47 18:48	28	07:18 (6) 16:54 07:46 (6) 16:19 07:18 (6) 16:20	
27	07:22 16:56	06:39 17:40	05:48 18:17		05:53 19:56	05:17 20:30	05:11 20:47	05:35 20:31	06:11 19:44	06:48 18:46	30	07:18 (6) 16:53 07:48 (6) 16:21 07:19 (6) 16:21	
28	07:21 16:58	06:37 17:41	05:46 18:18		05:51 19:57	05:16 20:31	05:12 20:47	05:36 20:30	06:13 19:42	06:50 18:44	28	07:17 (6) 16:51 07:47 (6) 16:21 07:18 (6) 16:22	
29	07:20 16:59		05:44 18:19		05:50 19:58	05:15 20:32	05:12 20:47	05:37 20:29	06:14 19:40	06:51 18:42	28	07:18 (6) 16:50 07:46 (6) 16:22 07:17 (6) 16:23	
30	07:19 17:00		05:42 18:21		05:48 20:00	05:14 20:33	05:12 20:47	05:38 20:27	06:15 19:38	06:52 18:40	30	07:17 (6) 16:48 06:31 16:24 07:47 (6) 16:24	
31	07:18 17:02		05:40 18:22		05:46 20:03	05:14 20:33	05:10 20:47	05:38 20:26	06:16 19:37	06:52 16:47		06:32 16:24 06:34 16:24	
Potential sun hours	286	291	369		380	-285	-254	-272	4	376		288	274
Total, worst case			434							256		182	
Sun reduction			0.50							0.55		0.45	
Oper. time red.			0.91							0.91		0.91	
Wind dir. red.			0.62							0.62		0.62	
Total reduction			0.28							0.31		0.26	
Total, real			123							80		46	

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)
	Minutes with flicker		

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, N part
 17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 038 - 038

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:35 16:25	07:17 17:03	06:35 17:43	05:38 18:23	06:15 (6) 05:47	05:13 20:00	05:13 20:00	05:41 20:25	06:17 19:35	06:53 18:38	06:34 16:45	07:13 16:17
2	07:35 16:26	07:16 17:05	06:34 17:44	05:37 18:24	06:15 (6) 05:44	05:13 20:01	05:13 20:01	05:42 20:24	06:19 19:33	06:55 18:36	06:35 16:44	07:15 16:16
3	07:35 16:27	07:15 17:06	06:32 17:46	05:35 18:26	06:17 (6) 05:44	05:12 20:02	05:12 20:02	05:43 20:23	06:20 19:31	06:56 18:34	06:36 16:43	07:16 16:16
4	07:35 16:28	07:13 17:08	06:30 17:47	05:33 18:27	06:17 (6) 05:42	05:12 20:03	05:12 20:03	05:44 20:21	06:21 19:29	06:57 18:33	06:38 16:41	07:17 16:16
5	07:35 16:29	07:12 17:09	06:28 17:48	06:31 19:28	07:21 (6) 05:41	05:11 20:05	05:11 20:05	05:45 20:20	06:22 19:27	06:58 18:31	06:39 16:40	07:18 16:15
6	07:34 16:30	07:11 17:10	06:27 17:50	06:29 19:29	07:29 (6) 05:40	05:11 20:06	05:11 20:06	05:46 20:19	06:23 19:26	07:00 18:29	06:41 16:39	07:19 16:15
7	07:34 16:31	07:10 17:12	06:25 17:51	06:27 19:31	05:38 20:07	05:10 20:39	05:10 20:45	05:48 20:17	06:24 19:24	07:16 (6) 07:24 (6)	07:01 18:27	07:20 16:15
8	07:34 16:32	07:08 17:13	06:23 17:52	06:26 19:32	05:37 20:08	05:10 20:40	05:10 20:45	05:49 20:16	06:26 19:22	07:13 (6) 07:27 (6)	07:02 18:25	07:21 16:15
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:10	05:10 20:41	05:10 20:45	05:50 20:14	06:27 19:20	07:10 (6) 07:30 (6)	07:03 18:23	07:22 16:15
10	07:34 16:34	07:06 17:16	06:19 17:55	06:22 19:35	05:34 20:11	05:10 20:41	05:10 20:45	05:51 20:13	06:28 19:18	07:08 (6) 07:32 (6)	07:05 18:22	07:23 16:15
11	07:33 16:35	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:09 20:42	05:09 20:44	05:52 20:11	06:29 19:16	07:07 (6) 07:33 (6)	07:06 18:20	07:24 16:15
12	07:33 16:36	07:03 17:19	06:16 17:57	06:18 19:37	05:32 20:13	05:09 20:42	05:09 20:43	05:53 20:10	06:30 19:14	07:06 (6) 07:32 (6)	07:07 18:18	07:25 16:15
13	07:32 16:37	07:01 17:20	06:14 17:59	06:17 19:38	05:30 20:14	05:09 20:43	05:09 20:43	05:55 20:08	06:32 19:12	07:05 (6) 07:33 (6)	07:08 18:16	07:26 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	05:29 20:15	05:09 20:44	05:09 20:42	05:56 20:07	06:33 19:10	07:04 (6) 07:32 (6)	07:10 18:14	07:26 16:15
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:17	05:09 20:44	05:09 20:41	05:57 20:05	06:34 19:09	07:03 (6) 07:33 (6)	07:11 18:13	07:27 16:15
16	07:31 16:41	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	05:09 20:44	05:09 20:41	05:58 20:04	06:35 19:07	07:03 (6) 07:33 (6)	07:12 18:11	07:28 16:15
17	07:30 16:43	06:55 17:26	06:06 18:04	06:09 19:43	05:26 20:19	05:09 20:45	05:09 20:40	05:59 20:02	06:36 19:05	07:02 (6) 07:32 (6)	07:14 18:09	07:29 16:16
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	05:09 20:45	05:09 20:39	06:01 20:01	06:38 19:03	07:01 (6) 07:33 (6)	07:15 18:08	07:29 16:16
19	07:29 16:45	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:09 20:46	05:09 20:38	06:02 19:57	06:39 19:01	07:02 (6) 07:32 (6)	07:16 18:06	07:30 16:16
20	07:28 16:47	06:51 17:30	06:01 18:08	06:04 19:47	05:23 20:22	05:09 20:46	05:09 20:38	06:03 19:56	06:40 18:59	07:01 (6) 07:31 (6)	07:18 18:04	07:30 16:17
21	07:28 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:09 20:46	05:09 20:37	06:04 19:54	06:41 18:57	07:02 (6) 07:30 (6)	07:19 18:03	07:31 16:17
22	07:27 16:49	06:47 17:33	05:57 18:10	06:01 19:50	05:21 20:24	05:10 20:46	05:10 20:36	06:05 19:52	06:42 18:55	07:04 (6) 07:28 (6)	07:20 18:01	07:32 16:18
23	07:26 16:51	06:46 17:35	05:55 18:12	05:59 19:51	05:20 20:26	05:10 20:47	05:10 20:35	06:07 19:51	06:44 18:53	07:05 (6) 07:27 (6)	07:22 17:59	07:32 16:18
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:27	05:10 20:47	05:10 20:34	06:08 19:49	06:45 18:51	07:06 (6) 07:24 (6)	07:23 17:58	07:33 16:19
25	07:24 16:53	06:42 17:37	05:51 18:14	05:56 19:53	05:18 20:28	05:10 20:47	05:10 20:33	06:09 19:47	06:46 18:50	07:07 (6) 07:23 (6)	06:24 18:56	07:33 16:19
26	07:23 16:55	06:41 17:39	05:50 18:16	05:54 19:55	05:17 20:29	05:11 20:47	05:11 20:32	06:10 19:45	06:47 18:48	07:10 (6) 07:18 (6)	06:26 16:54	07:33 16:20
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:30	05:11 20:47	05:11 20:31	06:11 19:44	06:48 18:46	06:27 16:53	07:09 16:19	07:34 16:21
28	07:21 16:58	06:37 17:41	05:46 18:18	05:51 19:57	05:16 20:31	05:12 20:47	05:12 20:30	06:13 19:42	06:50 18:44	06:50 16:51	07:10 16:18	07:34 16:21
29	07:20 16:59	06:35 18:19	05:44 18:19	05:50 19:58	05:15 20:32	05:12 20:47	05:12 20:29	06:14 19:40	06:51 18:42	06:51 16:50	07:11 16:17	07:34 16:22
30	07:19 17:00	06:33 18:21	05:42 18:21	05:48 20:00	05:14 20:33	05:12 20:47	05:12 20:27	06:15 19:38	06:52 18:40	06:52 16:48	07:12 16:17	07:34 16:23
31	07:18 17:02	06:31 18:22	05:40 18:22	05:44 19:59	05:14 20:33	05:10 20:47	05:10 20:26	06:16 19:37	06:52 16:47	06:52 16:47	07:12 16:17	07:34 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	274
Total, worst case			368	92					472			
Sun reduction			0.50	0.55					0.55			
Oper. time red.			0.91	0.91					0.91			
Wind dir. red.			0.62	0.62					0.62			
Total reduction			0.28	0.31					0.31			
Total, real			104	29					147			

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:

060119 Marble River

Description:

Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 039 - 039

Assumptions for shadow calculations

Maximum distance for influence 1,000 m

Minimum sun height over horizon for influence 3 °

Day step for calculation 1 days

Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Table with 12 columns (January to December) and 31 rows (1 to 31) showing sunrise and sunset times for each day in each month, along with potential sun hours and various reduction factors.

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: 060119 Marble River

Description: Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 040 - 040

Assumptions for shadow calculations

Maximum distance for influence: 1,000 m
Minimum sun height over horizon for influence: 3 °
Day step for calculation: 1 days
Time step for calculation: 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Table with 12 columns for months (January-December) and rows for each day of the month. Columns contain start/end times for sun rise and set, and potential sun hours. A summary table at the bottom shows total values for sun hours and various reductions.

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

Matrix with 4 columns: 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: 060119 Marble River

Description: Marble River Wind Project Shadow-Flicker, N part 17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 041 - 041

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Table with sun shine probabilities for months Jan-Dec and wind directions N, NE, E, SE, S, SW, W, NW, Sum.

Main table showing shadow calculations for months January to December, including sun rise/set times, shadow length, and potential sun hours.

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

Matrix layout for each day in each month: Day in month, Sun rise/set, Minutes with flicker, Last time with flicker, WTG causing flicker.

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 047 - 047

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June			
1	07:35	08:23 (16)	07:17	06:35	16:18 (9)	05:38	05:47	05:13	
	16:25	24 08:47 (16)	17:03	17:43	48 17:06 (9)	18:23	20:00	20:34	
2	07:35	08:23 (16)	07:16	06:34	16:18 (9)	05:37	05:45	05:13	
	16:26	24 08:47 (16)	17:05	17:44	50 17:08 (9)	18:24	20:01	20:35	
3	07:35	08:25 (16)	07:15	06:32	16:17 (9)	05:35	05:44	05:12	
	16:27	22 08:47 (16)	17:06	17:46	52 17:09 (9)	18:26	20:02	20:36	
4	07:35	08:25 (16)	07:13	06:30	16:17 (9)	05:33	05:42	05:12	
	16:28	22 08:47 (16)	17:08	17:47	52 17:09 (9)	18:27	20:03	20:37	
5	07:35	08:27 (16)	07:12	06:28	16:17 (9)	06:31	05:41	05:11	
	16:29	20 08:47 (16)	17:09	17:48	52 17:09 (9)	19:28	20:05	20:38	
6	07:34	08:27 (16)	07:11	06:27	16:15 (9)	06:29	05:40	05:11	
	16:30	20 08:47 (16)	17:10	17:50	54 17:09 (9)	19:29	20:06	20:38	
7	07:34	08:29 (16)	07:10	06:25	16:15 (9)	06:27	05:38	05:11	
	16:31	18 08:47 (16)	17:12	17:51	54 17:09 (9)	19:31	20:07	20:39	
8	07:34	08:30 (16)	07:08	06:23	16:16 (9)	06:26	05:37	05:10	
	16:32	16 08:46 (16)	17:13	17:52	52 17:08 (9)	19:32	20:08	20:40	
9	07:34	08:30 (16)	07:07	06:21	16:16 (9)	06:24	05:36	05:10	
	16:33	16 08:46 (16)	17:15	17:54	52 17:08 (9)	19:33	20:10	20:41	
10	07:34	08:31 (16)	07:06	06:19	16:16 (9)	06:22	05:34	05:10	
	16:34	14 08:45 (16)	17:16	17:55	52 17:08 (9)	19:35	20:11	20:41	
11	07:33	08:33 (16)	07:04	06:18	16:14 (9)	06:20	05:33	05:09	
	16:35	12 08:45 (16)	17:18	17:56	54 17:08 (9)	19:36	20:12	20:42	
12	07:33	08:37 (16)	07:03	06:16	16:14 (9)	06:18	05:32	05:09	
	16:37	6 08:43 (16)	17:19	17:57	52 17:06 (9)	19:37	20:13	20:42	
13	07:32		07:01	06:14	16:16 (9)	06:17	05:30	05:09	
	16:38		17:21	17:59	50 17:06 (9)	19:38	20:14	20:43	
14	07:32		07:00	06:12	16:16 (9)	06:15	05:29	05:09	
	16:39		17:22	18:00	50 17:06 (9)	19:40	20:15	20:43	
15	07:31		06:58	06:10	16:17 (9)	06:13	05:28	05:09	
	16:40		17:23	18:01	48 17:05 (9)	19:41	20:17	20:44	
16	07:31		06:57	06:08	16:17 (9)	06:11	05:27	05:09	
	16:41		17:25	18:03	48 17:05 (9)	19:42	20:18	20:44	
17	07:30		06:55	06:06	16:17 (9)	06:10	05:26	05:09	
	16:43		17:26	18:04	46 17:03 (9)	19:43	20:19	20:45	
18	07:30		06:54	06:05	16:19 (9)	06:08	05:25	05:09	
	16:44		17:28	18:05	42 17:01 (9)	19:45	20:20	20:45	
19	07:29		06:52	16:41 (9)	06:03	16:19 (9)	06:06	05:24	05:09
	16:45		17:29	4 16:45 (9)	18:07	40 16:59 (9)	19:46	20:21	20:46
20	07:28		06:51	16:36 (9)	06:01	16:21 (9)	06:04	05:23	05:09
	16:47		17:30	18 16:54 (9)	18:08	38 16:59 (9)	19:47	20:22	20:46
21	07:28		06:49	16:32 (9)	05:59	16:21 (9)	06:03	05:22	05:09
	16:48		17:32	24 16:56 (9)	18:09	36 16:57 (9)	19:48	20:23	20:46
22	07:27		06:47	16:28 (9)	05:57	16:23 (9)	06:01	05:21	05:10
	16:49		17:33	30 16:58 (9)	18:10	30 16:53 (9)	19:50	20:24	20:46
23	07:26		06:46	16:27 (9)	05:55	16:25 (9)	05:59	05:20	05:10
	16:51		17:35	34 17:01 (9)	18:12	26 16:51 (9)	19:51	20:26	20:47
24	07:25		06:44	16:25 (9)	05:53	16:30 (9)	05:58	05:19	05:10
	16:52		17:36	38 17:03 (9)	18:13	18 16:48 (9)	19:52	20:27	20:47
25	07:24		06:42	16:23 (9)	05:51	16:34 (9)	05:56	05:18	05:10
	16:53		17:37	40 17:03 (9)	18:14	8 16:42 (9)	19:53	20:28	20:47
26	07:23		06:41	16:21 (9)	05:50		05:55	05:17	05:11
	16:55		17:39	44 17:05 (9)	18:16		19:55	20:29	20:47
27	07:22		06:39	16:22 (9)	05:48		05:53	05:17	05:11
	16:56		17:40	44 17:06 (9)	18:17		19:56	20:30	20:47
28	07:21		06:37	16:20 (9)	05:46		05:51	05:16	05:12
	16:58		17:41	46 17:06 (9)	18:18		19:57	20:31	20:47
29	07:20			05:44			05:50	05:15	05:12
	16:59			18:19			19:58	20:32	20:47
30	07:19			05:42			05:48	05:15	05:13
	17:00			18:21			20:00	20:32	20:47
31	07:18			05:40				05:14	
	17:02			18:22				20:33	
Potential sun hours	286	291	369	1104	380	-285	-254		
Total, worst case	214	322	1104						
Sun reduction	0.45	0.45	0.50						
Oper. time red.	0.91	0.91	0.91						
Wind dir. red.	0.69	0.56	0.56						
Total reduction	0.28	0.23	0.26						
Total, real	60	74	282						

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 047 - 047

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	06:17 19:35	06:53 18:38	16:55 (9) 17:47 (9)	06:34 16:46
2	05:14 20:47	05:42 20:24	06:19 19:33	06:55 18:36	16:54 (9) 17:46 (9)	06:35 16:44
3	05:14 20:47	05:43 20:22	06:20 19:31	06:56 18:34	16:53 (9) 17:45 (9)	06:36 16:43
4	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:33	16:52 (9) 17:46 (9)	06:38 16:41
5	05:15 20:46	05:45 20:20	06:22 19:27	06:58 18:31	16:52 (9) 17:46 (9)	06:39 16:40
6	05:16 20:46	05:46 20:19	06:23 19:26	07:00 18:29	16:51 (9) 17:45 (9)	06:41 16:39
7	05:17 20:45	05:48 20:17	06:24 19:24	07:01 18:27	16:52 (9) 17:44 (9)	06:42 16:37
8	05:17 20:45	05:49 20:16	06:26 19:22	07:02 18:25	16:51 (9) 17:43 (9)	06:43 16:36
9	05:18 20:45	05:50 20:14	06:27 19:20	07:03 18:23	16:51 (9) 17:43 (9)	06:45 16:35
10	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	16:52 (9) 17:42 (9)	06:46 16:34
11	05:20 20:44	05:52 20:11	06:29 19:16	07:06 18:20	16:51 (9) 17:41 (9)	06:47 16:33
12	05:21 20:43	05:54 20:10	06:30 19:14	07:07 18:18	16:53 (9) 17:41 (9)	06:49 16:31
13	05:21 20:43	05:55 20:08	06:32 19:12	07:08 18:16	16:52 (9) 17:40 (9)	06:50 16:30
14	05:22 20:42	05:56 20:07	06:33 19:10	07:10 18:14	16:53 (9) 17:39 (9)	06:52 16:29
15	05:23 20:41	05:57 20:05	06:34 19:09	07:11 18:13	16:53 (9) 17:37 (9)	06:53 16:28
16	05:24 20:41	05:58 20:04	06:35 19:07	07:12 18:11	16:54 (9) 17:36 (9)	06:54 16:27
17	05:25 20:40	05:59 20:02	06:36 19:05	07:14 18:09	16:55 (9) 17:35 (9)	06:56 16:26
18	05:26 20:39	06:01 20:01	06:38 19:03	07:15 18:08	16:57 (9) 17:33 (9)	06:57 16:25
19	05:27 20:38	06:02 19:57	06:39 19:01	17:16 (9) 17:34 (9)	06:58 (9) 18:06	06:58 16:24
20	05:28 20:37	06:03 19:56	06:40 18:59	17:13 (9) 17:37 (9)	07:18 18:04	07:00 16:24
21	05:29 20:37	06:04 19:54	06:41 18:57	17:10 (9) 17:38 (9)	07:19 18:03	07:01 16:23
22	05:30 20:36	06:05 19:52	06:42 18:55	17:08 (9) 17:42 (9)	07:20 18:01	07:02 16:22
23	05:31 20:35	06:07 19:51	06:44 18:53	17:05 (9) 17:43 (9)	07:22 17:59	07:04 16:21
24	05:32 20:34	06:08 19:49	06:45 18:51	17:04 (9) 17:44 (9)	07:23 17:58	07:05 16:20
25	05:33 20:33	06:09 19:47	06:46 18:50	17:01 (9) 17:43 (9)	06:24 16:56	07:06 16:20
26	05:34 20:32	06:10 19:45	06:47 18:48	17:00 (9) 17:44 (9)	06:26 16:54	07:07 16:19
27	05:35 20:31	06:11 19:44	06:48 18:46	16:58 (9) 17:46 (9)	06:27 16:53	07:09 16:19
28	05:36 20:30	06:13 19:42	06:50 18:44	16:57 (9) 17:45 (9)	06:28 16:51	07:10 16:18
29	05:37 20:29	06:14 19:40	06:51 18:42	16:56 (9) 17:46 (9)	06:30 16:50	07:11 16:17
30	05:38 20:27	06:15 19:38	06:52 18:40	16:55 (9) 17:45 (9)	06:31 16:48	07:12 16:17
31	05:40 20:26	06:16 19:37		06:32 16:47		07:13 16:17
Potential sun hours	-272	4	376	341	288	274
Total, worst case			464	976	6	694
Sun reduction			0.55	0.45	0.35	0.35
Oper. time red.			0.91	0.91	0.91	0.91
Wind dir. red.			0.56	0.56	0.69	0.69
Total reduction			0.28	0.23	0.22	0.22
Total, real			131	225	1	153

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: 060119 Marble River

Description: Marble River Wind Project Shadow-Flicker, N part 17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 048 - 048

Assumptions for shadow calculations

Maximum distance for influence 1,000 m Minimum sun height over horizon for influence 3 ° Day step for calculation 1 days Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time N NE E SE S SW W NW Sum 1,850 1,325 800 713 625 663 700 1,275 7,950

Table with columns for months (January to December) and rows for time intervals (07:35 to 17:02). Includes summary rows for Total sun hours, Total, worst case, Sun reduction, Oper. time red., Wind dir. red., Total reduction, and 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) First time (hh:mm) with flicker (WTG causing flicker first time) Last time (hh:mm) with flicker (WTG causing flicker last time)

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 049 - 049

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:35	07:17	07:43 (13)	06:35	05:38	05:13
	16:25	17:03	72 16:19 (11)	17:43	18:23	20:00
2	07:35	07:16	07:44 (13)	06:34	05:37	05:13
	16:26	17:05	72 16:20 (11)	17:44	18:24	20:01
3	07:35	07:15	07:45 (13)	06:32	05:35	05:12
	16:27	17:06	70 16:19 (11)	17:46	18:26	20:02
4	07:35	07:13	07:45 (13)	06:30	05:33	05:12
	16:28	17:08	70 16:19 (11)	17:47	18:27	20:03
5	07:35	07:12	07:46 (13)	06:28	06:31	05:11
	16:29	17:09	68 16:20 (11)	17:48	19:28	20:05
6	07:34	07:11	07:47 (13)	06:27	06:29	05:11
	16:30	17:10	66 16:21 (11)	17:50	19:29	20:06
7	07:34	07:10	07:49 (13)	06:25	06:27	05:11
	16:31	17:12	62 16:19 (11)	17:51	19:31	20:07
8	07:34	07:08	07:50 (13)	06:23	06:26	05:10
	16:32	17:13	60 16:20 (11)	17:52	19:32	20:08
9	07:34	07:07	15:30 (11)	06:21	06:24	05:10
	16:33	17:15	50 16:20 (11)	17:54	19:33	20:10
10	07:33	07:06	15:31 (11)	06:19	06:22	05:10
	16:34	17:16	48 16:19 (11)	17:55	19:35	20:11
11	07:33	15:45 (11)	07:04	15:32 (11)	06:18	05:09
	16:35	6 15:51 (11)	17:18	48 16:20 (11)	17:56	20:12
12	07:33	15:43 (11)	07:03	15:32 (11)	06:16	05:09
	16:37	12 15:55 (11)	17:19	46 16:18 (11)	17:57	20:13
13	07:32	15:40 (11)	07:01	15:33 (11)	06:14	05:09
	16:38	18 15:58 (11)	17:21	46 16:19 (11)	17:59	20:14
14	07:32	15:37 (11)	07:00	15:33 (11)	06:12	05:09
	16:39	22 15:59 (11)	17:22	44 16:17 (11)	18:00	20:15
15	07:31	15:37 (11)	06:58	15:36 (11)	06:10	05:09
	16:40	24 16:01 (11)	17:23	42 16:18 (11)	18:01	20:17
16	07:31	15:36 (11)	06:57	15:36 (11)	06:08	05:09
	16:41	26 16:02 (11)	17:25	40 16:16 (11)	18:03	20:18
17	07:30	15:36 (11)	06:55	15:36 (11)	06:06	05:09
	16:43	28 16:04 (11)	17:26	38 16:14 (11)	18:04	20:19
18	07:30	15:35 (11)	06:54	15:39 (11)	06:05	05:09
	16:44	32 16:07 (11)	17:28	34 16:13 (11)	18:05	20:20
19	07:29	15:34 (11)	06:52	15:39 (11)	06:03	05:09
	16:45	34 16:08 (11)	17:29	32 16:11 (11)	18:07	20:21
20	07:28	15:33 (11)	06:51	15:42 (11)	06:01	05:09
	16:47	36 16:09 (11)	17:30	28 16:10 (11)	18:08	20:22
21	07:27	07:50 (13)	06:49	15:44 (11)	05:59	05:09
	16:48	44 16:10 (11)	17:32	24 16:08 (11)	18:09	20:23
22	07:27	07:50 (13)	06:47	15:48 (11)	05:57	05:10
	16:49	48 16:12 (11)	17:33	16 16:04 (11)	18:10	20:24
23	07:26	07:49 (13)	06:46	15:55 (11)	05:55	05:10
	16:51	54 16:13 (11)	17:35	4 15:59 (11)	18:12	20:26
24	07:25	07:48 (13)	06:44	05:53	06:20 (16)	05:58
	16:52	56 16:14 (11)	17:36	18 16:13 (11)	19:52	20:27
25	07:24	07:47 (13)	06:42	05:51	06:16 (16)	05:56
	16:53	60 16:15 (11)	17:37	18:14	24 06:40 (16)	19:53
26	07:23	07:46 (13)	06:41	05:50	06:14 (16)	05:55
	16:55	64 16:16 (11)	17:39	18:16	28 06:42 (16)	19:55
27	07:22	07:45 (13)	06:39	05:48	06:12 (16)	05:53
	16:56	66 16:17 (11)	17:40	18:17	32 06:44 (16)	19:56
28	07:21	07:44 (13)	06:37	05:46	06:10 (16)	05:51
	16:58	66 16:16 (11)	17:41	18:18	34 06:44 (16)	19:57
29	07:20	07:42 (13)		05:44	06:10 (16)	05:50
	16:59	68 16:16 (11)		18:19	34 06:44 (16)	19:58
30	07:19	07:43 (13)		05:42	06:08 (16)	05:48
	17:00	70 16:17 (11)		18:21	36 06:44 (16)	20:00
31	07:18	07:42 (13)		05:40	06:06 (16)	05:46
	17:02	72 16:18 (11)		18:22	40 06:46 (16)	20:03
Potential sun hours	286	291	369	380	-285	-254
Total, worst case	906	1080	256	618		
Sun reduction	0.45	0.45	0.50	0.55		
Oper. time red.	0.91	0.91	0.91	0.91		
Wind dir. red.	0.61	0.61	0.62	0.62		
Total reduction	0.25	0.25	0.28	0.31		
Total, real	225	267	72	191		

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

Day in month	Sun rise (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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 049 - 049

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	06:17 19:35	07:03 (16) 07:39 (16)	06:53 18:38	06:34 15:01 (11)
2	05:14 20:47	05:42 20:24	06:19 19:33	07:02 (16) 07:40 (16)	06:55 18:36	48 15:49 (11)
3	05:14 20:47	05:43 20:22	06:20 19:31	07:02 (16) 07:40 (16)	06:56 18:34	6 15:33 (11)
4	05:15 20:46	05:44 20:21	06:21 19:29	07:01 (16) 07:41 (16)	06:57 18:33	15:16 (11)
5	05:15 20:46	05:45 20:20	06:22 19:27	07:00 (16) 07:40 (16)	06:58 18:31	15:16 (11)
6	05:16 20:46	05:46 20:19	06:23 19:26	06:59 (16) 07:41 (16)	07:00 18:29	15:16 (11)
7	05:17 20:45	05:48 20:17	06:24 19:24	07:00 (16) 07:40 (16)	07:01 18:27	15:16 (11)
8	05:17 20:45	05:49 20:16	06:26 19:22	06:59 (16) 07:39 (16)	07:02 18:25	15:16 (11)
9	05:18 20:45	05:50 20:14	06:27 19:20	06:58 (16) 07:38 (16)	07:03 18:23	15:16 (11)
10	05:19 20:44	05:51 20:13	06:28 19:18	06:58 (16) 07:40 (16)	07:05 18:22	15:16 (11)
11	05:20 20:44	05:52 20:11	06:29 19:16	06:59 (16) 07:39 (16)	07:06 18:20	15:16 (11)
12	05:21 20:43	05:54 20:10	06:30 19:14	06:58 (16) 07:38 (16)	07:07 18:18	15:16 (11)
13	05:21 20:43	05:55 20:08	06:32 19:12	06:59 (16) 07:37 (16)	07:08 18:16	15:16 (11)
14	05:22 20:42	05:56 20:07	06:33 19:10	07:00 (16) 07:36 (16)	07:10 18:14	15:16 (11)
15	05:23 20:41	05:57 20:05	06:34 19:09	06:59 (16) 07:33 (16)	07:11 18:13	15:16 (11)
16	05:24 20:41	05:58 20:04	06:35 19:07	07:01 (16) 07:33 (16)	07:12 18:11	15:16 (11)
17	05:25 20:40	05:59 20:02	06:36 19:05	07:02 (16) 07:30 (16)	07:14 18:09	15:16 (11)
18	05:26 20:39	06:01 20:01	06:38 19:03	07:03 (16) 07:29 (16)	07:15 18:08	15:16 (11)
19	05:27 20:38	06:02 19:57	06:39 19:01	07:06 (16) 07:26 (16)	07:16 18:06	15:16 (11)
20	05:28 20:37	06:03 19:56	06:40 18:59	07:09 (16) 07:21 (16)	07:18 18:04	15:16 (11)
21	05:29 20:37	06:04 19:54	06:41 18:57	07:19 18:03	07:19 16:39 (11)	15:16 (11)
22	05:30 20:36	06:05 19:52	06:42 18:55	07:20 18:01	07:02 16:12 (11)	15:16 (11)
23	05:31 20:35	06:07 19:51	06:44 18:53	07:21 17:59	07:04 16:12 (11)	15:16 (11)
24	05:32 20:34	06:08 19:49	06:45 18:51	07:23 17:58	07:05 16:13 (11)	15:16 (11)
25	05:33 20:33	06:09 19:47	07:17 (16) 07:29 (16)	06:46 18:50	07:06 16:56	15:16 (11)
26	05:34 20:32	06:10 19:45	07:13 (16) 07:33 (16)	06:47 18:48	06:26 16:54	15:16 (11)
27	05:35 20:31	06:11 19:44	07:12 (16) 07:36 (16)	06:48 18:46	06:27 16:53	15:16 (11)
28	05:36 20:30	06:13 19:42	07:09 (16) 07:37 (16)	06:50 18:44	06:28 16:51	15:16 (11)
29	05:37 20:29	06:14 19:40	07:08 (16) 07:38 (16)	06:51 18:42	06:30 16:50	15:16 (11)
30	05:38 20:27	06:15 19:38	07:05 (16) 07:39 (16)	06:52 18:40	06:31 16:48	15:16 (11)
31	05:40 20:26	06:16 19:37	07:04 (16) 07:38 (16)	06:52 16:47	15:01 (11) 15:49 (11)	15:16 (11)
Potential sun hours	-272	4	376	341	288	274
Total, worst case		182	702	460	1546	6
Sun reduction		0.55	0.55	0.45	0.35	0.35
Oper. time red.		0.91	0.91	0.91	0.91	0.91
Wind dir. red.		0.62	0.62	0.60	0.61	0.60
Total reduction		0.31	0.31	0.24	0.19	0.19
Total, real		56	217	113	299	1

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)

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, N part
 17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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01/20/06 13:37 / 23

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Wind Engineers, Inc.
 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated:

01/20/06 13:20/2.4.0.67

SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 354 - 354

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:35 16:25	07:17 17:03	06:35 17:43	06:56 (13) 07:20 (13)	05:38 18:23	05:47 18:28 (11)
2	07:35 16:26	07:16 17:05	06:34 17:44	06:56 (13) 07:20 (13)	05:37 18:24	05:45 18:28 (11)
3	07:35 16:27	07:15 17:06	06:32 17:46	06:55 (13) 07:21 (13)	05:35 18:26	05:44 18:31 (11)
4	07:35 16:28	07:13 17:08	06:30 17:47	06:55 (13) 07:21 (13)	05:33 18:27	05:42 18:32 (11)
5	07:35 16:29	07:12 17:09	06:28 17:48	06:53 (13) 07:21 (13)	06:31 19:28	05:41 19:04 (11)
6	07:34 16:30	07:11 17:10	06:27 17:50	06:53 (13) 07:21 (13)	06:29 19:29	05:40 19:03 (11)
7	07:34 16:31	07:10 17:12	06:25 17:51	06:53 (13) 07:21 (13)	06:27 19:31	18:45 (11) 19:01 (11)
8	07:34 16:32	07:08 17:13	06:23 17:52	06:54 (13) 07:20 (13)	06:26 19:32	18:42 (11) 19:04 (11)
9	07:34 16:33	07:07 17:15	06:21 17:54	06:54 (13) 07:20 (13)	06:24 19:33	18:38 (11) 19:06 (11)
10	07:33 16:34	07:06 17:16	06:19 17:55	06:54 (13) 07:18 (13)	06:22 19:35	18:36 (11) 19:08 (11)
11	07:33 16:35	07:04 17:18	06:18 17:56	06:56 (13) 07:16 (13)	06:20 19:36	18:34 (11) 19:08 (11)
12	07:33 16:37	07:03 17:19	06:16 17:57	06:56 (13) 07:14 (13)	06:18 19:37	18:33 (11) 19:11 (11)
13	07:32 16:38	07:01 17:21	06:14 17:59	06:58 (13) 07:12 (13)	06:17 19:38	18:33 (11) 19:11 (11)
14	07:32 16:39	07:00 17:22	06:12 18:00	07:02 (13) 07:06 (13)	06:15 19:40	18:31 (11) 19:11 (11)
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	18:29 (11) 19:11 (11)	05:28 20:17
16	07:31 16:41	06:57 17:25	06:08 18:03	06:11 19:42	18:30 (11) 19:12 (11)	05:27 20:18
17	07:30 16:43	06:55 17:26	06:06 18:04	06:10 19:43	18:28 (11) 19:12 (11)	05:26 20:19
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 19:45	18:28 (11) 19:12 (11)	05:25 20:20
19	07:29 16:45	06:52 17:29	06:03 18:07	06:06 19:46	18:27 (11) 19:13 (11)	05:24 20:21
20	07:28 16:47	06:51 17:30	06:01 18:08	06:04 19:47	18:27 (11) 19:13 (11)	05:23 20:22
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	18:27 (11) 19:13 (11)	05:22 20:23
22	07:27 16:49	06:47 17:33	05:57 18:10	06:01 19:50	18:26 (11) 19:12 (11)	05:21 20:24
23	07:26 16:51	06:46 17:35	05:55 18:12	05:59 19:51	18:26 (11) 19:12 (11)	05:20 20:25
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	18:26 (11) 19:12 (11)	05:19 20:27
25	07:24 16:53	06:42 17:37	07:03 (13) 07:15 (13)	05:51 18:14	05:56 19:53	18:27 (11) 19:11 (11)
26	07:23 16:55	06:41 17:39	07:01 (13) 07:17 (13)	05:50 18:16	05:55 19:55	18:27 (11) 19:11 (11)
27	07:22 16:56	06:39 17:40	07:00 (13) 07:20 (13)	05:48 18:17	05:53 19:56	18:26 (11) 19:10 (11)
28	07:21 16:58	06:37 17:41	06:58 (13) 07:20 (13)	05:46 18:18	05:51 19:57	18:26 (11) 19:10 (11)
29	07:20 16:59		05:44 18:19	05:50 19:58	18:27 (11) 19:09 (11)	05:15 20:32
30	07:19 17:00		05:42 18:21	05:48 20:00	18:27 (11) 19:09 (11)	05:15 20:32
31	07:18 17:02		05:40 18:22		05:14 20:33	
Potential sun hours	286	291	369	380	-285	-254
Total, worst case		70	316	956	284	
Sun reduction		0.45	0.50	0.55	0.55	
Oper. time red.		0.91	0.91	0.91	0.91	
Wind dir. red.		0.62	0.62	0.63	0.63	
Total reduction		0.25	0.28	0.31	0.31	
Total, real		18	89	298	89	

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)
	Minutes with flicker		

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, N part
 17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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01/20/06 13:37 / 24

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Wind Engineers, Inc.
 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated:

01/20/06 13:20/2.4.0.67

SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 354 - 354

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
 N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	06:17 19:35	18:33 (11) 18:38	07:37 (13) 07:53 (13)	06:34 16:46
2	05:14 20:47	05:42 20:24	18:58 (11) 19:02 (11)	18:34 (11) 18:36 (11)	07:34 (13) 07:54 (13)	16:17 16:44
3	05:14 20:47	05:43 20:22	18:51 (11) 19:05 (11)	18:36 (11) 19:04 (11)	07:33 (13) 07:55 (13)	16:35 16:43
4	05:15 20:46	05:44 20:21	18:48 (11) 19:08 (11)	18:39 (11) 19:01 (11)	07:32 (13) 07:56 (13)	16:38 16:41
5	05:15 20:46	05:45 20:20	18:47 (11) 19:09 (11)	18:42 (11) 18:58 (11)	07:32 (13) 07:58 (13)	16:39 16:40
6	05:16 20:46	05:46 20:19	18:44 (11) 19:12 (11)	18:44 (11) 18:29	07:31 (13) 07:57 (13)	16:41 16:39
7	05:17 20:45	05:48 20:17	18:43 (11) 19:13 (11)	18:43 (11) 18:27	07:30 (13) 07:56 (13)	16:42 16:37
8	05:18 20:45	05:49 20:16	18:42 (11) 19:14 (11)	18:42 (11) 18:25	07:29 (13) 07:57 (13)	16:43 16:36
9	05:18 20:45	05:50 20:14	18:39 (11) 19:15 (11)	18:41 (11) 18:23	07:29 (13) 07:57 (13)	16:45 16:35
10	05:19 20:44	05:51 20:13	18:38 (11) 19:16 (11)	18:40 (11) 18:22	07:28 (13) 07:56 (13)	16:46 16:34
11	05:20 20:44	05:52 20:11	18:38 (11) 19:16 (11)	18:39 (11) 18:20	07:29 (13) 07:55 (13)	16:47 16:33
12	05:21 20:43	05:54 20:10	18:37 (11) 19:17 (11)	18:38 (11) 18:18	07:29 (13) 07:55 (13)	16:49 16:31
13	05:21 20:43	05:55 20:08	18:36 (11) 19:18 (11)	18:37 (11) 18:16	07:30 (13) 07:54 (13)	16:50 16:30
14	05:22 20:42	05:56 20:07	18:35 (11) 19:17 (11)	18:36 (11) 18:14	07:31 (13) 07:51 (13)	16:52 16:29
15	05:23 20:41	05:57 20:05	18:34 (11) 19:18 (11)	18:35 (11) 18:13	07:33 (13) 07:51 (13)	16:53 16:28
16	05:24 20:41	05:58 20:04	18:33 (11) 19:17 (11)	18:34 (11) 18:11	07:34 (13) 07:48 (13)	16:54 16:27
17	05:25 20:40	05:59 20:02	18:32 (11) 19:18 (11)	18:33 (11) 18:09	07:37 (13) 07:45 (13)	16:56 16:26
18	05:26 20:39	06:01 20:01	18:31 (11) 19:17 (11)	18:32 (11) 18:08	07:40 (13) 18:08	16:57 16:25
19	05:27 20:38	06:02 19:57	18:30 (11) 19:19 (11)	18:31 (11) 18:06	07:43 (13) 18:06	16:58 16:24
20	05:28 20:37	06:03 19:56	18:30 (11) 19:18 (11)	18:30 (11) 18:04	07:46 (13) 18:04	16:59 16:23
21	05:29 20:37	06:04 19:54	18:30 (11) 19:17 (11)	18:29 (11) 18:03	07:49 (13) 18:03	17:01 16:23
22	05:30 20:36	06:05 19:52	18:30 (11) 19:18 (11)	18:28 (11) 18:01	07:52 (13) 18:01	17:02 16:22
23	05:31 20:35	06:07 19:51	18:30 (11) 19:17 (11)	18:27 (11) 17:59	07:55 (13) 18:01	17:04 16:21
24	05:32 20:34	06:08 19:49	18:30 (11) 19:16 (11)	18:26 (11) 17:58	07:58 (13) 18:02	17:05 16:19
25	05:33 20:33	06:09 19:47	18:31 (11) 19:15 (11)	18:25 (11) 17:56	08:01 (13) 18:03	17:06 16:18
26	05:34 20:32	06:10 19:45	18:31 (11) 19:15 (11)	18:24 (11) 17:54	08:04 (13) 18:04	17:07 16:19
27	05:35 20:31	06:11 19:44	18:32 (11) 19:14 (11)	18:23 (11) 17:53	08:07 (13) 18:05	17:09 16:20
28	05:36 20:30	06:13 19:42	18:31 (11) 19:13 (11)	18:22 (11) 17:51	08:10 (13) 18:06	17:10 16:21
29	05:37 20:29	06:14 19:40	18:32 (11) 19:12 (11)	18:21 (11) 17:50	08:13 (13) 18:07	17:11 16:22
30	05:39 20:27	06:15 19:38	18:33 (11) 19:11 (11)	18:20 (11) 17:48	08:16 (13) 18:08	17:12 16:23
31	05:40 20:26	06:16 19:37	18:32 (11) 19:10 (11)	18:19 (11) 17:47	08:19 (13) 18:09	17:13 16:24
Potential sun hours	-272	4	376	341	288	274
Total, worst case		1128	144	380		
Sun reduction		0.55	0.55	0.45		
Oper. time red.		0.91	0.91	0.91		
Wind dir. red.		0.63	0.62	0.62		
Total reduction		0.31	0.31	0.25		
Total, real		352	45	96		

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)
	Minutes with flicker		

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, N part
 17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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01/20/06 13:37 / 25

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Wind Engineers, Inc.
 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated:

01/20/06 13:20/2.4.0.67

SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 355 - 355

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:35 16:25	07:17 17:03	06:35 17:43	15:52 (11) 18:23	05:38 20:00	06:32 (16) 20:34
2	07:35 16:26	07:16 17:05	06:34 17:44	15:52 (11) 18:24	05:37 20:01	06:34 (16) 20:35
3	07:35 16:27	07:15 17:06	07:37 (13) 17:46	15:53 (11) 18:26	05:35 20:02	06:35 (16) 20:36
4	07:35 16:28	07:13 17:08	07:35 (13) 17:47	15:53 (11) 18:27	05:33 20:03	06:36 (16) 20:37
5	07:35 16:29	07:12 17:09	07:34 (13) 17:48	15:53 (11) 19:28	06:31 20:05	06:36 (16) 20:38
6	07:34 16:30	07:11 17:10	07:33 (13) 17:50	15:53 (11) 19:29	06:29 20:06	06:39 (16) 20:38
7	07:34 16:31	07:10 17:12	07:31 (13) 17:51	15:53 (11) 19:31	06:27 20:07	06:42 (16) 20:39
8	07:34 16:32	07:08 17:13	07:30 (13) 17:52	15:56 (11) 19:32	06:26 20:08	06:46 (16) 20:40
9	07:34 16:33	07:07 17:15	07:28 (13) 17:54	15:56 (11) 19:33	06:24 20:10	06:50 (16) 20:40
10	07:33 16:34	07:06 17:16	07:27 (13) 17:55	15:58 (11) 19:35	06:22 20:11	06:46 (16) 20:41
11	07:33 16:35	07:04 17:18	07:28 (13) 17:56	15:58 (11) 19:36	06:20 20:12	06:42 (16) 20:42
12	07:33 16:37	07:03 17:19	07:28 (13) 17:57	16:00 (11) 19:37	06:18 20:13	06:41 (16) 20:42
13	07:32 16:38	07:01 17:21	07:27 (13) 17:59	16:02 (11) 19:38	06:17 20:14	06:39 (16) 20:43
14	07:32 16:39	07:00 17:22	07:27 (13) 18:00	16:04 (11) 19:40	06:15 20:15	06:37 (16) 20:43
15	07:31 16:40	06:58 17:23	07:28 (13) 18:01	16:08 (11) 19:41	06:13 20:17	06:35 (16) 20:44
16	07:31 16:41	06:57 17:25	07:30 (13) 18:03	16:13 (11) 19:42	06:11 20:18	06:36 (16) 20:44
17	07:30 16:43	06:55 17:26	07:30 (13) 18:04	16:23 (11) 19:43	06:10 20:19	06:34 (16) 20:45
18	07:30 16:44	06:54 17:28	07:33 (13) 18:05	16:08 19:45	06:08 20:20	06:32 (16) 20:45
19	07:29 16:45	06:52 17:29	07:35 (13) 18:07	16:06 19:46	06:06 20:21	06:33 (16) 20:46
20	07:28 16:47	06:51 17:30	15:54 (11) 18:08	16:04 19:47	06:31 (16) 20:22	06:31 (16) 20:46
21	07:27 16:48	06:49 17:32	15:52 (11) 18:09	16:03 19:48	06:31 (16) 20:23	06:31 (16) 20:46
22	07:27 16:49	06:47 17:33	15:52 (11) 18:10	16:01 19:50	06:32 (16) 20:24	06:32 (16) 20:46
23	07:26 16:51	06:46 17:35	15:53 (11) 18:12	16:03 19:51	06:30 (16) 20:25	06:30 (16) 20:47
24	07:25 16:52	06:44 17:36	15:51 (11) 18:13	16:05 19:52	06:30 (16) 20:27	06:30 (16) 20:47
25	07:24 16:53	06:42 17:37	15:51 (11) 18:14	16:05 19:53	06:31 (16) 20:28	06:31 (16) 20:47
26	07:23 16:55	06:41 17:39	15:51 (11) 18:16	16:05 19:55	06:31 (16) 20:29	06:31 (16) 20:47
27	07:22 16:56	06:39 17:40	15:52 (11) 18:17	16:05 19:56	06:32 (16) 20:30	06:32 (16) 20:47
28	07:21 16:58	06:37 17:41	15:52 (11) 18:18	16:05 19:57	06:30 (16) 20:31	06:30 (16) 20:47
29	07:20 16:59		05:44 18:19	16:05 19:58	06:31 (16) 20:32	06:31 (16) 20:47
30	07:19 17:00		05:42 18:21	16:05 20:00	06:31 (16) 20:32	06:31 (16) 20:47
31	07:18 17:02		05:40 18:22		05:14 20:33	
Potential sun hours	286	291	369	380	285	254
Total, worst case		1344	676	730	172	
Sun reduction		0.45	0.50	0.55	0.55	
Oper. time red.		0.91	0.91	0.91	0.91	
Wind dir. red.		0.57	0.56	0.60	0.60	
Total reduction		0.23	0.26	0.30	0.30	
Total, real		315	172	217	51	

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)

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, N part
 17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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01/20/06 13:37 / 26

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Wind Engineers, Inc.
 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated:

01/20/06 13:20/2.4.0.67

SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 355 - 355

Assumptions for shadow calculations

Maximum distance for influence

1,000 m

Minimum sun height over horizon for influence

3 °

Day step for calculation

1 days

Time step for calculation

2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December	
1	05:13 20:47	05:41 20:25	06:17 19:35	06:41 (16) 07:03 (16)	06:53 18:38	16:41 (11) 16:46	06:57 (13) 16:17
2	05:14 20:47	05:42 20:24	06:19 19:33	06:44 (16) 07:00 (16)	06:55 18:36	16:38 (11) 17:16 (11)	06:58 (13) 16:16
3	05:14 20:47	05:43 20:22	06:20 19:31	06:48 (16) 06:56 (16)	06:56 18:34	16:35 (11) 17:17 (11)	07:00 (13) 16:16
4	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:33	06:57 18:33	16:34 (11) 17:18 (11)	07:01 (13) 16:16
5	05:15 20:46	05:45 20:20	06:53 (16) 07:01 (16)	06:22 19:27	06:58 18:31	16:32 (11) 17:20 (11)	06:39 16:40
6	05:16 20:46	05:46 20:19	06:50 (16) 07:06 (16)	06:23 19:26	07:00 18:29	16:31 (11) 17:21 (11)	06:41 16:39
7	05:17 20:45	05:48 20:17	06:47 (16) 07:07 (16)	06:24 19:24	07:01 18:27	16:30 (11) 17:20 (11)	06:42 16:37
8	05:18 20:45	05:49 20:16	06:46 (16) 07:08 (16)	06:26 19:22	07:02 18:25	16:29 (11) 17:21 (11)	06:43 16:36
9	05:18 20:45	05:50 20:14	06:45 (16) 07:11 (16)	06:27 19:20	07:03 18:23	16:27 (11) 17:21 (11)	06:45 16:35
10	05:19 20:44	05:51 20:13	06:42 (16) 07:12 (16)	06:28 19:18	07:05 18:22	16:26 (11) 17:22 (11)	06:46 16:34
11	05:20 20:44	05:52 20:11	06:42 (16) 07:14 (16)	06:29 19:16	07:06 18:20	16:25 (11) 17:21 (11)	06:47 16:33
12	05:21 20:43	05:54 20:10	06:41 (16) 07:13 (16)	06:30 19:14	07:07 18:18	16:25 (11) 17:21 (11)	06:49 16:31
13	05:21 20:43	05:55 20:08	06:40 (16) 07:14 (16)	06:32 19:12	07:08 18:16	16:24 (11) 17:22 (11)	06:50 16:30
14	05:22 20:42	05:56 20:07	06:39 (16) 07:15 (16)	06:33 19:10	07:10 18:14	16:23 (11) 17:21 (11)	06:52 16:29
15	05:23 20:41	05:57 20:05	06:38 (16) 07:14 (16)	06:34 19:09	07:11 18:13	16:23 (11) 17:21 (11)	06:53 16:28
16	05:24 20:41	05:58 20:04	06:37 (16) 07:15 (16)	06:35 19:07	07:12 18:11	16:24 (11) 17:22 (11)	06:54 16:27
17	05:25 20:40	05:59 20:02	06:38 (16) 07:16 (16)	06:36 19:05	07:14 18:09	16:23 (11) 17:21 (11)	06:56 16:26
18	05:26 20:39	06:01 20:01	06:37 (16) 07:15 (16)	06:38 19:03	07:15 18:08	16:23 (11) 17:21 (11)	06:57 16:25
19	05:27 20:38	06:02 19:57	06:37 (16) 07:17 (16)	06:39 19:01	07:16 18:06	16:22 (11) 17:20 (11)	06:58 16:24
20	05:28 20:37	06:03 19:56	06:36 (16) 07:16 (16)	06:40 18:59	07:18 18:04	16:24 (11) 17:20 (11)	07:00 16:24
21	05:29 20:37	06:04 19:54	06:37 (16) 07:15 (16)	06:41 18:57	07:19 18:03	16:23 (11) 17:19 (11)	07:01 16:23
22	05:30 20:36	06:05 19:52	06:36 (16) 07:16 (16)	06:42 18:55	07:20 18:01	16:22 (11) 17:18 (11)	07:02 16:22
23	05:31 20:35	06:07 19:51	06:35 (16) 07:15 (16)	06:44 18:53	07:21 17:59	08:04 (13) 17:18 (11)	07:04 16:21
24	05:32 20:34	06:08 19:49	06:36 (16) 07:14 (16)	06:45 18:51	07:23 17:58	08:01 (13) 17:17 (11)	07:05 16:20
25	05:33 20:33	06:09 19:47	06:35 (16) 07:13 (16)	06:46 18:50	06:24 16:56	07:01 (13) 16:17 (11)	07:06 16:20
26	05:34 20:32	06:10 19:45	06:37 (16) 07:13 (16)	06:47 18:48	06:26 16:54	06:58 (13) 16:16 (11)	07:07 16:19
27	05:35 20:31	06:11 19:44	06:38 (16) 07:12 (16)	06:48 18:46	06:27 16:53	06:57 (13) 16:13 (11)	07:09 16:19
28	05:36 20:30	06:13 19:42	06:37 (16) 07:11 (16)	06:50 18:44	06:28 16:51	06:57 (13) 16:13 (11)	07:10 16:18
29	05:37 20:29	06:14 19:40	06:38 (16) 07:10 (16)	06:51 18:42	06:30 16:50	06:56 (13) 16:12 (11)	07:11 16:17
30	05:39 20:27	06:15 19:38	06:39 (16) 07:07 (16)	06:52 18:40	06:31 16:48	06:56 (13) 16:10 (11)	07:12 16:17
31	05:40 20:26	06:16 19:37	06:40 (16) 07:06 (16)	06:53 18:40	06:32 16:47	06:57 (13) 16:09 (11)	07:13 16:24
Potential sun hours	-272	4	376	341	288	244	274
Total, worst case		870	120	1748		244	
Sun reduction		0.55	0.55	0.45		0.35	
Oper. time red.		0.91	0.91	0.91		0.91	
Wind dir. red.		0.60	0.58	0.57		0.59	
Total reduction		0.30	0.29	0.23		0.19	
Total, real		259	34	405		46	

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

Day in month	Sun rise (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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/20/06 13:20/2.4.0.67

SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 356 - 356

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes
Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:35 16:25	07:17 17:03	07:39 (13) 17:43	06:35 17:04 (11)	05:38 18:23	05:47 20:00
2	07:35 16:26	07:16 17:05	07:38 (13) 17:44	06:34 17:04 (11)	05:37 18:24	05:45 20:01
3	07:35 16:27	07:15 17:06	07:36 (13) 17:46	06:32 17:03 (11)	05:35 18:26	05:44 20:02
4	07:35 16:28	07:13 17:08	07:37 (13) 17:47	06:30 17:03 (11)	05:33 18:27	05:42 20:03
5	07:35 16:29	07:12 17:09	07:36 (13) 17:48	06:28 17:03 (11)	06:31 19:28	05:41 20:05
6	07:34 16:30	07:11 17:10	07:37 (13) 17:50	06:27 17:01 (11)	06:29 19:29	05:40 20:06
7	07:34 16:31	07:10 17:12	07:37 (13) 17:51	06:25 17:01 (11)	06:27 19:31	05:38 20:07
8	07:34 16:32	07:08 17:13	07:38 (13) 17:52	06:23 17:00 (11)	06:26 19:32	05:37 20:08
9	07:34 16:33	07:07 17:15	07:38 (13) 17:54	06:21 16:58 (11)	06:24 19:33	05:36 20:09
10	07:33 16:34	07:06 17:16	07:39 (13) 17:55	06:19 16:58 (11)	06:22 19:35	05:34 20:11
11	07:33 16:35	07:04 17:18	07:40 (13) 17:56	06:18 16:56 (11)	06:20 19:36	05:33 20:12
12	07:33 16:37	07:03 17:19	07:40 (13) 17:57	06:18 16:54 (11)	06:18 19:37	05:32 20:13
13	07:32 16:38	07:01 17:21	07:43 (13) 17:59	06:17 16:52 (11)	06:17 19:38	05:31 20:14
14	07:32 16:39	07:00 17:22	07:43 (13) 18:00	06:15 16:48 (11)	06:15 19:40	05:29 20:15
15	07:31 16:40	06:58 17:23	16:32 (11) 18:01	06:10 16:44 (11)	06:13 19:41	05:28 20:17
16	07:31 16:41	06:57 17:25	16:28 (11) 18:03	06:11 16:54 (11)	06:38 (16) 19:42	05:27 20:18
17	07:30 16:43	06:55 17:26	16:26 (11) 18:04	06:10 19:43	06:36 (16) 20:19	05:26 20:19
18	07:30 16:44	06:54 17:28	16:25 (11) 18:05	06:08 19:45	06:34 (16) 20:20	05:25 20:22
19	07:29 16:45	06:52 17:29	16:23 (11) 18:07	06:06 19:46	06:33 (16) 20:21	05:24 20:16
20	07:28 16:47	06:51 17:30	16:22 (11) 18:08	06:04 19:47	06:31 (16) 20:22	05:23 20:12
21	07:27 16:48	06:49 17:32	16:22 (11) 18:09	06:03 19:48	06:31 (16) 20:23	05:22 20:16
22	07:27 16:49	06:47 17:33	16:20 (11) 18:10	06:01 19:50	06:30 (16) 20:24	05:21 20:16
23	07:26 16:51	06:46 17:35	16:21 (11) 18:12	05:59 19:51	06:28 (16) 20:25	05:20 20:17
24	07:25 16:52	06:44 17:36	16:19 (11) 18:13	05:58 19:52	06:28 (16) 20:27	05:19 20:17
25	07:24 16:53	06:42 17:37	16:19 (11) 18:14	05:56 19:53	06:27 (16) 20:28	05:18 20:17
26	07:23 16:55	06:41 17:39	16:17 (11) 18:16	05:55 19:55	06:27 (16) 20:29	05:17 20:17
27	07:22 16:56	06:39 17:45 (13)	16:18 (11) 18:17	05:53 19:56	06:28 (16) 20:30	05:17 20:17
28	07:21 16:58	06:37 17:44 (13)	16:18 (11) 18:18	05:51 19:57	06:26 (16) 20:31	05:16 20:17
29	07:20 16:59	06:36 17:46 (13)	16:17 (11) 18:19	05:50 19:58	06:27 (16) 20:32	05:15 20:17
30	07:19 17:00	06:35 17:48 (13)	16:16 (11) 18:21	05:48 20:00	06:27 (16) 20:32	05:15 20:17
31	07:18 17:02	06:34 17:50 (13)	16:15 (11) 18:22	05:47 20:01	06:27 (16) 20:33	05:14 20:17
Potential sun hours	286	291	369	380	-285	-254
Total, worst case	66	852	548	752	714	
Sun reduction	0.45	0.45	0.50	0.55	0.55	
Oper. time red.	0.91	0.91	0.91	0.91	0.91	
Wind dir. red.	0.63	0.58	0.55	0.59	0.59	
Total reduction	0.26	0.24	0.25	0.30	0.30	
Total, real	17	200	136	222	211	

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/20/06 13:20/2.4.0.67

SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 356 - 356

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	06:40 (16) 07:18 (16)	06:17 19:35	06:53 18:38	17:05 (11) 17:33 (11)
2	05:14 20:47	05:42 20:24	06:40 (16) 07:20 (16)	06:19 19:33	06:55 18:36	17:02 (11) 17:34 (11)
3	05:14 20:47	05:43 20:22	06:39 (16) 07:19 (16)	06:20 19:31	06:56 18:34	16:59 (11) 17:35 (11)
4	05:15 20:46	05:44 20:21	06:38 (16) 07:20 (16)	06:21 19:29	06:57 18:33	16:58 (11) 17:36 (11)
5	05:15 20:46	05:45 20:20	06:39 (16) 07:21 (16)	06:22 19:27	06:58 18:31	16:58 (11) 17:36 (11)
6	05:16 20:46	05:46 20:19	06:38 (16) 07:22 (16)	06:23 19:26	07:00 18:29	16:55 (11) 17:37 (11)
7	05:17 20:45	05:48 20:17	06:37 (16) 07:21 (16)	06:24 19:24	07:01 18:27	16:54 (11) 17:36 (11)
8	05:17 20:45	05:49 20:16	06:36 (16) 07:22 (16)	06:26 19:22	07:02 18:25	16:53 (11) 17:37 (11)
9	05:18 20:45	05:50 20:14	06:35 (16) 07:21 (16)	06:27 19:20	07:03 18:23	16:53 (11) 17:37 (11)
10	05:19 20:44	05:51 20:13	06:36 (16) 07:22 (16)	06:28 19:18	07:05 18:22	16:52 (11) 17:38 (11)
11	05:20 20:44	05:52 20:11	06:36 (16) 07:24 (16)	06:29 19:16	07:06 18:20	16:51 (11) 17:37 (11)
12	05:21 20:43	05:54 20:10	06:35 (16) 07:23 (16)	06:30 19:14	07:07 18:18	16:51 (11) 17:37 (11)
13	05:21 20:43	05:55 20:08	06:34 (16) 07:22 (16)	06:32 19:12	07:08 18:16	16:50 (11) 17:36 (11)
14	05:22 20:42	05:56 20:07	06:35 (16) 07:23 (16)	06:33 19:10	07:10 18:14	16:51 (11) 17:37 (11)
15	05:23 20:41	05:57 20:05	06:34 (16) 07:22 (16)	06:34 19:09	07:11 18:13	16:51 (11) 17:37 (11)
16	05:24 20:41	05:58 20:04	06:33 (16) 07:23 (16)	06:35 19:07	07:12 18:11	16:50 (11) 17:36 (11)
17	05:25 20:40	05:59 20:02	06:34 (16) 07:22 (16)	06:36 19:05	07:14 18:09	16:51 (11) 17:35 (11)
18	05:26 20:39	06:01 20:01	06:33 (16) 07:21 (16)	06:38 19:03	07:15 18:08	16:51 (11) 17:35 (11)
19	05:27 20:38	06:02 19:57	06:35 (16) 07:21 (16)	06:39 19:01	07:16 18:06	16:52 (11) 17:34 (11)
20	05:28 20:37	06:03 19:56	06:34 (16) 07:20 (16)	06:40 18:59	07:18 18:04	16:51 (11) 17:33 (11)
21	05:29 20:37	06:04 19:54	06:35 (16) 07:19 (16)	06:41 18:57	07:19 18:03	16:53 (11) 17:31 (11)
22	05:30 20:36	06:05 19:52	06:36 (16) 07:18 (16)	06:42 18:55	07:20 18:01	16:52 (11) 17:30 (11)
23	05:31 20:35	06:55 (16) 07:03 (16)	06:07 19:51	06:44 18:53	07:21 17:59	16:54 (11) 17:30 (11)
24	05:32 20:34	06:52 (16) 07:06 (16)	06:08 19:49	06:45 18:51	07:23 17:58	16:55 (11) 17:27 (11)
25	05:33 20:33	06:49 (16) 07:09 (16)	06:09 19:47	06:46 18:49	06:24 16:56	15:57 (11) 16:27 (11)
26	05:34 20:32	06:48 (16) 07:10 (16)	06:10 19:45	06:47 18:48	06:26 16:54	15:58 (11) 16:24 (11)
27	05:35 20:31	06:47 (16) 07:11 (16)	06:11 19:44	06:48 18:46	06:27 16:53	07:15 (13) 16:21 (11)
28	05:36 20:30	06:44 (16) 07:14 (16)	06:13 19:42	06:50 18:44	06:28 16:51	07:13 (13) 16:19 (11)
29	05:37 20:29	06:43 (16) 07:15 (16)	06:14 19:40	06:51 18:42	06:30 16:50	07:10 (13) 07:26 (13)
30	05:38 20:27	06:42 (16) 07:16 (16)	06:15 19:38	06:52 18:40	06:31 16:48	07:10 (13) 07:28 (13)
31	05:40 20:26	06:41 (16) 07:17 (16)	06:16 19:37	06:48 (16) 07:02 (16)	06:32 16:47	07:09 (13) 07:29 (13)
Potential sun hours	-272	4	1270	376	341	288
Total, worst case	220		48		1144	302
Sun reduction	0.58		0.55		0.45	0.35
Oper. time red.	0.91		0.91		0.91	0.91
Wind dir. red.	0.59		0.59		0.55	0.63
Total reduction	0.31		0.30		0.22	0.20
Total, real	69		375	13	257	61

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/20/06 13:20/2.4.0.67

SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 357 - 357

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:35 16:25	07:17 17:03	07:39 (13) 08:03 (13)	06:35 17:43	16:12 (11) 18:23	05:38 20:00
2	07:35 16:26	07:16 17:05	07:40 (13) 08:04 (13)	06:34 17:44	16:12 (11) 18:24	05:37 20:01
3	07:35 16:27	07:15 17:06	07:40 (13) 08:04 (13)	06:32 17:46	16:13 (11) 18:26	05:35 20:02
4	07:35 16:28	07:13 17:08	07:39 (13) 08:05 (13)	06:30 17:47	16:15 (11) 18:27	05:33 20:03
5	07:35 16:29	07:12 17:09	07:40 (13) 08:04 (13)	06:28 17:48	16:15 (11) 19:28	06:31 20:05
6	07:34 16:30	07:11 17:10	07:41 (13) 08:05 (13)	06:27 17:50	16:15 (11) 19:29	06:29 20:06
7	07:34 16:31	07:10 17:12	07:41 (13) 08:03 (13)	06:25 17:51	16:17 (11) 19:31	06:27 20:07
8	07:34 16:32	07:08 17:13	07:42 (13) 08:04 (13)	06:23 17:52	16:20 (11) 19:32	06:26 20:08
9	07:34 16:33	07:07 17:15	07:42 (13) 16:40 (11)	06:21 17:54	16:22 (11) 19:33	06:24 20:09
10	07:33 16:34	07:06 17:16	07:43 (13) 16:45 (11)	06:19 17:55	16:24 (11) 19:35	06:22 20:11
11	07:33 16:35	07:04 17:18	07:46 (13) 16:48 (11)	06:18 17:56	16:30 (11) 19:36	06:20 20:12
12	07:33 16:37	07:03 17:19	07:48 (13) 16:48 (11)	06:16 17:57	16:36 (11) 19:37	06:18 20:13
13	07:32 16:38	07:01 17:21	16:19 (11) 16:51 (11)	06:14 17:59	06:17 19:38	06:31 20:14
14	07:32 16:39	07:00 17:22	16:17 (11) 16:51 (11)	06:12 18:00	06:15 19:40	06:29 20:15
15	07:31 16:40	06:58 17:23	16:16 (11) 16:54 (11)	06:10 18:01	06:13 19:41	06:28 20:17
16	07:31 16:41	06:57 17:25	16:16 (11) 16:54 (11)	06:08 18:03	06:11 19:42	06:27 20:18
17	07:30 16:43	06:55 17:26	16:14 (11) 16:54 (11)	06:06 18:04	06:10 19:43	06:26 20:19
18	07:30 16:44	06:54 17:28	16:13 (11) 16:55 (11)	06:05 18:05	06:08 19:45	06:25 20:20
19	07:29 16:45	06:52 17:29	16:13 (11) 16:55 (11)	06:03 18:07	06:06 19:46	06:24 20:21
20	07:28 16:47	06:51 17:30	16:12 (11) 16:58 (11)	06:01 18:08	06:04 19:47	06:23 20:22
21	07:27 16:48	06:49 17:32	16:12 (11) 16:58 (11)	05:59 18:09	06:03 19:48	06:22 20:23
22	07:27 16:49	06:47 17:33	16:12 (11) 16:56 (11)	05:57 18:10	06:01 19:50	06:21 20:24
23	07:26 16:51	06:46 17:35	16:11 (11) 16:57 (11)	05:55 18:12	05:59 19:51	06:20 20:25
24	07:25 16:52	07:48 (13) 07:54 (13)	16:11 (11) 16:57 (11)	05:53 18:13	05:58 19:52	06:19 20:27
25	07:24 16:53	07:47 (13) 07:57 (13)	16:11 (11) 16:57 (11)	05:51 18:14	05:56 19:53	06:18 20:28
26	07:23 16:55	07:46 (13) 07:58 (13)	16:11 (11) 16:57 (11)	05:50 18:16	05:55 19:55	06:17 20:29
27	07:22 16:56	07:45 (13) 08:01 (13)	16:12 (11) 16:56 (11)	05:48 18:17	05:53 19:56	06:16 20:30
28	07:21 16:58	07:44 (13) 08:02 (13)	16:12 (11) 16:56 (11)	05:46 18:18	05:51 19:57	06:15 20:31
29	07:20 16:59	07:42 (13) 08:02 (13)	05:44 18:19	05:50 18:19	05:50 19:58	06:14 20:32
30	07:19 17:00	07:41 (13) 08:03 (13)	05:42 18:21	05:48 18:21	05:48 20:00	06:13 20:32
31	07:18 17:02	07:40 (13) 08:04 (13)	05:40 18:22	05:40 18:22	05:40 20:00	06:12 20:33
Potential sun hours	286	291	369	380	-285	-254
Total, worst case	128	1012	344	984	382	
Sun reduction	0.45	0.45	0.50	0.55	0.55	
Oper. time red.	0.91	0.91	0.91	0.91	0.91	
Wind dir. red.	0.64	0.57	0.55	0.60	0.60	
Total reduction	0.26	0.23	0.25	0.30	0.30	
Total, real	33	237	86	295	115	

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

Day in month	Sun rise (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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/20/06 13:37 / 30
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/20/06 13:20/2.4.0.67

SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 357 - 357

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	06:58 (16) 19:35	06:17 18:38	06:53 16:46	07:13 (13) 16:17
2	05:14 20:47	05:42 20:24	06:56 (16) 19:33	06:19 18:36	06:55 16:44	07:12 (13) 16:16
3	05:14 20:47	05:43 20:22	06:55 (16) 19:31	06:20 18:34	06:56 16:43	07:12 (13) 16:16
4	05:15 20:46	05:44 20:21	06:54 (16) 19:29	06:21 18:33	06:57 16:41	07:11 (13) 16:16
5	05:15 20:46	05:45 20:20	06:51 (16) 19:27	06:22 18:31	06:58 16:40	07:11 (13) 16:15
6	05:16 20:46	05:46 20:19	06:50 (16) 19:26	06:23 18:29	06:59 16:39	07:10 (13) 16:15
7	05:17 20:45	05:48 20:17	06:49 (16) 19:24	06:24 18:27	07:00 16:38	07:10 (13) 16:15
8	05:17 20:45	05:49 20:16	06:48 (16) 19:22	06:26 18:25	07:01 16:36	07:11 (13) 16:15
9	05:18 20:45	05:50 20:14	06:47 (16) 19:20	06:27 18:23	07:02 16:35	07:11 (13) 16:15
10	05:19 20:44	05:51 20:13	06:46 (16) 19:18	06:28 18:22	07:03 16:34	07:10 (13) 16:15
11	05:20 20:44	05:52 20:11	06:46 (16) 19:16	06:29 18:20	07:04 16:33	07:11 (13) 16:15
12	05:21 20:43	05:54 20:10	06:45 (16) 19:14	06:30 18:18	07:05 16:31	07:13 (13) 16:15
13	05:21 20:43	05:55 20:08	06:44 (16) 19:12	06:32 18:16	07:06 16:30	07:14 (13) 16:15
14	05:22 20:42	05:56 20:07	06:43 (16) 19:10	06:33 18:14	07:07 16:29	07:16 (13) 16:15
15	05:23 20:41	05:57 20:05	06:42 (16) 19:09	06:34 18:13	07:08 16:28	07:17 (13) 16:15
16	05:24 20:41	05:58 20:04	06:43 (16) 19:07	06:35 18:11	07:09 16:27	07:19 (13) 16:15
17	05:25 20:40	05:59 20:02	06:42 (16) 19:05	06:36 18:09	07:10 16:26	07:20 (13) 16:16
18	05:26 20:39	06:01 20:01	06:41 (16) 19:03	06:38 18:08	07:11 16:25	07:22 (13) 16:16
19	05:27 20:38	06:02 19:57	06:41 (16) 19:01	06:39 18:06	07:12 16:24	07:23 (13) 16:16
20	05:28 20:37	06:03 19:56	06:42 (16) 18:59	06:40 18:04	07:13 16:23	07:24 (13) 16:17
21	05:29 20:37	06:04 19:54	06:41 (16) 18:57	06:41 18:03	07:14 16:22	07:25 (13) 16:17
22	05:30 20:36	06:05 19:52	06:40 (16) 18:55	06:42 18:01	07:15 16:21	07:26 (13) 16:18
23	05:31 20:35	06:07 19:51	06:41 (16) 18:53	06:43 17:59	07:16 16:20	07:27 (13) 16:18
24	05:32 20:34	06:08 19:49	06:40 (16) 18:51	06:44 17:58	07:17 16:19	07:28 (13) 16:19
25	05:33 20:33	06:09 19:47	06:41 (16) 18:49	06:45 16:56	07:18 16:25	07:29 (13) 16:19
26	05:34 20:32	06:10 19:45	06:41 (16) 18:48	06:46 16:54	07:19 16:24	07:30 (13) 16:20
27	05:35 20:31	06:11 19:44	06:42 (16) 18:46	06:47 16:53	07:20 16:23	07:31 (13) 16:21
28	05:36 20:30	06:13 19:42	06:43 (16) 18:44	06:48 16:51	07:21 16:22	07:32 (13) 16:21
29	05:37 20:29	06:14 19:40	06:42 (16) 18:42	06:49 16:50	07:22 16:21	07:33 (13) 16:22
30	05:38 20:27	06:15 19:38	06:43 (16) 18:40	06:50 16:48	07:23 16:20	07:34 (13) 16:23
31	05:40 20:26	06:16 19:37	06:44 (16) 18:38	06:51 16:47	07:24 16:19	07:35 (13) 16:24
Potential sun hours	-272	4	376	341	288	274
Total, worst case	8	1248	124	1112	386	
Sun reduction	0.58	0.55	0.55	0.45	0.35	
Oper. time red.	0.91	0.91	0.91	0.91	0.91	
Wind dir. red.	0.60	0.60	0.60	0.55	0.63	
Total reduction	0.32	0.30	0.30	0.23	0.20	
Total, real	3	374	37	251	77	

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/20/06 13:20/2.4.0.67

SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 358 - 358

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June				
1	07:35	07:17	07:49 (16)	06:35	05:38	05:47	19:22 (9)	05:13	19:11 (9)	
	16:25	17:03	34 08:23 (16)	17:43	18:23	20:00	14 19:36 (9)	20:34	38 19:49 (9)	
2	07:35	07:16	07:48 (16)	06:34	05:37	05:45	19:18 (9)	05:13	19:12 (9)	
	16:26	17:05	36 08:24 (16)	17:44	18:24	20:01	18 19:36 (9)	20:35	36 19:48 (9)	
3	07:35	07:15	07:49 (16)	06:32	05:35	05:44	19:17 (9)	05:12	19:12 (9)	
	16:27	17:06	36 08:25 (16)	17:46	18:26	20:02	20 19:37 (9)	20:36	36 19:48 (9)	
4	07:35	07:13	07:47 (16)	06:30	05:33	05:42	19:14 (9)	05:12	19:13 (9)	
	16:28	17:08	38 08:25 (16)	17:47	18:27	20:03	26 19:40 (9)	20:37	34 19:47 (9)	
5	07:35	07:12	07:48 (16)	06:28	06:31	05:41	19:12 (9)	05:11	19:13 (9)	
	16:29	17:09	38 08:26 (16)	17:48	19:28	20:05	28 19:40 (9)	20:38	34 19:47 (9)	
6	07:34	07:11	07:49 (16)	06:27	06:29	05:40	19:13 (9)	05:11	19:15 (9)	
	16:30	17:10	38 08:27 (16)	17:50	19:29	20:06	28 19:41 (9)	20:38	32 19:47 (9)	
7	07:34	07:10	07:47 (16)	06:25	06:27	05:38	19:12 (9)	05:11	19:14 (9)	
	16:31	17:12	40 08:27 (16)	17:51	19:31	20:07	30 19:42 (9)	20:39	32 19:46 (9)	
8	07:34	07:08	07:48 (16)	06:23	06:26	05:37	19:10 (9)	05:10	19:14 (9)	
	16:32	17:13	38 08:26 (16)	17:52	19:32	20:08	34 19:44 (9)	20:40	34 19:48 (9)	
9	07:34	07:07	07:48 (16)	06:21	06:24	05:36	19:09 (9)	05:10	19:16 (9)	
	16:33	17:15	38 08:26 (16)	17:54	19:33	20:10	36 19:45 (9)	20:41	32 19:48 (9)	
10	07:33	07:06	07:47 (16)	06:19	06:22	05:34	19:10 (9)	05:10	19:16 (9)	
	16:34	17:16	40 08:27 (16)	17:55	19:35	20:11	36 19:46 (9)	20:41	32 19:48 (9)	
11	07:33	07:04	07:48 (16)	06:18	06:20	05:33	19:09 (9)	05:09	19:16 (9)	
	16:35	17:18	38 08:26 (16)	17:56	19:36	20:12	38 19:47 (9)	20:42	32 19:48 (9)	
12	07:33	07:03	07:48 (16)	06:16	06:18	05:32	19:08 (9)	05:09	19:17 (9)	
	16:37	17:19	38 08:26 (16)	17:57	19:37	20:13	40 19:48 (9)	20:42	30 19:47 (9)	
13	07:32	07:01	07:49 (16)	06:14	06:17	05:30	19:08 (9)	05:09	19:17 (9)	
	16:38	17:21	36 08:25 (16)	17:59	19:38	20:14	40 19:48 (9)	20:43	30 19:47 (9)	
14	07:32	07:00	07:49 (16)	06:12	06:15	05:29	19:07 (9)	05:09	19:17 (9)	
	16:39	17:22	36 08:25 (16)	18:00	19:40	20:15	42 19:49 (9)	20:43	30 19:47 (9)	
15	07:31	06:58	07:50 (16)	06:10	06:13	05:28	19:08 (9)	05:09	19:17 (9)	
	16:40	17:23	34 08:24 (16)	18:01	19:41	20:17	40 19:48 (9)	20:44	30 19:47 (9)	
16	07:31	06:57	07:50 (16)	06:08	06:11	05:27	19:07 (9)	05:09	19:19 (9)	
	16:41	17:25	34 08:24 (16)	18:03	19:42	20:18	42 19:49 (9)	20:44	28 19:47 (9)	
17	07:30	06:55	07:50 (16)	06:06	06:09	05:26	19:06 (9)	05:09	19:19 (9)	
	16:43	17:26	32 08:22 (16)	18:04	19:43	20:19	42 19:48 (9)	20:45	28 19:47 (9)	
18	07:30	06:54	07:53 (16)	06:05	06:08	05:25	19:07 (9)	05:09	19:19 (9)	
	16:44	17:28	28 08:21 (16)	18:05	19:45	20:20	42 19:49 (9)	20:45	28 19:47 (9)	
19	07:29	06:52	07:53 (16)	06:03	06:06	05:24	19:06 (9)	05:09	19:20 (9)	
	16:45	17:29	26 08:19 (16)	18:07	19:46	20:21	42 19:48 (9)	20:46	28 19:48 (9)	
20	07:28	06:51	07:56 (16)	06:01	06:04	05:23	19:07 (9)	05:09	19:20 (9)	
	16:47	17:30	22 08:18 (16)	18:08	19:47	20:22	42 19:49 (9)	20:46	28 19:48 (9)	
21	07:27	06:49	07:58 (16)	05:59	06:03	05:22	19:08 (9)	05:09	19:20 (9)	
	16:48	17:32	16 08:14 (16)	18:09	19:48	20:23	40 19:48 (9)	20:46	28 19:48 (9)	
22	07:27	06:47	08:02 (16)	05:57	06:01	05:21	19:08 (9)	05:10	19:20 (9)	
	16:49	17:33	8 08:10 (16)	18:10	19:50	20:24	42 19:50 (9)	20:46	28 19:48 (9)	
23	07:26	08:03 (16)	06:46	05:55	05:59	05:20	19:09 (9)	05:10	19:20 (9)	
	16:51	4 08:07 (16)	17:35	18:12	19:51	20:26	40 19:49 (9)	20:47	28 19:48 (9)	
24	07:25	07:58 (16)	06:44	05:53	05:58	05:19	19:08 (9)	05:10	19:21 (9)	
	16:52	14 08:12 (16)	17:36	18:13	19:52	20:27	42 19:50 (9)	20:47	28 19:49 (9)	
25	07:24	07:57 (16)	06:42	05:51	05:56	05:18	19:09 (9)	05:10	19:21 (9)	
	16:53	18 08:15 (16)	17:37	18:14	19:53	20:28	40 19:49 (9)	20:47	28 19:49 (9)	
26	07:23	07:54 (16)	06:41	05:50	05:55	05:17	19:08 (9)	05:11	19:21 (9)	
	16:55	22 08:16 (16)	17:39	18:16	19:55	20:29	40 19:48 (9)	20:47	28 19:49 (9)	
27	07:22	07:53 (16)	06:39	05:48	05:53	05:17	19:10 (9)	05:11	19:22 (9)	
	16:56	24 08:17 (16)	17:40	18:17	19:56	20:30	40 19:50 (9)	20:47	28 19:50 (9)	
28	07:21	07:52 (16)	06:37	05:46	05:51	05:16	19:09 (9)	05:12	19:20 (9)	
	16:58	28 08:20 (16)	17:41	18:18	19:57	20:31	40 19:49 (9)	20:47	30 19:50 (9)	
29	07:20	07:50 (16)		05:44	05:50	05:15	19:10 (9)	05:12	19:21 (9)	
	16:59	30 08:20 (16)		18:19	19:58	20:32	38 19:48 (9)	20:47	30 19:51 (9)	
30	07:19	07:51 (16)		05:42	05:48	19:25 (9)	05:15	19:10 (9)	05:13	19:21 (9)
	17:00	30 08:21 (16)		18:21	20:00	6 19:31 (9)	20:32	38 19:48 (9)	20:47	30 19:51 (9)
31	07:18	07:50 (16)		05:40			05:14	19:11 (9)		
	17:02	32 08:22 (16)		18:22			20:33	38 19:49 (9)		
Potential sun hours	286	291	369	380	418	428	418	254	418	
Total, worst case	202	724		6	1118		918			
Sun reduction	0.45	0.45		0.55	0.55		0.55			
Oper. time red.	0.91	0.91		0.91	0.91		0.91			
Wind dir. red.	0.65	0.65		0.61	0.61		0.61			
Total reduction	0.26	0.26		0.31	0.31		0.31			
Total, real	53	192		2	342		281			

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/20/06 13:20/2.4.0.67

SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 358 - 358

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	19:22 (9) 20:25	19:18 (9) 06:17	06:53	06:34 16:46	07:17 (16) 16:17
2	05:14 20:47	19:20 (9) 20:24	19:20 (9) 06:19	06:55	06:35 16:44	07:16 (16) 16:16
3	05:14 20:47	19:21 (9) 20:22	19:19 (9) 06:20	06:56	06:36 16:43	07:18 (16) 16:16
4	05:15 20:46	19:21 (9) 20:21	19:20 (9) 06:21	06:57	06:38 16:41	07:17 (16) 16:16
5	05:15 20:46	19:20 (9) 20:20	19:21 (9) 06:22	06:58	06:39 16:40	07:17 (16) 16:15
6	05:16 20:46	19:21 (9) 20:19	19:22 (9) 06:23	07:00	06:41 16:39	07:18 (16) 16:15
7	05:17 20:45	19:19 (9) 20:17	19:23 (9) 06:24	07:01	06:42 16:38	07:18 (16) 16:15
8	05:17 20:45	19:20 (9) 20:16	19:22 (9) 06:26	07:02	06:43 16:36	07:19 (16) 16:15
9	05:18 20:45	19:19 (9) 20:14	19:25 (9) 06:27	07:03	06:45 16:35	07:19 (16) 16:15
10	05:19 20:44	19:20 (9) 20:13	19:26 (9) 06:28	07:05	06:46 16:34	07:20 (16) 16:15
11	05:20 20:44	19:18 (9) 20:11	19:28 (9) 06:29	07:06	06:47 16:33	07:22 (16) 16:15
12	05:21 20:43	19:19 (9) 20:10	19:46 (9) 19:16	18:20	06:49 16:31	07:23 (16) 16:15
13	05:21 20:43	19:18 (9) 20:08	19:31 (9) 06:30	07:07	06:50 16:30	07:22 (16) 16:15
14	05:22 20:42	19:19 (9) 20:07	19:45 (9) 19:14	18:18	06:52 16:29	07:22 (16) 16:15
15	05:23 20:41	19:18 (9) 20:05	06:32 07:08	18:16	06:53 16:28	07:25 (16) 16:15
16	05:24 20:41	19:58 (9) 20:05	19:09 18:13	18:13	06:54 16:27	07:27 (16) 16:15
17	05:25 20:40	19:19 (9) 20:04	06:35 07:12	18:12	06:54 16:26	07:27 (16) 16:15
18	05:26 20:39	19:17 (9) 20:02	19:07 18:11	18:11	06:56 16:26	07:30 (16) 16:16
19	05:27 20:38	19:18 (9) 20:01	19:05 18:09	18:09	06:57 16:25	07:32 (16) 16:16
20	05:28 20:37	19:58 (9) 20:01	06:39 07:16	18:06	06:58 16:24	07:37 (16) 16:16
21	05:29 20:37	19:18 (9) 20:03	19:01 18:06	18:06	06:59 16:24	07:41 (16) 16:16
22	05:30 20:36	19:18 (9) 20:05	06:40 07:18	18:03	07:00 16:24	07:30 16:17
23	05:31 20:35	19:58 (9) 20:04	18:59 18:04	18:04	07:01 16:24	16:17
24	05:32 20:34	19:17 (9) 20:06	06:41 07:19	18:03	07:01 16:23	07:31 16:18
25	05:33 20:33	19:18 (9) 20:05	18:57 18:03	18:03	07:02 16:23	16:17
26	05:34 20:32	19:18 (9) 20:06	06:42 07:20	18:02	07:02 16:22	07:32 16:18
27	05:35 20:31	20:00 (9) 19:52	18:55 18:01	22	08:48 (16) 16:22	16:18
28	05:36 20:30	19:17 (9) 20:07	06:44 07:21	18:01	08:24 (16) 16:22	07:32 16:18
29	05:37 20:29	19:59 (9) 19:51	18:53 17:59	26	08:50 (16) 16:21	16:18
30	05:38 20:27	19:18 (9) 20:08	06:45 07:23	18:01	08:21 (16) 16:21	07:32 16:19
31	05:40 20:26	19:17 (9) 20:09	06:46 06:24	18:00	08:51 (16) 16:20	07:33 16:19
		19:59 (9) 19:47	18:49 16:56	32	07:53 (16) 16:20	16:19
		19:18 (9) 20:10	06:47 06:26	07:20 (16) 07:07	07:07 16:19	07:33 16:20
		20:00 (9) 19:45	18:48 16:54	34	07:54 (16) 16:19	16:20
		19:17 (9) 06:11	06:48 06:27	07:19 (16) 07:09	07:09 16:19	07:34 16:21
		19:59 (9) 19:44	18:46 16:53	34	07:53 (16) 16:19	16:21
		19:18 (9) 06:13	06:50 06:28	07:19 (16) 07:10	07:10 16:18	07:34 16:21
		20:00 (9) 19:42	18:44 16:51	36	07:55 (16) 16:18	16:21
		19:17 (9) 06:14	06:51 06:30	07:18 (16) 07:11	07:11 16:17	07:34 16:22
		19:59 (9) 19:40	18:42 16:50	36	07:54 (16) 16:17	16:22
		19:18 (9) 06:15	06:52 06:31	07:18 (16) 07:12	07:12 16:17	07:34 16:23
		19:58 (9) 19:38	18:40 16:48	38	07:56 (16) 16:17	16:23
		19:17 (9) 06:16	06:32 07:17 (16)	38	07:17 (16) 16:17	07:34 16:24
		19:59 (9) 19:37	16:47 07:55 (16)	38	07:55 (16) 16:17	16:24
Potential sun hours	-272	4	376	341	288	274
Total, worst case	1184	342	354	578		
Sun reduction	0.58	0.55	0.45	0.35		
Oper. time red.	0.91	0.91	0.91	0.91		
Wind dir. red.	0.61	0.61	0.65	0.65		
Total reduction	0.32	0.31	0.26	0.21		
Total, real	382	105	94	119		

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

Day in month	Sun rise (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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/20/06 13:37 / 33
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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/20/06 13:20/2.4.0.67

SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 359 - 359

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:35 16:25	15:35 (6) 17:03	15:27 (6) 17:43	05:38 18:23	05:47 20:00	05:13 20:34
2	07:35 16:26	15:33 (6) 17:05	15:28 (6) 17:44	05:36 18:24	05:45 20:01	05:13 20:35
3	07:35 16:27	15:33 (6) 17:06	15:28 (6) 17:45	05:35 18:26	05:44 20:02	05:12 20:36
4	07:35 16:28	15:33 (6) 17:08	15:27 (6) 17:47	05:33 18:27	05:42 20:03	05:12 20:37
5	07:35 16:29	15:31 (6) 17:09	15:28 (6) 17:48	06:31 19:28	05:41 20:05	05:11 20:38
6	07:34 16:30	15:31 (6) 17:10	15:29 (6) 17:49	06:29 19:29	05:40 20:06	05:11 20:39
7	07:34 16:31	15:30 (6) 17:12	15:29 (6) 17:51	06:27 19:31	05:38 20:07	05:10 20:40
8	07:34 16:32	15:30 (6) 17:13	15:30 (6) 17:52	06:23 19:32	05:37 20:08	05:10 20:41
9	07:34 16:33	15:30 (6) 17:15	15:32 (6) 17:53	06:24 19:33	05:35 20:09	05:10 20:42
10	07:33 16:34	15:29 (6) 17:16	15:33 (6) 17:55	06:22 19:34	05:34 20:11	05:10 20:43
11	07:33 16:35	15:29 (6) 17:18	15:34 (6) 17:56	06:20 19:36	05:33 20:12	05:09 20:44
12	07:33 16:36	15:29 (6) 17:19	15:34 (6) 17:57	06:18 19:37	05:32 20:13	05:09 20:45
13	07:32 16:38	16:01 (6) 17:20	15:37 (6) 17:59	06:16 19:38	05:30 20:14	05:09 20:46
14	07:32 16:39	16:02 (6) 17:22	16:09 (6) 18:00	06:15 19:40	05:29 20:15	05:09 20:47
15	07:31 16:40	16:03 (6) 17:23	16:07 (6) 18:01	06:15 19:41	05:29 20:17	05:09 20:48
16	07:31 16:41	16:05 (6) 17:25	16:06 (6) 18:03	06:13 19:42	05:28 20:18	05:09 20:49
17	07:30 16:43	16:06 (6) 17:26	16:08 (6) 18:04	06:11 19:43	05:27 20:19	05:09 20:50
18	07:30 16:44	16:08 (6) 17:28	16:09 (6) 18:05	06:10 19:45	05:26 20:20	05:09 20:51
19	07:29 16:45	16:07 (6) 17:29	16:08 (6) 18:07	06:09 19:46	05:25 20:21	05:09 20:52
20	07:28 16:47	16:08 (6) 17:30	16:07 (6) 18:08	06:08 19:47	05:24 20:22	05:09 20:53
21	07:27 16:48	16:09 (6) 17:32	16:06 (6) 18:09	06:07 19:48	05:23 20:23	05:09 20:54
22	07:27 16:49	16:10 (6) 17:33	16:05 (6) 18:10	06:06 19:50	05:22 20:24	05:09 20:55
23	07:26 16:51	16:11 (6) 17:35	16:04 (6) 18:12	06:05 19:51	05:21 20:26	05:10 20:57
24	07:25 16:52	16:12 (6) 17:36	16:03 (6) 18:13	06:04 19:52	05:20 20:27	05:10 20:58
25	07:24 16:53	16:13 (6) 17:37	16:02 (6) 18:14	06:03 19:53	05:19 20:28	05:10 20:59
26	07:23 16:55	16:14 (6) 17:39	16:01 (6) 18:15	06:02 19:55	05:18 20:29	05:10 21:00
27	07:22 16:56	16:15 (6) 17:40	16:00 (6) 18:17	06:01 19:56	05:17 20:30	05:11 21:01
28	07:21 16:58	16:16 (6) 17:41	15:59 (6) 18:18	06:00 19:57	05:16 20:31	05:11 21:02
29	07:20 16:59	16:17 (6) 17:42	15:58 (6) 18:19	05:59 19:58	05:15 20:32	05:11 21:03
30	07:19 17:00	16:18 (6) 17:43	15:57 (6) 18:20	05:58 20:00	05:14 20:33	05:11 21:04
31	07:18 17:02	16:19 (6) 17:44	15:56 (6) 18:22	05:57 20:03	05:13 20:36	05:11 21:07
Potential sun hours	286	291	369	380	-285	-254
Total, worst case	1098	642	232	614	1062	
Sun reduction	0.45	0.45	0.50	0.55	0.55	
Oper. time red.	0.91	0.91	0.91	0.91	0.91	
Wind dir. red.	0.60	0.60	0.63	0.61	0.61	
Total reduction	0.25	0.25	0.28	0.30	0.30	
Total, real	271	158	66	187	324	

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/20/06 13:37 / 34
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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/20/06 13:20/2.4.0.67

SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 359 - 359

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	19:34 (3) 20:10 (3)	05:41 20:25	19:44 (3) 19:35	06:17 18:38	06:53 18:38
2	05:13 20:47	19:34 (3) 20:10 (3)	05:42 20:24	19:47 (3) 19:57 (3)	06:18 19:33	18:36 18:36
3	05:14 20:47	19:35 (3) 20:11 (3)	05:43 20:22	19:51 (3) 19:57 (3)	06:20 19:31	18:34 18:34
4	05:15 20:46	19:33 (3) 20:09 (3)	05:44 20:21	19:29 19:29	06:21 18:33	18:33 16:41
5	05:15 20:46	19:34 (3) 20:10 (3)	05:45 20:20	19:27 19:27	06:22 18:31	18:31 12:46
6	05:16 20:46	19:35 (3) 20:11 (3)	05:46 20:19	19:25 19:25	06:23 18:29	18:29 8:46
7	05:17 20:45	19:33 (3) 20:11 (3)	05:48 20:17	19:24 19:24	06:24 18:27	18:27 16:37
8	05:17 20:45	19:34 (3) 20:12 (3)	05:49 20:16	19:22 19:22	06:26 18:25	18:25 16:36
9	05:18 20:45	19:35 (3) 20:11 (3)	05:50 20:14	19:20 19:20	06:27 18:23	18:23 16:35
10	05:19 20:44	19:33 (3) 20:11 (3)	05:51 20:13	19:18 19:18	07:05 18:22	18:22 16:34
11	05:20 20:44	19:34 (3) 20:12 (3)	05:52 20:11	19:16 19:16	07:06 18:20	18:20 16:32
12	05:21 20:43	19:35 (3) 20:11 (3)	05:53 20:10	19:14 19:14	07:07 18:18	18:18 16:31
13	05:21 20:43	19:34 (3) 20:12 (3)	05:55 20:08	19:12 19:12	07:08 18:16	18:16 16:30
14	05:22 20:42	19:35 (3) 20:13 (3)	05:56 20:07	19:10 19:10	07:10 18:14	18:14 16:29
15	05:23 20:41	19:36 (3) 20:12 (3)	05:57 20:05	19:09 19:09	07:11 18:13	18:13 16:28
16	05:24 20:41	19:34 (3) 20:12 (3)	05:58 20:04	19:07 19:07	07:12 18:11	18:11 16:27
17	05:25 20:40	19:35 (3) 20:11 (3)	05:59 20:02	19:05 19:05	07:14 18:09	18:09 16:26
18	05:26 20:39	19:36 (3) 20:12 (3)	06:01 20:01	19:03 19:03	07:15 18:07	18:07 16:25
19	05:27 20:38	19:35 (3) 20:11 (3)	06:02 19:57	19:01 19:01	07:16 18:06	18:06 16:24
20	05:28 20:37	19:36 (3) 20:10 (3)	06:03 19:56	19:00 18:59	07:17 18:04	18:04 16:23
21	05:29 20:37	19:37 (3) 20:09 (3)	06:04 19:54	18:57 18:57	07:19 18:02	18:02 16:23
22	05:30 20:36	19:36 (3) 20:08 (3)	06:05 19:52	18:52 18:52	07:20 18:01	18:01 16:22
23	05:31 20:35	19:37 (3) 20:07 (3)	06:07 19:51	18:50 18:53	07:21 17:59	17:59 16:21
24	05:32 20:34	19:38 (3) 20:06 (3)	06:08 19:49	18:48 18:51	07:23 17:58	17:58 16:20
25	05:33 20:33	19:39 (3) 20:05 (3)	06:09 19:47	18:46 18:49	07:24 17:56	17:56 16:19
26	05:34 20:32	19:38 (3) 20:04 (3)	06:10 19:45	18:44 18:48	07:25 17:54	17:54 16:18
27	05:35 20:31	19:39 (3) 20:03 (3)	06:11 19:44	18:42 18:46	07:26 17:53	17:53 16:17
28	05:36 20:30	19:40 (3) 20:02 (3)	06:12 19:42	18:40 18:44	07:27 17:51	17:51 16:16
29	05:37 20:29	19:41 (3) 20:01 (3)	06:14 19:40	18:38 18:42	07:28 17:50	17:50 16:15
30	05:38 20:27	19:42 (3) 20:00 (3)	06:15 19:38	18:36 18:40	07:29 17:48	17:48 16:14
31	05:40 20:26	19:43 (3) 19:59 (3)	06:16 19:36	18:34 18:38	07:30 17:46	17:46 16:13
Potential sun hours	-272	4	376	341	288	274
Total, worst case	1006	30	138	296	1306	258
Sun reduction	0.58	0.55	0.55	0.45	0.35	0.35
Oper. time red.	0.91	0.91	0.91	0.91	0.91	0.91
Wind dir. red.	0.61	0.61	0.63	0.61	0.60	0.60
Total reduction	0.32	0.30	0.31	0.25	0.19	0.19
Total, real	323	9	43	74	251	50

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)
	Minutes with flicker		

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, N part
 17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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01/20/06 13:37 / 35

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 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated:

01/20/06 13:20/2.4.0.67

SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 360 - 360

Assumptions for shadow calculations

Maximum distance for influence

1,000 m

Minimum sun height over horizon for influence

3 °

Day step for calculation

1 days

Time step for calculation

2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35

Operational time

N	NE	E	SE	S	SW	W	NW	Sum
1,850	1,325	800	713	625	663	700	1,275	7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:35 16:25	07:17 17:03	06:35 17:43	05:38 18:23	05:47 20:00	05:13 20:34	05:41 20:25	06:17 19:35	06:53 18:38	06:34 16:45	16:07 16:21	07:13 16:16
2	07:35 16:26	07:16 17:05	06:34 17:44	05:36 18:24	05:45 20:01	05:13 20:35	05:42 20:24	06:18 19:33	06:54 18:36	06:35 16:44	16:08 16:18	07:14 16:16
3	07:35 16:27	07:15 17:02	06:32 17:45	05:35 18:25	05:44 20:02	05:12 20:36	05:43 20:22	06:20 19:31	06:56 18:34	06:36 16:44	16:10 16:18	07:16 16:16
4	07:35 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:42 20:03	05:12 20:37	05:44 20:21	06:21 19:29	06:57 18:32	06:38 16:41	16:11 16:15	07:17 16:15
5	07:35 16:29	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:05	05:11 20:38	05:45 20:20	06:22 19:27	06:58 18:31	06:39 16:40	16:15 16:21	07:18 16:15
6	07:34 16:30	07:11 17:10	06:27 17:49	06:29 19:29	05:39 20:06	05:11 20:38	05:46 20:19	06:23 19:25	06:59 18:29	08:05 16:39	06:41 16:39	07:19 16:15
7	07:34 16:31	07:10 17:12	16:41 17:51	17:55 19:31	19:34 20:07	20:11 20:39	20:44 20:17	20:44 19:24	19:10 18:27	12 20	08:17 08:20	16:39 16:37
8	07:34 16:32	07:08 17:13	16:40 17:52	16:23 19:32	16:25 20:08	16:20 20:40	16:25 20:16	16:26 19:22	16:26 18:25	16:26 07:59	16:43 16:36	16:15 16:21
9	07:34 16:33	07:07 17:15	16:38 17:53	16:21 19:33	16:24 20:09	16:24 20:40	16:24 20:14	16:27 19:20	16:27 18:23	16:27 07:57	16:45 16:35	16:15 16:22
10	07:33 16:34	07:05 17:16	16:37 17:55	16:19 19:34	16:22 20:11	16:22 20:41	16:22 20:13	16:28 19:18	16:28 18:22	16:28 07:56	16:46 16:34	16:15 16:23
11	07:33 16:35	07:04 17:18	16:38 17:56	16:18 19:36	16:20 20:12	16:20 20:42	16:20 20:11	16:28 19:16	16:28 18:20	16:28 07:57	16:47 16:32	16:15 16:25
12	07:33 16:36	07:03 17:19	16:32 17:57	16:16 19:37	16:18 20:03	16:18 20:34	16:18 20:10	16:26 19:14	16:26 18:18	16:26 08:27	16:31 16:31	16:15 16:25
13	07:32 16:37	07:01 17:20	16:29 17:59	16:14 19:38	16:16 20:05	16:16 20:34	16:16 20:04	16:24 19:12	16:24 18:16	16:24 07:53	16:50 16:30	16:15 16:25
14	07:32 16:38	07:00 17:22	16:27 17:58	16:12 19:39	16:15 20:11	16:15 20:41	16:15 20:13	16:24 19:07	16:24 18:14	16:24 07:51	16:52 16:32	16:15 16:23
15	07:31 16:40	06:58 17:23	16:25 18:01	16:10 19:41	16:13 20:17	16:13 20:44	16:13 20:05	16:22 19:08	16:22 18:13	16:22 07:51	16:53 16:28	16:15 16:27
16	07:31 16:41	06:57 17:25	16:24 18:03	16:08 19:42	16:11 20:18	16:11 20:44	16:11 20:04	16:20 19:07	16:20 18:11	16:20 07:50	16:54 16:27	16:15 16:28
17	07:30 16:43	06:55 17:26	16:22 18:04	16:06 19:43	16:09 20:19	16:09 20:45	16:09 20:02	16:17 19:05	16:17 18:14	16:17 07:49	16:56 16:26	16:15 16:29
18	07:30 16:44	06:54 17:27	16:21 18:05	16:05 19:45	16:08 20:16	16:08 20:45	16:08 20:01	16:16 19:03	16:16 18:07	16:16 07:46	16:57 16:25	16:15 16:26
19	07:29 16:45	06:52 17:29	16:21 18:07	16:03 19:46	16:06 20:17	16:06 20:46	16:06 20:02	16:14 19:01	16:14 18:06	16:14 07:45	16:58 16:24	16:15 16:30
20	07:28 16:47	06:50 17:30	16:19 18:08	16:01 19:47	16:04 20:18	16:04 20:46	16:04 20:01	16:12 19:03	16:12 18:04	16:12 07:49	16:50 16:23	16:15 16:30
21	07:27 16:48	06:49 17:32	16:17 18:09	16:00 19:48	16:03 20:19	16:03 20:46	16:03 20:02	16:10 19:01	16:10 18:05	16:10 07:49	16:57 16:23	16:15 16:31
22	07:27 16:49	06:47 17:33	16:15 18:10	15:57 19:49	16:01 20:20	16:01 20:46	16:01 20:04	16:09 19:03	16:09 18:07	16:09 07:48	16:53 16:22	16:15 16:32
23	07:26 16:51	06:46 17:34	16:15 18:12	15:55 19:51	16:00 20:25	16:00 20:47	16:00 20:04	16:08 19:03	16:08 18:08	16:08 07:48	16:54 16:21	16:15 16:32
24	07:25 16:52	06:44 17:36	16:14 18:13	15:54 19:52	16:00 20:27	16:00 20:47	16:00 20:04	16:08 19:03	16:08 18:08	16:08 07:48	16:54 16:20	16:15 16:32
25	07:24 16:53	06:42 17:37	16:13 18:14	15:53 19:53	16:00 20:28	16:00 20:47	16:00 20:04	16:08 19:03	16:08 18:08	16:08 07:48	16:54 16:20	16:15 16:32
26	07:23 16:55	06:41 17:39	16:12 18:15	15:52 19:55	16:00 20:29	16:00 20:47	16:00 20:04	16:08 19:03	16:08 18:08	16:08 07:48	16:54 16:20	16:15 16:32
27	07:22 16:56	06:39 17:40	16:11 18:16	15:51 19:56	16:00 20:30	16:00 20:47	16:00 20:04	16:08 19:03	16:08 18:08	16:08 07:48	16:54 16:20	16:15 16:32
28	07:21 16:58	06:37 17:41	16:10 18:18	15:50 19:57	16:00 20:31	16:00 20:47	16:00 20:04	16:08 19:03	16:08 18:08	16:08 07:48	16:54 16:20	16:15 16:32
29	07:20 17:00		16:09 18:19	15:49 20:00	16:00 20:32	16:00 20:47	16:00 20:04	16:08 19:03	16:08 18:08	16:08 07:48	16:54 16:20	16:15 16:32
30	07:19 17:02		16:08 18:22	15:48 20:00	16:00 20:33	16:00 20:47	16:00 20:04	16:08 19:03	16:08 18:08	16:08 07:48	16:54 16:20	16:15 16:32
Potential sun hours	286	291	369	380	285	254	272	4	376	341	288	274
Total, worst case		826	202	168				164	4	1010	36	
Sun reduction		0.45	0.50	0.55				0.55	0.55	0.45	0.35	
Oper. time red.		0.91	0.91	0.91				0.91	0.91	0.91	0.91	
Wind dir. red.		0.59	0.61	0.62				0.62	0.62	0.59	0.55	
Total reduction		0.24	0.27	0.31				0.31	0.31	0.24	0.17	
Total, real		197	55	52				51	1	243	6	

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

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

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, N part
 17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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01/20/06 13:37 / 37

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Wind Engineers, Inc.
 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated:

01/20/06 13:20/2.4.0.67

SHADOW - Calendar

Calculation: 060119 Northern area Shadow receptor: 362 - 362

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:35 16:25	07:17 17:03	06:36 17:43	07:02 (3) 18:23	05:38 20:00	05:47 20:34	05:13 20:47	05:13 20:25	05:41 19:35	06:17 18:38	07:41 (3) 08:07 (3)	06:34 16:45	07:13 16:17
2	07:35 16:26	07:16 17:05	06:34 17:44	07:02 (3) 18:24	05:37 20:01	05:45 20:35	05:13 20:47	05:42 20:24	05:19 19:33	06:19 18:36	07:40 (3) 08:06 (3)	06:35 16:44	07:15 16:16
3	07:35 16:27	07:15 17:06	06:32 17:46	07:01 (3) 18:26	05:35 20:02	05:44 20:36	05:12 20:47	05:14 20:23	05:43 19:31	06:20 18:34	07:39 (3) 08:07 (3)	06:36 16:43	07:16 16:16
4	07:35 16:28	07:13 17:08	06:30 17:47	07:01 (3) 18:27	05:33 20:03	05:42 20:37	05:12 20:46	05:15 20:21	05:44 19:29	06:21 18:33	07:38 (3) 08:08 (3)	06:38 16:41	07:17 16:16
5	07:35 16:29	07:12 17:09	06:28 17:48	07:01 (3) 19:28	06:31 20:05	05:41 20:38	05:11 20:46	05:15 20:20	05:45 19:27	06:22 18:31	07:38 (3) 08:08 (3)	06:39 16:40	07:18 16:15
6	07:34 16:30	07:11 17:10	06:27 17:50	06:59 (3) 19:29	06:29 20:06	05:40 20:38	05:10 20:46	05:16 20:19	05:46 19:26	06:23 18:29	07:00 08:09 (3)	06:41 16:39	07:19 16:15
7	07:34 16:31	07:10 17:12	06:25 17:51	06:59 (3) 19:31	06:27 20:07	05:38 20:39	05:10 20:45	05:17 20:17	05:48 19:24	06:24 18:27	07:01 08:08 (3)	06:42 16:37	07:20 16:15
8	07:34 16:32	07:08 17:13	06:23 17:52	07:00 (3) 19:32	06:26 20:08	05:37 20:40	05:10 20:45	05:17 20:16	05:49 19:22	06:26 18:25	07:02 08:07 (3)	06:43 16:36	07:21 16:15
9	07:34 16:33	07:07 17:15	06:21 17:54	07:00 (3) 19:33	06:24 20:10	05:36 20:41	05:10 20:45	05:50 20:14	06:27 19:20	07:03 18:23	07:35 (3) 08:07 (3)	06:45 16:35	07:22 16:15
10	07:34 16:34	07:06 17:16	06:19 17:55	07:00 (3) 19:35	06:22 20:11	05:34 20:41	05:10 20:44	05:19 20:13	05:51 19:18	06:28 18:22	07:36 (3) 08:06 (3)	06:46 16:34	07:23 16:15
11	07:33 16:35	07:04 17:18	06:18 17:56	07:00 (3) 19:36	06:20 20:12	05:33 20:42	05:09 20:44	05:52 20:11	06:29 19:16	06:29 18:20	07:37 (3) 08:05 (3)	06:48 16:33	07:24 16:15
12	07:33 16:36	07:03 17:19	06:16 17:58	07:02 (3) 19:37	06:18 20:13	05:32 20:42	05:09 20:43	05:53 20:10	06:30 19:14	07:07 18:18	07:37 (3) 08:05 (3)	06:49 16:31	07:25 16:15
13	07:32 16:38	07:01 17:20	06:14 17:59	07:02 (3) 19:38	06:17 20:14	05:30 20:43	05:09 20:43	05:55 20:09	06:32 19:12	07:08 18:16	07:36 (3) 08:04 (3)	06:50 16:30	07:26 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	07:04 (3) 19:40	06:15 20:16	05:29 20:44	05:09 20:42	05:22 20:07	05:56 19:10	06:33 18:14	07:10 08:03 (3)	06:52 16:29	07:26 16:15
15	07:31 16:40	06:58 17:23	06:10 18:01	07:07 (3) 19:41	06:13 20:17	05:28 20:44	05:09 20:41	05:23 20:05	05:57 19:09	06:34 18:13	07:11 08:03 (3)	06:53 16:28	07:27 16:15
16	07:31 16:41	06:57 17:25	06:08 18:03	07:13 (3) 19:42	06:11 20:18	05:27 20:44	05:09 20:41	05:24 20:04	05:58 19:07	06:35 18:11	07:12 08:00 (3)	06:54 16:27	07:28 16:15
17	07:30 16:43	06:55 17:26	06:07 18:04	07:17 (3) 19:43	06:10 20:19	05:26 20:45	05:09 20:40	05:25 20:02	05:59 19:05	06:36 18:09	07:14 07:57 (3)	06:56 16:26	07:29 16:16
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:01	06:38 19:03	07:15 18:08	07:45 (3) 07:55 (3)	06:57 16:25	07:29 16:16
19	07:29 16:45	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:09 20:46	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	07:16 07:18	06:58 16:24	07:30 16:16
20	07:28 16:47	06:51 17:30	06:01 18:08	06:04 19:47	05:23 20:22	05:09 20:46	05:28 20:38	06:03 19:56	06:40 18:59	07:18 18:04	07:18 07:19	07:00 16:23	07:31 16:17
21	07:28 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:09 20:46	05:29 20:37	06:04 19:54	06:41 18:57	07:19 18:02	06:41 07:20	07:01 16:23	07:31 16:17
22	07:27 16:49	06:47 17:33	05:57 18:10	06:01 19:50	05:21 20:25	05:10 20:46	05:30 20:36	06:05 19:52	06:42 18:55	07:20 18:01	06:42 07:22	07:02 16:22	07:32 16:18
23	07:26 16:51	06:46 17:35	05:55 18:12	05:59 19:51	05:20 20:26	05:10 20:47	05:31 20:35	06:07 19:51	06:44 18:53	07:22 17:59	06:44 07:23	07:04 16:21	07:32 16:18
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:27	05:10 20:47	05:32 20:34	06:08 19:49	06:45 18:51	07:23 17:58	07:23 07:58	07:05 16:20	07:33 16:19
25	07:24 16:53	06:42 17:37	05:52 18:14	07:09 (3) 19:53	05:52 20:28	05:10 20:47	05:33 20:33	06:09 19:47	06:46 18:50	06:46 18:56	06:24 07:12	07:06 16:20	07:33 16:19
26	07:23 16:55	06:41 17:39	05:50 18:16	07:07 (3) 19:54	05:50 20:29	05:11 20:47	05:34 20:32	06:10 19:45	06:47 18:48	06:26 18:48	06:47 07:14	07:07 16:19	07:33 16:20
27	07:22 16:56	06:39 17:40	05:48 18:17	07:29 (3) 19:56	05:48 20:30	05:12 20:47	05:11 20:31	06:11 19:44	06:48 18:46	06:27 16:53	06:48 07:49 (3)	07:09 16:18	07:34 16:21
28	07:21 16:58	06:37 17:41	05:46 18:18	07:32 (3) 19:57	05:46 20:31	05:12 20:47	05:36 20:30	06:13 19:42	06:50 18:44	06:28 16:51	07:49 (3) 08:01 (3)	07:10 16:18	07:34 16:21
29	07:20 16:59	06:36 17:42	05:45 18:19	07:33 (3) 19:58	05:45 20:32	05:12 20:47	05:37 20:29	06:14 19:40	06:51 18:42	06:30 16:50	07:46 (3) 08:02 (3)	07:11 16:17	07:34 16:22
30	07:19 17:00	06:35 17:43	05:44 18:20	07:34 (3) 20:00	05:44 20:33	05:12 20:47	05:38 20:27	06:15 19:38	06:52 18:40	06:31 16:48	07:43 (3) 08:05 (3)	07:12 16:17	07:34 16:23
31	07:18 17:02	06:34 17:44	05:43 18:22	07:35 (3) 20:01	05:43 20:34	05:12 20:48	05:39 20:26	06:16 19:37	06:53 18:40	06:32 16:47	07:44 (3) 08:06 (3)	07:13 16:18	07:34 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	340	288	274	
Total, worst case		106	428						50	480			
Sun reduction		0.45	0.50						0.55	0.45			
Oper. time red.		0.91	0.91						0.91	0.91			
Wind dir. red.		0.62	0.62						0.62	0.62			
Total reduction		0.25	0.28						0.31	0.25			
Total, real		27	120						15	121			

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

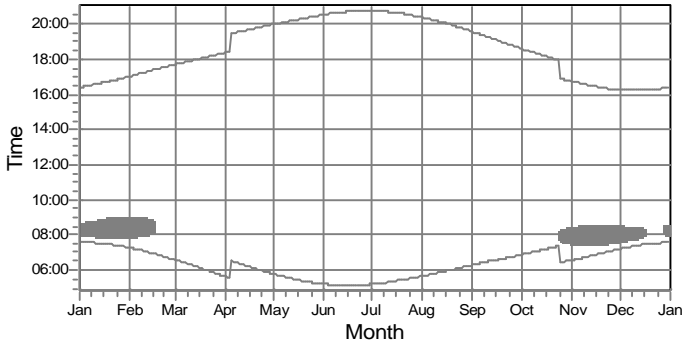
Printed/Page
01/20/06 13:37 / 38
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/20/06 13:20/2.4.0.67

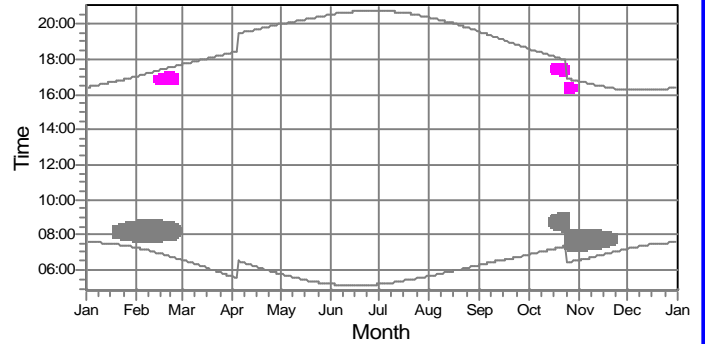
SHADOW - Calendar, graphical

Calculation: 060119 Northern area

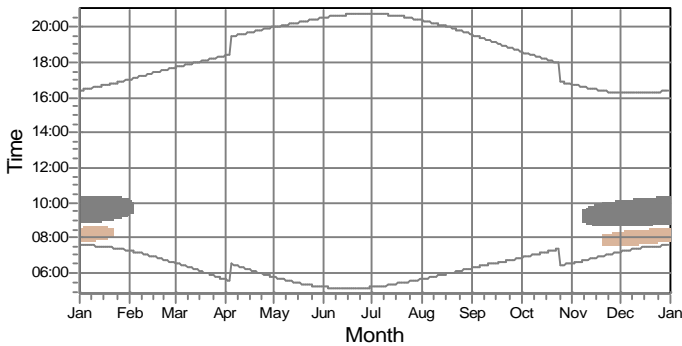
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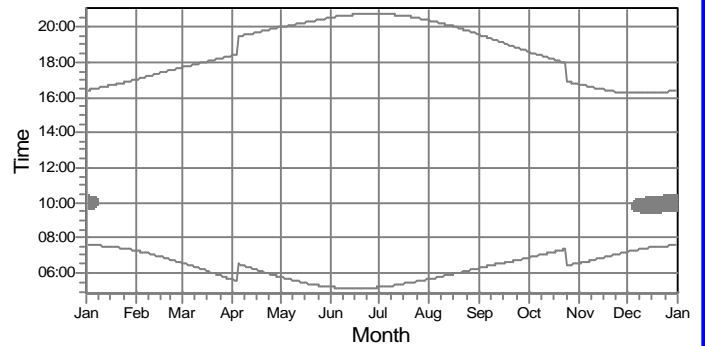
002: 002



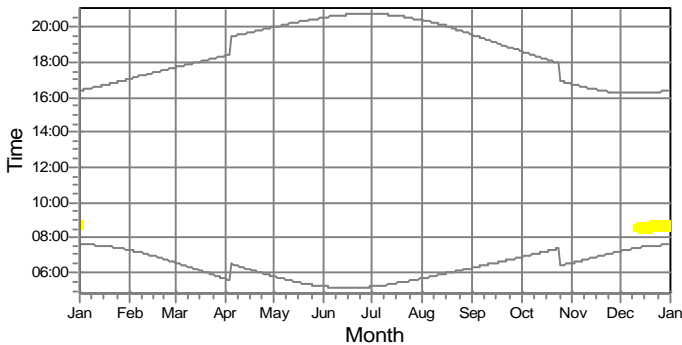
003: 003



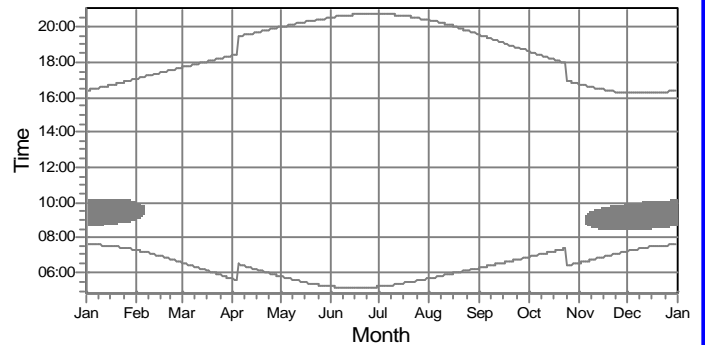
004: 004



031: 031



032: 032



WTGs



Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

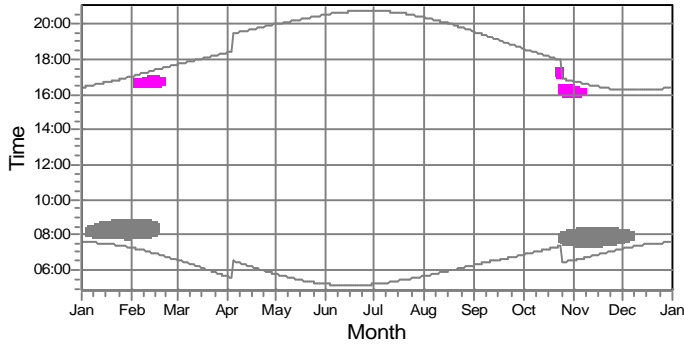
Printed/Page
01/20/06 13:37 / 39
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/20/06 13:20/2.4.0.67

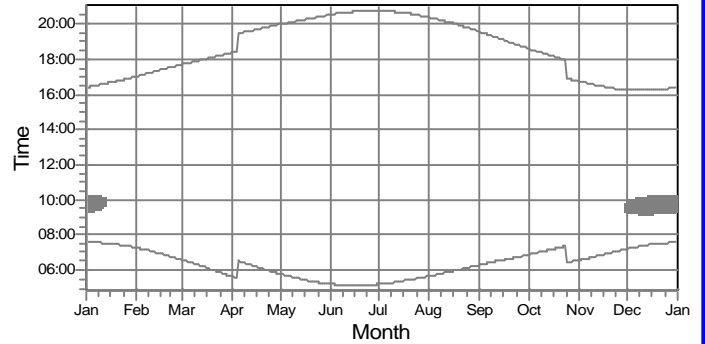
SHADOW - Calendar, graphical

Calculation: 060119 Northern area

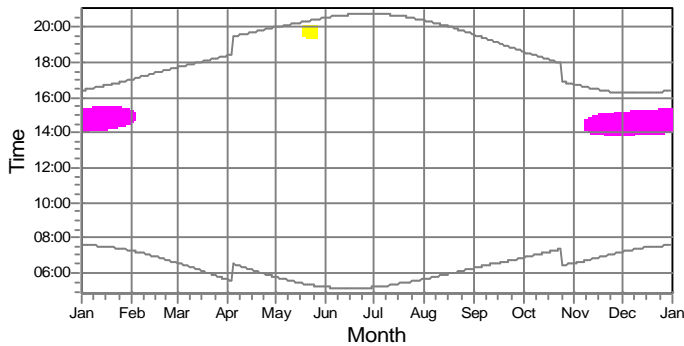
033: 033



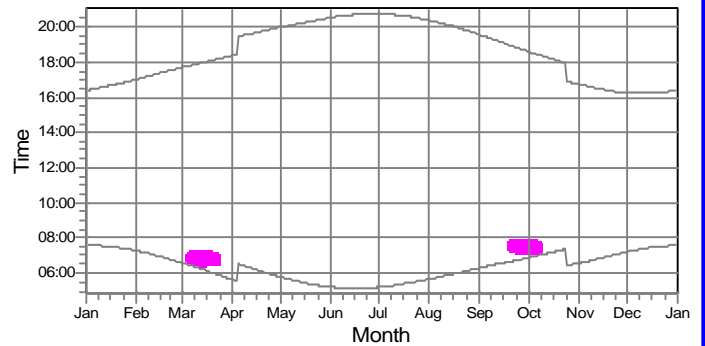
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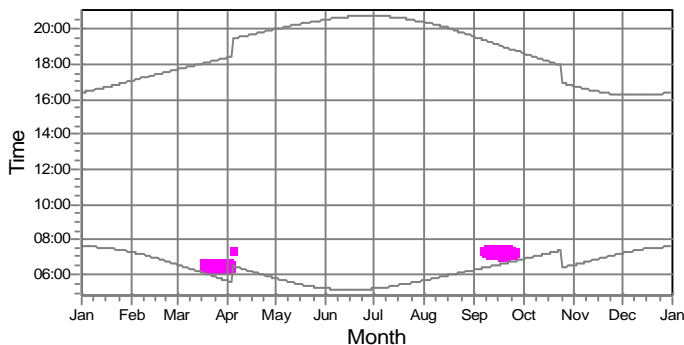
035: 035



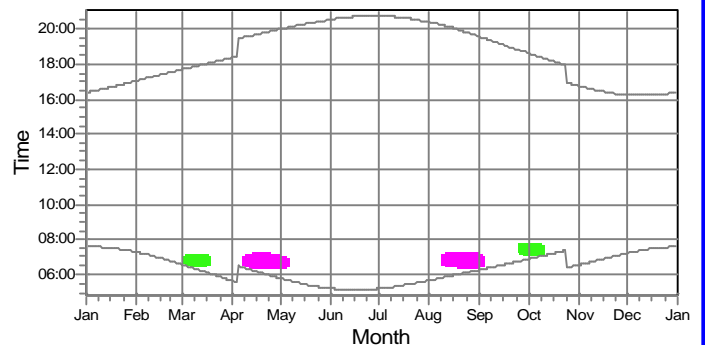
037: 037



038: 038



039: 039



WTGs



003



005-A



006



175

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

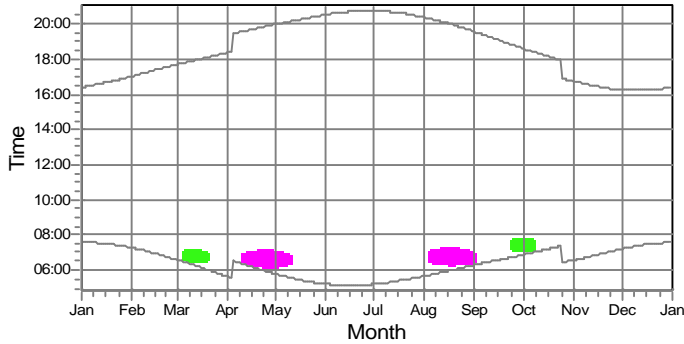
Printed/Page
01/20/06 13:37 / 40
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/20/06 13:20/2.4.0.67

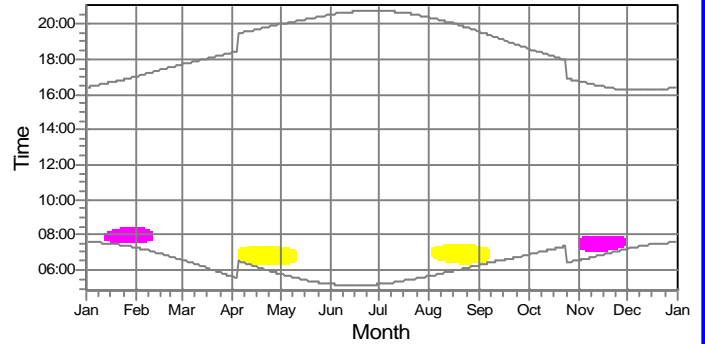
SHADOW - Calendar, graphical

Calculation: 060119 Northern area

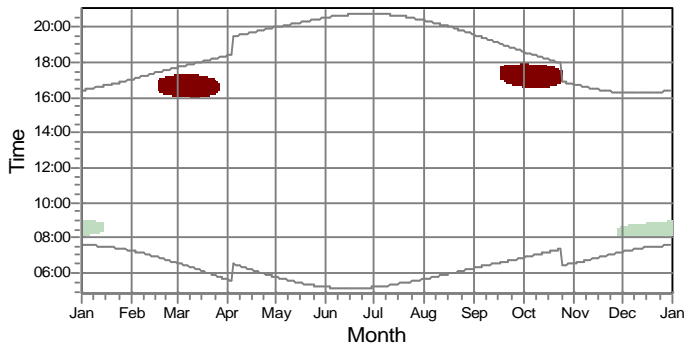
040: 040



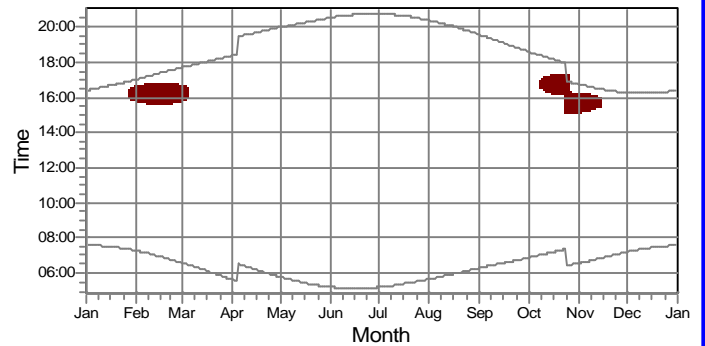
041: 041



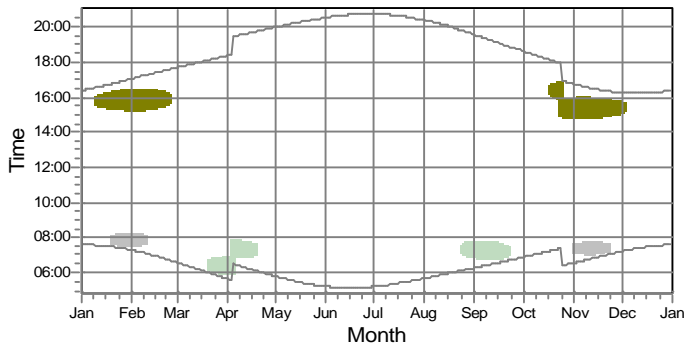
047: 047



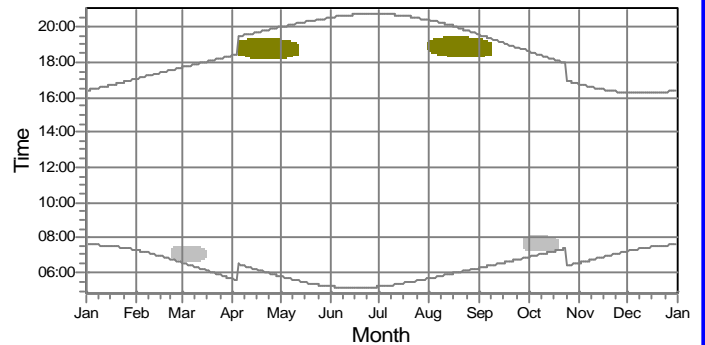
048: 048




049: 049



354: 354



WTGs

- | | | | |
|---|---|---|---|
|  003 |  011 |  021 |  175 |
|  006 |  015 |  148 | |

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

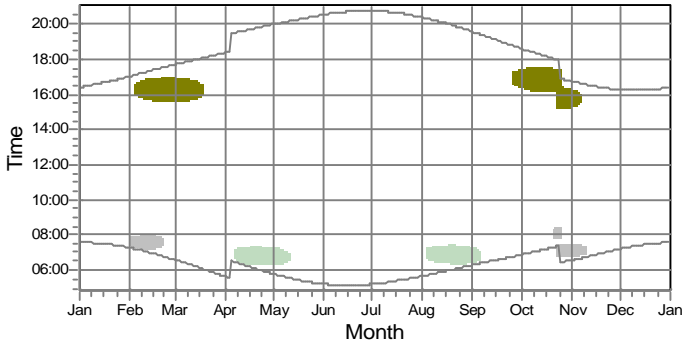
Printed/Page
01/20/06 13:37 / 41
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US-RIVERSIDE, CA 92506

Calculated:
01/20/06 13:20/2.4.0.67

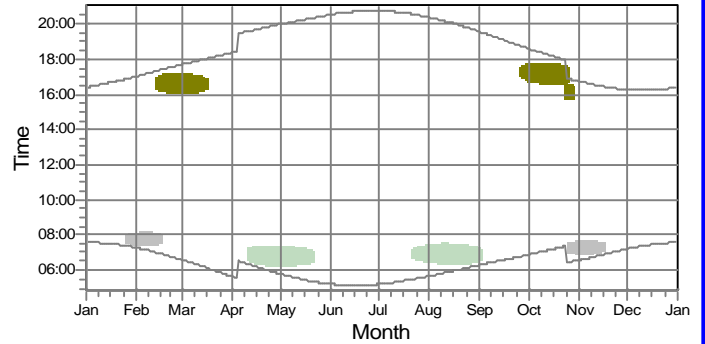
SHADOW - Calendar, graphical

Calculation: 060119 Northern area

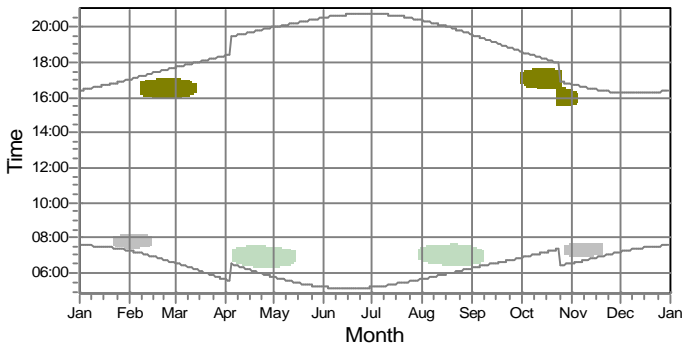
355: 355



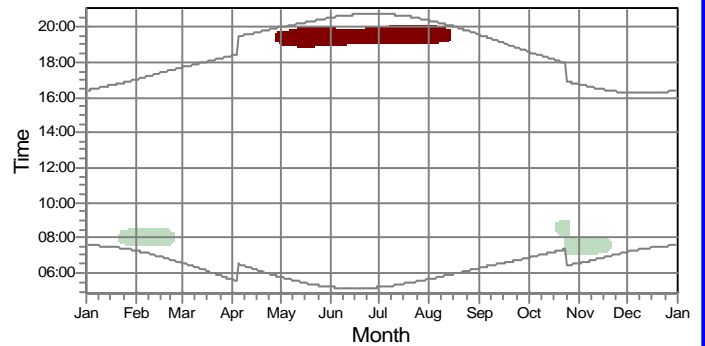
356: 356



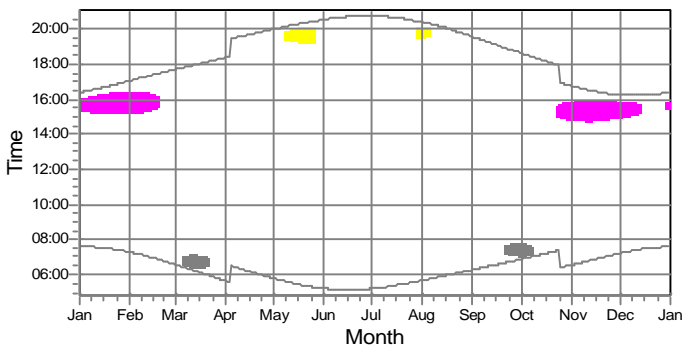
357: 357



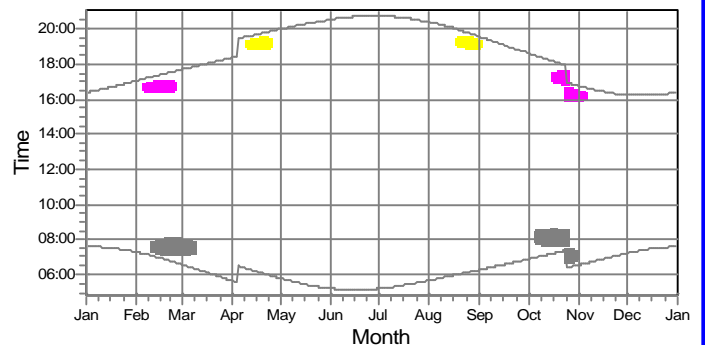
358: 358



359: 359



360: 360



WTGs



Project:
060119 Marble River

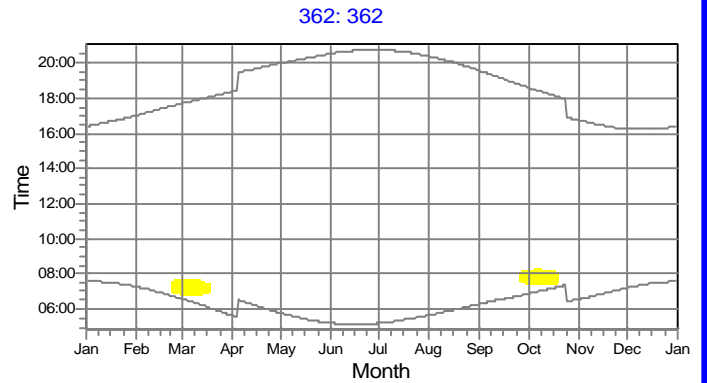
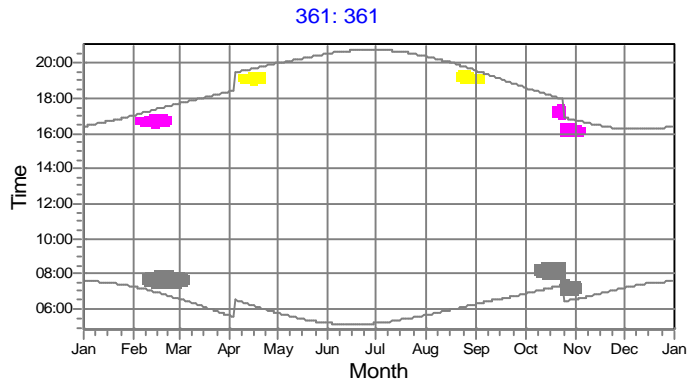
Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar, graphical

Calculation: 060119 Northern area



WTGs



Project:
060119 Marble River

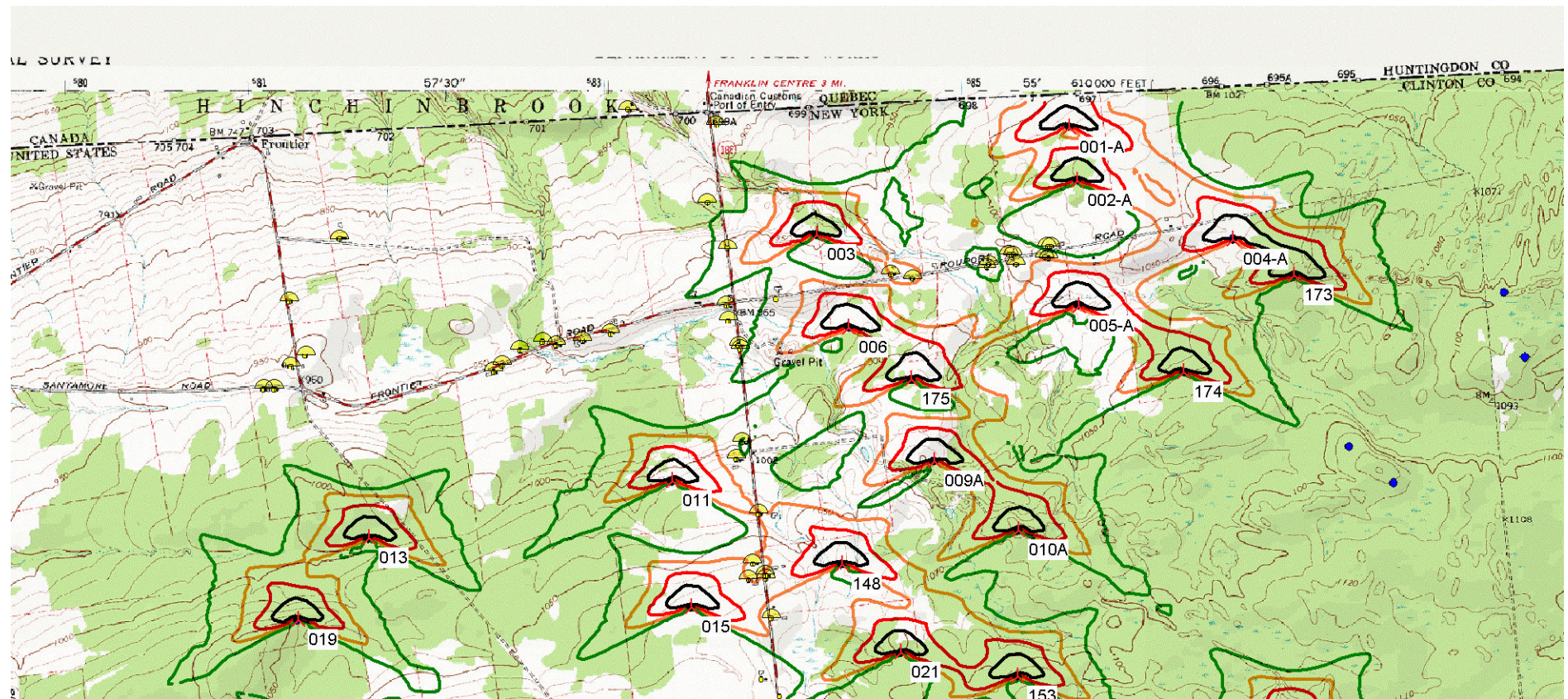
Description:
Marble River Wind Project
Shadow-Flicker, N part
17 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Bitmap map: 060106 Marble River USGS 50kz13.bmi

Calculation: 060119 Northern area File: 060106 Marble River USGS 50kz13.bmi



Map: 060106 Marble River USGS 50kz13, Print scale 1:35,000, Map center UTM NAD27 Zone: 18 East: 584,000 North: 4,981,750

- New WTG
 - Shadow receptor
 - 10
 - 25
 - 50
 - 100
- Isolines showing shadow in Shadow hours/per year. Real value calculation.

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NE part
23 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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Calculated:
01/21/06 13:21/2.4.0.67

SHADOW - Main Result

Calculation: 060120 NorthEast area

Assumptions for shadow calculations

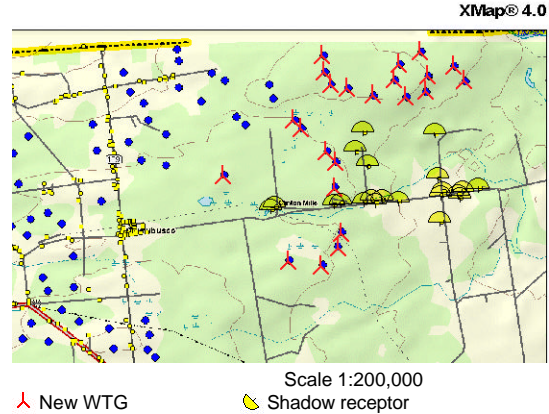
Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35

Operational time

N	NE	E	SE	S	SW	W	NW	Sum
1,850	1,325	800	713	625	663	700	1,275	7,950



WTGs

UTM NAD27 Zone: 18			Row data/Description	WTG type		Valid	Manufact.	Type	Power [kW]	Diam. [m]	Height [m]	RPM [RPM]
East	North	Z [m]		WTG type	WTG type							
1	592,974	4,982,758	320 112	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
2	593,277	4,982,376	300 113-R	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
3	592,301	4,982,491	330 114	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
4	591,724	4,981,935	332 115	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
5	592,098	4,983,136	324 116	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
6	591,414	4,982,375	343 117	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
7	591,540	4,982,787	339 119	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
8	588,759	4,981,272	335 125	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
9	588,949	4,981,063	335 126	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
10	589,624	4,980,464	335 132	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
11	589,885	4,980,175	335 133	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
12	589,873	4,979,497	341 134-S	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
13	590,062	4,978,309	331 135	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
14	586,901	4,979,788	350 136	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
15	590,175	4,982,139	337 137-W	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
16	589,725	4,982,241	337 138	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
17	589,537	4,982,557	343 139	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
18	589,492	4,982,985	343 140	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
19	588,664	4,977,534	343 141	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
20	589,970	4,977,921	328 146-R	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
21	589,541	4,977,425	335 147	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
22	590,860	4,981,958	335 155	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7
23	592,245	4,982,087	318 156	Gamesa G90/2000	Gamesa G90/2000	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7

Shadow receptor-Input

		UTM NAD27 Zone: 18			Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]
No.	Name	East	North	Z [m]					
005	005	592,512	4,980,953	297	1.0	1.0	1.0	0.0	0.0
006	006	588,179	4,978,874	335	1.0	1.0	1.0	0.0	0.0
007	007	588,282	4,978,954	335	1.0	1.0	1.0	0.0	0.0
008	008	589,856	4,979,023	333	1.0	1.0	1.0	0.0	0.0
009	009	590,038	4,979,070	333	1.0	1.0	1.0	0.0	0.0
010	010	590,657	4,979,098	320	1.0	1.0	1.0	0.0	0.0
011	011	590,966	4,979,081	313	1.0	1.0	1.0	0.0	0.0

Continued on next page...

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NE part
23 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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Calculated:
01/21/06 13:21/2.4.0.67

SHADOW - Main Result

Calculation: 060120 NorthEast area

...continued from previous page

UTM NAD27 Zone: 18

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window
				[m]	[m]	[m]	[m]	[°]	[°]
012	012	590,862	4,979,172	315	1.0	1.0	1.0	0.0	0.0
013	013	590,424	4,980,451	316	1.0	1.0	1.0	0.0	0.0
014	014	590,620	4,980,977	315	1.0	1.0	1.0	0.0	0.0
015	015	590,745	4,980,083	312	1.0	1.0	1.0	0.0	0.0
016	016	591,134	4,979,174	309	1.0	1.0	1.0	0.0	0.0
017	017	591,570	4,979,140	301	1.0	1.0	1.0	0.0	0.0
018	018	592,614	4,979,774	279	1.0	1.0	1.0	0.0	0.0
019	019	592,700	4,979,313	290	1.0	1.0	1.0	0.0	0.0
020	020	592,753	4,979,405	290	1.0	1.0	1.0	0.0	0.0
021	021	593,148	4,979,340	282	1.0	1.0	1.0	0.0	0.0
022	022	593,271	4,979,443	276	1.0	1.0	1.0	0.0	0.0
023	023	593,203	4,979,248	280	1.0	1.0	1.0	0.0	0.0
024	024	593,692	4,979,519	274	1.0	1.0	1.0	0.0	0.0
025	025	592,684	4,978,622	292	1.0	1.0	1.0	0.0	0.0

Calculation Results

No.	Name	Shadow, worst case			Shadow, expected values
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
005	005	0:00	0	0:00	0:00
006	006	0:00	0	0:00	0:00
007	007	0:00	0	0:00	0:00
008	008	0:00	0	0:00	0:00
009	009	0:00	0	0:00	0:00
010	010	18:52	53	0:26	6:00
011	011	0:00	0	0:00	0:00
012	012	0:00	0	0:00	0:00
013	013	33:22	83	0:36	8:29
014	014	0:00	0	0:00	0:00
015	015	10:42	33	0:26	3:20
016	016	0:00	0	0:00	0:00
017	017	0:00	0	0:00	0:00
018	018	0:00	0	0:00	0:00
019	019	0:00	0	0:00	0:00
020	020	0:00	0	0:00	0:00
021	021	0:00	0	0:00	0:00
022	022	0:00	0	0:00	0:00
023	023	0:00	0	0:00	0:00
024	024	0:00	0	0:00	0:00
025	025	0:00	0	0:00	0:00

Project: 060119 Marble River

Description: Marble River Wind Project
Shadow-Flicker, NE part
23 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060120 NorthEast area Shadow receptor: 010 - 010

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Table with 12 columns for months (January to December) and rows for each day (1-31) showing sun rise and set times. Includes summary rows for Potential sun hours, Total, worst case, Sun reduction, Oper. time red., Wind dir. red., Total reduction, and Total, real.

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

Matrix for table layout: 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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NE part
23 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060120 NorthEast area Shadow receptor: 013 - 013

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes
Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34 16:25	07:17 17:03	06:35 17:42	16:20 (11) 16:34 (11)	05:38 18:23	17:34 (10) 20:01
2	07:34 16:26	07:15 17:04	06:33 17:44	16:19 (11) 17:44	05:36 18:24	17:32 (10) 20:01
3	07:34 16:26	07:14 17:06	06:32 17:45	16:18 (11) 17:45	05:34 18:25	17:32 (10) 20:02
4	07:34 16:27	07:13 17:07	06:30 17:47	16:18 (11) 17:47	05:33 18:27	17:31 (10) 20:03
5	07:34 16:28	07:12 17:09	06:28 17:48	16:18 (11) 17:48	06:31 19:28	18:31 (10) 20:04
6	07:34 16:29	07:11 17:10	16:24 (11) 16:30 (11)	06:26 17:49	06:29 19:29	18:31 (10) 20:06
7	07:34 16:31	07:09 17:12	16:19 (11) 16:35 (11)	06:25 17:51	06:27 19:30	18:31 (10) 20:07
8	07:34 16:32	07:08 17:13	16:18 (11) 16:38 (11)	06:23 17:52	06:25 19:32	18:31 (10) 20:08
9	07:33 16:33	07:07 17:14	16:16 (11) 16:38 (11)	06:21 17:53	06:23 19:33	18:32 (10) 20:09
10	07:33 16:34	07:05 17:16	16:15 (11) 16:41 (11)	06:19 17:55	06:22 19:34	18:32 (10) 20:10
11	07:33 16:35	07:04 17:17	16:13 (11) 16:41 (11)	06:17 17:56	06:20 19:35	18:32 (10) 20:12
12	07:32 16:36	07:02 17:19	16:12 (11) 16:42 (11)	06:15 17:57	06:18 19:37	18:34 (10) 20:13
13	07:32 16:37	07:01 17:20	16:12 (11) 16:42 (11)	06:14 17:58	06:16 19:38	18:36 (10) 20:14
14	07:32 16:39	06:59 17:22	16:11 (11) 16:45 (11)	06:12 18:00	06:14 19:39	18:46 (10) 20:15
15	07:31 16:40	06:58 17:23	16:11 (11) 16:45 (11)	06:10 18:01	06:13 19:40	18:46 (10) 20:16
16	07:30 16:41	06:56 17:24	16:12 (11) 16:44 (11)	06:08 18:02	06:11 19:42	18:46 (10) 20:17
17	07:30 16:42	06:55 17:26	16:10 (11) 16:44 (11)	06:06 18:04	06:09 19:43	18:46 (10) 20:19
18	07:29 16:44	06:53 17:27	16:10 (11) 16:44 (11)	06:04 18:05	06:07 19:44	18:46 (10) 20:20
19	07:29 16:45	06:52 17:29	16:11 (11) 16:45 (11)	06:02 18:06	06:06 19:46	18:46 (10) 20:21
20	07:28 16:46	06:50 17:30	16:11 (11) 16:45 (11)	06:01 18:08	06:04 19:47	18:46 (10) 20:22
21	07:27 16:48	06:49 17:31	16:12 (11) 16:44 (11)	05:59 18:09	06:02 19:48	18:46 (10) 20:23
22	07:26 16:49	06:47 17:33	16:12 (11) 16:44 (11)	05:57 18:10	06:01 19:49	18:46 (10) 20:24
23	07:26 16:50	06:45 17:34	16:12 (11) 16:42 (11)	05:55 18:11	05:59 19:51	18:46 (10) 20:25
24	07:25 16:52	06:44 17:36	16:13 (11) 16:43 (11)	05:53 18:13	05:57 19:52	18:46 (10) 20:26
25	07:24 16:53	06:42 17:37	16:13 (11) 16:41 (11)	05:51 18:14	05:56 19:53	18:46 (10) 20:27
26	07:23 16:55	06:40 17:38	16:15 (11) 16:39 (11)	05:49 18:15	05:54 19:54	18:46 (10) 20:28
27	07:22 16:56	06:39 17:40	16:15 (11) 16:39 (11)	05:47 18:16	05:53 19:56	18:46 (10) 20:29
28	07:21 16:57	06:37 17:41	16:18 (11) 16:36 (11)	05:46 18:18	17:42 (10) 17:50 (10)	18:46 (10) 19:57
29	07:20 16:59		05:44 18:19	17:38 (10) 17:52 (10)	05:49 19:58	18:46 (10) 20:31
30	07:19 17:00		05:42 18:20	17:36 (10) 17:54 (10)	05:48 19:59	18:46 (10) 20:32
31	07:18 17:02		05:40 18:22	17:34 (10) 17:56 (10)	05:47 19:59	18:46 (10) 20:33
Potential sun hours	286	291	369	404	282	-254
Total, worst case		632	76	282		
Sun reduction		0.45	0.50	0.55		
Oper. time red.		0.91	0.91	0.91		
Wind dir. red.		0.57	0.61	0.62		
Total reduction		0.23	0.28	0.31		
Total, real		145	21	87		

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NE part
23 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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Calculated:
01/21/06 13:21/2.4.0.67

SHADOW - Calendar

Calculation: 060120 NorthEast area Shadow receptor: 013 - 013

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:40 20:25	06:17 19:34	18:31 (10) 18:51 (10)	06:53 18:38	06:33 16:45
2	05:13 20:46	05:42 20:23	06:18 19:33	18:30 (10) 18:50 (10)	06:54 18:36	16:45 16:08 (11)
3	05:14 20:46	05:43 20:22	06:19 19:31	18:29 (10) 18:51 (10)	06:55 18:34	16:46 16:08 (11)
4	05:14 20:46	05:44 20:21	06:21 19:29	18:28 (10) 18:52 (10)	06:57 18:32	16:47 16:05 (11)
5	05:15 20:46	05:45 20:20	06:22 19:27	18:28 (10) 18:52 (10)	06:58 18:30	16:48 16:05 (11)
6	05:16 20:45	05:46 20:18	06:23 19:25	18:27 (10) 18:53 (10)	06:59 18:29	16:49 16:04 (11)
7	05:16 20:45	05:47 20:17	06:24 19:23	18:26 (10) 18:52 (10)	07:00 18:27	16:50 16:03 (11)
8	05:17 20:45	05:48 20:15	06:25 19:21	18:25 (10) 18:51 (10)	07:02 18:25	16:51 16:02 (11)
9	05:18 20:44	05:50 20:14	06:27 19:20	18:26 (10) 18:50 (10)	07:03 18:23	16:52 16:01 (11)
10	05:19 20:44	05:51 20:13	06:28 19:18	18:25 (10) 18:49 (10)	07:04 18:21	16:53 16:00 (11)
11	05:19 20:43	05:52 20:11	06:29 19:16	18:26 (10) 18:48 (10)	07:06 18:19	16:54 16:00 (11)
12	05:20 20:43	05:53 20:10	06:30 19:14	18:26 (10) 18:48 (10)	07:07 18:18	16:55 16:00 (11)
13	05:21 20:42	05:54 20:08	06:31 19:12	18:27 (10) 18:45 (10)	07:08 18:16	16:56 16:00 (11)
14	05:22 20:42	05:56 20:07	06:32 19:10	18:28 (10) 18:44 (10)	07:09 18:14	16:57 16:00 (11)
15	05:23 20:41	05:57 20:05	06:34 19:08	18:31 (10) 18:41 (10)	07:11 18:12	16:58 16:00 (11)
16	05:24 20:40	05:58 20:03	06:35 19:06	18:32 (10) 18:11	07:12 18:11	16:59 16:00 (11)
17	05:25 20:40	05:59 20:02	06:36 19:04	18:33 (10) 18:09	07:13 18:10	17:00 16:00 (11)
18	05:26 20:39	06:00 20:00	06:37 19:03	18:34 (10) 18:07	07:14 18:10	17:01 16:00 (11)
19	05:27 20:38	06:01 19:57	06:38 19:01	18:35 (10) 18:06	07:15 18:10	17:02 16:00 (11)
20	05:28 20:37	06:03 19:55	06:40 18:59	18:36 (10) 18:04	07:16 18:10	17:03 16:00 (11)
21	05:29 20:36	06:04 19:54	06:41 18:57	18:37 (10) 18:02	07:17 18:10	17:04 16:00 (11)
22	05:30 20:35	06:05 19:52	06:42 18:55	18:38 (10) 18:01	07:18 18:10	17:05 16:00 (11)
23	05:31 20:34	06:06 19:50	06:43 18:53	18:39 (10) 17:59	07:19 18:10	17:06 16:00 (11)
24	05:32 20:33	06:07 19:49	06:44 18:51	18:40 (10) 17:57	07:20 18:10	17:07 16:00 (11)
25	05:33 20:32	06:09 19:47	06:46 18:49	18:41 (10) 16:56	07:21 18:10	17:08 16:00 (11)
26	05:34 20:31	06:10 19:45	06:47 18:47	18:42 (10) 16:54	07:22 18:10	17:09 16:00 (11)
27	05:35 20:30	06:11 19:43	06:48 18:45	18:43 (10) 16:53	07:23 18:10	17:10 16:00 (11)
28	05:36 20:29	06:12 19:42	06:49 18:43	18:44 (10) 16:51	07:24 18:10	17:11 16:00 (11)
29	05:37 20:28	06:13 19:40	06:51 18:42	18:45 (10) 16:50	07:25 18:10	17:12 16:00 (11)
30	05:38 20:27	06:15 19:38	18:37 (10) 18:40	06:52 18:40	07:26 18:10	17:13 16:00 (11)
31	05:39 20:26	06:16 19:36	18:34 (10) 18:48 (10)	06:53 18:47	07:27 18:10	17:14 16:00 (11)
Potential sun hours	-272	4	376	341	288	274
Total, worst case		24	324	578	86	
Sun reduction		0.55	0.55	0.45	0.35	
Oper. time red.		0.91	0.91	0.91	0.91	
Wind dir. red.		0.62	0.62	0.57	0.57	
Total reduction		0.31	0.31	0.23	0.18	
Total, real		7	100	133	15	

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)

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NE part
23 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/21/06 23:46 / 6
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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/21/06 13:21/2.4.0.67

SHADOW - Calendar

Calculation: 060120 NorthEast area Shadow receptor: 015 - 015

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes
 Sun shine probabilities (part of time from sun rise to sun set with sun shine)
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
 Operational time
 N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:03	06:35 17:42	05:38 18:23	05:46 20:01	05:13 20:34	05:13 20:46	05:40 20:25	06:17 19:34	18:45 (11) 19:07 (11)	06:53 18:38	06:33 16:45	07:13 16:16
2	07:34 16:26	07:15 17:04	06:33 17:44	05:36 18:24	05:36 20:01	05:12 20:35	05:13 20:46	05:42 20:23	06:18 19:33	18:46 (11) 19:06 (11)	06:54 18:36	06:35 16:44	07:14 16:16
3	07:34 16:26	07:14 17:06	06:32 17:45	05:34 18:25	05:34 20:02	05:12 20:36	05:14 20:46	05:43 20:22	06:19 19:31	18:45 (11) 19:05 (11)	06:55 18:34	06:36 16:42	07:15 16:16
4	07:34 16:27	07:13 17:07	06:30 17:47	05:32 18:27	05:32 20:03	05:11 20:36	05:14 20:46	05:44 20:21	06:21 19:29	18:48 (11) 19:02 (11)	06:57 18:32	06:37 16:41	07:16 16:15
5	07:34 16:28	07:12 17:09	06:28 17:48	06:31 19:28	06:31 20:04	05:11 20:37	05:15 20:46	05:45 20:20	06:22 19:27	18:50 (11) 19:00 (11)	06:58 18:30	06:39 16:40	07:17 16:15
6	07:34 16:29	07:11 17:10	06:26 17:49	06:29 19:29	06:29 20:05	05:11 20:38	05:16 20:45	05:46 20:18	06:23 19:25	19:00 (11)	06:59 18:29	06:40 16:38	07:19 16:15
7	07:34 16:31	07:09 17:12	06:25 17:51	06:27 19:30	18:53 (11) 19:03 (11)	05:38 20:07	05:16 20:39	05:47 20:45	06:24 19:23	07:00 18:27	06:42 16:37	07:20 16:15	07:20 16:15
8	07:34 16:32	07:08 17:13	06:23 17:52	06:25 19:32	18:51 (11) 19:05 (11)	05:37 20:08	05:10 20:39	05:48 20:45	06:25 19:21	07:02 18:25	06:43 16:36	07:21 16:14	07:21 16:14
9	07:33 16:33	07:07 17:14	06:21 17:53	06:23 19:33	18:48 (11) 19:08 (11)	05:35 20:09	05:10 20:40	05:18 20:44	06:27 19:20	07:03 18:23	06:44 16:35	07:22 16:14	07:22 16:14
10	07:33 16:34	07:05 17:16	06:19 17:55	06:22 19:34	18:48 (11) 19:08 (11)	05:34 20:10	05:09 20:44	05:19 20:13	06:28 19:18	07:04 18:21	06:46 16:33	07:22 16:14	07:22 16:14
11	07:33 16:35	07:04 17:17	06:17 17:56	06:20 19:35	18:46 (11) 19:08 (11)	05:33 20:12	05:09 20:43	05:19 20:11	06:29 19:16	07:05 18:19	06:47 16:32	07:23 16:14	07:23 16:14
12	07:32 16:36	07:02 17:19	06:15 17:57	06:18 19:37	18:44 (11) 19:08 (11)	05:31 20:13	05:09 20:42	05:20 20:10	06:30 19:14	07:07 18:18	06:48 16:31	07:24 16:14	07:24 16:14
13	07:32 16:37	07:01 17:20	06:14 17:58	06:16 19:38	18:44 (11) 19:08 (11)	05:30 20:14	05:09 20:42	05:21 20:08	06:31 19:12	07:08 18:16	06:50 16:30	07:25 16:14	07:25 16:14
14	07:32 16:39	06:59 17:22	06:12 18:00	06:14 19:39	18:45 (11) 19:09 (11)	05:29 20:15	05:09 20:43	05:22 20:07	06:32 19:10	07:09 18:14	06:51 16:29	07:26 16:15	07:26 16:15
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:40	18:43 (11) 19:09 (11)	05:28 20:16	05:09 20:44	05:23 20:05	06:34 19:08	07:11 18:12	06:53 16:28	07:27 16:15	07:27 16:15
16	07:30 16:41	06:56 17:24	06:08 18:02	06:11 19:42	18:43 (11) 19:07 (11)	05:27 20:17	05:09 20:44	05:24 20:03	06:35 19:06	07:12 18:11	06:54 16:27	07:27 16:15	07:27 16:15
17	07:30 16:42	06:55 17:26	06:06 18:04	06:09 19:43	18:44 (11) 19:08 (11)	05:26 20:19	05:09 20:44	05:25 20:02	06:36 19:04	07:13 18:09	06:55 16:26	07:28 16:15	07:28 16:15
18	07:29 16:44	06:53 17:27	06:04 18:05	06:07 19:44	18:44 (11) 19:06 (11)	05:25 20:20	05:09 20:45	06:00 20:00	06:37 19:02	07:15 18:07	06:57 16:25	07:29 16:16	07:29 16:16
19	07:29 16:45	06:52 17:29	06:02 18:06	06:06 19:46	18:44 (11) 19:06 (11)	05:23 20:21	05:09 20:45	06:01 19:57	06:38 19:01	07:16 18:06	06:58 16:24	07:29 16:16	07:29 16:16
20	07:28 16:46	06:50 17:30	06:01 18:08	06:04 19:47	18:47 (11) 19:05 (11)	05:22 20:22	05:09 20:45	06:03 19:55	06:40 18:59	07:17 18:04	06:59 16:23	07:30 16:16	07:30 16:16
21	07:27 16:48	06:49 17:31	05:59 18:09	06:02 19:48	18:47 (11) 19:03 (11)	05:21 20:23	05:09 20:46	06:04 19:54	06:41 18:57	07:18 18:02	07:01 16:22	07:31 16:17	07:31 16:17
22	07:26 16:49	06:47 17:33	05:57 18:10	06:01 19:49	18:49 (11) 18:59 (11)	05:21 20:24	05:09 20:46	06:05 19:52	06:42 18:55	07:20 18:01	07:02 16:22	07:31 16:17	07:31 16:17
23	07:26 16:50	06:45 17:34	05:55 18:11	05:59 19:51	05:20 20:25	05:10 20:46	05:31 20:34	06:06 19:50	06:43 18:53	07:21 17:59	07:03 16:21	07:32 16:18	07:32 16:18
24	07:25 16:52	06:44 17:36	05:53 18:13	05:57 19:52	05:19 20:26	05:10 20:46	05:32 20:33	06:07 19:49	06:44 18:51	07:22 17:57	07:04 16:20	07:32 16:18	07:32 16:18
25	07:24 16:53	06:42 17:37	05:51 18:14	05:56 19:53	05:18 20:27	05:10 20:47	05:33 20:32	06:09 19:47	06:46 18:49	07:24 16:56	07:06 16:19	07:32 16:19	07:32 16:19
26	07:23 16:54	06:40 17:38	05:49 18:15	05:54 19:54	05:17 20:28	05:10 20:47	05:34 20:31	06:10 19:45	06:47 18:47	07:25 16:54	07:07 16:19	07:33 16:20	07:33 16:20
27	07:22 16:56	06:39 17:40	05:47 18:16	05:53 19:56	05:16 20:29	05:11 20:47	05:35 20:30	06:11 19:43	06:48 18:45	07:27 16:53	07:08 16:18	07:33 16:20	07:33 16:20
28	07:21 16:57	06:37 17:41	05:46 18:18	05:51 19:57	05:16 20:30	05:11 20:47	05:36 20:29	06:12 19:42	06:49 18:44	07:28 16:51	07:09 16:18	07:33 16:21	07:33 16:21
29	07:20 16:59		05:44 18:19	05:49 19:58	05:15 20:31	05:12 20:47	05:37 20:28	06:13 19:40	06:51 18:46	07:29 16:50	07:11 16:17	07:34 16:22	07:34 16:22
30	07:19 17:00		05:42 18:20	05:48 19:59	05:14 20:32	05:12 20:47	05:38 20:27	06:15 19:38	06:52 18:45	07:31 16:48	07:12 16:17	07:34 16:23	07:34 16:23
31	07:18 17:02		05:40 18:22		05:14 20:33	05:13 20:26	05:39 20:36	06:16 19:36	06:53 18:44	07:32 16:47	07:13 16:18	07:34 16:23	07:34 16:23
Potential sun hours	286	291	369	404		-285	-254	-272	4	376	341	288	274
Total, worst case				320					236	86			
Sun reduction				0.55					0.55	0.55			
Oper. time red.				0.91					0.91	0.91			
Wind dir. red.				0.63					0.63	0.63			
Total reduction				0.31					0.31	0.31			
Total, real				100					74	27			

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NE part
23 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

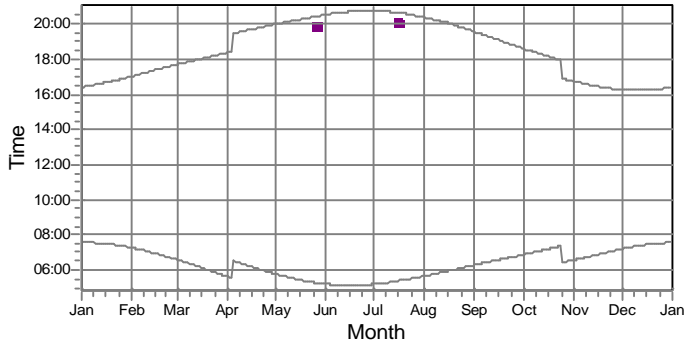
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01/21/06 23:46 / 7
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/21/06 13:21/2.4.0.67

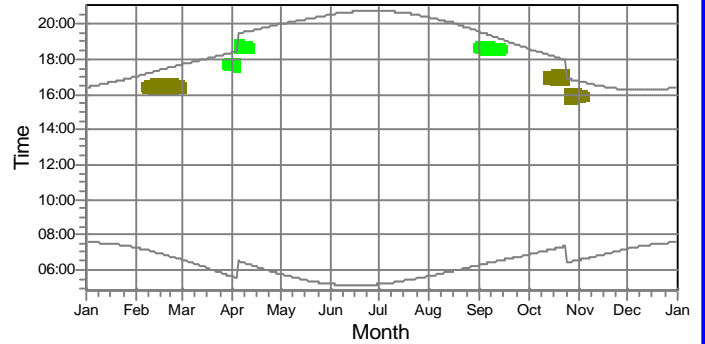
SHADOW - Calendar, graphical

Calculation: 060120 NorthEast area

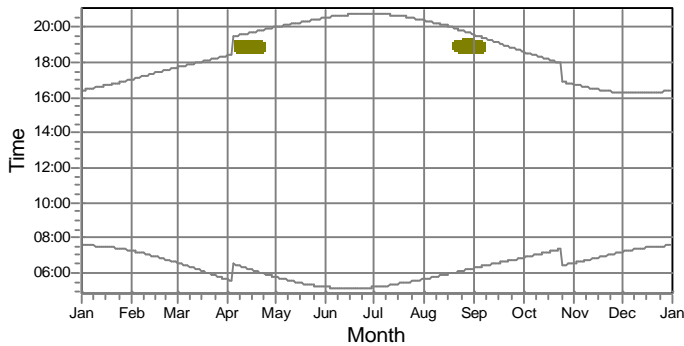
010: 010



013: 013



015: 015



WTGs

132

133

134-S

Project:
060119 Marble River

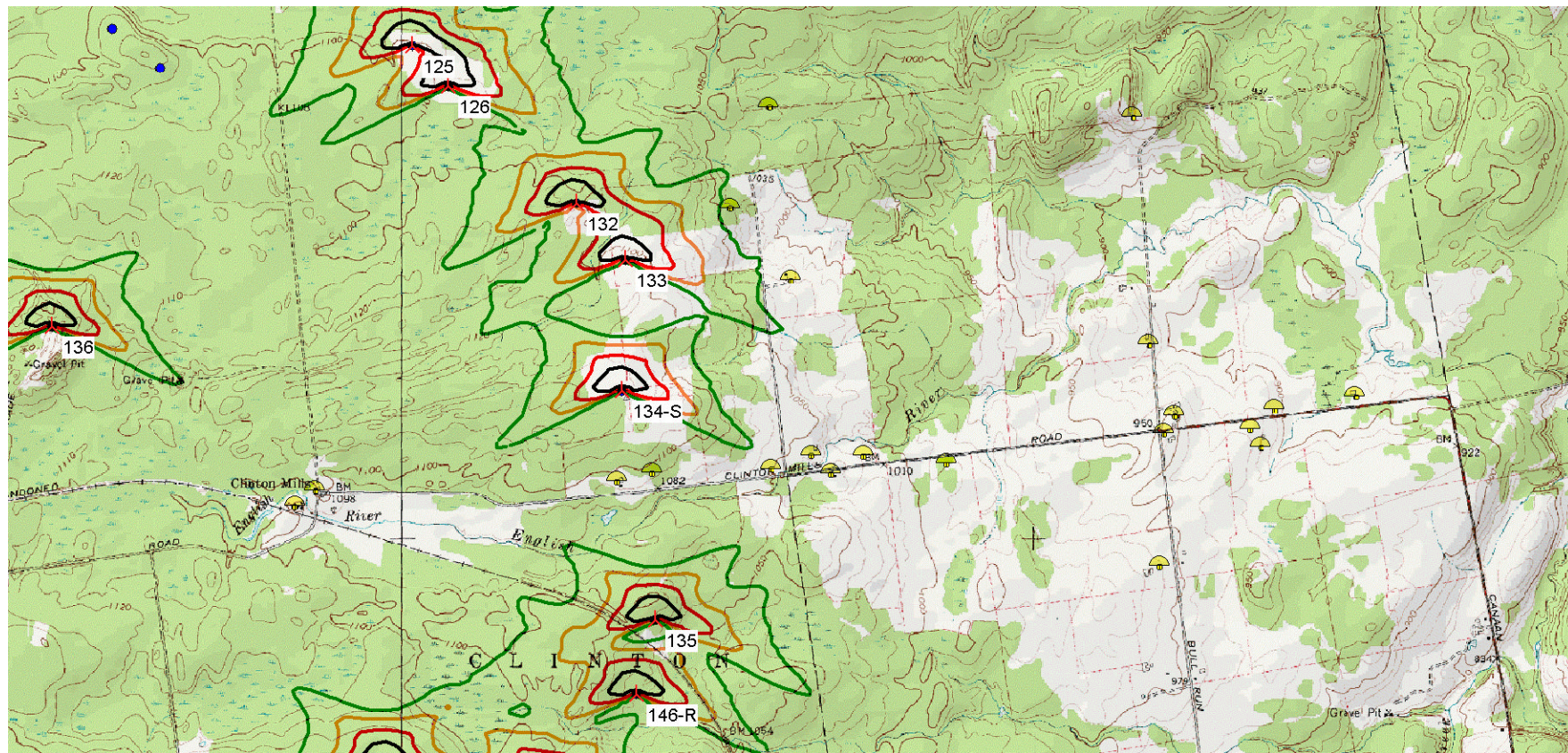
Description:
 Marble River Wind Project
 Shadow-Flicker, NE part
 23 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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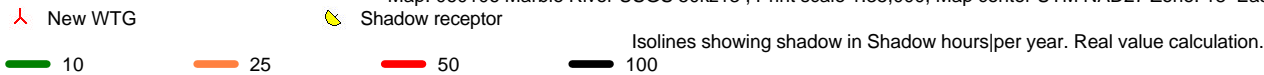
Calculated:
 01/21/06 13:21/2.4.0.67

SHADOW - Bitmap map: 060106 Marble River USGS 50kz13.bmi

Calculation: 060120 NorthEast area File: 060106 Marble River USGS 50kz13.bmi



Map: 060106 Marble River USGS 50kz13, Print scale 1:35,000, Map center UTM NAD27 Zone: 18 East: 591,000 North: 4,979,500



Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 22:52/2.4.0.67

SHADOW - Main Result

Calculation: 060123 NorthWest area

Assumptions for shadow calculations

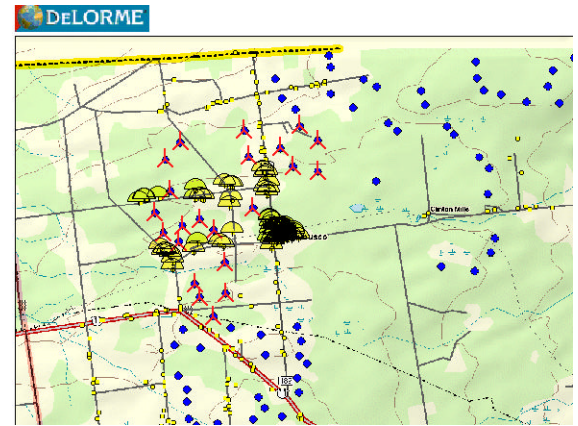
Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35

Operational time

N	NE	E	SE	S	SW	W	NW	Sum
1,850	1,325	800	713	625	663	700	1,275	7,950



New WTG

Shadow receptor

WTGs

UTM NAD27 Zone: 18				Row data/Description	WTG type		Valid	Manufact.	Type	Power [kW]	Diam. [m]	Height [m]	RPM [RPM]
East	North	Z	Valid		Type								
1	584,870	4,981,221	317	009A	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
2	585,348	4,980,842	328	010A	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
3	583,400	4,981,092	309	011	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
4	581,703	4,980,749	305	013	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
5	583,517	4,980,388	326	015	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
6	581,310	4,980,287	319	019	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
7	584,694	4,980,148	335	021	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
8	583,653	4,979,018	351	028	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
9	581,041	4,978,859	328	031	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
10	582,621	4,978,422	350	033	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
11	582,238	4,978,704	339	034	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
12	581,269	4,978,339	335	035	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
13	581,697	4,978,098	343	036-A	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
14	582,640	4,976,154	373	042	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
15	582,264	4,976,648	359	083	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
16	582,131	4,977,001	352	084	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
17	582,952	4,976,751	363	085	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
18	582,926	4,977,575	357	087	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
19	584,358	4,980,639	325	148	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
20	581,781	4,978,525	337	151	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
21	585,354	4,980,026	338	153	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		
22	581,455	4,979,460	334	172	Yes	GAMESA	G90/2000	2,000	90.0	78.0	16.7		

Shadow receptor-Input

UTM NAD27 Zone: 18									
No.	Name	East	North	Z	Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]
050	050	584,016	4,979,897	334	1.0	1.0	1.0	0.0	0.0
051	051	582,907	4,979,631	341	1.0	1.0	1.0	0.0	0.0
052	052	583,054	4,979,578	344	1.0	1.0	1.0	0.0	0.0
053	053	583,088	4,979,232	351	1.0	1.0	1.0	0.0	0.0
054	054	584,072	4,979,445	345	1.0	1.0	1.0	0.0	0.0
055	055	583,032	4,979,053	348	1.0	1.0	1.0	0.0	0.0
056	056	583,122	4,978,364	349	1.0	1.0	1.0	0.0	0.0
057	057	584,106	4,978,736	351	1.0	1.0	1.0	0.0	0.0

Continued on next page...

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, NW part
 22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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Licensed user:

Wind Engineers, Inc.
 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated:

01/23/06 22:52/2.4.0.67

SHADOW - Main Result

Calculation: 060123 NorthWest area

...continued from previous page

UTM NAD27 Zone: 18

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window
				[m]	[m]	[m]	[m]	[°]	[°]
058	058	584,104	4,978,696	352	1.0	1.0	1.0	0.0	0.0
059	059	584,120	4,978,551	355	1.0	1.0	1.0	0.0	0.0
060	060	584,179	4,978,654	353	1.0	1.0	1.0	0.0	0.0
061	061	584,178	4,978,470	357	1.0	1.0	1.0	0.0	0.0
062	062	584,258	4,978,482	356	1.0	1.0	1.0	0.0	0.0
063	063	584,289	4,978,493	356	1.0	1.0	1.0	0.0	0.0
064	064	584,308	4,978,496	356	1.0	1.0	1.0	0.0	0.0
065	065	584,317	4,978,209	358	1.0	1.0	1.0	0.0	0.0
066	066	584,339	4,978,207	358	1.0	1.0	1.0	0.0	0.0
067	067	584,390	4,978,214	358	1.0	1.0	1.0	0.0	0.0
068	068	584,413	4,978,233	358	1.0	1.0	1.0	0.0	0.0
069	069	584,378	4,978,172	358	1.0	1.0	1.0	0.0	0.0
070	070	584,340	4,978,165	358	1.0	1.0	1.0	0.0	0.0
071	071	584,321	4,978,158	358	1.0	1.0	1.0	0.0	0.0
072	072	584,096	4,978,184	358	1.0	1.0	1.0	0.0	0.0
073	073	584,471	4,978,180	358	1.0	1.0	1.0	0.0	0.0
074	074	584,451	4,978,180	358	1.0	1.0	1.0	0.0	0.0
075	075	584,501	4,978,187	358	1.0	1.0	1.0	0.0	0.0
076	076	584,500	4,978,229	358	1.0	1.0	1.0	0.0	0.0
077	077	584,494	4,978,320	358	1.0	1.0	1.0	0.0	0.0
078	078	584,477	4,978,300	358	1.0	1.0	1.0	0.0	0.0
079	079	584,490	4,978,359	358	1.0	1.0	1.0	0.0	0.0
080	080	584,477	4,978,391	358	1.0	1.0	1.0	0.0	0.0
081	081	584,482	4,978,410	358	1.0	1.0	1.0	0.0	0.0
082	082	584,467	4,978,426	357	1.0	1.0	1.0	0.0	0.0
083	083	584,461	4,978,450	357	1.0	1.0	1.0	0.0	0.0
084	084	584,513	4,978,463	356	1.0	1.0	1.0	0.0	0.0
085	085	584,518	4,978,418	357	1.0	1.0	1.0	0.0	0.0
086	086	584,524	4,978,364	358	1.0	1.0	1.0	0.0	0.0
087	087	584,526	4,978,335	358	1.0	1.0	1.0	0.0	0.0
088	088	584,532	4,978,310	358	1.0	1.0	1.0	0.0	0.0
089	089	584,536	4,978,283	358	1.0	1.0	1.0	0.0	0.0
090	090	584,537	4,978,260	358	1.0	1.0	1.0	0.0	0.0
091	091	584,579	4,978,237	358	1.0	1.0	1.0	0.0	0.0
092	092	584,577	4,978,194	358	1.0	1.0	1.0	0.0	0.0
093	093	584,452	4,978,521	356	1.0	1.0	1.0	0.0	0.0
094	094	584,412	4,978,517	356	1.0	1.0	1.0	0.0	0.0
095	095	584,388	4,978,512	356	1.0	1.0	1.0	0.0	0.0
096	096	584,363	4,978,503	356	1.0	1.0	1.0	0.0	0.0
097	097	584,344	4,978,499	356	1.0	1.0	1.0	0.0	0.0
098	098	584,143	4,978,365	358	1.0	1.0	1.0	0.0	0.0
099	099	584,209	4,978,234	358	1.0	1.0	1.0	0.0	0.0
100	100	584,510	4,978,528	355	1.0	1.0	1.0	0.0	0.0
101	101	584,708	4,978,253	358	1.0	1.0	1.0	0.0	0.0
102	102	584,755	4,978,372	357	1.0	1.0	1.0	0.0	0.0
103	103	584,750	4,978,412	356	1.0	1.0	1.0	0.0	0.0
104	104	584,866	4,978,228	358	1.0	1.0	1.0	0.0	0.0
105	105	584,685	4,978,213	358	1.0	1.0	1.0	0.0	0.0
106	106	584,164	4,977,949	358	1.0	1.0	1.0	0.0	0.0
107	107	584,214	4,978,077	358	1.0	1.0	1.0	0.0	0.0
108	108	584,155	4,978,129	358	1.0	1.0	1.0	0.0	0.0
109	109	582,792	4,978,057	355	1.0	1.0	1.0	0.0	0.0
110	110	581,549	4,977,555	343	1.0	1.0	1.0	0.0	0.0
111	111	581,404	4,977,781	341	1.0	1.0	1.0	0.0	0.0
112	112	581,487	4,977,708	343	1.0	1.0	1.0	0.0	0.0
113	113	581,212	4,977,898	337	1.0	1.0	1.0	0.0	0.0
114	114	582,329	4,979,229	343	1.0	1.0	1.0	0.0	0.0
115	115	581,544	4,977,368	343	1.0	1.0	1.0	0.0	0.0
259	259	581,334	4,977,795	340	1.0	1.0	1.0	0.0	0.0

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Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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US-RIVERSIDE, CA 92506
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SHADOW - Main Result

Calculation: 060123 NorthWest area

...continued from previous page

UTM NAD27 Zone: 18

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window
		[m]	[m]	[m]	[m]	[m]	[m]	[°]	[°]
260	260	582,088	4,977,840	351	1.0	1.0	1.0	0.0	0.0
261	261	582,199	4,978,079	349	1.0	1.0	1.0	0.0	0.0
262	262	582,130	4,979,485	339	1.0	1.0	1.0	0.0	0.0
264	264	583,956	4,979,845	335	1.0	1.0	1.0	0.0	0.0
336	336	581,275	4,977,762	339	1.0	1.0	1.0	0.0	0.0
337	337	580,632	4,979,137	325	1.0	1.0	1.0	0.0	0.0
338	338	580,767	4,979,206	328	1.0	1.0	1.0	0.0	0.0
339	339	580,797	4,979,209	328	1.0	1.0	1.0	0.0	0.0
340	340	581,151	4,979,271	329	1.0	1.0	1.0	0.0	0.0
341	341	582,263	4,979,266	342	1.0	1.0	1.0	0.0	0.0
342	342	582,114	4,979,243	340	1.0	1.0	1.0	0.0	0.0
343	343	583,088	4,979,575	345	1.0	1.0	1.0	0.0	0.0
344	344	582,885	4,977,988	359	1.0	1.0	1.0	0.0	0.0
346	346	584,286	4,978,156	358	1.0	1.0	1.0	0.0	0.0
347	347	584,232	4,978,329	358	1.0	1.0	1.0	0.0	0.0
348	348	584,229	4,978,499	356	1.0	1.0	1.0	0.0	0.0
349	349	584,325	4,978,497	356	1.0	1.0	1.0	0.0	0.0
350	350	584,016	4,979,373	347	1.0	1.0	1.0	0.0	0.0
351	351	583,974	4,979,473	345	1.0	1.0	1.0	0.0	0.0
352	352	584,062	4,979,626	339	1.0	1.0	1.0	0.0	0.0
353	353	583,916	4,979,994	333	1.0	1.0	1.0	0.0	0.0

Calculation Results

No.	Name	Shadow, worst case			Shadow, expected values
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
050	050	23:04	61	0:30	6:28
051	051	19:30	56	0:24	4:32
052	052	16:08	46	0:26	3:44
053	053	21:20	47	0:36	5:21
054	054	36:40	68	0:38	7:54
055	055	27:06	78	0:34	7:24
056	056	42:36	99	0:42	13:15
057	057	0:00	0	0:00	0:00
058	058	0:00	0	0:00	0:00
059	059	0:00	0	0:00	0:00
060	060	0:00	0	0:00	0:00
061	061	0:00	0	0:00	0:00
062	062	0:00	0	0:00	0:00
063	063	0:00	0	0:00	0:00
064	064	0:00	0	0:00	0:00
065	065	0:00	0	0:00	0:00
066	066	0:00	0	0:00	0:00
067	067	0:00	0	0:00	0:00
068	068	0:00	0	0:00	0:00
069	069	0:00	0	0:00	0:00
070	070	0:00	0	0:00	0:00
071	071	0:00	0	0:00	0:00
072	072	0:00	0	0:00	0:00
073	073	0:00	0	0:00	0:00
074	074	0:00	0	0:00	0:00
075	075	0:00	0	0:00	0:00
076	076	0:00	0	0:00	0:00
077	077	0:00	0	0:00	0:00
078	078	0:00	0	0:00	0:00
079	079	0:00	0	0:00	0:00
080	080	0:00	0	0:00	0:00

Continued on next page...

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
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SHADOW - Main Result

Calculation: 060123 NorthWest area

...continued from previous page

No.	Name	Shadow, worst case		Shadow, expected values	
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
081	081	0:00	0	0:00	0:00
082	082	0:00	0	0:00	0:00
083	083	0:00	0	0:00	0:00
084	084	0:00	0	0:00	0:00
085	085	0:00	0	0:00	0:00
086	086	0:00	0	0:00	0:00
087	087	0:00	0	0:00	0:00
088	088	0:00	0	0:00	0:00
089	089	0:00	0	0:00	0:00
090	090	0:00	0	0:00	0:00
091	091	0:00	0	0:00	0:00
092	092	0:00	0	0:00	0:00
093	093	0:56	14	0:04	0:18
094	094	0:00	0	0:00	0:00
095	095	0:00	0	0:00	0:00
096	096	0:00	0	0:00	0:00
097	097	0:00	0	0:00	0:00
098	098	0:00	0	0:00	0:00
099	099	0:00	0	0:00	0:00
100	100	7:24	43	0:14	2:23
101	101	0:00	0	0:00	0:00
102	102	0:00	0	0:00	0:00
103	103	0:00	0	0:00	0:00
104	104	0:00	0	0:00	0:00
105	105	0:00	0	0:00	0:00
106	106	0:00	0	0:00	0:00
107	107	0:00	0	0:00	0:00
108	108	0:00	0	0:00	0:00
109	109	0:00	0	0:00	0:00
110	110	16:32	46	0:26	3:50
111	111	0:00	0	0:00	0:00
112	112	0:00	0	0:00	0:00
113	113	56:44	91	0:42	15:40
114	114	8:42	36	0:22	2:41
115	115	21:54	54	0:32	5:12
259	259	0:00	0	0:00	0:00
260	260	11:56	61	0:24	3:12
261	261	54:32	143	0:42	15:41
262	262	14:40	39	0:32	4:23
264	264	20:46	62	0:28	5:45
336	336	0:00	0	0:00	0:00
337	337	59:10	128	0:44	15:10
338	338	62:56	123	0:48	16:19
339	339	57:08	120	0:42	15:01
340	340	0:00	0	0:00	0:00
341	341	10:40	38	0:26	3:18
342	342	22:38	60	0:32	7:01
343	343	12:06	38	0:24	2:46
344	344	0:00	0	0:00	0:00
346	346	0:00	0	0:00	0:00
347	347	0:00	0	0:00	0:00
348	348	0:00	0	0:00	0:00
349	349	0:00	0	0:00	0:00
350	350	54:34	84	0:44	11:52
351	351	4:06	20	0:16	0:48
352	352	0:00	0	0:00	0:00
353	353	12:50	39	0:28	3:47

<p>Project: 060119 Marble River</p>	<p>Description: Marble River Wind Project Shadow-Flicker, NW part 22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)</p>	<p>Printed/Page 01/24/06 03:39 / 5</p> <p>Licensed user: Wind Engineers, Inc. 7660 Whitegate Avenue US-RIVERSIDE, CA 92506</p> <p>Calculated: 01/23/06 22:52/2.4.0.67</p>
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SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 050 - 050

Assumptions for shadow calculations

Maximum distance for influence	1,000 m	Sun shine probabilities (part of time from sun rise to sun set with sun shine)											
Minimum sun height over horizon for influence	3 °	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Day step for calculation	1 days	0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35
Time step for calculation	2 minutes	Operational time											
		N	NE	E	SE	S	SW	W	NW	Sum			
		1,850	1,325	800	713	625	663	700	1,275	7,950			

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:35 16:25	07:17 17:03	06:35 17:43	05:38 18:23	05:47 20:00	06:08 (7) 20:47	05:13 20:34	05:13 20:47	05:41 20:25	06:08 (7) 19:35	06:53 18:38	06:34 16:46
2	07:35 16:26	07:16 17:05	06:34 17:44	05:37 18:24	05:45 20:01	06:06 (7) 20:35	05:13 20:47	05:14 20:47	05:42 20:24	06:08 (7) 19:33	06:55 18:36	06:35 16:44
3	07:35 16:27	07:15 17:06	06:32 17:46	05:35 18:26	05:44 20:02	06:05 (7) 20:36	05:12 20:46	05:14 20:46	05:43 20:22	06:09 (7) 19:31	06:56 18:34	06:36 16:43
4	07:35 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:42 20:03	06:04 (7) 20:37	05:12 20:46	05:15 20:46	05:44 20:21	06:08 (7) 19:29	06:57 18:33	06:38 16:41
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:05	06:02 (7) 20:38	05:11 20:46	05:15 20:46	05:45 20:20	06:09 (7) 19:27	06:58 18:31	06:39 16:40
6	07:34 16:30	07:11 17:10	06:27 17:50	06:29 19:29	05:40 20:06	06:01 (7) 20:38	05:11 20:46	05:16 20:46	05:46 20:19	06:10 (7) 19:25	07:00 18:29	06:41 16:39
7	07:34 16:31	07:10 17:12	06:25 17:51	06:27 19:31	05:38 20:07	06:00 (7) 20:39	05:11 20:45	05:17 20:45	05:48 20:17	06:11 (7) 19:24	07:01 18:27	06:42 16:37
8	07:34 16:32	07:08 17:13	06:23 17:52	06:26 19:32	05:37 20:08	05:58 (7) 20:40	05:10 20:45	05:18 20:45	05:49 20:16	06:12 (7) 19:22	07:02 18:25	06:43 16:36
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:59 (7) 20:40	05:10 20:45	05:18 20:45	05:50 20:14	06:13 (7) 19:20	07:03 18:23	06:45 16:35
10	07:33 16:34	07:06 17:16	06:19 17:55	06:22 19:35	05:34 20:11	05:58 (7) 20:41	05:10 20:44	05:19 20:44	05:51 20:13	06:14 (7) 19:18	07:05 18:22	06:46 16:34
11	07:33 16:35	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:59 (7) 20:42	05:09 20:44	05:20 20:44	05:52 20:11	06:16 (7) 19:16	07:06 18:20	06:47 16:33
12	07:33 16:37	07:03 17:19	06:16 17:57	06:18 19:37	05:32 20:13	05:58 (7) 20:42	05:09 20:43	05:21 20:43	05:54 20:10	06:17 (7) 19:14	07:07 18:18	06:49 16:31
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	05:58 (7) 20:43	05:09 20:42	05:21 20:42	05:55 20:08	06:18 (7) 19:12	07:08 18:16	06:50 16:30
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	05:29 20:15	05:57 (7) 20:43	05:09 20:42	05:22 20:42	05:56 20:07	06:21 (7) 19:10	07:09 18:14	06:52 16:29
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:17	05:58 (7) 20:44	05:09 20:41	05:23 20:41	05:57 20:05	06:18 (7) 19:09	07:11 18:13	06:53 16:28
16	07:31 16:41	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	05:57 (7) 20:44	05:09 20:41	05:24 20:41	05:58 20:04	06:17 (7) 19:07	07:12 18:11	06:54 16:27
17	07:30 16:43	06:55 17:26	06:06 18:04	06:10 19:43	05:26 20:19	05:58 (7) 20:45	05:09 20:40	05:25 20:40	05:59 20:02	06:15 (7) 19:05	07:14 18:09	06:56 16:26
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	05:59 (7) 20:45	05:09 20:39	05:26 20:39	06:14 (7) 20:01	06:30 (7) 19:01	07:15 18:08	06:57 16:25
19	07:29 16:45	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:58 (7) 20:46	05:09 20:38	05:27 20:38	06:13 (7) 19:57	06:02 (7) 19:01	07:16 18:06	06:58 16:24
20	07:28 16:47	06:51 17:30	06:01 18:08	06:04 19:47	05:23 20:22	05:59 (7) 20:46	05:09 20:37	05:28 20:37	06:12 (7) 19:56	06:03 (7) 18:59	07:17 18:04	07:00 16:24
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	06:00 (7) 20:46	05:09 20:37	05:29 20:37	06:11 (7) 19:54	06:04 (7) 18:57	07:19 18:03	07:01 16:23
22	07:27 16:49	06:47 17:33	05:57 18:10	06:01 19:50	05:21 20:24	06:02 (7) 20:46	05:10 20:36	05:30 20:36	06:10 (7) 19:52	06:05 (7) 18:55	07:20 18:01	07:02 16:22
23	07:26 16:51	06:46 17:35	05:55 18:12	05:59 19:51	05:20 20:25	06:01 (7) 20:47	05:10 20:35	05:31 20:35	06:11 (7) 19:51	06:07 (7) 18:53	07:21 17:59	07:03 16:21
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:27	06:02 (7) 20:47	05:10 20:34	05:32 20:34	06:10 (7) 19:49	06:08 (7) 18:51	07:23 17:58	07:05 16:20
25	07:24 16:53	06:42 17:37	05:51 18:14	05:56 19:53	05:18 20:28	06:03 (7) 20:47	05:10 20:33	05:33 20:33	06:09 (7) 19:47	06:09 (7) 18:49	07:24 18:56	07:06 16:19
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	05:17 20:29	06:04 (7) 20:47	05:11 20:32	05:34 20:32	06:08 (7) 19:45	06:10 (7) 18:48	07:25 18:48	07:07 16:19
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:30	06:06 (7) 20:47	05:11 20:31	05:35 20:31	06:09 (7) 19:44	06:11 (7) 18:46	07:26 18:53	07:09 16:19
28	07:21 16:58	06:37 17:41	05:46 18:18	05:51 19:57	05:16 20:31	06:07 (7) 20:47	05:12 20:30	05:36 20:30	06:08 (7) 19:42	06:13 (7) 18:44	07:10 18:44	07:34 16:18
29	07:20 16:59		05:44 18:19	05:50 19:58	05:15 20:31	06:11 (7) 20:47	05:12 20:28	05:37 20:28	06:09 (7) 19:40	06:14 (7) 18:42	07:11 18:42	07:34 16:17
30	07:19 17:00		05:42 18:21	05:48 20:00	06:09 (7) 10 06:19 (7)	05:15 20:32	05:13 20:47	05:39 20:27	06:08 (7) 19:38	06:15 (7) 18:40	07:12 18:48	07:34 16:17
31	07:18 17:02		05:40 18:22	05:48 20:00	05:14 20:33	05:14 20:33	05:14 20:26	05:40 20:26	06:07 (7) 19:37	06:16 (7) 19:37	07:13 16:47	07:34 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	274
Total, worst case				10	684			396	294			
Sun reduction				0.55	0.55			0.58	0.55			
Oper. time red.				0.91	0.91			0.91	0.91			
Wind dir. red.				0.55	0.55			0.55	0.55			
Total reduction				0.28	0.28			0.29	0.28			
Total, real				3	189			115	81			

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)
	Minutes with flicker		

Project: 060119 Marble River

Description: Marble River Wind Project Shadow-Flicker, NW part 22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)

Printed/Page 01/24/06 03:39 / 6
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Calculated: 01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 051 - 051

Assumptions for shadow calculations

- Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Table with months (Jan-Dec) and probability values ranging from 0.45 to 0.55.

Operational time

Table with directions (N, NE, E, SE, S, SW, W, NW, Sum) and corresponding values from 1,850 to 7,950.

Main shadow calculation table with columns for months (January-December) and rows for daily sun rise/set times and potential sun hours. Includes summary rows for total, worst case, and real values.

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

Matrix layout for daily calculations: Day in month, Sun rise, Sun set, Minutes with flicker, First/Last time with flicker, WTG causing flicker first/last time.

Project: **060119 Marble River**

Description: Marble River Wind Project
 Shadow-Flicker, NW part
 22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated: 01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 052 - 052

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
 N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December		
1	07:35 16:25	08:17 (8) 17:03	07:17 17:43	06:36 17:43	05:38 18:23	05:47 20:00	05:13 20:34	05:13 20:47	05:41 20:25	06:17 19:35	06:53 18:38	06:34 16:46	07:13 16:17	08:09 (8) 08:21 (8)
2	07:35 16:26	08:17 (8) 17:05	07:16 17:44	06:34 17:44	05:37 18:24	05:45 20:01	05:13 20:35	05:14 20:47	05:42 20:24	06:19 19:33	06:55 18:36	06:35 16:44	07:15 16:16	08:08 (8) 16:16
3	07:35 16:27	08:19 (8) 17:06	07:15 17:46	06:32 17:46	05:35 18:26	05:44 20:02	05:12 20:36	05:12 20:47	05:43 20:22	06:20 19:31	06:56 18:34	06:36 16:43	07:16 16:16	08:07 (8) 18:25 (8)
4	07:35 16:28	08:19 (8) 17:07	07:13 17:47	06:30 17:47	05:33 18:27	05:42 20:03	05:12 20:37	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:33	06:38 16:41	07:17 16:16	08:09 (8) 18:27 (8)
5	07:35 16:29	08:21 (8) 17:09	07:12 17:48	06:28 17:48	06:31 19:28	05:41 20:05	05:11 20:38	05:15 20:46	05:45 20:20	06:22 19:27	06:58 18:31	06:39 16:40	07:18 16:15	08:08 (8) 20:28 (8)
6	07:34 16:30	08:21 (8) 17:11	07:11 17:50	06:27 17:50	06:29 19:29	05:40 20:06	05:11 20:38	05:16 20:46	05:47 20:19	06:23 19:26	07:00 18:29	06:41 16:39	07:19 16:15	08:07 (8) 22:29 (8)
7	07:34 16:31	08:22 (8) 17:12	07:10 17:51	06:25 17:51	06:27 19:31	05:38 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27	06:42 16:37	07:20 16:15	08:08 (8) 22:30 (8)
8	07:34 16:32	08:24 (8) 17:13	07:08 17:52	06:23 17:52	06:26 19:32	05:37 20:08	05:10 20:40	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	06:43 16:36	07:21 16:15	08:07 (8) 22:29 (8)
9	07:34 16:33	08:24 (8) 17:15	07:07 17:54	06:21 17:54	06:24 19:33	05:36 20:10	05:10 20:41	05:18 20:45	05:50 20:14	06:27 19:20	07:03 18:23	06:45 16:35	07:22 16:15	08:08 (8) 22:30 (8)
10	07:33 16:34	08:25 (8) 17:16	07:06 17:55	06:19 17:55	06:22 19:35	05:34 20:11	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	06:46 16:34	07:23 16:15	08:09 (8) 22:31 (8)
11	07:33 16:35	08:27 (8) 17:18	07:04 17:56	06:18 17:56	06:20 19:36	05:33 20:12	05:10 20:42	05:20 20:44	05:52 20:11	06:29 19:16	07:06 18:20	06:47 16:33	07:24 16:15	08:08 (8) 24:32 (8)
12	07:33 16:37	08:29 (8) 17:19	07:03 17:58	06:16 17:58	06:18 19:37	05:32 20:13	05:09 20:42	05:21 20:43	05:54 20:10	06:30 19:14	07:07 18:18	06:49 16:31	07:25 16:15	08:09 (8) 24:33 (8)
13	07:32 16:38	08:32 (8) 17:21	07:01 17:59	06:14 17:59	06:17 19:38	05:31 20:14	05:09 20:43	05:22 20:43	05:55 20:08	06:32 19:12	07:08 18:16	06:50 16:30	07:25 16:15	08:09 (8) 24:33 (8)
14	07:32 16:39	08:36 (8) 17:22	07:00 18:00	06:12 18:00	06:15 19:40	05:29 20:15	05:09 20:43	05:22 20:42	05:56 20:07	06:33 19:10	07:10 18:15	06:52 16:29	07:26 16:15	08:08 (8) 26:34 (8)
15	07:31 16:40	08:39 (8) 17:23	06:58 18:01	06:10 18:01	06:13 19:41	05:28 20:17	05:09 20:44	05:23 20:41	05:57 20:05	06:34 19:09	07:11 18:13	06:53 16:28	07:27 16:15	08:09 (8) 26:35 (8)
16	07:31 16:42	08:42 (8) 17:25	06:57 18:03	06:08 18:03	06:11 19:42	05:27 20:18	05:09 20:44	05:24 20:41	05:58 20:04	06:35 19:07	07:12 18:11	06:54 16:27	07:28 16:15	08:10 (8) 26:36 (8)
17	07:30 16:43	08:44 (8) 17:26	06:56 18:04	06:07 18:04	06:10 19:43	05:26 20:19	05:09 20:45	05:25 20:40	06:00 20:02	06:36 19:05	07:14 18:09	06:56 16:26	07:29 16:16	08:10 (8) 24:34 (8)
18	07:30 16:44	08:46 (8) 17:28	06:54 18:05	06:05 18:05	06:08 19:45	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:01	06:38 19:03	07:15 18:08	06:57 16:25	07:29 16:16	08:11 (8) 24:35 (8)
19	07:29 16:45	08:48 (8) 17:29	06:52 18:07	06:03 18:07	06:06 19:46	05:24 20:21	05:09 20:46	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:24	07:30 16:16	08:12 (8) 24:36 (8)
20	07:28 16:47	08:50 (8) 17:30	06:51 18:08	06:01 18:08	06:04 19:47	05:23 20:22	05:09 20:46	05:28 20:37	06:03 19:56	06:40 18:59	07:18 18:04	07:00 16:24	07:30 16:17	08:10 (8) 26:36 (8)
21	07:27 16:48	08:52 (8) 17:32	06:49 18:09	05:59 18:09	06:03 19:48	05:22 20:23	05:09 20:46	05:29 20:37	06:04 19:54	06:41 18:57	07:19 18:03	07:01 16:23	07:31 16:17	08:11 (8) 26:37 (8)
22	07:27 16:49	08:54 (8) 17:33	06:47 18:10	05:57 18:10	06:01 19:50	05:21 20:24	05:10 20:46	05:30 20:36	06:05 19:52	06:42 18:55	07:20 18:01	07:02 16:22	07:32 16:18	08:11 (8) 26:38 (8)
23	07:26 16:51	08:56 (8) 17:35	06:46 18:12	05:55 18:12	05:59 19:51	05:20 20:26	05:10 20:47	05:31 20:35	06:07 19:51	06:44 18:53	07:22 17:59	07:04 16:21	07:32 16:18	08:12 (8) 26:38 (8)
24	07:25 16:52	08:58 (8) 17:36	06:44 18:13	05:53 18:13	05:58 19:52	05:19 20:27	05:10 20:47	05:32 20:34	06:08 19:49	06:45 18:51	07:23 17:58	07:05 16:21	07:32 16:19	08:12 (8) 26:38 (8)
25	07:24 16:54	08:59 (8) 17:37	06:42 18:14	05:52 18:14	05:56 19:53	05:18 20:28	05:11 20:47	05:33 20:33	06:09 19:47	06:46 18:50	06:24 18:56	07:06 16:20	07:33 16:19	08:14 (8) 24:38 (8)
26	07:23 16:55	09:01 (8) 17:39	06:41 18:16	05:50 18:16	05:55 19:55	05:17 20:29	05:11 20:47	05:34 20:32	06:10 19:45	06:47 18:48	06:26 18:55	07:07 16:19	07:33 16:20	08:15 (8) 24:39 (8)
27	07:22 16:56	09:03 (8) 17:40	06:39 18:17	05:48 18:17	05:53 19:56	05:17 20:30	05:11 20:47	05:35 20:31	06:11 19:44	06:48 18:46	06:27 16:53	07:09 16:19	07:34 16:21	08:15 (8) 26:41 (8)
28	07:21 16:58	09:05 (8) 17:41	06:37 18:18	05:46 18:18	05:51 19:57	05:16 20:31	05:12 20:47	05:36 20:30	06:13 19:42	06:50 18:44	06:28 16:51	07:10 16:18	07:34 16:21	08:15 (8) 26:41 (8)
29	07:20 16:59	09:07 (8) 17:42	06:35 18:19	05:44 18:19	05:50 19:58	05:15 20:32	05:12 20:47	05:37 20:29	06:14 19:40	06:51 18:42	06:30 16:50	07:11 16:18	07:34 16:22	08:15 (8) 26:41 (8)
30	07:19 17:01	09:09 (8) 17:43	06:33 18:20	05:42 18:21	05:48 20:00	05:15 20:32	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	06:31 16:48	07:12 16:17	07:34 16:23	08:15 (8) 26:41 (8)
31	07:18 17:02	09:11 (8) 17:44	06:31 18:22	05:40 18:22	05:46 20:01	05:14 20:33	05:11 20:47	05:40 20:26	06:16 19:37	06:32 16:47	07:13 16:47	07:13 16:24	07:34 16:24	08:17 (8) 24:41 (8)
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	274		
Total, worst case		232									14		722	
Sun reduction		0.45									0.35		0.35	
Oper. time red.		0.91									0.91		0.91	
Wind dir. red.		0.68									0.68		0.68	
Total reduction		0.28									0.22		0.22	
Total, real		65									3		157	

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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US-RIVERSIDE, CA 92506

Calculated:
01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 053 - 053

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:35 16:25	07:17 17:03	06:35 17:43	07:16 (8) 17:43	05:38 20:00	05:47 20:34	05:13 20:47	05:13 20:25	05:41 19:35	06:17 18:38	06:53 18:38	06:34 16:17	
2	07:35 16:26	07:16 17:05	06:34 17:44	07:16 (8) 18:24	05:37 20:01	05:45 20:35	05:13 20:47	05:42 20:24	05:19 19:33	06:19 18:36	06:55 18:36	06:35 16:16	
3	07:35 16:27	07:15 17:06	06:32 17:46	07:17 (8) 18:26	05:35 20:02	05:44 20:36	05:12 20:47	05:14 20:22	05:43 19:31	06:20 18:34	06:56 18:34	06:36 16:16	
4	07:35 16:28	07:13 17:08	06:30 17:47	07:19 (8) 18:27	05:33 20:03	05:42 20:37	05:12 20:46	05:15 20:21	05:44 19:29	06:21 18:33	06:57 18:33	06:38 16:16	
5	07:35 16:29	07:12 17:09	06:28 17:48	07:21 (8) 18:28	06:31 20:05	05:41 20:38	05:11 20:46	05:16 20:20	05:45 19:27	06:22 18:31	06:58 18:31	06:39 16:15	
6	07:34 16:30	07:11 17:11	06:27 17:50	07:23 (8) 19:29	06:29 20:06	05:40 20:38	05:11 20:46	05:16 20:19	05:47 19:26	06:23 18:29	07:00 18:29	06:41 16:15	
7	07:34 16:31	07:10 17:12	06:25 17:51	07:35 (8) 19:31	06:27 20:07	05:38 20:39	05:11 20:45	05:17 20:17	05:48 19:24	06:25 18:27	07:01 18:27	06:42 16:15	
8	07:34 16:32	07:08 17:13	06:23 17:52	07:38 (8) 19:32	06:26 20:08	05:37 20:40	05:10 20:45	05:18 20:16	05:49 19:22	06:26 18:25	07:02 18:25	06:43 16:15	
9	07:34 16:33	07:07 17:15	06:21 17:54	07:41 (8) 19:33	06:24 20:10	05:36 20:40	05:10 20:45	05:50 20:14	06:27 19:20	07:03 18:23	07:55 (8) 18:23	06:45 16:15	
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11	07:33 16:35	07:04 17:18	06:18 17:56	07:47 (8) 19:36	06:20 20:12	05:33 20:42	05:10 20:42	05:52 20:11	06:29 19:16	07:06 18:20	07:51 (8) 18:20	06:47 16:15	
12	07:33 16:37	07:03 17:19	06:16 17:58	07:50 (8) 19:37	06:18 20:13	05:29 20:42	05:09 20:42	05:54 20:10	06:30 19:14	07:07 18:18	07:49 (8) 18:18	06:49 16:15	
13	07:32 16:38	07:01 17:21	06:14 17:59	07:53 (8) 19:38	06:17 20:14	05:29 20:43	05:09 20:43	05:55 20:08	06:32 19:12	07:08 18:16	07:48 (8) 18:16	06:50 16:15	
14	07:32 16:39	07:00 17:22	06:12 18:00	07:56 (8) 19:40	06:15 20:15	05:29 20:43	05:09 20:43	05:56 20:07	06:33 19:10	07:10 18:15	07:47 (8) 18:15	06:52 16:15	
15	07:31 16:40	06:58 17:23	06:10 18:01	07:59 (8) 19:41	06:13 20:17	05:29 20:44	05:09 20:44	05:57 20:05	06:34 19:09	07:11 18:13	07:47 (8) 18:13	06:53 16:15	
16	07:31 16:42	06:57 17:25	06:08 18:03	08:01 (8) 19:42	06:11 20:18	05:29 20:44	05:09 20:44	05:58 20:04	06:35 19:07	07:12 18:11	07:46 (8) 18:11	06:54 16:15	
17	07:30 16:43	06:55 17:26	06:07 18:04	08:04 (8) 19:43	06:10 20:19	05:29 20:45	05:09 20:45	06:00 20:02	06:36 19:05	07:14 18:09	07:45 (8) 18:09	06:56 16:16	
18	07:30 16:44	06:54 17:28	06:05 18:05	08:07 (8) 19:45	06:08 20:20	05:29 20:45	05:09 20:45	05:56 20:01	06:38 19:03	07:15 18:08	07:45 (8) 18:08	06:57 16:16	
19	07:29 16:45	06:52 17:29	06:03 18:07	08:10 (8) 19:46	06:06 20:21	05:24 20:46	05:09 20:46	05:27 19:57	06:02 19:01	06:39 18:06	07:16 18:06	06:58 16:16	
20	07:28 16:47	06:51 17:30	06:01 18:08	08:13 (8) 19:47	06:04 20:22	05:23 20:46	05:09 20:46	05:28 19:56	06:03 18:59	07:18 18:04	07:46 (8) 18:04	07:00 16:17	
21	07:27 16:48	06:49 17:32	05:59 18:09	08:16 (8) 19:48	06:03 20:23	05:22 20:46	05:09 20:46	05:29 19:54	06:04 18:57	06:41 18:03	07:19 18:03	07:01 16:17	
22	07:27 16:49	06:47 17:33	05:57 18:10	08:19 (8) 19:50	06:01 20:24	05:21 20:46	05:10 20:46	06:05 19:52	06:42 18:55	07:20 18:01	07:20 18:01	07:02 16:18	
23	07:26 16:51	06:46 17:35	05:55 18:12	08:22 (8) 19:51	05:59 20:25	05:20 20:47	05:10 20:47	06:07 20:35	06:44 18:51	07:22 17:59	07:22 17:59	07:04 16:18	
24	07:25 16:52	06:44 17:36	05:53 18:13	08:25 (8) 19:52	05:58 20:27	05:19 20:47	05:10 20:47	06:08 19:49	06:45 18:51	07:23 17:58	07:23 17:58	07:05 16:19	
25	07:24 16:54	06:42 17:37	05:52 18:14	08:28 (8) 19:53	05:56 20:28	05:18 20:47	05:11 20:47	06:09 19:47	06:46 18:50	06:24 18:56	06:24 18:56	07:06 16:19	
26	07:23 16:55	06:41 17:39	05:50 18:16	08:31 (8) 19:55	05:55 20:29	05:17 20:47	05:11 20:47	06:10 20:32	06:47 19:45	06:26 18:48	06:26 18:48	07:07 16:20	
27	07:22 16:56	06:39 17:40	05:48 18:17	08:34 (8) 19:56	05:53 20:30	05:17 20:47	05:11 20:47	06:11 20:31	06:48 19:44	06:27 18:46	06:27 18:46	07:09 16:21	
28	07:21 16:58	06:37 17:42	05:46 18:18	08:37 (8) 19:57	05:51 20:31	05:16 20:47	05:12 20:47	06:13 20:30	06:50 19:42	06:28 18:44	06:28 18:44	07:10 16:21	
29	07:20 16:59	06:35 17:41	05:44 18:19	08:40 (8) 19:58	05:50 20:32	05:15 20:47	05:12 20:47	06:14 19:40	06:51 18:42	06:30 18:42	06:30 18:42	07:11 16:22	
30	07:19 17:01	06:33 17:43	05:42 18:20	08:43 (8) 20:00	05:48 20:33	05:15 20:47	05:13 20:47	06:15 19:38	06:52 18:40	06:31 18:40	06:31 18:40	07:12 16:23	
31	07:18 17:02	06:31 17:44	05:40 18:22	08:46 (8) 20:01	05:46 20:34	05:14 20:47	05:14 20:47	06:16 19:37	06:32 18:47	06:32 18:47	06:32 18:47	07:13 16:24	
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	644	288	274
Total, worst case		500	136								644		
Sun reduction		0.45	0.50								0.45		
Oper. time red.		0.91	0.91								0.91		
Wind dir. red.		0.61	0.61								0.61		
Total reduction		0.25	0.28								0.25		
Total, real		124	38								160		

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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US-RIVERSIDE, CA 92506

Calculated:
01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 054 - 054

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1 07:35	14:59 (8) 07:17	06:35	05:38	05:47	05:13	05:13	05:41	06:17	06:53	06:34	07:13	14:47 (8)
16:25 38	15:37 (8) 17:03	17:43	18:23	20:00	20:34	20:47	20:25	19:35	18:38	16:46	16:17	34 15:21 (8)
2 07:35	14:59 (8) 07:16	06:34	05:37	05:45	05:13	05:14	05:42	06:19	06:55	06:35	07:14	14:48 (8)
16:26 38	15:37 (8) 17:05	17:44	18:24	20:01	20:35	20:47	20:24	19:33	18:36	16:44	16:16	34 15:22 (8)
3 07:35	15:01 (8) 07:15	06:32	05:35	05:44	05:12	05:14	05:43	06:20	06:56	06:36	07:16	14:47 (8)
16:27 36	15:37 (8) 17:06	17:46	18:26	20:02	20:36	20:46	20:22	19:31	18:34	16:43	16:16	36 15:23 (8)
4 07:35	15:01 (8) 07:13	06:30	05:33	05:42	05:12	05:15	05:44	06:21	06:57	06:38	07:17	14:49 (8)
16:28 38	15:39 (8) 17:08	17:47	18:27	20:03	20:37	20:46	20:21	19:29	18:33	16:41	16:16	36 15:25 (8)
5 07:34	15:01 (8) 07:12	06:28	06:31	05:41	05:11	05:15	05:45	06:22	06:58	06:39	07:18	14:48 (8)
16:29 38	15:39 (8) 17:09	17:48	19:28	20:05	20:38	20:46	20:20	19:27	18:31	16:40	16:15	36 15:24 (8)
6 07:34	15:04 (8) 07:11	06:27	06:29	05:40	05:11	05:16	05:46	06:23	07:00	06:41	07:19	14:49 (8)
16:30 36	15:39 (8) 17:10	17:50	19:29	20:06	20:38	20:46	20:18	19:25	18:29	16:39	16:15	36 15:25 (8)
7 07:34	15:02 (8) 07:10	06:25	06:27	05:38	05:11	05:17	05:48	06:24	07:01	06:42	07:20	14:48 (8)
16:31 36	15:38 (8) 17:12	17:51	19:31	20:07	20:39	20:45	20:17	19:24	18:27	16:37	16:15	38 15:26 (8)
8 07:34	15:04 (8) 07:08	06:23	06:26	05:37	05:10	05:18	05:49	06:26	07:02	06:43	07:21	14:49 (8)
16:32 36	15:40 (8) 17:13	17:52	19:32	20:08	20:40	20:45	20:16	19:22	18:25	16:36	16:15	38 15:27 (8)
9 07:34	15:04 (8) 07:07	06:21	06:24	05:36	05:10	05:18	05:50	06:27	07:03	06:45	07:22	14:50 (8)
16:33 36	15:40 (8) 17:15	17:54	19:33	20:09	20:40	20:45	20:14	19:20	18:23	16:35	16:15	36 15:26 (8)
10 07:33	15:05 (8) 07:05	06:19	06:22	05:34	05:10	05:19	05:51	06:28	07:05	06:46	07:23	14:49 (8)
16:34 34	15:39 (8) 17:16	17:55	19:34	20:11	20:41	20:44	20:13	19:18	18:22	16:34	16:15	38 15:27 (8)
11 07:33	15:05 (8) 07:04	06:18	06:20	05:33	05:09	05:20	05:52	06:29	07:06	06:47	07:24	14:50 (8)
16:35 34	15:39 (8) 17:18	17:56	19:36	20:12	20:42	20:44	20:11	19:16	18:20	16:33	16:15	38 15:28 (8)
12 07:33	15:06 (8) 07:03	06:16	06:18	05:32	05:09	05:21	05:54	06:30	07:07	06:49	07:25	14:51 (8)
16:37 34	15:40 (8) 17:19	17:57	19:37	20:13	20:42	20:43	20:10	19:14	18:18	16:31	16:15	38 15:29 (8)
13 07:32	15:06 (8) 07:01	06:14	06:17	05:31	05:09	05:22	05:55	06:32	07:08	06:50	07:25	14:51 (8)
16:38 34	15:40 (8) 17:21	17:59	19:38	20:14	20:43	20:42	20:08	19:12	18:16	16:30	16:15	36 15:27 (8)
14 07:32	15:07 (8) 07:00	06:12	06:15	05:29	05:09	05:22	05:56	06:33	07:10	06:52	07:26	14:50 (8)
16:39 32	15:39 (8) 17:22	18:00	19:40	20:15	20:43	20:42	20:07	19:10	18:14	16:29	16:15	38 15:28 (8)
15 07:31	15:09 (8) 06:58	06:10	06:13	05:28	05:09	05:23	05:57	06:34	07:11	06:53	07:27	14:51 (8)
16:40 32	15:41 (8) 17:23	18:01	19:41	20:17	20:44	20:41	20:05	19:09	18:13	16:28	16:15	38 15:29 (8)
16 07:31	15:10 (8) 06:57	06:08	06:11	05:27	05:09	05:24	05:58	06:35	07:12	06:54	07:28	14:52 (8)
16:41 30	15:40 (8) 17:25	18:03	19:42	20:18	20:44	20:41	20:04	19:07	18:11	16:27	16:15	38 15:30 (8)
17 07:30	15:11 (8) 06:55	06:06	06:10	05:26	05:09	05:25	05:59	06:36	07:14	06:56	07:28	14:52 (8)
16:43 28	15:39 (8) 17:26	18:04	19:43	20:19	20:45	20:40	20:02	19:05	18:09	16:26	16:16	38 15:30 (8)
18 07:30	15:11 (8) 06:54	06:05	06:08	05:25	05:09	05:26	06:01	06:38	07:15	06:57	14:58 (8) 07:29	14:53 (8)
16:44 28	15:39 (8) 17:28	18:05	19:45	20:20	20:45	20:39	20:01	19:03	18:08	16:25	6 15:04 (8) 16:16	38 15:31 (8)
19 07:29	15:12 (8) 06:52	06:03	06:06	05:24	05:09	05:27	06:02	06:39	07:16	06:58	14:55 (8) 07:30	14:54 (8)
16:45 26	15:38 (8) 17:29	18:07	19:46	20:21	20:45	20:38	19:57	19:01	18:06	16:24	14 15:09 (8) 16:16	38 15:32 (8)
20 07:28	15:15 (8) 06:50	06:01	06:04	05:23	05:09	05:28	06:03	06:40	07:17	07:00	14:52 (8) 07:30	14:54 (8)
16:47 22	15:37 (8) 17:30	18:08	19:47	20:22	20:46	20:37	19:56	18:59	18:04	16:24	18 15:10 (8) 16:17	38 15:32 (8)
21 07:27	15:16 (8) 06:49	05:59	06:03	05:22	05:09	05:29	06:04	06:41	07:19	07:01	14:52 (8) 07:31	14:55 (8)
16:48 20	15:36 (8) 17:32	18:09	19:48	20:23	20:46	20:37	19:54	18:57	18:03	16:23	20 15:12 (8) 16:17	38 15:33 (8)
22 07:27	15:17 (8) 06:47	05:57	06:01	05:21	05:10	05:30	06:05	06:42	07:20	07:02	14:51 (8) 07:31	14:55 (8)
16:49 18	15:35 (8) 17:33	18:10	19:50	20:24	20:46	20:36	19:52	18:55	18:01	16:22	22 15:13 (8) 16:18	38 15:33 (8)
23 07:26	15:21 (8) 06:46	05:55	05:59	05:20	05:10	05:31	06:07	06:44	07:21	07:03	14:51 (8) 07:32	14:56 (8)
16:51 14	15:35 (8) 17:35	18:12	19:51	20:25	20:47	20:35	19:51	18:53	17:59	16:21	24 15:15 (8) 16:18	38 15:34 (8)
24 07:25	15:24 (8) 06:44	05:53	05:58	05:19	05:10	05:32	06:08	06:45	07:23	07:05	14:50 (8) 07:32	14:56 (8)
16:52 6	15:30 (8) 17:36	18:13	19:52	20:27	20:47	20:34	19:49	18:51	17:58	16:20	26 15:16 (8) 16:19	38 15:34 (8)
25 07:24	15:25 (8) 06:42	05:51	05:56	05:18	05:10	05:33	06:09	06:46	07:24	07:06	14:49 (8) 07:33	14:56 (8)
16:53	17:37	18:14	19:53	20:28	20:47	20:33	19:47	18:49	18:56	16:20	28 15:17 (8) 16:19	38 15:34 (8)
26 07:23	15:26 (8) 06:41	05:50	05:55	05:17	05:11	05:34	06:10	06:47	07:25	07:07	14:49 (8) 07:33	14:57 (8)
16:55	17:39	18:16	19:55	20:29	20:47	20:32	19:45	18:48	18:54	16:19	30 15:19 (8) 16:20	38 15:35 (8)
27 07:22	15:27 (8) 06:39	05:48	05:53	05:17	05:11	05:35	06:11	06:48	07:27	07:09	14:48 (8) 07:33	14:57 (8)
16:56	17:40	18:17	19:56	20:30	20:47	20:31	19:44	18:46	18:53	16:19	32 15:20 (8) 16:21	38 15:35 (8)
28 07:21	15:28 (8) 06:37	05:46	05:51	05:16	05:12	05:36	06:13	06:50	07:30	07:10	14:47 (8) 07:34	14:57 (8)
16:58	17:41	18:18	19:57	20:31	20:47	20:30	19:42	18:44	18:51	16:18	32 15:19 (8) 16:21	38 15:35 (8)
29 07:20	15:29 (8) 06:36	05:44	05:50	05:15	05:12	05:37	06:14	06:51	07:30	07:11	14:47 (8) 07:34	14:57 (8)
16:59	18:19	18:19	19:58	20:31	20:47	20:28	19:40	18:42	18:50	16:17	34 15:21 (8) 16:22	38 15:35 (8)
30 07:19	15:30 (8) 06:35	05:42	05:48	05:15	05:13	05:39	06:15	06:52	07:31	07:12	14:48 (8) 07:34	14:59 (8)
17:00	18:21	20:00	20:32	20:47	20:27	20:19	19:38	18:40	18:48	16:17	34 15:22 (8) 16:23	36 15:35 (8)
31 07:18	15:31 (8) 06:34	05:40	05:44	05:14	05:14	05:40	06:16	06:52	07:32	07:13	14:48 (8) 07:34	14:59 (8)
17:02	18:22	20:01	20:33	20:47	20:26	20:18	19:36	18:38	18:46	16:17	36 15:23 (8) 16:24	38 15:37 (8)
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	274
Total, worst case	724										320	1156
Sun reduction	0.45										0.35	0.35
Oper. time red.	0.91										0.91	0.91
Wind dir. red.	0.62										0.62	0.62
Total reduction	0.25										0.20	0.20
Total, real	184										63	228

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

Project: 060119 Marble River

Description: Marble River Wind Project Shadow-Flicker, NW part 22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)

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Calculated: 01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 055 - 055

Assumptions for shadow calculations

Maximum distance for influence 1,000 m Minimum sun height over horizon for influence 3 ° Day step for calculation 1 days Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Table with 12 columns (Jan-Dec) and 1 row of values: 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

Table with 10 columns (N-Sum) and 1 row of values: 1,850 1,325 800 713 625 663 700 1,275 7,950

Main data table with columns for months (January-December) and rows for each day (1-31) showing sun rise/set times and shadow reduction percentages.

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

Summary table with 4 columns: 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:

060119 Marble River

Description:

Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/24/06 03:39 / 11

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Calculated:

01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 056 - 056

Assumptions for shadow calculations

Maximum distance for influence

Minimum sun height over horizon for influence

Day step for calculation

Time step for calculation

1,000 m

3 °

1 days

2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December					
1	07:35	07:17	06:35	05:38	05:47	18:34 (10)	05:13	05:13	05:41	19:43 (11)	06:17	18:35 (10)	06:53	08:34	07:13		
	16:25	17:03	17:43	18:23	20:00	18:59 (10)	20:00	20:47	20:25	16	19:59 (11)	19:35	32	19:07 (10)	18:38	16:46	16:17
2	07:35	07:16	06:34	05:37	05:45	18:37 (10)	05:13	05:14	05:42	19:42 (11)	06:19	18:37 (10)	06:55	08:35	07:14		
	16:26	17:05	17:44	18:24	20:01	19:01 (10)	20:35	20:47	20:24	16	19:58 (11)	19:33	30	19:07 (10)	18:36	16:44	16:16
3	07:35	07:15	06:32	05:35	05:44	18:37 (10)	05:12	05:14	05:43	19:43 (11)	06:20	18:38 (10)	06:56	08:36	07:16		
	16:27	17:06	17:46	18:26	20:02	18:59 (10)	20:36	20:46	20:22	12	19:55 (11)	19:31	26	19:04 (10)	18:34	16:43	16:16
4	07:35	07:13	06:30	05:33	05:42	18:40 (10)	05:12	05:15	05:44	19:42 (11)	06:21	18:39 (10)	06:57	08:38	07:17		
	16:28	17:08	17:47	18:27	20:03	19:04 (11)	20:37	20:46	20:21	12	19:54 (11)	19:29	22	19:01 (10)	18:33	16:41	16:16
5	07:34	07:12	06:28	06:31	05:41	18:42 (10)	05:11	05:16	05:45	19:43 (11)	06:22	18:40 (10)	06:58	08:39	07:18		
	16:29	17:09	17:48	18:28	20:05	18	19:40 (11)	20:38	20:20	10	19:53 (11)	19:27	18	18:58 (10)	18:31	16:40	16:15
6	07:34	07:11	06:27	06:29	05:40	19:33 (11)	05:11	05:16	05:47	19:44 (11)	06:23	18:45 (10)	07:00	08:41	07:19		
	16:30	17:11	17:50	18:29	10	18:59 (10)	20:06	20:46	20:19	8	19:52 (11)	19:26	10	18:55 (10)	18:29	16:39	16:15
7	07:34	07:10	06:25	06:27	05:38	18:44 (10)	05:38	05:17	05:48	18:57 (10)	06:25	18:45 (10)	07:01	08:42	07:20		
	16:31	17:12	17:51	18:31	18	19:02 (10)	20:07	20:45	20:17	12	19:51 (11)	19:24	10	18:27	16:37	16:15	
8	07:34	07:08	06:23	06:26	05:37	18:42 (10)	05:37	05:18	05:49	18:50 (10)	06:26	18:46 (10)	07:02	08:43	07:21		
	16:32	17:13	17:52	18:32	22	19:04 (10)	20:08	20:45	20:16	20	19:50 (11)	19:22	10	18:25	16:36	16:15	
9	07:34	07:07	06:21	06:24	05:36	18:40 (10)	05:36	05:18	05:50	18:47 (10)	06:27	18:47 (10)	07:03	08:45	07:22		
	16:33	17:15	17:54	18:33	26	19:06 (10)	20:09	20:45	20:14	24	19:49 (11)	19:20	10	18:23	16:35	16:15	
10	07:33	07:06	06:19	06:22	05:34	18:38 (10)	05:34	05:19	05:51	18:46 (10)	06:28	18:48 (10)	07:05	08:46	07:23		
	16:34	17:16	17:55	18:35	30	19:08 (10)	20:11	20:44	20:13	22	19:08 (10)	19:18	10	18:22	16:34	16:15	
11	07:33	07:04	06:18	06:20	05:33	18:36 (10)	05:33	05:20	05:52	18:44 (10)	06:29	18:49 (10)	07:06	08:47	07:24		
	16:35	17:18	17:56	18:36	32	19:08 (10)	20:12	20:44	20:11	26	19:10 (10)	19:16	10	18:20	16:33	16:15	
12	07:33	07:03	06:16	06:18	05:32	18:35 (10)	05:32	05:21	05:54	18:43 (10)	06:30	18:43 (10)	07:07	08:49	07:25		
	16:37	17:19	17:58	18:37	34	19:09 (10)	20:13	20:43	20:10	28	19:11 (10)	19:14	10	18:18	16:32	16:15	
13	07:32	07:01	06:14	06:17	05:31	18:33 (10)	05:31	05:22	05:55	18:42 (10)	06:32	18:44 (10)	07:08	08:50	07:25		
	16:38	17:21	17:59	18:38	38	19:11 (10)	20:14	20:42	20:08	30	19:12 (10)	19:12	10	18:16	16:30	16:15	
14	07:32	07:00	06:12	06:15	05:29	18:33 (10)	05:29	05:22	05:56	18:39 (10)	06:33	18:45 (10)	07:10	08:52	07:26		
	16:39	17:22	18:00	18:40	38	19:11 (10)	20:15	20:42	20:07	34	19:13 (10)	19:10	10	18:15	16:29	16:15	
15	07:31	06:58	06:10	06:13	05:28	18:31 (10)	05:28	05:23	05:57	18:38 (10)	06:34	18:46 (10)	07:11	08:53	07:27		
	16:40	17:23	18:01	18:41	40	19:11 (10)	20:17	20:41	20:05	36	19:14 (10)	19:09	10	18:13	16:28	16:15	
16	07:31	06:57	06:08	06:11	05:27	18:32 (10)	05:27	05:24	05:58	18:37 (10)	06:35	18:47 (10)	07:12	08:54	07:28		
	16:42	17:25	18:03	18:42	40	19:12 (10)	20:18	20:41	20:04	36	19:13 (10)	19:07	10	18:11	16:27	16:15	
17	07:30	06:55	06:07	06:10	05:26	18:30 (10)	05:26	05:25	06:00	18:36 (10)	06:36	18:49 (10)	07:14	08:56	07:28		
	16:43	17:26	18:04	18:43	42	19:12 (10)	20:19	20:40	20:02	38	19:14 (10)	19:05	10	18:09	16:26	16:16	
18	07:30	06:54	06:05	06:08	05:25	18:30 (10)	05:25	05:26	06:01	18:36 (10)	06:38	18:51 (10)	07:15	08:57	07:29		
	16:44	17:28	18:05	18:44	40	19:10 (10)	20:20	20:39	20:01	40	19:16 (10)	19:03	10	18:08	16:25	16:16	
19	07:29	06:52	06:03	06:06	05:24	18:29 (10)	05:24	05:27	05:57	18:35 (10)	06:39	18:50 (10)	07:16	08:58	07:30		
	16:45	17:29	18:07	18:46	42	19:11 (10)	20:21	20:38	4	19:55 (11)	19:57	40	19:15 (10)	19:01	18:06	16:24	16:16
20	07:28	06:51	06:01	06:04	05:23	18:29 (10)	05:23	05:28	05:58	19:48 (11)	06:03	18:34 (10)	06:40	07:18	07:00	07:30	
	16:47	17:30	18:08	18:47	42	19:11 (10)	20:22	20:37	20:01	40	19:16 (10)	18:59	10	18:04	16:24	16:17	
21	07:27	06:49	05:59	06:03	05:22	18:29 (10)	05:22	05:29	05:57	19:47 (11)	06:04	18:35 (10)	06:41	07:19	07:01	07:31	
	16:48	17:32	18:09	18:48	42	19:11 (10)	20:23	20:37	12	19:59 (11)	19:54	40	19:15 (10)	18:57	18:03	16:23	16:17
22	07:27	06:47	05:57	06:01	05:21	18:30 (10)	05:21	05:30	05:57	19:46 (11)	06:05	18:34 (10)	06:42	07:20	07:02	07:31	
	16:49	17:33	18:10	18:49	40	19:10 (10)	20:24	20:36	14	20:00 (11)	19:52	40	19:14 (10)	18:55	18:01	16:22	16:18
23	07:26	06:46	05:55	05:59	05:20	18:30 (10)	05:20	05:31	05:58	19:45 (11)	06:07	18:33 (10)	06:44	07:21	07:04	07:32	
	16:51	17:35	18:12	18:51	40	19:10 (10)	20:25	20:35	16	20:01 (11)	19:51	42	19:15 (10)	18:53	17:59	16:21	16:18
24	07:25	06:44	05:53	05:58	05:19	18:30 (10)	05:19	05:32	05:59	19:44 (11)	06:08	18:32 (10)	06:45	07:23	07:05	07:32	
	16:52	17:36	18:13	18:52	38	19:08 (10)	20:27	20:34	18	20:02 (11)	19:49	42	19:14 (10)	18:51	17:58	16:21	16:19
25	07:24	06:42	05:52	05:56	05:18	18:29 (10)	05:18	05:33	05:59	19:43 (11)	06:09	18:33 (10)	06:46	07:24	07:06	07:33	
	16:54	17:37	18:14	18:53	40	19:08 (10)	20:28	20:47	20:03 (11)	19:47	40	19:13 (10)	18:50	18:06	16:20	16:19	
26	07:23	06:41	05:50	05:55	05:18	18:29 (10)	05:18	05:34	05:59	19:42 (11)	06:10	18:33 (10)	06:47	07:25	07:07	07:33	
	16:55	17:39	18:16	18:55	38	19:07 (10)	20:29	20:47	20:04 (11)	19:45	40	19:13 (10)	18:48	18:03	16:19	16:20	
27	07:22	06:39	05:48	05:53	05:17	18:30 (10)	05:17	05:35	05:59	19:43 (11)	06:11	18:34 (10)	06:48	07:26	07:09	07:34	
	16:56	17:40	18:17	18:56	38	19:08 (10)	20:30	20:47	20:03 (11)	19:44	40	19:14 (10)	18:46	18:04	16:19	16:21	
28	07:21	06:37	05:46	05:51	05:16	18:32 (10)	05:16	05:36	05:59	19:42 (11)	06:13	18:33 (10)	06:50	07:28	07:10	07:34	
	16:58	17:42	18:18	18:57	34	19:06 (10)	20:31	20:47	20:02 (11)	19:42	40	19:13 (10)	18:44	18:02	16:18	16:22	
29	07:20	06:33	05:42	05:47	05:15	18:33 (10)	05:15	05:37	05:59	19:41 (11)	06:14	18:34 (10)	06:51	07:29	07:11	07:34	
	16:59	17:43	18:19	18:58	32	19:05 (10)	20:31	20:47	20:01 (11)	19:40	38	19:12 (10)	18:42	18:01	16:18	16:22	
30	07:19	06:32	05:41	05:46	05:15	18:33 (10)	05:15	05:39	05:59	19:42 (11)	06:15	18:33 (10)	06:52	07:30	07:12	07:34	
	17:01	17:45	18:21	19:00	30	19:03 (10)	20:32	20:47	20:01 (11)	19:38	36	19:09 (10)	18:40	18:00	16:17	16:23	
31	07:18	06:31	05:40	05:45	05:14	18:32 (10)	05:14	05:40	05:59	19:41 (11)	06:16	18:34 (10)	06:52	07:31	07:13	07:34	
	17:02	17:46	18:22	19:01	20:33	18	19:59 (11)	19:37	4	19:08 (10)	19:37	34	19:08 (10)	18:40	16:42	16:24	
Potential sun hours	286	291	369	380	-285	-254	-272	212	934	138		341	288	27			

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, NW part
 22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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01/24/06 03:39 / 12

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Wind Engineers, Inc.
 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated:

01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 092 - 092

Assumptions for shadow calculations

Maximum distance for influence

1,000 m

Minimum sun height over horizon for influence

3 °

Day step for calculation

1 days

Time step for calculation

2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:34 16:25	07:17 17:03	06:35 17:43	05:38 18:23	05:47 20:00	05:13 20:34	05:13 20:47	05:41 20:25	06:17 19:35	06:53 18:38	06:34 16:46	07:13 16:17
2	07:35 16:26	07:16 17:05	06:34 17:44	05:37 18:24	05:45 20:01	05:13 20:35	05:14 20:47	05:42 20:24	06:19 19:33	06:55 18:36	06:35 16:44	07:14 16:16
3	07:35 16:27	07:15 17:06	06:32 17:46	05:35 18:26	05:44 20:02	05:12 20:36	05:14 20:46	05:43 20:22	06:20 19:31	06:56 18:34	06:36 16:43	07:16 16:16
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:42 20:03	05:12 20:37	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:33	06:38 16:41	07:17 16:16
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:05	05:11 20:37	05:15 20:46	05:45 20:20	06:22 19:27	06:58 18:31	06:39 16:40	07:18 16:15
6	07:34 16:30	07:11 17:10	06:27 17:50	06:29 19:29	05:40 20:06	05:11 20:38	05:16 20:46	05:47 20:18	06:23 19:25	06:59 18:29	06:40 16:39	07:19 16:15
7	07:34 16:31	07:09 17:12	06:25 17:51	06:27 19:31	05:38 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:24 19:24	07:01 18:27	06:42 16:37	07:20 16:15
8	07:34 16:32	07:08 17:13	06:23 17:52	06:25 19:32	05:37 20:08	05:10 20:40	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	06:43 16:36	07:21 16:15
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40	05:18 20:44	05:50 20:14	06:27 19:20	07:03 18:23	06:45 16:35	07:22 16:15
10	07:33 16:34	07:05 17:16	06:19 17:55	06:22 19:34	05:34 20:11	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	06:46 16:34	07:23 16:15
11	07:33 16:35	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:09 20:42	05:20 20:44	05:52 20:11	06:29 19:16	07:06 18:20	06:47 16:33	07:24 16:15
12	07:33 16:37	07:03 17:19	06:16 17:57	06:18 19:37	05:32 20:13	05:09 20:42	05:21 20:43	05:54 20:10	06:30 19:14	07:07 18:18	06:49 16:31	07:24 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	05:09 20:43	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:16	06:50 16:30	07:25 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:39	05:29 20:15	05:09 20:43	05:22 20:42	05:56 20:07	06:33 19:10	07:10 18:14	06:51 16:29	07:26 16:15
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:17	05:09 20:44	05:23 20:41	05:57 20:05	06:34 19:09	07:11 18:13	06:53 16:28	07:27 16:15
16	07:31 16:41	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	05:09 20:44	05:24 20:40	05:58 20:04	06:35 19:07	07:12 18:11	06:54 16:27	07:28 16:15
17	07:30 16:43	06:55 17:26	06:06 18:04	06:10 19:43	05:26 20:19	05:09 20:45	05:25 20:40	05:59 20:02	06:36 19:05	07:14 18:09	06:56 16:26	07:28 16:16
18	07:29 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:01	06:38 19:03	07:15 18:08	06:57 16:25	07:29 16:16
19	07:29 16:45	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:09 20:45	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:24	07:30 16:16
20	07:28 16:47	06:50 17:30	06:01 18:08	06:04 19:47	05:23 20:22	05:09 20:46	05:28 20:37	06:03 19:56	06:40 18:59	07:17 18:04	07:00 16:24	07:30 16:17
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:09 20:46	05:29 20:37	06:04 19:54	06:41 18:57	07:19 18:03	07:01 16:23	07:31 16:17
22	07:27 16:49	06:47 17:33	05:57 18:10	06:01 19:50	05:21 20:24	05:10 20:46	05:30 20:36	06:05 19:52	06:42 18:55	07:20 18:01	07:02 16:22	07:31 16:18
23	07:26 16:51	06:46 17:35	05:55 18:12	05:59 19:51	05:20 20:25	05:10 20:46	05:31 20:35	06:07 19:51	06:44 18:53	07:21 17:59	07:03 16:21	07:32 16:18
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:26	05:10 20:47	05:32 20:34	06:08 19:49	06:45 18:51	07:23 17:58	07:05 16:20	07:32 16:19
25	07:24 16:53	06:42 17:37	05:51 18:14	05:56 19:53	05:18 20:27	05:10 20:47	05:33 20:33	06:09 19:47	06:46 18:49	06:24 18:56	07:06 16:20	07:33 16:19
26	07:23 16:55	06:41 17:39	05:50 18:15	05:55 19:55	05:17 20:28	05:11 20:47	05:34 20:32	06:10 19:45	06:47 18:48	06:25 18:54	07:07 16:19	07:33 16:20
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	05:11 20:47	05:35 20:31	06:11 19:44	06:48 18:46	06:27 18:53	07:08 16:19	07:33 16:21
28	07:21 16:58	06:37 17:41	05:46 18:18	05:51 19:57	05:16 20:30	05:12 20:47	05:36 20:30	06:13 19:42	06:50 18:44	06:28 18:51	07:10 16:18	07:34 16:21
29	07:20 16:59		05:44 18:19	05:50 19:58	05:15 20:31	05:12 20:47	05:37 20:28	06:14 19:40	06:51 18:42	06:30 18:50	07:11 16:18	07:34 16:22
30	07:19 17:00		05:42 18:21	05:48 20:00	05:15 20:32	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	06:31 18:48	07:12 16:17	07:34 16:23
31	07:18 17:02		05:40 18:22		05:14 20:33		05:40 20:26	06:16 19:36		06:32 16:47		07:34 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	274
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)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 093 - 093

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:34 16:25	07:17 17:03	06:35 17:43	05:38 18:23	05:47 20:00	05:13 20:34	05:13 20:47	05:41 20:25	06:17 19:35	06:53 18:38	06:34 16:46	07:13 16:17
2	07:35 16:26	07:16 17:05	06:34 17:44	05:37 18:24	05:45 20:01	05:13 20:35	05:14 20:47	05:42 20:24	06:19 19:33	06:55 18:36	06:35 16:44	07:14 16:16
3	07:35 16:27	07:15 17:06	06:32 17:46	05:35 18:26	05:44 20:02	05:12 20:36	05:14 20:46	05:43 20:22	06:20 19:31	06:56 18:34	06:36 16:43	07:16 16:16
4	07:35 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:42 20:03	05:12 20:37	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:33	06:38 16:41	07:17 16:16
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:05	05:11 20:37	05:15 20:46	05:45 20:20	06:22 19:27	06:58 18:31	06:39 16:40	07:18 16:15
6	07:34 16:30	07:11 17:10	06:27 17:50	06:29 19:29	05:40 20:06	05:11 20:38	05:16 20:46	05:47 20:18	06:23 19:25	06:59 18:29	06:41 16:39	07:19 16:15
7	07:34 16:31	07:10 17:12	06:25 17:51	06:27 19:31	05:38 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:24 19:24	07:01 18:27	06:42 16:37	07:20 16:15
8	07:34 16:32	07:08 17:13	06:23 17:52	06:26 19:32	05:37 20:08	05:10 20:40	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	06:43 16:36	07:21 16:15
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40	05:18 20:44	05:50 20:14	06:27 19:20	07:03 18:23	06:45 16:35	07:22 16:15
10	07:33 16:34	07:05 17:16	06:19 17:55	06:22 19:34	05:34 20:11	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	06:46 16:34	07:23 16:15
11	07:33 16:35	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:09 20:42	05:20 20:44	05:52 20:11	06:29 19:16	07:06 18:20	06:47 16:33	07:24 16:15
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13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	05:09 20:43	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:16	06:50 16:30	07:25 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	05:29 20:15	05:09 20:43	05:22 20:42	05:56 20:07	06:33 19:10	07:10 18:14	06:51 16:29	07:26 16:15
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:17	05:09 20:44	20:13 (8) 20:17 (8)	05:23 20:05	06:34 19:09	07:11 18:13	06:53 16:28	07:27 16:15
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17	07:30 16:43	06:55 17:26	06:06 18:04	06:10 19:43	05:26 20:19	05:09 20:45	20:13 (8) 20:17 (8)	05:25 20:02	05:59 19:05	07:14 18:09	06:56 16:26	07:28 16:16
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	05:09 20:45	20:14 (8) 20:18 (8)	05:26 20:39	06:01 20:01	06:38 19:03	07:15 18:08	06:57 16:25
19	07:29 16:45	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:09 20:45	20:14 (8) 20:18 (8)	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:24
20	07:28 16:47	06:50 17:30	06:01 18:08	06:04 19:47	05:23 20:22	05:09 20:46	20:14 (8) 20:18 (8)	05:28 20:37	06:03 19:56	06:40 18:59	07:17 18:04	07:00 16:24
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25	07:24 16:53	06:42 17:37	05:51 18:14	05:56 19:53	05:18 20:27	05:10 20:47	20:15 (8) 20:19 (8)	05:33 20:33	06:09 19:47	06:46 18:49	06:24 18:56	07:06 16:20
26	07:23 16:55	06:41 17:39	05:50 18:15	05:55 19:55	05:17 20:28	05:11 20:47	20:15 (8) 20:19 (8)	05:34 20:32	06:10 19:45	06:47 18:48	06:25 16:54	07:07 16:19
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	05:11 20:47	20:16 (8) 20:20 (8)	05:35 20:31	06:11 19:44	06:48 18:46	06:27 16:53	07:08 16:19
28	07:21 16:58	06:37 17:41	05:46 18:18	05:51 19:57	05:16 20:30	05:12 20:47	20:16 (8) 20:20 (8)	05:36 20:30	06:13 19:42	06:50 18:44	06:28 16:51	07:10 16:18
29	07:20 16:59		05:44 18:19	05:50 19:58	05:15 20:31	05:12 20:47	05:37 20:28	06:14 19:40	06:51 18:42	06:30 16:50	07:11 16:18	07:34 16:22
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31	07:18 17:02		05:40 18:22		05:14 20:33		05:40 20:26	06:16 19:36		06:32 16:47		07:34 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	274
Total, worst case						56						
Sun reduction						0.55						
Oper. time red.						0.91						
Wind dir. red.						0.65						
Total reduction						0.32						
Total, real						18						

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/24/06 03:39 / 14
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 100 - 100

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:03	06:35 17:43	05:38 18:23	05:47 20:00	05:13 20:34	20:05 (8) 20:09 (8)	05:13 20:47	20:06 (8) 20:18 (8)	05:41 20:25	06:17 19:35	06:53 18:38	06:34 16:46
2	07:35 16:26	07:16 17:05	06:34 17:44	05:37 18:24	05:45 20:01	05:13 20:35	20:04 (8) 20:08 (8)	05:14 20:47	20:06 (8) 20:18 (8)	05:42 20:24	06:19 19:33	06:55 18:36	06:35 16:44
3	07:35 16:27	07:15 17:06	06:32 17:46	05:35 18:26	05:44 20:02	05:12 20:36	20:04 (8) 20:10 (8)	05:14 20:46	20:07 (8) 20:19 (8)	05:43 20:22	06:20 19:31	06:56 18:34	06:36 16:43
4	07:35 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:42 20:03	05:12 20:37	20:04 (8) 20:10 (8)	05:15 20:46	20:07 (8) 20:17 (8)	05:44 20:21	06:21 19:29	06:57 18:33	06:38 16:41
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:05	05:11 20:37	20:11 (8) 20:11 (8)	05:15 20:46	20:08 (8) 20:18 (8)	05:45 20:20	06:22 19:27	06:58 18:31	06:39 16:40
6	07:34 16:30	07:11 17:10	06:27 17:50	06:29 19:29	05:40 20:06	05:11 20:38	20:03 (8) 20:11 (8)	05:16 20:46	20:09 (8) 20:17 (8)	05:46 20:18	06:23 19:25	06:59 18:29	06:40 16:39
7	07:34 16:31	07:10 17:12	06:25 17:51	06:27 19:31	05:38 20:07	05:11 20:39	20:02 (8) 20:12 (8)	05:17 20:45	20:09 (8) 20:17 (8)	05:48 20:18	06:24 19:24	07:01 18:27	06:42 16:37
8	07:34 16:32	07:08 17:13	06:23 17:52	06:25 19:32	05:37 20:08	05:10 20:40	20:02 (8) 20:12 (8)	05:18 20:45	20:10 (8) 20:16 (8)	05:49 20:16	06:26 19:22	07:02 18:25	06:43 16:36
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40	20:02 (8) 20:14 (8)	05:18 20:44	20:11 (8) 20:17 (8)	05:50 20:14	06:27 19:20	07:03 18:23	06:45 16:35
10	07:33 16:34	07:05 17:16	06:19 17:55	06:22 19:34	05:34 20:11	05:10 20:41	20:02 (8) 20:14 (8)	05:19 20:44	20:12 (8) 20:16 (8)	05:51 20:13	06:28 19:18	07:05 18:22	06:46 16:34
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12	07:33 16:37	07:03 17:19	06:16 17:57	06:18 19:37	05:32 20:13	05:09 20:42	20:02 (8) 20:16 (8)	05:21 20:43	20:13 (8) 20:17 (8)	05:54 20:10	06:30 19:14	07:07 18:18	06:49 16:31
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14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	05:29 20:15	05:09 20:43	20:03 (8) 20:15 (8)	05:22 20:42	05:56 20:07	06:33 19:10	07:10 18:14	06:51 16:29	07:26 16:15
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:17	05:09 20:44	20:03 (8) 20:15 (8)	05:23 20:41	05:57 20:05	06:34 19:09	07:11 18:13	06:53 16:28	07:27 16:15
16	07:31 16:41	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	05:09 20:44	20:03 (8) 20:17 (8)	05:24 20:40	05:58 20:04	06:35 19:07	07:12 18:11	06:54 16:27	07:28 16:15
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28	07:21 16:58	06:37 17:41	05:46 18:18	05:51 19:57	05:16 20:30	05:12 20:47	20:06 (8) 20:18 (8)	05:36 20:30	06:13 19:42	06:50 18:44	06:28 16:51	07:10 16:18	07:34 16:21
29	07:20 16:59	06:36 17:41	05:44 18:19	05:50 19:58	05:15 20:31	05:12 20:47	20:07 (8) 20:19 (8)	05:37 20:28	06:14 19:40	06:51 18:42	06:30 16:50	07:11 16:18	07:34 16:22
30	07:19 17:00	06:35 18:21	05:42 18:21	05:48 20:00	05:15 20:32	05:13 20:47	20:07 (8) 20:19 (8)	05:39 20:27	06:15 19:38	06:52 18:40	06:31 16:48	07:12 16:17	07:34 16:23
31	07:18 17:02	06:34 18:22	05:40 18:22	05:44 20:00	05:14 20:33	20:05 (8) 20:09 (8)	05:40 20:26	05:40 20:26	06:16 19:36	06:52 16:47	06:32 16:47	07:13 16:24	07:34 16:24
Potential sun hours	286	291	369	380	-285	4	-254	344	96	376	341	288	274
Total, worst case					4			344	96				
Sun reduction					0.55			0.55	0.58				
Oper. time red.					0.91			0.91	0.91				
Wind dir. red.					0.64			0.64	0.64				
Total reduction					0.32			0.32	0.34				
Total, real					1			110	32				

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)
	Minutes with flicker		

Project: 060119 Marble River	Description: Marble River Wind Project Shadow-Flicker, NW part 22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)	Printed/Page 01/24/06 03:39 / 15 Licensed user: Wind Engineers, Inc. 7660 Whitegate Avenue US-RIVERSIDE, CA 92506 Calculated: 01/23/06 22:52/2.4.0.67
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SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 110 - 110

Assumptions for shadow calculations

Maximum distance for influence	1,000 m	Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Minimum sun height over horizon for influence	3 °	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Day step for calculation	1 days	0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
Time step for calculation	2 minutes	Operational time
		N NE E SE S SW W NW Sum
		1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:35 16:25	08:19 (16) 17:03	07:17 17:43	06:36 18:23	05:39 20:00	05:47 20:34	05:14 20:47	05:13 20:25	05:41 19:35	06:17 18:38	06:53 16:46	07:13 16:17	08:11 (16) 08:25 (16)
2	07:35 16:26	08:21 (16) 17:05	07:16 17:44	06:34 18:24	05:37 20:01	05:45 20:35	05:13 20:47	05:14 20:24	05:42 19:33	06:19 18:36	06:55 16:44	07:15 16:16	08:10 (16) 08:26 (16)
3	07:35 16:27	08:21 (16) 17:06	07:15 17:46	06:32 18:26	05:35 20:02	05:44 20:36	05:12 20:47	05:14 20:23	05:43 19:31	06:20 18:35	06:56 16:43	07:16 16:16	08:11 (16) 08:27 (16)
4	07:35 16:28	08:23 (16) 17:07	07:13 17:47	06:30 18:27	05:33 20:03	05:43 20:37	05:12 20:46	05:15 20:21	05:44 19:29	06:21 18:33	06:57 16:42	07:17 16:16	08:11 (16) 08:29 (16)
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14	07:32 16:39	08:40 (16) 17:17	07:00 17:57	06:12 18:37	06:15 20:13	05:30 20:45	05:09 20:42	05:23 20:07	05:56 19:11	06:33 18:15	07:10 16:29	07:26 16:15	08:12 (16) 08:36 (16)
15	07:31 16:40	06:58 17:18	06:10 18:00	06:13 19:40	05:28 20:15	05:09 20:43	05:23 20:42	05:57 20:07	06:34 19:11	07:11 18:15	06:53 16:29	07:27 16:15	08:11 (16) 08:37 (16)
16	07:31 16:42	06:57 17:19	06:08 18:01	06:11 19:41	05:27 20:16	05:09 20:44	05:24 20:41	05:58 20:05	06:35 19:09	07:12 18:13	06:54 16:28	07:28 16:16	08:12 (16) 08:38 (16)
17	07:30 16:43	06:55 17:20	06:07 18:02	06:10 19:42	05:26 20:17	05:09 20:44	05:25 20:40	06:00 20:02	06:37 19:05	07:14 18:09	06:56 16:26	07:29 16:16	08:12 (16) 08:38 (16)
18	07:30 16:44	06:54 17:21	06:05 18:03	06:08 19:43	05:25 20:18	05:09 20:45	05:26 20:39	06:01 20:01	06:38 19:03	07:15 18:08	06:57 16:25	07:29 16:16	08:13 (16) 08:39 (16)
19	07:29 16:46	06:52 17:22	06:03 18:04	06:06 19:44	05:24 20:19	05:09 20:46	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:25	07:30 16:17	08:14 (16) 08:40 (16)
20	07:28 16:47	06:51 17:23	06:01 18:05	06:05 19:45	05:23 20:20	05:09 20:47	05:28 20:38	06:03 19:56	06:40 18:59	07:18 18:04	07:00 16:24	07:30 16:17	08:14 (16) 08:40 (16)
21	07:28 16:48	06:49 17:24	05:59 18:06	06:03 19:46	05:22 20:21	05:10 20:48	05:29 20:37	06:04 19:54	06:41 18:57	07:19 18:03	07:01 16:23	07:31 16:17	08:15 (16) 08:41 (16)
22	07:27 16:50	06:47 17:25	05:57 18:07	06:01 19:47	05:21 20:22	05:10 20:49	05:30 20:36	06:06 19:52	06:42 18:55	07:20 18:01	07:02 16:22	07:32 16:18	08:15 (16) 08:41 (16)
23	07:26 16:51	06:46 17:26	05:55 18:08	06:00 19:48	05:20 20:23	05:10 20:50	05:31 20:35	06:07 19:51	06:44 18:53	07:22 17:59	07:04 16:21	07:32 16:18	08:16 (16) 08:42 (16)
24	07:25 16:52	06:44 17:27	05:53 18:09	05:58 19:49	05:19 20:24	05:10 20:51	05:32 20:34	06:08 19:49	06:45 18:52	07:23 17:58	07:05 16:21	07:32 16:19	08:16 (16) 08:42 (16)
25	07:24 16:54	06:42 17:28	05:52 18:10	05:56 19:50	05:18 20:25	05:11 20:52	05:33 20:33	06:09 19:47	06:46 18:50	06:24 17:56	07:06 16:20	07:33 16:20	08:16 (16) 08:42 (16)
26	07:23 16:55	06:41 17:29	05:50 18:11	05:55 19:51	05:18 20:26	05:11 20:53	05:34 20:33	06:10 19:46	06:47 18:48	06:26 17:55	07:07 16:19	07:33 16:20	08:17 (16) 08:43 (16)
27	07:22 16:56	06:39 17:30	05:48 18:12	05:53 19:52	05:17 20:27	05:11 20:54	05:35 20:31	06:12 19:44	06:49 18:46	06:27 16:53	07:09 16:19	07:34 16:21	08:17 (16) 08:43 (16)
28	07:21 16:58	06:37 17:31	05:46 18:13	05:52 19:53	05:16 20:28	05:12 20:55	05:36 20:30	06:13 19:42	06:50 18:44	06:28 16:52	07:10 16:18	07:34 16:22	08:17 (16) 08:43 (16)
29	07:20 16:59	06:37 17:32	05:46 18:14	05:52 19:54	05:16 20:29	05:12 20:56	05:36 20:30	06:13 19:42	06:50 18:44	06:28 16:52	07:10 16:18	07:34 16:22	08:17 (16) 08:43 (16)
30	07:19 17:01	06:37 17:33	05:46 18:15	05:52 19:55	05:16 20:30	05:12 20:57	05:36 20:31	06:13 19:42	06:50 18:44	06:28 16:52	07:10 16:18	07:34 16:22	08:17 (16) 08:43 (16)
31	07:18 17:02	06:37 17:34	05:46 18:16	05:52 19:56	05:16 20:31	05:12 20:58	05:36 20:31	06:13 19:42	06:50 18:44	06:28 16:52	07:10 16:18	07:34 16:22	08:17 (16) 08:43 (16)
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	274	
Total, worst case	242										18	732	
Sun reduction	0.45										0.35	0.35	
Oper. time red.	0.91										0.91	0.91	
Wind dir. red.	0.68										0.68	0.68	
Total reduction	0.28										0.22	0.22	
Total, real	68										4	159	

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)
	Minutes with flicker	

Project: 060119 Marble River

Description: Marble River Wind Project Shadow-Flicker, NW part 22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)

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Calculated: 01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 113 - 113

Assumptions for shadow calculations

Maximum distance for influence 1,000 m Minimum sun height over horizon for influence 3 ° Day step for calculation 1 days Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time N NE E SE S SW W NW Sum 1,850 1,325 800 713 625 663 700 1,275 7,950

Table with 12 columns for months (January to December) and rows for each day of the month. Columns include start/end times, sun rise/set, and shadow reduction values. Summary rows at the bottom show total potential sun hours and reductions.

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: 060119 Marble River	Description: Marble River Wind Project Shadow-Flicker, NW part 22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)	Printed/Page: 01/24/06 03:39 / 17 Licensed user: Wind Engineers, Inc. 7660 Whitegate Avenue US-RIVERSIDE, CA 92506 Calculated: 01/23/06 22:52/2.4.0.67
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SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 114 - 114

Assumptions for shadow calculations

Maximum distance for influence	1,000 m	Sun shine probabilities (part of time from sun rise to sun set with sun shine)											
Minimum sun height over horizon for influence	3 °	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Day step for calculation	1 days	0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35
Time step for calculation	2 minutes	Operational time											
		N	NE	E	SE	S	SW	W	NW	Sum			
		1,850	1,325	800	713	625	663	700	1,275	7,950			

	January	February	March	April	May	June	July	August	September	October	November	December		
1	07:35 16:25	07:17 17:03	06:36 17:43	05:38 18:23	05:47 20:00	19:14 (22) 22 19:36 (22)	05:13 20:34	05:13 20:47	05:41 20:25	06:17 19:35	06:53 18:38	06:34 16:46	07:13 16:17	
2	07:35 16:26	07:16 17:05	06:34 17:44	05:37 18:24	05:45 20:01	19:15 (22) 20 19:35 (22)	05:13 20:35	05:14 20:47	05:42 20:24	06:19 19:33	06:55 18:36	06:35 16:44	07:15 16:16	
3	07:35 16:27	07:15 17:06	06:32 17:46	05:35 18:26	05:44 20:02	19:15 (22) 18 19:33 (22)	05:12 20:36	05:14 20:47	05:43 20:23	06:20 19:31	06:56 18:35	06:36 16:43	07:16 16:16	
4	07:35 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	19:16 (22) 18 19:34 (22)	05:12 20:37	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:33	06:38 16:41	07:17 16:16	
5	07:35 16:29	07:12 17:09	06:29 17:48	06:31 19:28	05:41 20:05	19:16 (22) 16 19:32 (22)	05:11 20:38	05:16 20:46	05:45 20:20	06:22 19:27	06:58 18:31	06:39 16:40	07:18 16:15	
6	07:34 16:30	07:11 17:11	06:27 17:50	06:29 19:30	05:40 20:06	19:19 (22) 10 19:29 (22)	05:11 20:38	05:16 20:46	05:47 20:19	19:30 (22) 8 19:38 (22)	06:23 19:26	07:00 18:29	06:41 16:39	07:19 16:15
7	07:34 16:31	07:10 17:12	06:25 17:51	06:27 19:31	05:38 20:07	19:22 (22) 6 19:28 (22)	05:11 20:39	05:17 20:45	05:48 20:17	19:27 (22) 12 19:39 (22)	06:25 19:24	07:01 18:27	06:42 16:38	07:20 16:15
8	07:34 16:32	07:08 17:13	06:23 17:52	06:26 19:32	05:37 20:08	19:26 (22) 20:40	05:10 20:45	05:18 20:16	05:49 20:16	19:26 (22) 16 19:42 (22)	06:26 19:22	07:02 18:25	06:43 16:36	07:21 16:15
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:10	19:23 (22) 20:41	05:10 20:45	05:18 20:14	05:50 20:20	19:23 (22) 20 19:43 (22)	06:27 19:20	07:03 18:23	06:45 16:35	07:22 16:15
10	07:34 16:34	07:06 17:16	06:19 17:55	06:22 19:35	05:34 20:11	19:22 (22) 20:41	05:10 20:44	05:19 20:13	05:51 20:13	19:22 (22) 20 19:42 (22)	06:28 19:18	07:05 18:22	06:46 16:34	07:23 16:15
11	07:33 16:35	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	19:22 (22) 20:42	05:10 20:44	05:20 20:11	05:52 20:11	19:22 (22) 22 19:44 (22)	06:29 19:16	07:06 18:20	06:47 16:33	07:24 16:15
12	07:33 16:37	07:03 17:19	06:16 17:58	06:18 19:37	05:32 20:13	19:21 (22) 20:42	05:10 20:43	05:21 20:10	05:54 20:10	19:21 (22) 22 19:43 (22)	06:31 19:14	07:07 18:18	06:49 16:32	07:25 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	19:20 (22) 20:43	05:09 20:43	05:22 20:08	05:55 20:08	19:22 (22) 20 19:42 (22)	06:32 19:12	07:08 18:16	06:50 16:30	07:25 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	05:29 20:15	19:21 (22) 20:43	05:09 20:42	05:22 20:07	05:56 20:07	19:21 (22) 20 19:41 (22)	06:33 19:11	07:10 18:15	06:52 16:29	07:26 16:15
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:17	19:20 (22) 20:44	05:09 20:41	05:23 20:05	05:57 20:05	19:20 (22) 20 19:40 (22)	06:34 19:09	07:11 18:13	06:53 16:28	07:27 16:15
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	19:19 (22) 20:44	05:09 20:41	05:24 20:04	05:58 20:04	19:21 (22) 16 19:37 (22)	06:35 19:07	07:12 18:11	06:54 16:27	07:28 16:16
17	07:30 16:43	06:55 17:26	06:07 18:04	06:10 19:43	05:26 20:19	19:18 (22) 20:45	05:09 20:40	05:25 20:02	06:00 20:02	19:20 (22) 16 19:36 (22)	06:36 19:05	07:14 18:09	06:56 16:26	07:29 16:16
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	19:17 (22) 20:45	05:09 20:39	05:26 20:01	06:01 20:01	19:20 (22) 16 19:36 (22)	06:38 19:03	07:15 18:08	06:57 16:25	07:29 16:16
19	07:29 16:45	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	19:16 (22) 20:46	05:09 20:38	05:27 19:57	06:02 19:57	19:21 (22) 12 19:33 (22)	06:39 19:01	07:16 18:06	06:58 16:24	07:30 16:16
20	07:28 16:47	06:51 17:30	06:01 18:08	06:04 19:47	05:23 20:22	19:15 (22) 4 19:25 (22)	05:09 20:46	05:28 20:38	06:03 19:56	19:22 (22) 10 19:32 (22)	06:40 18:59	07:18 18:04	07:00 16:24	07:30 16:17
21	07:28 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	19:14 (22) 4 19:23 (22)	05:10 20:46	05:29 20:37	06:04 19:54	19:23 (22) 6 19:29 (22)	06:41 18:57	07:19 18:03	07:01 16:23	07:31 16:17
22	07:27 16:49	06:47 17:33	05:57 18:11	06:01 19:50	05:21 20:24	19:13 (22) 8 19:26 (22)	05:10 20:46	05:30 20:36	06:06 19:52	19:24 (22) 4 19:28 (22)	06:42 18:55	07:20 18:01	07:02 16:22	07:32 16:18
23	07:26 16:51	06:46 17:35	05:55 18:12	05:59 19:51	05:20 20:26	19:12 (22) 10 19:26 (22)	05:10 20:47	05:31 20:35	06:07 19:51	19:25 (22) 4 19:29 (22)	06:44 18:53	07:22 17:59	07:04 16:21	07:32 16:18
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:27	19:11 (22) 12 19:27 (22)	05:10 20:47	05:32 20:34	06:08 19:49	19:24 (22) 18:51	06:45 17:58	07:23 18:01	07:05 16:21	07:32 16:19
25	07:24 16:54	06:42 17:37	05:52 18:14	05:56 19:53	05:18 20:28	19:10 (22) 14 19:29 (22)	05:11 20:47	05:33 20:33	06:09 19:47	19:23 (22) 18:50	06:46 17:56	07:24 18:00	07:06 16:20	07:33 16:19
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	05:18 20:29	19:09 (22) 16 19:29 (22)	05:11 20:47	05:34 20:32	06:10 19:45	19:22 (22) 18:48	06:47 17:55	07:25 18:00	07:07 16:19	07:33 16:20
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:30	19:08 (22) 18 19:32 (22)	05:11 20:47	05:35 20:31	06:11 19:44	19:21 (22) 18:46	06:48 17:53	07:26 18:00	07:09 16:19	07:34 16:21
28	07:21 16:58	06:37 17:42	05:46 18:18	05:51 19:57	05:16 20:31	19:07 (22) 20 19:32 (22)	05:12 20:47	05:36 20:30	06:13 19:42	19:20 (22) 18:44	06:50 17:52	07:10 18:00	07:10 16:18	07:34 16:22
29	07:20 16:59	06:35 18:19	05:44 19:58	05:50 20:32	05:15 20:32	19:06 (22) 20 19:33 (22)	05:12 20:47	05:38 20:29	06:14 19:40	19:19 (22) 18:42	06:51 17:50	07:11 18:00	07:11 16:18	07:34 16:22
30	07:19 17:01	06:33 18:21	05:42 20:00	05:48 20:00	05:15 20:32	19:05 (22) 22 19:35 (22)	05:13 20:47	05:39 20:27	06:15 19:38	19:18 (22) 18:40	06:52 17:49	07:12 18:00	07:12 16:17	07:34 16:23
31	07:18 17:02	06:31 18:22	05:40 20:00	05:46 20:33	05:14 20:33	19:04 (22) -285	05:14 20:26	05:40 20:26	06:16 19:37	19:17 (22) 376	06:32 17:47	07:13 18:00	07:13 16:17	07:34 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	264	376	341	288	274	
Total, worst case				148	110				264					
Sun reduction				0.55	0.55				0.55					
Oper. time red.				0.91	0.91				0.91					
Wind dir. red.				0.62	0.62				0.62					
Total reduction				0.31	0.31				0.31					
Total, real				46	34				82					

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 115 - 115

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:35 16:25	07:17 17:04	07:49 (16) 17:43	06:36 18:23	05:39 20:00	05:47 20:34	05:14 20:47	05:13 20:25	05:41 19:35	06:17 18:38	06:53 18:38	07:25 (16) 16:17
2	07:35 16:26	07:16 17:05	07:50 (16) 17:44	06:34 18:24	05:37 20:01	05:45 20:35	05:13 20:47	05:42 20:24	06:19 19:33	06:55 18:36	07:24 (16) 18:36	07:48 (16) 16:16
3	07:35 16:27	07:15 17:06	07:51 (16) 17:46	06:32 18:26	05:35 20:02	05:44 20:36	05:12 20:47	05:14 20:23	06:20 19:31	06:56 18:35	07:22 (16) 18:35	07:50 (16) 16:16
4	07:35 16:28	07:13 17:08	07:51 (16) 17:47	06:30 18:27	05:33 20:03	05:43 20:37	05:12 20:46	05:15 20:21	06:21 19:29	06:57 18:33	07:21 (16) 18:33	07:17 16:16
5	07:35 16:29	07:12 17:09	07:52 (16) 17:48	06:29 18:28	05:31 20:05	05:41 20:38	05:12 20:46	05:16 20:20	06:22 19:27	06:58 18:31	07:21 (16) 18:31	07:18 16:16
6	07:34 16:30	07:11 17:11	07:51 (16) 17:50	06:27 18:30	05:29 20:06	05:40 20:38	05:11 20:46	05:16 20:19	06:23 19:26	07:00 18:29	07:20 (16) 18:29	07:19 16:15
7	07:34 16:31	07:10 17:12	07:51 (16) 17:51	06:25 18:31	05:28 20:07	05:38 20:39	05:11 20:45	05:17 20:17	06:25 19:24	07:01 18:27	07:21 (16) 18:27	07:20 16:15
8	07:34 16:32	07:08 17:14	07:54 (16) 17:52	06:23 18:32	05:26 20:08	05:37 20:40	05:10 20:45	05:18 20:16	06:26 19:22	07:02 18:25	07:21 (16) 18:25	07:21 16:15
9	07:34 16:33	07:07 17:15	07:54 (16) 17:54	06:21 18:33	05:24 20:10	05:36 20:41	05:10 20:45	05:18 20:14	06:27 19:20	07:03 18:24	07:21 (16) 18:24	07:22 16:15
10	07:33 16:34	07:06 17:16	07:55 (16) 17:55	06:20 18:35	05:23 20:11	05:34 20:41	05:10 20:44	05:19 20:13	06:28 19:18	07:05 18:22	07:20 (16) 18:22	07:23 16:15
11	07:33 16:36	07:04 17:18	07:58 (16) 17:56	06:18 18:36	05:20 20:12	05:33 20:42	05:10 20:44	05:20 20:11	06:29 19:16	07:06 18:20	07:22 (16) 18:20	07:24 16:15
12	07:33 16:37	07:03 17:19	08:00 (16) 17:58	06:16 18:37	05:18 20:13	05:32 20:42	05:09 20:43	05:21 20:10	06:31 19:14	07:07 18:18	07:21 (16) 18:18	07:25 16:15
13	07:32 16:38	07:01 17:21	08:03 (16) 17:59	06:14 19:38	05:16 20:14	05:31 20:43	05:09 20:43	05:22 20:08	06:32 19:12	07:08 18:16	07:22 (16) 18:16	07:25 16:15
14	07:32 16:39	07:00 17:22	08:09 (16) 18:00	06:12 19:40	05:15 20:15	05:30 20:43	05:09 20:42	05:23 20:07	06:33 19:11	07:10 18:15	07:22 (16) 18:15	07:26 16:15
15	07:31 16:40	06:58 17:24	06:10 18:02	06:13 19:41	05:28 20:17	05:09 20:44	05:23 20:41	05:57 20:05	06:34 19:09	07:11 18:13	07:23 (16) 18:13	07:27 16:15
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	05:09 20:44	05:24 20:41	05:58 20:04	06:35 19:07	07:12 18:11	07:23 (16) 18:11	07:28 16:16
17	07:30 16:43	06:55 17:26	06:07 18:04	06:10 19:43	05:26 20:19	05:09 20:45	05:24 20:40	06:00 20:02	06:37 19:05	07:14 18:09	07:24 (16) 18:09	07:29 16:16
18	07:30 16:44	07:57 (16) 08:07 (16)	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:01	06:38 19:03	07:15 18:08	07:26 (16) 16:16
19	07:29 16:46	07:56 (16) 08:10 (16)	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:09 20:46	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	07:27 (16) 16:17
20	07:28 16:47	07:55 (16) 08:11 (16)	06:51 17:31	06:01 18:08	06:05 19:47	05:23 20:22	05:09 20:46	05:28 20:37	06:03 19:56	06:40 18:59	07:18 18:04	07:28 (16) 16:17
21	07:28 16:48	07:52 (16) 08:12 (16)	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46	05:29 20:37	06:04 19:54	06:41 18:57	07:19 18:03	07:28 (16) 16:17
22	07:27 16:50	07:52 (16) 08:14 (16)	06:47 17:33	05:57 18:11	06:01 19:50	05:21 20:24	05:10 20:46	05:30 20:36	06:06 19:52	06:42 18:55	07:20 18:01	07:31 (16) 16:18
23	07:26 16:51	07:53 (16) 08:15 (16)	06:46 17:35	05:55 18:12	06:00 19:51	05:20 20:26	05:10 20:47	05:31 20:35	06:07 19:51	07:22 18:53	07:22 17:59	07:33 (16) 16:18
24	07:25 16:52	07:52 (16) 08:16 (16)	06:44 17:36	05:54 18:13	05:58 19:52	05:19 20:27	05:10 20:47	05:32 20:34	06:08 19:49	06:45 18:52	07:23 17:58	07:34 (16) 16:19
25	07:24 16:54	07:51 (16) 08:17 (16)	06:42 17:37	05:52 18:14	05:56 19:53	05:18 20:28	05:11 20:47	05:33 20:33	06:09 19:47	06:46 18:50	06:24 18:56	07:35 (16) 16:20
26	07:23 16:55	07:50 (16) 08:18 (16)	06:41 17:39	05:50 18:16	05:55 19:55	05:18 20:29	05:11 20:47	05:34 20:32	06:10 19:45	06:47 18:48	06:26 18:55	07:36 (16) 16:21
27	07:22 16:56	07:51 (16) 08:19 (16)	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:30	05:11 20:47	05:35 20:31	06:12 19:44	06:49 18:46	06:27 18:53	07:37 (16) 16:22
28	07:21 16:58	07:50 (16) 08:20 (16)	06:37 17:42	05:46 18:18	05:52 19:57	05:16 20:31	05:12 20:47	05:36 20:30	06:13 19:42	06:50 18:44	06:28 16:52	07:38 (16) 16:23
29	07:20 16:59	07:51 (16) 08:21 (16)	06:36 17:42	05:44 18:19	05:50 19:58	05:15 20:32	05:12 20:47	05:38 20:29	06:14 19:40	06:51 18:42	06:30 16:50	07:39 (16) 16:24
30	07:19 17:01	07:49 (16) 08:21 (16)	06:35 17:42	05:42 18:21	05:48 20:00	05:15 20:32	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	07:28 (16) 16:49	07:40 (16) 16:25
31	07:18 17:02	07:50 (16) 08:20 (16)	06:34 17:42	05:40 18:22	05:46 20:33	05:14 20:33	05:14 20:26	05:39 20:37	06:16 19:37	06:32 16:47	07:25 (16) 20	07:41 (16) 16:26
Potential sun hours	286	291	369	380	285	254	272	4	376	341	288	274
Total, worst case	332	318								46	618	
Sun reduction	0.45	0.45								0.45	0.35	
Oper. time red.	0.91	0.91								0.91	0.91	
Wind dir. red.	0.65	0.65								0.65	0.65	
Total reduction	0.27	0.27								0.27	0.21	
Total, real	88	85								12	128	

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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: 060119 Marble River	Description: Marble River Wind Project Shadow-Flicker, NW part 22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)	Printed/Page 01/24/06 03:39 / 19 Licensed user: Wind Engineers, Inc. 7660 Whitegate Avenue US-RIVERSIDE, CA 92506 Calculated: 01/23/06 22:52/2.4.0.67
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SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 260 - 260

Assumptions for shadow calculations

Maximum distance for influence	1,000 m	Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Minimum sun height over horizon for influence	3 °	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Day step for calculation	1 days	0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
Time step for calculation	2 minutes	Operational time
		N NE E SE S SW W NW Sum
		1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:35	07:17	06:36	07:04 (18)	05:39	05:47	05:13	20:14 (12)	05:41	06:17	06:53	06:34	07:13
2	07:35	07:16	06:34	07:06 (18)	05:37	05:45	05:14	20:14 (12)	05:42	06:19	06:55	06:35	07:15
3	07:35	07:15	06:32	07:07 (18)	05:35	05:44	05:12	20:15 (12)	05:43	06:20	06:56	06:36	07:16
4	07:35	07:13	06:30	07:09 (18)	05:33	05:43	05:12	20:16 (12)	05:44	06:21	06:57	06:38	07:17
5	07:35	07:12	06:29	07:11 (18)	05:31	05:41	05:11	20:16 (12)	05:45	06:22	06:58	06:39	07:18
6	07:34	07:11	06:27	07:19 (18)	05:29	05:40	05:11	20:20 (12)	05:46	06:23	07:00	06:41	07:19
7	07:34	07:10	06:25	07:19 (18)	05:27	05:38	05:11	20:19 (12)	05:47	06:24	07:01	06:42	07:20
8	07:34	07:08	06:23	07:21 (18)	05:25	05:37	05:10	20:18 (12)	05:48	06:25	07:02	06:43	07:21
9	07:34	07:07	06:21	07:24 (18)	05:23	05:36	05:10	20:17 (12)	05:49	06:26	07:03	06:44	07:22
10	07:33	07:06	06:19	07:26 (18)	05:21	05:34	05:10	20:16 (12)	05:50	06:27	07:04	06:45	07:23
11	07:33	07:04	06:18	07:28 (18)	05:19	05:32	05:10	20:15 (12)	05:51	06:28	07:05	06:46	07:24
12	07:33	07:03	06:16	07:30 (18)	05:17	05:30	05:09	20:14 (12)	05:52	06:29	07:06	06:47	07:25
13	07:32	07:01	06:14	07:32 (18)	05:15	05:28	05:09	20:13 (12)	05:53	06:30	07:07	06:48	07:26
14	07:32	07:00	06:12	07:34 (18)	05:13	05:26	05:09	20:12 (12)	05:54	06:31	07:08	06:49	07:27
15	07:31	06:58	06:10	07:36 (18)	05:11	05:24	05:09	20:11 (12)	05:55	06:32	07:09	06:50	07:28
16	07:31	06:57	06:08	07:38 (18)	05:09	05:22	05:09	20:10 (12)	05:56	06:33	07:10	06:51	07:29
17	07:30	06:55	06:06	07:40 (18)	05:07	05:20	05:09	20:09 (12)	05:57	06:34	07:11	06:52	07:30
18	07:30	06:54	06:05	07:42 (18)	05:05	05:18	05:09	20:08 (12)	05:58	06:35	07:12	06:53	07:31
19	07:29	06:52	06:03	07:44 (18)	05:03	05:16	05:09	20:07 (12)	05:59	06:36	07:13	06:54	07:32
20	07:28	06:51	06:01	07:46 (18)	05:01	05:14	05:09	20:06 (12)	06:00	06:37	07:14	06:55	07:33
21	07:27	06:49	05:59	07:48 (18)	04:59	05:12	05:09	20:05 (12)	06:01	06:38	07:15	06:56	07:34
22	07:27	06:47	05:57	07:50 (18)	04:57	05:10	05:09	20:04 (12)	06:02	06:39	07:16	06:57	07:35
23	07:26	06:46	05:55	07:52 (18)	04:55	05:08	05:09	20:03 (12)	06:03	06:40	07:17	06:58	07:36
24	07:25	06:44	05:53	07:54 (18)	04:53	05:06	05:09	20:02 (12)	06:04	06:41	07:18	06:59	07:37
25	07:24	06:42	05:52	07:56 (18)	04:51	05:04	05:09	20:01 (12)	06:05	06:42	07:19	07:00	07:38
26	07:23	06:41	05:50	07:58 (18)	04:49	05:02	05:09	20:00 (12)	06:06	06:43	07:20	07:01	07:39
27	07:22	06:39	05:48	08:00 (18)	04:47	05:00	05:09	19:59 (12)	06:07	06:44	07:21	07:02	07:40
28	07:21	06:37	05:46	08:02 (18)	04:45	04:58	05:09	19:58 (12)	06:08	06:45	07:22	07:03	07:41
29	07:20	06:35	05:44	08:04 (18)	04:43	04:56	05:09	19:57 (12)	06:09	06:46	07:23	07:04	07:42
30	07:19	06:33	05:42	08:06 (18)	04:41	04:54	05:09	19:56 (12)	06:10	06:47	07:24	07:05	07:43
31	07:18	06:31	05:40	08:08 (18)	04:39	04:52	05:09	19:55 (12)	06:11	06:48	07:25	07:06	07:44
Potential sun hours	286	291	369	380	285	254	272	4	376	341	286	274	
Total, worst case		206	78			126	20				286		
Sun reduction		0.45	0.50			0.55	0.58				0.45		
Oper. time red.		0.91	0.91			0.91	0.91				0.91		
Wind dir. red.		0.62	0.62			0.65	0.65				0.62		
Total reduction		0.25	0.28			0.32	0.34				0.25		
Total, real		52	22			41	7				72		

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/24/06 03:39 / 20
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 261 - 261

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35

Operational time

N	NE	E	SE	S	SW	W	NW	Sum
1,850	1,325	800	713	625	663	700	1,275	7,950

	January	February	March	April	May	June	
1	07:35 16:25	07:17 17:03	08:07 (18) 08:13 (18)	06:36 17:43	05:39 18:23	17:29 (13) 20:00	19:18 (12) 20:34
2	07:35 16:26	07:16 17:05		06:34 17:44	05:37 18:24	17:27 (13) 20:01	19:19 (12) 20:35
3	07:35 16:27	07:15 17:06		06:32 17:46	05:35 18:26	17:27 (13) 20:02	19:19 (12) 20:36
4	07:35 16:28	07:13 17:08		06:30 17:47	05:33 18:27	17:25 (13) 20:03	19:20 (12) 20:37
5	07:35 16:29	07:12 17:09		06:29 17:48	05:31 18:28	18:23 (13) 20:04	19:20 (12) 20:38
6	07:34 16:30	07:11 17:10		06:27 17:50	05:29 18:29	18:23 (13) 20:05	19:23 (12) 20:39
7	07:34 16:31	07:11 17:11		06:25 17:51	05:27 18:30	18:24 (13) 20:06	19:26 (12) 20:40
8	07:34 16:32	07:11 17:12		06:23 17:52	05:26 18:31	18:24 (13) 20:07	19:26 (12) 20:41
9	07:34 16:33	07:11 17:13		06:21 17:53	05:24 18:32	18:22 (13) 20:08	19:26 (12) 20:42
10	07:33 16:34	07:10 17:14		06:19 17:54	05:22 18:33	18:22 (13) 20:09	19:26 (12) 20:43
11	07:33 16:35	07:10 17:15		06:18 17:55	05:21 18:34	18:22 (13) 20:10	19:26 (12) 20:44
12	07:33 16:36	07:10 17:16		06:16 17:56	05:19 18:35	18:22 (13) 20:11	19:26 (12) 20:45
13	07:32 16:37	07:09 17:17		06:14 17:57	05:17 18:36	18:21 (13) 20:12	19:26 (12) 20:46
14	07:32 16:38	07:09 17:18		06:12 17:58	05:15 18:37	18:21 (13) 20:13	19:26 (12) 20:47
15	07:31 16:39	07:08 17:19		06:10 17:59	05:13 18:38	18:21 (13) 20:14	19:26 (12) 20:48
16	07:31 16:40	07:08 17:20		06:08 18:00	05:11 18:39	18:21 (13) 20:15	19:26 (12) 20:49
17	07:30 16:41	07:07 17:21		06:06 18:01	05:09 18:40	18:21 (13) 20:16	19:26 (12) 20:50
18	07:30 16:42	07:07 17:22		06:05 18:02	05:08 18:41	18:21 (13) 20:17	19:26 (12) 20:51
19	07:29 16:43	07:06 17:23		06:03 18:03	05:06 18:42	18:21 (13) 20:18	19:26 (12) 20:52
20	07:28 16:44	07:05 17:24		06:01 18:04	05:04 18:43	18:21 (13) 20:19	19:26 (12) 20:53
21	07:27 16:45	07:04 17:25		05:59 18:05	05:02 18:44	18:21 (13) 20:20	19:26 (12) 20:54
22	07:27 16:46	07:04 17:26		05:57 18:06	05:01 18:45	18:21 (13) 20:21	19:26 (12) 20:55
23	07:26 16:47	07:03 17:27		05:55 18:07	05:00 18:46	18:21 (13) 20:22	19:26 (12) 20:56
24	07:25 16:48	07:02 17:28		05:53 18:08	04:58 18:47	18:21 (13) 20:23	19:26 (12) 20:57
25	07:24 16:49	07:01 17:29		05:52 18:09	04:56 18:48	18:21 (13) 20:24	19:26 (12) 20:58
26	07:23 16:50	07:00 17:30		05:50 18:10	04:55 18:49	18:21 (13) 20:25	19:26 (12) 20:59
27	07:22 16:51	06:59 17:31		05:48 18:11	04:53 18:50	18:21 (13) 20:26	19:26 (12) 21:00
28	07:21 16:52	06:58 17:32		05:46 18:12	04:52 18:51	18:21 (13) 20:27	19:26 (12) 21:01
29	07:20 16:53	06:57 17:33		05:44 18:13	04:50 18:52	18:21 (13) 20:28	19:26 (12) 21:02
30	07:19 16:54	06:56 17:34		05:42 18:14	04:49 18:53	18:21 (13) 20:29	19:26 (12) 21:03
31	07:18 16:55	06:55 17:35		05:40 18:15	04:47 18:54	18:21 (13) 20:30	19:26 (12) 21:04
Potential sun hours	286	291	369	380	380	285	-254
Total, worst case	532	6	92	898	98		
Sun reduction	0.45	0.45	0.50	0.55	0.55		
Oper. time red.	0.91	0.91	0.91	0.91	0.91		
Wind dir. red.	0.66	0.66	0.62	0.62	0.62		
Total reduction	0.27	0.27	0.28	0.31	0.31		
Total, real	144	2	26	280	30		

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/24/06 03:39 / 21
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 261 - 261

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	06:17 19:35	18:21 (13) 19:01 (13)	06:53 18:38	06:34 16:46
2	05:14 20:47	05:42 20:24	06:19 19:33	18:21 (13) 19:01 (13)	06:55 18:36	06:35 16:44
3	05:14 20:47	05:43 20:23	06:20 19:31	18:20 (13) 19:02 (13)	06:56 18:35	06:36 16:43
4	05:15 20:46	05:44 20:21	06:21 19:29	18:19 (13) 19:01 (13)	06:57 18:33	06:38 16:41
5	05:16 20:46	05:45 20:20	06:22 19:27	18:20 (13) 19:00 (13)	06:58 18:31	06:39 16:40
6	05:16 20:46	05:47 20:19	19:34 (12) 19:42 (12)	06:23 19:26	18:19 (13) 18:59 (13)	07:00 18:29
7	05:17 20:45	05:48 20:17	19:31 (12) 19:43 (12)	06:25 19:24	18:18 (13) 18:58 (13)	07:01 18:27
8	05:18 20:45	05:49 20:16	19:30 (12) 19:44 (12)	06:26 19:22	18:19 (13) 18:57 (13)	06:43 18:25
9	05:18 20:45	05:50 20:14	19:29 (12) 19:45 (12)	06:27 19:20	18:21 (13) 18:57 (13)	07:03 18:23
10	05:19 20:44	05:51 20:13	19:29 (12) 19:47 (12)	06:28 19:18	18:20 (13) 18:54 (13)	07:05 18:22
11	05:20 20:44	05:52 20:11	19:28 (12) 19:46 (12)	06:29 19:16	18:21 (13) 18:53 (13)	07:06 18:20
12	05:21 20:43	05:54 20:10	19:27 (12) 19:43 (12)	06:31 19:14	18:22 (13) 18:50 (13)	07:07 18:18
13	05:22 20:43	05:55 20:08	19:26 (12) 19:42 (12)	06:32 19:12	18:23 (13) 18:49 (13)	07:08 18:16
14	05:23 20:42	05:56 20:07	19:25 (12) 19:41 (12)	06:33 19:11	18:24 (13) 18:46 (13)	07:10 18:15
15	05:23 20:41	05:57 20:05	19:26 (12) 19:40 (12)	06:34 19:09	18:27 (13) 18:43 (13)	07:11 18:13
16	05:24 20:41	05:58 20:04	19:25 (12) 19:37 (12)	06:35 19:07	18:33 (13) 18:39 (13)	07:12 18:11
17	05:25 20:40	06:00 20:02	19:24 (12) 19:36 (12)	06:36 19:05	18:34 (13) 18:09	07:13 18:06
18	05:26 20:39	06:01 20:01	19:26 (12) 19:36 (12)	06:38 19:03	18:35 (13) 18:08	07:14 18:05
19	05:27 20:38	06:02 19:57	18:43 (13) 19:33 (12)	06:39 19:01	18:36 (13) 18:06	07:15 18:04
20	05:28 20:37	06:03 19:56	18:38 (13) 19:32 (12)	06:40 18:59	18:37 (13) 18:04	07:16 18:03
21	05:29 20:37	06:04 19:54	18:35 (13) 19:31 (12)	06:41 18:57	18:38 (13) 18:03	07:17 18:02
22	05:30 20:36	06:06 19:52	18:32 (13) 18:56 (13)	06:42 18:55	18:39 (13) 18:01	07:18 18:01
23	05:31 20:35	06:07 19:51	18:29 (13) 18:57 (13)	06:44 18:53	18:40 (13) 17:59	07:19 18:00
24	05:32 20:34	06:08 19:49	18:28 (13) 18:58 (13)	06:45 18:51	18:41 (13) 17:58	07:20 18:00
25	05:33 20:33	06:09 19:47	18:28 (13) 19:00 (13)	06:46 18:50	18:42 (13) 16:56	07:21 18:00
26	05:34 20:32	06:10 19:45	18:27 (13) 19:01 (13)	06:47 18:48	18:43 (13) 16:55	07:22 18:00
27	05:35 20:31	06:11 19:44	18:24 (13) 19:02 (13)	06:49 18:46	18:44 (13) 16:53	07:23 18:00
28	05:36 20:30	06:13 19:42	18:23 (13) 19:01 (13)	06:50 18:44	18:45 (13) 16:52	07:24 18:00
29	05:38 20:29	06:14 19:40	18:22 (13) 19:02 (13)	06:51 18:42	18:46 (13) 16:50	07:25 18:00
30	05:39 20:27	06:15 19:38	18:21 (13) 19:01 (13)	06:52 18:40	18:47 (13) 16:49	07:26 18:00
31	05:40 20:26	06:16 19:37	18:20 (13) 19:02 (13)	06:53 18:40	18:48 (13) 16:47	07:27 18:00
Potential sun hours	-272	4	376	341	288	274
Total, worst case		584	522		442	98
Sun reduction		0.55	0.55		0.35	0.35
Oper. time red.		0.91	0.91		0.91	0.91
Wind dir. red.		0.62	0.62		0.66	0.66
Total reduction		0.31	0.31		0.21	0.21
Total, real		182	163		93	21

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/24/06 03:39 / 22
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 262 - 262

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December		
1	07:35 16:25	07:17 17:03	06:36 17:43	05:38 18:23	17:25 (22) 20:00	05:47 20:34	05:13 20:47	05:13 20:25	05:41 19:35	06:17 18:38	06:34 16:46	07:13 16:17		
2	07:35 16:26	07:16 17:05	06:34 17:44	05:37 18:24	17:25 (22) 20:01	05:45 20:35	05:13 20:47	05:14 20:24	05:42 19:33	06:19 18:36	06:35 16:44	07:15 16:16		
3	07:35 16:27	07:15 17:06	06:32 17:46	05:35 18:26	17:25 (22) 20:02	05:44 20:36	05:12 20:47	05:14 20:23	05:43 19:31	06:20 18:35	06:37 16:43	07:16 16:16		
4	07:35 16:28	07:13 17:08	06:30 17:47	05:33 18:27	17:25 (22) 20:03	05:43 20:37	05:12 20:46	05:15 20:21	05:44 19:29	06:21 18:33	06:38 16:41	07:17 16:16		
5	07:35 16:29	07:12 17:09	06:29 17:48	06:31 19:28	18:27 (22) 20:05	05:41 20:38	05:11 20:46	05:16 20:20	05:45 19:27	06:22 18:40 (22)	06:58 18:31	06:39 16:40	07:18 16:15	
6	07:34 16:30	07:11 17:11	06:27 17:50	06:29 19:30	18:27 (22) 20:06	05:40 20:38	05:11 20:46	05:16 20:19	05:47 19:26	06:23 18:41 (22)	07:00 18:29	06:41 16:39	07:19 16:15	
7	07:34 16:31	07:10 17:12	06:25 17:51	06:27 19:31	18:32 (22) 20:07	05:38 20:39	05:11 20:45	05:17 20:17	05:48 19:24	06:25 20	18:22 (22) 18:27	07:01 16:38	06:42 16:15	07:20 16:15
8	07:34 16:32	07:08 17:13	06:23 17:52	06:26 19:32	18:44 (22) 20:07	05:37 20:40	05:10 20:45	05:18 20:16	05:49 19:22	06:26 24	18:19 (22) 18:25	06:43 16:36	06:43 16:15	07:21 16:15
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	19:32 20:10	05:36 20:10	05:10 20:41	05:18 20:14	05:50 19:20	06:27 26	18:19 (22) 18:45 (22)	07:03 18:23	06:45 16:35	07:22 16:15
10	07:34 16:34	07:06 17:16	06:19 17:55	06:22 19:35	20:11 20:11	05:34 20:41	05:10 20:41	05:19 20:13	05:51 19:18	06:28 28	18:18 (22) 18:46 (22)	07:05 18:22	06:46 16:34	07:23 16:15
11	07:33 16:35	07:04 17:18	06:18 17:56	06:20 19:36	20:12 20:12	05:33 20:42	05:10 20:42	05:20 20:12	05:52 19:16	06:29 28	18:17 (22) 18:45 (22)	07:06 18:20	06:48 16:33	07:24 16:15
12	07:33 16:37	07:03 17:19	06:16 17:58	06:18 19:37	20:13 20:13	05:32 20:42	05:09 20:43	05:21 20:10	05:54 19:14	06:31 30	18:16 (22) 18:46 (22)	07:07 18:18	06:49 16:32	07:25 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	20:14 20:14	05:31 20:43	05:09 20:43	05:22 20:09	05:55 19:12	06:32 30	18:15 (22) 18:45 (22)	07:08 18:16	06:50 16:30	07:26 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	20:16 20:16	05:29 20:43	05:09 20:42	05:22 20:07	05:56 19:11	06:33 30	18:14 (22) 18:44 (22)	07:10 18:15	06:52 16:29	07:26 16:15
15	07:31 16:40	06:58 17:23	06:10 18:02	06:13 19:41	20:17 20:17	05:28 20:44	05:09 20:41	05:23 20:05	05:57 19:09	06:34 32	18:13 (22) 18:45 (22)	07:11 18:13	06:53 16:28	07:27 16:15
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	20:18 20:18	05:27 20:44	05:09 20:41	05:24 20:04	05:58 19:07	06:35 28	18:15 (22) 18:43 (22)	07:12 18:11	06:54 16:27	07:28 16:16
17	07:30 16:43	06:55 17:26	06:07 18:04	06:10 19:43	20:19 20:19	05:26 20:45	05:09 20:40	05:25 20:02	06:00 19:05	06:36 28	18:14 (22) 18:42 (22)	07:14 18:09	06:56 16:26	07:29 16:16
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 19:45	20:20 20:20	05:25 20:45	05:09 20:39	05:26 20:01	06:01 19:03	06:38 24	18:15 (22) 18:39 (22)	07:15 18:08	06:57 16:25	07:29 16:16
19	07:29 16:45	06:52 17:29	06:03 18:07	06:06 19:46	20:21 20:21	05:24 20:46	05:09 20:38	05:27 19:57	06:02 19:01	06:39 24	18:14 (22) 18:38 (22)	07:16 18:06	06:58 16:24	07:30 16:16
20	07:28 16:47	06:51 17:30	06:01 18:08	06:04 19:47	20:22 20:22	05:23 20:46	05:09 20:38	05:28 19:56	06:03 18:59	06:40 20	18:15 (22) 18:35 (22)	07:18 18:04	07:00 16:24	07:30 16:17
21	07:28 16:48	06:49 17:32	05:59 18:09	06:03 19:48	20:23 20:23	05:22 20:46	05:10 20:37	05:29 19:54	06:04 18:57	06:41 16	18:17 (22) 18:33 (22)	07:19 18:03	07:01 16:23	07:31 16:17
22	07:27 16:49	06:47 17:33	05:57 18:11	06:01 19:50	20:24 20:24	05:21 20:46	05:10 20:36	06:02 19:52	06:06 18:55	06:42 14	18:18 (22) 18:32 (22)	07:20 18:01	07:02 16:22	07:32 16:18
23	07:26 16:51	06:46 17:35	05:55 18:12	05:59 19:51	20:25 20:26	05:20 20:47	05:10 20:35	06:07 19:51	06:44 18:53	10	18:19 (22) 18:29 (22)	07:22 17:59	07:04 16:21	07:32 16:18
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	20:27 20:27	05:19 20:47	05:10 20:34	06:08 19:49	06:45 18:51	4	18:24 (22) 18:28 (22)	07:23 17:58	07:05 16:21	07:33 16:19
25	07:24 16:54	06:42 17:37	05:52 18:14	05:56 19:53	20:28 20:28	05:18 20:47	05:11 20:33	06:09 19:47	06:46 18:50	18:51	18:28 (22)	07:24 17:58	07:06 16:20	07:33 16:19
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	20:29 20:29	05:18 20:47	05:11 20:32	06:10 19:45	06:47 18:48	18:48	18:48	07:25 16:55	07:07 16:19	07:33 16:20
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	20:30 20:30	05:17 20:47	05:11 20:31	06:11 19:44	06:49 18:46	18:46	18:46	07:26 16:53	07:09 16:19	07:34 16:21
28	07:21 16:58	06:37 17:42	05:46 18:18	05:51 19:57	20:31 20:31	05:16 20:47	05:12 20:30	06:13 19:42	06:50 18:44	18:44	18:44	07:27 16:52	07:10 16:18	07:34 16:22
29	07:20 16:59	06:36 18:19	05:44 18:19	05:50 19:58	20:32 20:32	05:15 20:47	05:12 20:29	06:14 19:40	06:51 18:42	18:42	18:42	07:28 16:50	07:11 16:18	07:34 16:22
30	07:19 17:01	06:35 18:21	05:42 18:21	05:48 20:00	20:33 20:33	05:15 20:47	05:13 20:27	06:15 19:38	06:52 18:40	18:40	18:40	07:29 16:49	07:12 16:17	07:34 16:23
31	07:18 17:02	06:34 18:22	05:40 18:22	05:46 19:59	20:34 20:34	05:14 20:47	05:12 20:26	06:16 19:37	06:52 18:40	18:40	18:40	07:30 16:47	07:13 16:17	07:34 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376		341	288	274	
Total, worst case			280	156					444					
Sun reduction			0.50	0.55					0.55					
Oper. time red.			0.91	0.91					0.91					
Wind dir. red.			0.62	0.62					0.62					
Total reduction			0.28	0.31					0.31					
Total, real			78	48					137					

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)

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/24/06 03:39 / 23
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 264 - 264

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:35 16:25	07:17 17:03	06:35 17:43	05:38 18:23	05:47 20:00	05:13 20:34	05:13 20:47	05:41 20:25	06:04 (7) 19:35	06:17 18:38	06:53 16:46	07:13 16:17
2	07:35 16:26	07:16 17:05	06:34 17:44	05:37 18:24	05:45 20:01	05:13 20:35	05:13 20:47	05:42 20:24	06:06 (7) 19:33	06:19 18:36	06:55 16:44	07:14 16:16
3	07:35 16:27	07:15 17:06	06:32 17:46	05:35 18:26	05:44 20:02	05:12 20:36	05:12 20:46	05:43 20:22	06:07 (7) 19:31	06:20 18:34	06:56 16:43	07:16 16:16
4	07:35 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:42 20:03	05:12 20:37	05:12 20:46	05:44 20:21	06:08 (7) 19:29	06:21 18:33	06:57 16:41	07:18 16:16
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9	07:34 16:33	07:07 17:15	06:21 17:54	05:24 18:33	05:36 20:09	05:10 20:40	05:10 20:45	05:50 20:14	06:13 (7) 19:20	06:27 18:23	07:03 16:35	07:22 16:15
10	07:33 16:34	07:06 17:16	06:19 17:55	05:22 18:35	05:34 20:11	05:10 20:41	05:10 20:44	05:51 20:13	06:10 (7) 19:18	06:28 18:22	07:05 16:34	07:23 16:15
11	07:33 16:35	07:04 17:18	06:18 17:56	05:20 18:36	05:33 20:12	05:09 20:42	05:09 20:44	05:52 20:11	06:08 (7) 19:16	06:29 18:20	07:06 16:33	07:24 16:15
12	07:33 16:37	07:03 17:19	06:16 17:57	05:18 18:37	05:32 20:13	05:09 20:42	05:09 20:43	05:54 20:14	06:07 (7) 19:14	06:30 18:18	07:07 16:31	07:25 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	05:17 18:38	05:31 20:14	05:09 20:43	05:09 20:42	05:55 20:08	06:06 (7) 19:12	06:32 18:16	07:08 16:30	07:25 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	05:15 19:40	05:29 20:15	05:09 20:43	05:09 20:42	05:56 20:07	06:07 (7) 19:10	06:33 18:14	07:10 16:29	07:26 16:15
15	07:31 16:40	06:58 17:23	06:10 18:01	05:13 19:41	05:28 20:17	05:09 20:44	05:09 20:41	05:57 20:05	06:06 (7) 19:09	06:34 18:13	07:11 16:28	07:27 16:15
16	07:31 16:41	06:57 17:25	06:08 18:03	05:11 19:42	05:27 20:18	05:09 20:44	05:09 20:41	05:58 20:04	06:05 (7) 19:07	06:35 18:12	07:12 16:27	07:28 16:15
17	07:30 16:43	06:55 17:26	06:06 18:04	05:10 19:43	05:26 20:19	05:09 20:45	05:09 20:40	05:59 20:02	06:03 (7) 19:05	06:36 18:09	07:14 16:26	07:28 16:16
18	07:30 16:44	06:54 17:28	06:05 18:05	05:08 19:45	05:25 20:20	05:09 20:45	05:09 20:39	06:04 20:01	06:04 (7) 19:03	06:38 18:08	07:15 16:25	07:29 16:16
19	07:29 16:45	06:52 17:29	06:03 18:07	05:06 19:46	05:24 20:21	05:09 20:46	05:09 20:38	06:03 20:02	06:03 (7) 19:01	06:39 18:06	07:16 16:24	07:30 16:16
20	07:28 16:47	06:51 17:30	06:01 18:08	05:04 19:47	05:23 20:22	05:09 20:46	05:09 20:37	06:02 20:02	06:02 (7) 19:56	06:40 18:59	07:17 16:24	07:30 16:17
21	07:27 16:48	06:49 17:32	05:59 18:09	05:03 19:48	05:22 20:23	05:09 20:46	05:09 20:37	06:03 20:02	06:03 (7) 19:54	06:41 18:57	07:19 16:23	07:31 16:17
22	07:27 16:49	06:47 17:33	05:57 18:10	05:01 19:50	05:21 20:24	05:10 20:46	05:10 20:36	06:02 20:02	06:02 (7) 19:52	06:42 18:55	07:20 16:22	07:31 16:18
23	07:26 16:51	06:46 17:35	05:55 18:12	05:09 19:51	05:20 20:25	05:10 20:47	05:10 20:35	06:01 20:02	06:01 (7) 19:51	06:44 18:53	07:21 16:21	07:32 16:18
24	07:25 16:52	06:44 17:36	05:53 18:13	05:08 19:52	05:19 20:27	05:10 20:47	05:10 20:34	06:02 20:02	06:02 (7) 19:49	06:45 18:51	07:23 16:20	07:32 16:19
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26	07:23 16:55	06:41 17:39	05:50 18:16	05:05 19:55	05:17 20:29	05:11 20:47	05:11 20:32	06:02 20:02	06:02 (7) 19:45	06:47 18:48	07:26 16:20	07:33 16:20
27	07:22 16:56	06:39 17:40	05:48 18:17	05:03 19:56	05:17 20:30	05:11 20:47	05:11 20:31	06:01 20:02	06:01 (7) 19:44	06:48 18:46	07:27 16:21	07:34 16:21
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29	07:20 16:59		05:44 18:19	05:00 19:58	05:15 20:31	05:12 20:47	05:12 20:28	06:01 20:02	06:01 (7) 19:40	06:51 18:42	07:11 16:17	07:34 16:22
30	07:19 17:00		05:42 18:21	05:08 20:00	05:15 20:32	05:13 20:47	05:13 20:27	06:02 20:02	06:02 (7) 19:38	06:52 18:40	07:12 16:17	07:34 16:23
31	07:18 17:02		05:40 18:22	05:06 20:03	05:14 20:33	05:14 20:47	05:14 20:26	06:03 20:02	06:03 (7) 19:37	06:32 16:47	07:13 16:24	07:34 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	274
Total, worst case					600	22		486	138			
Sun reduction					0.55	0.55		0.58	0.55			
Oper. time red.					0.91	0.91		0.91	0.91			
Wind dir. red.					0.54	0.54		0.54	0.54			
Total reduction					0.27	0.27		0.29	0.27			
Total, real					163	6		139	37			

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)

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/24/06 03:39 / 24
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 337 - 337

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:35 16:25	07:17 17:04 44	07:55 (9) 08:39 (9) 17:43	06:36 17:43	05:39 18:23	05:47 20:00
2	07:35 16:26	07:16 17:05 44	07:56 (9) 08:40 (9) 17:44	06:34 17:44	05:37 18:25	05:46 20:01
3	07:35 16:27	07:15 17:06 44	07:57 (9) 08:41 (9) 17:46	06:32 17:46	05:35 18:26	05:44 20:02
4	07:35 16:28	07:14 17:08 42	07:57 (9) 08:39 (9) 17:47	06:30 17:47	05:33 18:27	05:43 20:04
5	07:35 16:29	07:12 17:09 44	07:56 (9) 08:40 (9) 17:48	06:29 17:48	06:31 19:28	05:41 20:05
6	07:35 16:30	07:11 17:11 42	07:57 (9) 08:39 (9) 17:50	06:27 17:50	06:29 19:30	05:40 20:06
7	07:34 16:31	07:10 17:12 42	07:57 (9) 08:39 (9) 17:51	06:25 17:51	06:28 19:31	05:38 20:07
8	07:34 16:32	07:08 17:14 40	07:58 (9) 08:38 (9) 17:52	06:23 17:52	06:26 19:32	05:37 20:08
9	07:34 16:33	07:07 17:15 40	07:59 (9) 08:39 (9) 17:54	06:21 17:54	06:24 19:33	05:36 20:10
10	07:34 16:34	07:06 17:16 38	07:59 (9) 08:37 (9) 17:55	06:20 17:55	06:22 19:35	05:34 20:11
11	07:33 16:36	08:07 (9) 08:17 (9) 17:18	07:04 08:36 (9) 17:56	06:18 17:56	06:20 19:36	05:33 20:12
12	07:33 16:37	08:05 (9) 08:19 (9) 17:19	07:03 08:36 (9) 17:58	06:16 17:58	06:18 19:37	05:32 20:13
13	07:32 16:38	08:04 (9) 08:22 (9) 17:21	07:01 08:35 (9) 17:59	06:14 17:59	06:17 19:38	05:31 20:14
14	07:32 16:39	08:04 (9) 08:24 (9) 17:22	07:00 08:33 (9) 18:00	06:12 18:00	06:15 19:40	05:30 20:16
15	07:31 16:40	08:01 (9) 08:25 (9) 17:24	06:58 08:32 (9) 18:02	06:10 18:02	06:13 19:41	05:28 20:17
16	07:31 16:42	08:00 (9) 08:26 (9) 17:25	06:57 08:28 (9) 18:03	06:09 18:03	06:11 19:42	05:27 20:18
17	07:30 16:43	08:00 (9) 08:28 (9) 17:26	06:55 08:27 (9) 18:04	06:07 18:04	06:10 19:43	05:26 20:19
18	07:30 16:44	07:59 (9) 08:29 (9) 17:28	06:54 08:19 (9) 18:05	06:05 18:05	06:08 19:45	05:25 20:20
19	07:29 16:46	07:58 (9) 08:30 (9) 17:29	06:52 18:07	06:03 18:07	06:06 19:46	05:24 20:21
20	07:28 16:47	07:59 (9) 08:31 (9) 17:31	06:51 18:08	06:01 18:08	06:05 19:47	05:23 20:22
21	07:28 16:48	07:59 (9) 08:33 (9) 17:32	06:49 18:09	05:59 18:09	06:03 19:49	05:22 20:23
22	07:27 16:50	07:58 (9) 08:34 (9) 17:33	06:47 18:11	05:57 18:11	06:01 19:50	05:21 20:25
23	07:26 16:51	07:57 (9) 08:35 (9) 17:35	06:46 18:12	05:55 18:12	06:00 19:51	05:20 20:26
24	07:25 16:52	07:58 (9) 08:36 (9) 17:36	06:44 18:13	05:54 18:13	05:58 19:52	05:19 20:27
25	07:24 16:54	07:57 (9) 08:37 (9) 17:38	06:42 18:14	05:52 18:14	05:56 19:54	05:18 20:28
26	07:23 16:55	07:56 (9) 08:38 (9) 17:39	06:41 18:16	05:50 18:16	05:55 19:55	05:18 20:29
27	07:22 16:56	07:57 (9) 08:37 (9) 17:40	06:39 18:17	05:48 18:17	05:53 19:56	05:17 20:30
28	07:21 16:58	07:56 (9) 08:38 (9) 17:42	06:37 18:18	05:46 18:18	05:52 19:57	05:16 20:31
29	07:20 16:59	07:57 (9) 08:39 (9)	06:36 18:19	05:44 18:19	05:50 19:59	05:15 20:32
30	07:19 17:01	07:55 (9) 08:39 (9)	06:35 18:21	05:42 20:00	05:48 20:00	05:15 20:33
31	07:18 17:02	07:56 (9) 08:38 (9)	06:34 18:22	05:40 18:22	05:46 20:00	05:14 20:33
Potential sun hours	286	291	369	380	-285	-254
Total, worst case	672	620			476	
Sun reduction	0.45	0.45			0.55	
Oper. time red.	0.91	0.91			0.91	
Wind dir. red.	0.66	0.66			0.55	
Total reduction	0.27	0.27			0.28	
Total, real	183	169			132	

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/24/06 03:39 / 25
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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 337 - 337

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	06:07 (22) 06:31 (22)	06:18 19:35	06:53 18:38	07:29 (9) 16:17
2	05:14 20:47	05:42 20:24	06:06 (22) 06:30 (22)	06:19 19:33	06:55 18:36	07:28 (9) 16:16
3	05:14 20:47	05:43 20:23	06:07 (22) 06:29 (22)	06:20 19:31	06:56 18:35	07:28 (9) 16:16
4	05:15 20:46	05:44 20:21	06:08 (22) 06:30 (22)	06:21 19:29	06:57 18:33	07:27 (9) 16:16
5	05:16 20:46	05:46 20:20	06:09 (22) 06:29 (22)	06:22 19:28	06:58 18:31	07:27 (9) 16:16
6	05:16 20:46	05:47 20:19	06:10 (22) 06:28 (22)	06:23 19:26	07:00 18:29	07:26 (9) 16:15
7	05:17 20:46	05:48 20:17	06:11 (22) 06:27 (22)	06:25 19:24	07:01 18:27	07:26 (9) 16:15
8	05:18 20:45	05:49 20:16	06:12 (22) 06:24 (22)	06:26 19:22	07:02 18:25	07:27 (9) 16:15
9	05:18 20:45	05:50 20:14	06:13 (22) 06:23 (22)	06:27 19:20	07:03 18:24	07:27 (9) 16:15
10	05:19 20:44	05:51 20:13	06:21 (22) 06:29	06:28 19:18	07:05 18:22	07:26 (9) 16:15
11	05:20 20:44	05:53 20:12	06:29 (22) 06:37	06:30 19:16	07:06 18:20	07:28 (9) 16:15
12	05:21 20:43	05:54 20:10	06:30 (22) 06:39	06:31 19:14	07:07 18:18	07:27 (9) 16:15
13	05:22 20:43	05:55 20:09	06:32 (22) 06:40	06:33 19:13	07:09 18:16	07:29 (9) 16:15
14	05:23 20:42	05:56 20:07	06:33 (22) 06:49	06:34 19:11	07:11 18:15	07:28 (9) 16:15
15	05:23 20:41	05:57 20:06	06:34 (22) 06:58	06:35 19:09	07:12 18:13	07:29 (9) 16:15
16	05:24 20:41	06:15 (22) 06:21 (22)	05:58 20:04	06:35 19:07	07:12 18:11	07:29 (9) 16:16
17	05:25 20:40	06:12 (22) 06:22 (22)	06:00 20:02	06:37 19:05	07:14 18:09	07:30 (9) 16:16
18	05:26 20:39	06:11 (22) 06:25 (22)	06:01 20:01	06:38 19:03	07:15 18:08	07:32 (9) 16:16
19	05:27 20:38	06:09 (22) 06:25 (22)	06:02 19:57	06:39 19:01	07:16 18:06	07:31 (9) 16:17
20	05:28 20:38	06:08 (22) 06:26 (22)	06:03 19:56	06:40 18:59	07:18 18:04	07:33 (9) 16:17
21	05:29 20:37	06:09 (22) 06:27 (22)	06:04 19:54	06:41 18:57	07:19 18:03	07:34 (9) 16:17
22	05:30 20:36	06:08 (22) 06:28 (22)	06:06 19:52	06:43 18:55	07:20 18:01	07:35 (9) 16:18
23	05:31 20:35	06:07 (22) 06:29 (22)	06:07 19:51	06:44 18:53	07:22 17:59	07:35 (9) 16:18
24	05:32 20:34	06:06 (22) 06:28 (22)	06:08 19:49	06:45 18:52	07:23 17:58	07:36 (9) 16:19
25	05:33 20:33	06:07 (22) 06:29 (22)	06:09 19:47	06:46 18:50	07:24 17:56	07:38 (9) 16:20
26	05:34 20:32	06:06 (22) 06:30 (22)	06:10 19:46	06:47 18:48	07:26 17:55	07:39 (9) 16:20
27	05:35 20:31	06:05 (22) 06:29 (22)	06:12 19:44	06:49 18:46	07:27 17:53	07:40 (9) 16:21
28	05:36 20:30	06:06 (22) 06:30 (22)	06:13 19:42	06:50 18:44	07:28 17:52	07:43 (9) 16:22
29	05:38 20:29	06:05 (22) 06:29 (22)	06:14 19:40	06:51 18:42	07:30 (9) 17:50	07:45 (9) 16:22
30	05:39 20:27	06:07 (22) 06:31 (22)	06:15 19:38	06:52 18:40	07:31 (9) 17:49	07:46 (9) 16:23
31	05:40 20:26	06:06 (22) 06:30 (22)	06:16 19:37	06:53 18:47	07:32 (9) 17:47	07:47 (9) 16:24
Potential sun hours	-272	4	376	341	288	274
Total, worst case	312	168	212	1080	1080	10
Sun reduction	0.58	0.55	0.45	0.35	0.35	0.35
Oper. time red.	0.91	0.91	0.91	0.91	0.91	0.91
Wind dir. red.	0.55	0.55	0.66	0.66	0.66	0.66
Total reduction	0.29	0.28	0.27	0.21	0.21	0.21
Total, real	91	46	58	229	2	2

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)
	Minutes with flicker		

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, NW part
 22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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01/24/06 03:39 / 26

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Wind Engineers, Inc.
 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated:

01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 338 - 338

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
 N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:35 16:25	08:47 (9) 09:33 (9)	07:17 17:03	06:36 17:43	05:39 18:23	05:47 20:00	06:10 (22) 20:34	05:13 20:47	05:41 20:25	06:11 (22) 06:39 (22)	06:18 19:35	06:53 18:38	06:34 16:46
2	07:35 16:26	08:49 (9) 09:33 (9)	07:16 17:05	06:34 17:44	05:37 18:25	05:45 20:01	06:07 (22) 20:35	05:14 20:47	05:42 20:24	06:10 (22) 06:40 (22)	06:19 19:33	06:55 18:36	06:35 16:44
3	07:35 16:27	08:49 (9) 09:33 (9)	07:15 17:04	06:32 17:43	05:35 18:26	05:44 20:02	06:05 (22) 20:36	05:14 20:48	05:43 20:23	06:11 (22) 06:39 (22)	06:20 19:31	06:56 18:35	06:37 16:43
4	07:35 16:28	08:49 (9) 09:35 (9)	07:14 17:08	06:30 17:47	05:33 18:27	05:43 20:04	06:04 (22) 20:37	05:15 20:46	05:44 20:21	06:10 (22) 06:38 (22)	06:21 19:29	06:57 18:33	06:38 16:42
5	07:35 16:29	08:51 (9) 09:35 (9)	07:12 17:09	06:29 17:48	05:31 18:28	05:41 20:05	06:03 (22) 20:38	05:16 20:46	05:46 20:20	06:11 (22) 06:37 (22)	06:22 19:28	06:58 18:31	06:39 16:40
6	07:35 16:30	08:51 (9) 09:35 (9)	07:11 17:11	06:27 17:50	05:40 18:30	05:40 20:06	06:01 (22) 20:38	05:16 20:46	05:47 20:19	06:12 (22) 06:38 (22)	06:23 19:26	07:00 18:29	06:41 16:39
7	07:35 16:31	08:53 (9) 09:35 (9)	07:10 17:12	06:25 17:51	05:38 18:31	05:38 20:07	06:02 (22) 20:39	05:17 20:46	05:48 20:17	06:11 (22) 06:37 (22)	06:25 19:24	07:01 18:27	06:42 16:38
8	07:34 16:32	08:52 (9) 09:34 (9)	07:08 17:14	06:23 17:52	05:37 18:32	05:37 20:08	06:01 (22) 20:40	05:18 20:45	05:49 20:16	06:12 (22) 06:36 (22)	06:26 19:22	07:02 18:25	06:43 16:36
9	07:34 16:33	08:54 (9) 09:34 (9)	07:07 17:15	06:21 17:54	05:36 18:33	05:36 20:10	05:59 (22) 20:41	05:18 20:45	05:50 20:14	06:13 (22) 06:33 (22)	06:27 19:20	07:03 18:24	06:45 16:35
10	07:34 16:34	08:56 (9) 09:34 (9)	07:06 17:16	06:20 17:55	05:34 18:35	05:34 20:11	06:00 (22) 20:42	05:19 20:44	05:51 20:13	06:15 (22) 06:33 (22)	06:28 19:18	07:05 18:22	06:46 16:34
11	07:33 16:36	08:55 (9) 09:33 (9)	07:04 17:18	06:18 17:56	05:33 18:36	05:33 20:12	05:59 (22) 20:42	05:20 20:44	05:53 20:12	06:16 (22) 06:30 (22)	06:33 19:16	07:06 18:20	06:48 16:33
12	07:33 16:37	08:57 (9) 09:35 (9)	07:03 17:19	06:16 17:58	05:32 18:37	05:32 20:13	06:00 (22) 20:42	05:21 20:43	05:54 20:10	06:19 (22) 06:32 (22)	06:31 19:14	07:07 18:18	06:49 16:32
13	07:32 16:38	08:58 (9) 09:36 (9)	07:01 17:21	06:14 17:59	05:31 18:38	05:31 20:14	05:59 (22) 20:43	05:22 20:43	05:55 20:09	06:27 (22) 06:46 (22)	06:32 19:12	07:09 18:16	06:50 16:31
14	07:32 16:39	09:00 (9) 09:34 (9)	07:00 17:20	06:12 17:55	05:30 18:39	05:30 20:15	06:00 (22) 20:44	05:23 20:44	05:56 20:07	06:28 (22) 06:47 (22)	06:33 19:10	07:10 18:15	06:52 16:30
15	07:31 16:40	09:01 (9) 09:33 (9)	06:58 17:24	06:10 18:02	05:28 18:40	05:28 20:16	05:58 (22) 20:44	05:23 20:41	05:57 20:10	06:18 (22) 06:30 (22)	06:57 19:09	07:11 18:13	06:53 16:28
16	07:31 16:41	09:02 (9) 09:30 (9)	06:57 17:25	06:09 18:03	05:27 18:41	05:27 20:17	05:59 (22) 20:45	05:24 20:41	05:58 20:04	06:19 (22) 06:31 (22)	06:58 19:12	07:12 18:11	06:54 16:27
17	07:30 16:43	09:04 (9) 09:30 (9)	06:55 17:26	06:07 18:04	05:26 18:43	05:26 20:18	06:00 (22) 20:45	05:25 20:40	05:56 20:02	06:20 (22) 06:32 (22)	06:59 19:05	07:14 18:09	06:56 16:26
18	07:30 16:44	09:05 (9) 09:29 (9)	06:54 17:28	06:05 18:05	05:25 18:45	05:25 20:20	05:59 (22) 20:45	05:26 20:39	05:57 20:01	06:15 (22) 06:33 (22)	06:59 19:03	07:15 18:08	06:57 16:25
19	07:29 16:46	09:08 (9) 09:28 (9)	06:52 17:29	06:03 18:07	05:24 18:46	05:24 20:21	06:00 (22) 20:46	05:27 20:38	05:57 20:03	06:13 (22) 06:34 (22)	06:59 19:01	07:16 18:06	06:58 16:25
20	07:28 16:47	09:09 (9) 09:25 (9)	06:51 17:31	06:01 18:08	05:23 18:47	05:23 20:22	06:02 (22) 20:46	05:28 20:38	05:57 20:02	06:12 (22) 06:34 (22)	06:59 18:59	07:18 18:04	06:59 16:24
21	07:28 16:48	09:15 (9) 09:21 (9)	06:49 17:32	05:59 18:09	05:22 18:49	05:22 20:23	06:01 (22) 20:46	05:29 20:37	05:56 20:01	06:11 (22) 06:35 (22)	06:58 18:57	07:19 18:03	06:59 16:23
22	07:27 16:50	09:16 (9) 09:22 (9)	06:47 17:33	05:57 18:11	05:21 18:50	05:21 20:24	06:02 (22) 20:46	05:30 20:36	05:55 20:02	06:12 (22) 06:36 (22)	06:58 18:55	07:20 18:01	06:59 16:22
23	07:26 16:51	09:17 (9) 09:23 (9)	06:46 17:34	05:55 18:12	05:20 18:51	05:20 20:25	06:03 (22) 20:47	05:31 20:35	05:54 20:03	06:11 (22) 06:37 (22)	06:57 18:53	07:21 17:59	06:59 16:21
24	07:25 16:52	09:18 (9) 09:24 (9)	06:45 17:35	05:54 18:13	05:19 18:52	05:19 20:26	06:04 (22) 20:47	05:32 20:34	05:53 20:04	06:12 (22) 06:38 (22)	06:57 18:52	07:22 17:58	06:59 16:21
25	07:24 16:54	09:19 (9) 09:25 (9)	06:44 17:36	05:54 18:13	05:19 18:53	05:19 20:27	06:05 (22) 20:47	05:33 20:33	05:52 20:05	06:13 (22) 06:39 (22)	06:56 18:51	07:23 17:57	06:59 16:20
26	07:23 16:55	09:20 (9) 09:26 (9)	06:43 17:37	05:53 18:14	05:18 18:54	05:18 20:28	06:06 (22) 20:48	05:34 20:32	05:51 20:06	06:14 (22) 06:40 (22)	06:55 18:50	07:24 17:56	06:59 16:19
27	07:22 16:56	09:21 (9) 09:27 (9)	06:41 17:38	05:52 18:15	05:17 18:55	05:17 20:29	06:07 (22) 20:48	05:35 20:31	05:50 20:07	06:15 (22) 06:41 (22)	06:54 18:48	07:25 17:55	06:59 16:18
28	07:21 16:58	09:22 (9) 09:28 (9)	06:40 17:39	05:51 18:16	05:16 18:56	05:16 20:30	06:08 (22) 20:49	05:36 20:30	05:49 20:08	06:16 (22) 06:42 (22)	06:53 18:47	07:26 17:54	06:59 16:17
29	07:20 16:59	09:23 (9) 09:29 (9)	06:39 17:40	05:50 18:17	05:15 18:57	05:15 20:31	06:09 (22) 20:49	05:37 20:29	05:48 20:09	06:17 (22) 06:43 (22)	06:52 18:46	07:27 17:53	06:59 16:16
30	07:19 17:01	09:24 (9) 09:30 (9)	06:38 17:41	05:49 18:18	05:14 18:58	05:14 20:32	06:10 (22) 20:50	05:38 20:28	05:47 20:10	06:18 (22) 06:44 (22)	06:51 18:45	07:28 17:52	06:59 16:15
31	07:18 17:02	09:25 (9) 09:31 (9)	06:37 17:42	05:48 18:19	05:13 18:59	05:13 20:33	06:11 (22) 20:50	05:39 20:27	05:46 20:11	06:19 (22) 06:45 (22)	06:50 18:44	07:29 17:51	06:59 16:14
Potential sun hours	286	291	369	380	-285	-254	-272	4	276	376	341	288	260
Total, worst case	728					692		424					260
Sun reduction	0.45					0.55		0.58					0.35
Oper. time red.	0.91					0.91		0.91					0.91
Wind dir. red.	0.69					0.55		0.55					0.69
Total reduction	0.29					0.28		0.30					0.22
Total, real	210					195		126					313

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/24/06 03:39 / 27
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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 339 - 339

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:35 16:25	09:05 (9) 09:45 (9)	07:17 17:03	06:36 17:43	05:39 17:43	05:47 20:00
2	07:35 16:26	09:05 (9) 09:45 (9)	07:16 17:05	06:34 17:44	05:37 18:25	05:45 20:01
3	07:35 16:27	09:05 (9) 09:45 (9)	07:15 17:06	06:32 17:46	05:35 18:26	05:44 20:02
4	07:35 16:28	09:07 (9) 09:45 (9)	07:14 17:08	06:30 17:47	05:33 18:27	05:43 20:04
5	07:35 16:29	09:07 (9) 09:45 (9)	07:12 17:09	06:29 17:48	06:31 19:28	05:41 20:05
6	07:35 16:30	09:09 (9) 09:45 (9)	07:11 17:11	06:27 17:50	06:29 19:30	05:40 20:06
7	07:34 16:31	09:11 (9) 09:45 (9)	07:10 17:12	06:25 17:51	06:27 19:31	05:38 20:07
8	07:34 16:32	09:10 (9) 09:44 (9)	07:08 17:14	06:23 17:52	06:26 19:32	05:37 20:08
9	07:34 16:33	09:12 (9) 09:44 (9)	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:10
10	07:34 16:34	09:14 (9) 09:44 (9)	07:06 17:16	06:20 17:55	06:22 19:35	05:34 20:11
11	07:33 16:36	09:15 (9) 09:43 (9)	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12
12	07:33 16:37	09:17 (9) 09:41 (9)	07:03 17:19	06:16 17:58	06:18 19:37	05:32 20:13
13	07:32 16:38	09:18 (9) 09:40 (9)	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14
14	07:32 16:39	09:20 (9) 09:38 (9)	07:00 17:22	06:12 18:00	06:15 19:40	05:30 20:16
15	07:31 16:40	09:23 (9) 09:37 (9)	06:58 17:24	06:10 18:02	06:13 19:41	05:28 20:17
16	07:31 16:42	06:57 17:25	06:09 18:03	06:11 19:42	05:27 19:42	05:27 20:18
17	07:30 16:43	06:55 17:26	06:07 18:04	06:10 19:43	05:26 20:19	05:26 20:19
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	05:25 20:20
19	07:29 16:46	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:24 20:21
20	07:28 16:47	06:51 17:31	06:01 18:08	06:05 19:47	05:23 20:22	05:23 20:22
21	07:28 16:48	06:49 17:32	05:59 18:09	06:03 19:49	05:22 20:23	05:22 20:23
22	07:27 16:50	06:47 17:33	05:57 18:11	06:01 19:50	05:21 20:25	05:21 20:25
23	07:26 16:51	06:46 17:35	05:55 18:12	06:00 19:51	05:20 20:26	05:20 20:26
24	07:25 16:52	06:44 17:36	05:54 18:13	05:58 19:52	05:19 20:27	05:19 20:27
25	07:24 16:54	06:42 17:38	05:52 18:14	05:56 19:54	05:18 20:28	05:18 20:28
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	05:18 20:29	05:18 20:29
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:30	05:17 20:30
28	07:21 16:58	06:37 17:42	05:46 18:18	05:52 19:57	05:16 20:31	05:16 20:31
29	07:20 16:59	05:44 18:19	05:44 18:19	05:50 19:59	05:15 20:32	05:15 20:32
30	07:19 17:01	05:42 18:21	05:42 18:21	05:48 20:00	05:15 20:33	05:15 20:33
31	07:18 17:02	05:40 18:22	05:40 18:22	05:48 20:33	05:14 20:33	05:14 20:33
Potential sun hours	286	291	369	380	-285	-254
Total, worst case	468				762	62
Sun reduction	0.45				0.55	0.55
Oper. time red.	0.91				0.91	0.91
Wind dir. red.	0.69				0.55	0.55
Total reduction	0.29				0.28	0.28
Total, real	135				214	17

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/24/06 03:39 / 28
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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 339 - 339

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	06:09 (22) 19:35	06:18 18:38	06:53 16:46	07:13 16:17
2	05:14 20:47	05:42 20:24	06:10 (22) 19:33	06:19 18:36	06:55 16:44	07:15 16:16
3	05:14 20:47	05:43 20:23	06:09 (22) 19:31	06:20 18:35	06:56 16:43	07:16 16:16
4	05:15 20:46	05:44 20:21	06:10 (22) 19:29	06:21 18:33	06:57 16:42	07:17 16:16
5	05:16 20:46	05:46 20:20	06:11 (22) 19:28	06:22 18:31	06:58 16:40	07:18 16:15
6	05:16 20:46	05:47 20:19	06:12 (22) 19:26	06:23 18:29	06:41 16:39	07:19 16:15
7	05:17 20:46	06:18 (22) 20:17	05:48 22 06:33 (22)	06:25 19:24	07:01 18:27	06:42 16:38
8	05:18 20:45	06:16 (22) 20:16	05:49 20 06:32 (22)	06:26 19:22	07:02 18:25	06:43 16:36
9	05:18 20:45	06:15 (22) 20:14	05:50 16 06:31 (22)	06:27 19:20	07:03 18:24	06:45 16:35
10	05:19 20:44	06:14 (22) 20:13	05:51 12 06:29 (22)	06:28 19:18	07:05 18:22	06:46 16:34
11	05:20 20:44	06:15 (22) 20:12	05:53 16 06:31 (22)	06:29 19:16	07:06 18:20	06:48 16:33
12	05:21 20:43	06:13 (22) 20:10	05:54 18 06:31 (22)	06:31 19:14	07:07 18:18	06:49 16:32
13	05:22 20:43	06:12 (22) 20:09	05:55 20 06:32 (22)	06:32 19:12	07:09 18:16	06:50 16:31
14	05:23 20:42	06:11 (22) 20:07	05:56 22 06:33 (22)	06:33 19:11	07:10 18:15	06:52 16:29
15	05:23 20:41	06:12 (22) 20:05	05:57 22 06:34 (22)	06:34 19:09	07:11 18:13	06:53 16:28
16	05:24 20:41	06:11 (22) 20:04	05:58 24 06:35 (22)	06:35 19:07	07:12 18:11	06:54 16:27
17	05:25 20:40	06:10 (22) 20:02	06:00 26 06:36 (22)	06:37 19:05	07:14 18:09	06:56 16:26
18	05:26 20:39	06:11 (22) 20:01	06:01 26 06:37 (22)	06:38 19:03	07:15 18:08	06:57 16:25
19	05:27 20:38	06:09 (22) 19:57	06:02 26 06:35 (22)	06:39 19:01	07:16 18:06	06:58 16:25
20	05:28 20:38	06:08 (22) 19:56	06:03 28 06:36 (22)	06:40 18:59	07:18 18:04	07:00 16:24
21	05:29 20:37	06:09 (22) 19:54	06:04 28 06:37 (22)	06:41 18:57	07:19 18:03	07:01 16:23
22	05:30 20:36	06:08 (22) 19:52	06:06 30 06:38 (22)	06:43 18:55	07:20 18:01	07:02 16:22
23	05:31 20:35	06:09 (22) 19:51	06:07 28 06:39 (22)	06:44 18:53	07:22 17:59	07:04 16:21
24	05:32 20:34	06:08 (22) 19:49	06:08 30 06:38 (22)	06:45 18:52	07:23 17:58	07:05 16:21
25	05:33 20:33	06:07 (22) 19:47	06:09 32 06:39 (22)	06:46 18:50	06:24 16:56	07:06 16:20
26	05:34 20:32	06:08 (22) 19:46	06:10 30 06:38 (22)	06:47 18:48	06:26 16:55	07:07 16:19
27	05:35 20:31	06:07 (22) 19:44	06:12 32 06:39 (22)	06:49 18:46	06:27 16:53	07:09 16:19
28	05:36 20:30	06:08 (22) 19:42	06:13 30 06:38 (22)	06:50 18:44	06:28 16:52	07:10 16:18
29	05:38 20:29	06:07 (22) 19:40	06:14 32 06:39 (22)	06:51 18:42	06:30 16:50	07:11 16:18
30	05:39 20:27	06:09 (22) 19:38	06:15 30 06:39 (22)	06:52 18:40	06:31 16:49	07:12 16:17
31	05:40 20:26	06:08 (22) 19:37	06:16 30 06:38 (22)	06:53 16:47	06:32 16:47	07:13 16:24
Potential sun hours	-272	4	376	341	288	274
Total, worst case	602	232			74	1228
Sun reduction	0.58	0.55			0.35	0.35
Oper. time red.	0.91	0.91			0.91	0.91
Wind dir. red.	0.55	0.55			0.69	0.69
Total reduction	0.30	0.28			0.22	0.22
Total, real	178	65			17	275

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/24/06 03:39 / 29
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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 341 - 341

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:35 16:25	07:17 17:03	06:36 17:43	05:38 18:23	05:47 20:00	19:08 (22) 22	05:13 20:34	05:13 20:47	05:41 20:25	06:17 19:35	06:53 18:38	06:34 16:46	07:13 16:17
2	07:35 16:26	07:16 17:05	06:34 17:44	05:37 18:24	05:45 20:01	19:09 (22) 20	05:13 20:35	05:14 20:47	05:42 20:24	06:19 19:33	06:55 18:36	06:35 16:44	07:15 16:16
3	07:35 16:27	07:15 17:06	06:32 17:46	05:35 18:26	05:44 20:02	19:11 (22) 16	05:12 20:36	05:14 20:47	05:43 20:23	06:20 19:31	06:56 18:35	06:36 16:43	07:16 16:16
4	07:35 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	19:12 (22) 14	05:12 20:37	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:33	06:38 16:41	07:17 16:16
5	07:35 16:29	07:12 17:09	06:29 17:48	06:31 19:28	05:41 20:05	19:14 (22) 10	05:11 20:38	05:16 20:46	05:45 20:20	06:22 19:27	06:58 18:31	06:39 16:40	07:18 16:15
6	07:34 16:30	07:11 17:11	06:27 17:50	06:29 19:30	05:40 20:06	19:24 (22) 20:38	05:11 20:46	05:16 20:19	05:47 20:19	06:23 19:26	07:00 18:29	06:41 16:39	07:19 16:15
7	07:34 16:31	07:10 17:12	06:25 17:51	06:27 19:31	05:38 20:07	19:25 (22) 20:39	05:11 20:45	05:17 20:17	05:48 6	06:25 19:31 (22)	07:01 18:27	06:42 16:38	07:20 16:15
8	07:34 16:32	07:08 17:13	06:23 17:52	06:26 19:32	05:37 20:08	19:22 (22) 20:40	05:10 20:45	05:18 20:16	05:49 12	06:26 19:32 (22)	07:02 18:25	06:43 16:36	07:21 16:15
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:10	19:24 (22) 20:41	05:10 20:45	05:18 20:14	05:50 14	06:27 19:35 (22)	07:03 18:23	06:45 16:35	07:22 16:15
10	07:34 16:34	07:06 17:16	06:19 17:55	06:22 19:35	05:34 20:11	19:25 (22) 20:42	05:10 20:44	05:19 20:13	05:51 18	06:28 19:36 (22)	07:05 18:22	06:46 16:34	07:23 16:15
11	07:33 16:35	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	19:26 (22) 20:43	05:10 20:42	05:20 20:11	05:52 20	06:29 19:38 (22)	07:06 18:20	06:48 16:33	07:24 16:15
12	07:33 16:37	07:03 17:19	06:16 17:58	06:18 19:37	05:32 20:13	19:27 (22) 20:44	05:09 20:43	05:21 20:10	05:54 22	06:31 19:39 (22)	07:07 18:18	06:49 16:32	07:25 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	19:28 (22) 20:45	05:09 20:43	05:22 20:09	05:55 24	06:32 19:40 (22)	07:08 18:16	06:50 16:30	07:25 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	05:29 20:16	19:29 (22) 20:46	05:09 20:43	05:22 20:07	05:56 24	06:33 19:39 (22)	07:10 18:15	06:52 16:29	07:26 16:15
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:17	19:30 (22) 20:47	05:09 20:44	05:23 20:05	05:57 26	06:34 19:40 (22)	07:11 18:13	06:53 16:28	07:27 16:15
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	19:31 (22) 20:48	05:09 20:44	05:24 20:04	05:58 22	06:35 19:37 (22)	07:12 18:11	06:54 16:27	07:28 16:16
17	07:30 16:43	06:55 17:26	06:07 18:04	06:10 19:43	05:26 20:19	19:32 (22) 20:49	05:09 20:45	05:25 20:02	06:00 22	06:36 19:38 (22)	07:14 18:09	06:56 16:26	07:29 16:16
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	19:33 (22) 20:50	05:09 20:45	05:26 20:01	06:01 22	06:37 19:39 (22)	07:15 18:08	06:57 16:25	07:30 16:16
19	07:29 16:45	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	19:34 (22) 20:51	05:09 20:46	05:27 20:38	06:02 18	06:38 19:33 (22)	07:16 18:06	06:58 16:24	07:30 16:16
20	07:28 16:47	06:51 17:30	06:01 18:08	06:04 19:47	05:23 20:22	19:35 (22) 20:52	05:09 20:46	05:28 20:38	06:03 18	06:40 19:34 (22)	07:18 18:04	06:59 16:24	07:30 16:17
21	07:28 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	19:36 (22) 20:53	05:10 20:46	05:29 20:37	06:04 14	06:41 19:35 (22)	07:19 18:03	07:01 16:23	07:31 16:17
22	07:27 16:49	06:47 17:33	05:57 18:11	06:01 19:50	05:21 20:24	19:37 (22) 20:54	05:10 20:46	05:30 20:36	06:06 14	06:42 19:36 (22)	07:20 18:01	07:02 16:22	07:32 16:18
23	07:26 16:51	06:46 17:35	05:55 18:12	05:59 19:51	05:20 20:26	19:38 (22) 20:55	05:10 20:47	05:31 20:35	06:07 12	06:44 19:37 (22)	07:22 17:59	07:04 16:21	07:32 16:18
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:27	19:39 (22) 20:56	05:10 20:47	05:32 20:34	06:08 8	06:45 19:38 (22)	07:23 17:58	07:05 16:21	07:32 16:19
25	07:24 16:54	06:42 17:37	05:52 18:14	05:56 19:53	05:18 20:28	19:40 (22) 20:57	05:11 20:47	05:33 20:33	06:09 6	06:46 19:39 (22)	07:24 17:57	07:06 16:20	07:33 16:19
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	05:18 20:29	19:41 (22) 20:58	05:11 20:47	05:34 20:32	06:10 19:45	06:47 18:48	07:25 16:55	07:07 16:19	07:33 16:20
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:30	19:42 (22) 20:59	05:11 20:47	05:35 20:31	06:11 19:44	06:48 18:46	07:26 16:53	07:09 16:19	07:34 16:21
28	07:21 16:58	06:37 17:42	05:46 18:18	05:51 19:57	05:16 20:31	19:43 (22) 20:59	05:12 20:47	05:36 20:30	06:13 19:42	06:50 18:44	07:27 16:52	07:10 16:18	07:34 16:22
29	07:20 16:59	06:35 18:19	05:44 18:19	05:50 19:58	05:15 20:32	19:44 (22) 20:59	05:12 20:47	05:38 20:29	06:14 19:40	06:51 18:42	07:28 16:50	07:11 16:18	07:34 16:22
30	07:19 17:01	06:33 18:21	05:42 19:00	05:48 20:00	05:15 20:32	19:45 (22) 20:59	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	07:29 16:49	07:12 16:17	07:34 16:23
31	07:18 17:02	06:31 18:22	05:40 19:00	05:46 20:00	05:14 20:33	19:46 (22) 20:59	05:14 20:47	05:40 20:26	06:16 19:37	06:53 16:47	07:30 16:47	07:13 16:17	07:34 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	322	376	341	288	274
Total, worst case				236	82				322				
Sun reduction				0.55	0.55				0.55				
Oper. time red.				0.91	0.91				0.91				
Wind dir. red.				0.62	0.62				0.62				
Total reduction				0.31	0.31				0.31				
Total, real				73	25				100				

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)
	Minutes with flicker		

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, NW part
 22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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01/24/06 03:39 / 30

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Wind Engineers, Inc.
 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated:

01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 342 - 342

Assumptions for shadow calculations

Maximum distance for influence

1,000 m

Minimum sun height over horizon for influence

3 °

Day step for calculation

1 days

Time step for calculation

2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:35 16:25	07:17 17:03	06:36 17:43	05:38 18:23	05:47 20:00	19:18 (22) 20:34	05:13 20:47	05:41 20:25	19:25 (22) 19:35	06:17 18:38	06:53 18:46	06:34 16:17
2	07:35 16:26	07:16 17:05	06:34 17:44	05:37 18:24	05:45 20:01	19:17 (22) 20:35	05:13 20:47	05:42 20:24	19:24 (22) 19:33	06:19 18:36	06:55 18:44	06:35 16:16
3	07:35 16:27	07:15 17:06	06:32 17:46	05:35 18:26	05:44 20:02	19:15 (22) 20:36	05:12 20:47	05:43 20:23	19:25 (22) 19:31	06:20 18:35	06:56 18:43	06:37 16:16
4	07:35 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	19:16 (22) 20:37	05:12 20:46	05:44 20:21	19:24 (22) 19:29	06:21 18:33	06:57 18:41	06:38 16:16
5	07:35 16:29	07:12 17:09	06:29 17:48	06:31 18:28	05:41 20:05	19:14 (22) 20:38	05:11 20:46	05:45 20:20	19:23 (22) 19:27	06:22 18:31	06:58 18:40	06:39 16:15
6	07:34 16:30	07:11 17:11	06:27 17:50	06:29 18:30	05:40 20:06	19:15 (22) 20:38	05:11 20:46	05:47 20:19	19:24 (22) 19:26	06:23 18:29	07:00 18:39	06:41 16:15
7	07:34 16:31	07:10 17:12	06:25 17:51	06:27 18:31	05:38 20:07	19:14 (22) 20:39	05:11 20:45	05:48 20:17	19:23 (22) 19:24	06:25 18:29	07:01 18:39	06:42 16:15
8	07:34 16:32	07:08 17:13	06:23 17:52	06:26 18:32	05:37 20:08	19:15 (22) 20:40	05:10 20:45	05:49 20:16	19:24 (22) 19:22	06:26 18:25	07:02 18:36	06:43 16:15
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 18:33	05:36 20:10	19:13 (22) 20:41	05:10 20:45	05:50 20:14	19:25 (22) 19:20	06:27 18:23	07:03 18:35	06:45 16:15
10	07:34 16:34	07:06 17:16	06:19 17:55	06:22 18:35	05:34 20:11	19:14 (22) 20:41	05:10 20:44	05:51 20:13	19:25 (22) 19:18	06:28 18:22	07:05 18:34	06:46 16:15
11	07:33 16:35	07:04 17:18	06:18 17:56	06:20 18:36	05:33 20:12	19:13 (22) 20:42	05:10 20:44	05:52 20:12	19:26 (22) 19:16	06:29 18:20	07:06 18:33	06:48 16:15
12	07:33 16:37	07:03 17:19	06:16 17:58	06:18 18:37	05:32 20:13	19:14 (22) 20:42	05:09 20:43	05:54 20:10	19:27 (22) 19:14	06:31 18:18	07:07 18:32	06:49 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 18:38	05:31 20:14	19:15 (22) 20:43	05:09 20:43	05:55 20:09	19:28 (22) 19:12	06:32 18:16	07:08 18:30	06:50 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 18:40	05:29 20:16	19:13 (22) 20:43	05:09 20:42	05:56 20:07	19:29 (22) 19:11	06:33 18:15	07:10 18:35	06:52 16:15
15	07:31 16:40	06:58 17:23	06:10 18:02	06:13 18:41	05:28 20:17	19:14 (22) 20:44	05:09 20:41	05:57 20:05	19:32 (22) 19:09	06:34 18:13	07:11 18:38	06:53 16:15
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 18:42	05:27 20:18	19:15 (22) 20:44	05:09 20:41	05:58 20:04	19:33 (22) 19:07	06:35 18:11	07:12 18:39	06:54 16:16
17	07:30 16:43	06:55 17:26	06:07 18:04	06:10 18:43	05:26 20:19	19:16 (22) 20:45	05:09 20:40	06:00 20:02	19:34 (22) 20:02	06:36 18:09	07:14 18:36	06:58 16:16
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 18:45	05:25 20:20	19:15 (22) 20:45	05:09 20:39	06:01 20:01	19:34 (22) 20:01	06:38 18:03	07:15 18:37	06:57 16:16
19	07:29 16:45	06:52 17:29	06:03 18:07	06:06 18:46	05:24 20:21	19:16 (22) 20:46	05:09 20:38	06:02 19:57	19:33 (22) 19:47	06:02 18:06	07:16 18:38	06:58 16:16
20	07:28 16:47	06:51 17:31	06:01 18:08	06:04 18:47	05:23 20:22	19:17 (22) 20:46	05:09 20:38	06:03 19:56	19:30 (22) 19:48	06:03 18:59	07:18 18:40	07:00 16:17
21	07:28 16:48	06:49 17:32	05:59 18:09	06:03 18:48	05:22 20:23	19:19 (22) 20:46	05:10 20:37	06:04 19:54	19:29 (22) 19:54	06:04 18:57	07:19 18:40	07:01 16:17
22	07:27 16:49	06:47 17:33	05:57 18:11	06:01 18:50	05:21 20:24	19:20 (22) 20:46	05:10 20:36	06:06 19:52	19:28 (22) 19:52	06:06 18:55	07:20 18:41	07:02 16:18
23	07:26 16:51	06:46 17:35	05:55 18:12	05:59 19:51	05:20 20:26	19:21 (22) 20:47	05:10 20:35	06:07 19:51	19:29 (22) 19:51	06:07 18:53	07:22 17:59	07:04 16:18
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:27	19:22 (22) 20:47	05:10 20:34	06:08 19:49	19:28 (22) 19:52	06:08 18:51	07:23 17:58	07:05 16:19
25	07:24 16:54	06:42 17:37	05:52 18:14	05:56 19:53	05:18 20:28	19:23 (22) 20:47	05:11 20:33	06:09 19:47	19:27 (22) 19:53	06:09 18:50	07:24 18:56	07:06 16:19
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	05:18 20:29	19:27 (22) 20:47	05:11 20:32	06:10 19:45	19:26 (22) 19:52	06:10 18:48	07:26 18:55	07:07 16:20
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:30	19:35 (22) 20:30	20:47	06:11 20:31	19:25 (22) 19:53	06:11 18:46	07:27 18:53	07:09 16:21
28	07:21 16:58	06:37 17:42	05:46 18:18	05:51 19:57	05:16 20:31	19:32 (22) 20:31	20:47	06:12 20:30	19:26 (22) 19:54	06:13 18:44	07:28 18:52	07:10 16:22
29	07:20 16:59	06:36 17:41	05:44 18:19	05:50 19:58	05:15 20:32	19:33 (22) 20:32	20:47	06:13 20:29	19:25 (22) 19:55	06:14 18:42	07:29 18:50	07:11 16:22
30	07:19 17:01	06:35 18:21	05:42 18:21	05:48 20:00	05:14 20:33	19:34 (22) 20:33	20:47	06:14 20:27	19:24 (22) 19:38	06:15 18:40	07:30 18:49	07:12 16:23
31	07:18 17:02	06:34 18:22	05:40 18:22	05:44 19:59	05:14 20:33	19:35 (22) 20:33	20:47	06:16 19:37	19:24 (22) 19:37	06:16 18:47	07:31 18:56	07:13 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	274
Total, worst case				40	636		334	348				
Sun reduction				0.55	0.55		0.58	0.55				
Oper. time red.				0.91	0.91		0.91	0.91				
Wind dir. red.				0.61	0.61		0.61	0.61				
Total reduction				0.31	0.31		0.32	0.31				
Total, real				12	195		108	107				

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/24/06 03:39 / 31
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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 343 - 343

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:35 16:25	08:25 (8) 17:03	07:17 17:43	06:36 18:23	05:38 20:00	05:47 20:34	05:13 20:47	05:13 20:25	05:41 19:35	06:17 18:38	06:53 16:46	07:13 16:17
2	07:35 16:26	08:25 (8) 17:05	07:16 17:44	06:34 18:24	05:37 20:01	05:45 20:35	05:13 20:47	05:14 20:24	05:42 19:33	06:19 18:36	06:55 16:44	07:15 16:16
3	07:35 16:27	08:27 (8) 17:06	07:15 17:46	06:32 18:26	05:35 20:02	05:44 20:36	05:12 20:47	05:15 20:22	05:43 19:31	06:20 18:34	06:56 16:43	07:16 16:16
4	07:35 16:28	08:27 (8) 17:08	07:13 17:47	06:30 18:27	05:33 20:03	05:42 20:37	05:12 20:46	05:15 20:21	05:44 19:29	06:21 18:33	06:57 16:41	07:17 16:16
5	07:35 16:29	08:29 (8) 17:09	07:12 17:48	06:28 18:28	06:31 20:05	05:41 20:38	05:11 20:46	05:15 20:20	05:45 19:27	06:22 18:31	06:58 16:40	07:18 16:15
6	07:34 16:30	08:31 (8) 17:11	07:11 17:50	06:27 18:29	06:29 20:06	05:40 20:38	05:11 20:46	05:16 20:19	05:47 19:26	06:23 18:29	07:00 16:39	07:19 16:15
7	07:34 16:31	08:32 (8) 17:12	07:10 17:51	06:25 18:31	06:27 20:07	05:38 20:39	05:11 20:45	05:17 20:17	05:48 19:24	06:25 18:27	07:01 16:37	07:20 16:15
8	07:34 16:32	08:34 (8) 17:13	07:08 17:52	06:23 18:32	06:26 20:08	05:37 20:40	05:10 20:45	05:18 20:16	05:49 19:22	06:26 18:25	07:02 16:36	07:21 16:15
9	07:34 16:33	08:36 (8) 17:15	07:07 17:54	06:21 18:33	06:24 20:10	05:36 20:41	05:10 20:45	05:50 20:14	06:27 19:20	07:03 18:23	07:22 16:35	07:22 16:15
10	07:33 16:34	07:06 17:16	06:19 17:55	06:22 19:35	05:34 20:11	05:10 20:41	05:19 20:13	05:51 20:13	06:28 19:18	07:05 18:22	07:23 16:34	07:23 16:15
11	07:33 16:35	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:10 20:42	05:20 20:11	05:52 20:11	06:29 19:16	07:06 18:20	07:24 16:33	07:24 16:15
12	07:33 16:37	07:03 17:19	06:16 17:58	06:18 19:37	05:32 20:13	05:09 20:42	05:21 20:43	05:54 20:10	06:30 19:14	07:07 18:18	07:25 16:31	07:25 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	05:09 20:43	05:22 20:43	05:55 20:08	06:32 19:12	07:08 18:16	07:25 16:30	07:25 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	05:29 20:15	05:09 20:43	05:22 20:42	05:56 20:07	06:33 19:10	07:10 18:15	07:26 16:29	07:26 16:15
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:17	05:09 20:44	05:23 20:41	05:57 20:05	06:34 19:09	07:11 18:13	07:27 16:28	07:27 16:15
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	05:09 20:44	05:24 20:41	05:58 20:04	06:35 19:07	07:12 18:11	07:28 16:27	07:28 16:15
17	07:30 16:43	06:55 17:26	06:07 18:04	06:10 19:43	05:26 20:19	05:09 20:45	05:25 20:40	06:00 20:02	06:36 19:05	07:14 18:09	07:29 16:26	07:29 16:16
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:01	06:38 19:03	07:15 18:08	07:29 16:25	07:29 16:16
19	07:29 16:45	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:09 20:46	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	07:30 16:24	07:30 16:16
20	07:28 16:47	06:51 17:30	06:01 18:08	06:04 19:47	05:23 20:22	05:09 20:46	05:28 20:37	06:03 19:56	06:40 18:59	07:18 18:04	07:30 16:24	07:30 16:17
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:09 20:46	05:29 20:37	06:04 19:54	06:41 18:57	07:19 18:03	07:31 16:23	07:31 16:17
22	07:27 16:49	06:47 17:33	05:57 18:10	06:01 19:50	05:21 20:24	05:10 20:46	05:30 20:36	06:05 19:52	06:42 18:55	07:20 18:01	07:32 16:22	07:32 16:18
23	07:26 16:51	06:46 17:35	05:55 18:12	05:59 19:51	05:20 20:26	05:10 20:47	05:31 20:35	06:07 19:51	06:44 18:53	07:22 17:59	07:32 16:21	07:32 16:18
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:27	05:10 20:47	05:32 20:34	06:08 19:49	06:45 18:51	07:23 17:58	07:32 16:21	07:32 16:19
25	07:24 16:54	06:42 17:37	05:52 18:14	05:56 19:53	05:18 20:28	05:11 20:47	05:33 20:33	06:09 19:47	06:46 18:50	06:24 18:56	07:06 16:20	07:33 16:19
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	05:17 20:29	05:11 20:47	05:34 20:32	06:10 19:45	06:47 18:48	06:26 18:55	07:07 16:19	07:33 16:20
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:30	05:11 20:47	05:35 20:31	06:11 19:44	06:48 18:46	06:27 16:53	07:09 16:19	07:34 16:21
28	07:21 16:58	06:37 17:41	05:46 18:18	05:51 19:57	05:16 20:31	05:12 20:47	05:36 20:30	06:13 19:42	06:50 18:44	06:28 16:51	07:10 16:18	07:34 16:21
29	07:20 16:59		05:44 18:19	05:50 19:58	05:15 20:32	05:12 20:47	05:37 20:29	06:14 19:40	06:51 18:42	06:30 16:50	07:11 16:18	07:34 16:22
30	07:19 17:01		05:42 18:21	05:48 20:00	05:15 20:32	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	06:31 16:48	07:12 16:17	07:34 16:23
31	07:18 17:02		05:40 18:22	05:40 20:00	05:14 20:33	05:14 20:47	05:40 20:26	06:16 19:37	06:32 18:40	06:32 16:47	07:34 16:24	07:34 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	274
Total, worst case	132											594
Sun reduction	0.45											0.35
Oper. time red.	0.91											0.91
Wind dir. red.	0.69											0.69
Total reduction	0.28											0.22
Total, real	37											129

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/24/06 03:39 / 33
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 351 - 351

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December		
1	07:35 16:25	07:17 17:03	06:35 17:43	05:38 18:23	05:47 20:00	05:13 20:34	05:13 20:47	05:41 20:25	06:17 19:35	06:53 18:38	06:34 16:46	07:13 16:17		
2	07:35 16:26	07:16 17:05	06:34 17:44	05:37 18:24	05:45 20:01	05:13 20:35	05:14 20:47	05:42 20:24	06:19 19:33	06:55 18:36	06:35 16:44	07:14 16:16		
3	07:35 16:27	07:15 17:06	06:32 17:46	05:35 18:26	05:44 20:02	05:12 20:36	05:14 20:46	05:43 20:22	06:20 19:31	06:56 18:34	06:36 16:43	07:16 16:16		
4	07:35 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:42 20:03	05:12 20:37	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:33	06:38 16:41	07:17 16:16		
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:05	05:11 20:38	05:15 20:46	05:45 20:20	06:22 19:27	06:58 18:31	06:39 16:40	07:18 16:15		
6	07:34 16:30	07:11 17:10	06:27 17:50	06:29 19:29	05:40 20:06	05:11 20:38	05:16 20:46	05:47 20:18	06:23 19:25	07:00 18:29	06:41 16:39	07:19 16:15		
7	07:34 16:31	07:10 17:12	06:25 17:51	06:27 19:31	05:38 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:24 19:24	07:01 18:27	06:42 16:37	07:20 16:15		
8	07:34 16:32	07:08 17:13	06:23 17:52	06:26 19:32	05:37 20:08	05:10 20:40	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	06:43 16:36	07:21 16:15		
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40	05:18 20:45	05:50 20:14	06:27 19:20	07:03 18:23	06:45 16:35	07:22 16:15		
10	07:33 16:34	07:06 17:16	06:19 17:55	06:22 19:34	05:34 20:11	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	06:46 16:34	07:23 16:15		
11	07:33 16:35	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:09 20:42	05:20 20:44	05:52 20:11	06:29 19:16	07:06 18:20	06:47 16:33	07:24 16:15		
12	07:33 16:37	07:03 17:19	06:16 17:57	06:18 19:37	05:32 20:13	05:09 20:42	05:21 20:43	05:54 20:10	06:30 19:14	07:07 18:18	06:49 16:31	07:25 16:15	14:33 (8)	
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	05:09 20:43	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:16	06:50 16:30	07:25 16:15	14:29 (8)	8 14:37 (8)
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	05:29 20:15	05:09 20:43	05:22 20:42	05:56 20:07	06:33 19:10	07:10 18:14	06:52 16:29	07:26 16:15	14:30 (8)	10 14:40 (8)
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:17	05:09 20:44	05:23 20:41	05:57 20:05	06:34 19:09	07:11 18:13	06:53 16:28	07:27 16:15	14:29 (8)	12 14:41 (8)
16	07:31 16:41	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	05:09 20:44	05:24 20:41	05:58 20:04	06:35 19:07	07:12 18:11	06:54 16:27	07:28 16:15	14:30 (8)	12 14:42 (8)
17	07:30 16:43	06:55 17:26	06:06 18:04	06:10 19:43	05:26 20:19	05:09 20:45	05:25 20:40	05:59 20:02	06:36 19:05	07:14 18:09	06:56 16:26	07:28 16:16	14:28 (8)	14 14:42 (8)
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:01	06:38 19:03	07:15 18:08	06:57 16:25	07:29 16:16	14:29 (8)	14 14:43 (8)
19	07:29 16:45	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:09 20:46	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:24	07:30 16:16	14:30 (8)	14 14:44 (8)
20	07:28 16:47	06:51 17:30	06:01 18:08	06:04 19:47	05:23 20:22	05:09 20:46	05:28 20:37	06:03 19:56	06:40 18:59	07:17 18:04	07:00 16:24	07:30 16:17	14:28 (8)	16 14:44 (8)
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:09 20:46	05:29 20:37	06:04 19:54	06:41 18:57	07:19 18:03	07:01 16:23	07:31 16:17	14:29 (8)	16 14:45 (8)
22	07:27 16:49	06:47 17:33	05:57 18:10	06:01 19:50	05:21 20:24	05:10 20:46	05:30 20:36	06:05 19:52	06:42 18:55	07:20 18:01	07:02 16:22	07:31 16:18	14:29 (8)	16 14:45 (8)
23	07:26 16:51	06:46 17:35	05:55 18:12	05:59 19:51	05:20 20:25	05:10 20:47	05:31 20:35	06:07 19:51	06:44 18:53	07:21 17:59	07:03 16:21	07:32 16:18	14:30 (8)	16 14:46 (8)
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:27	05:10 20:47	05:32 20:34	06:08 19:49	06:45 18:51	07:23 17:58	07:05 16:20	07:32 16:19	14:32 (8)	14 14:46 (8)
25	07:24 16:53	06:42 17:37	05:51 18:14	05:56 19:53	05:18 20:28	05:10 20:47	05:33 20:33	06:09 19:47	06:46 18:49	06:24 18:56	07:06 16:20	07:33 16:19	14:32 (8)	14 14:46 (8)
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	05:17 20:29	05:11 20:47	05:34 20:32	06:10 19:45	06:47 18:48	06:25 18:54	07:07 16:19	07:33 16:20	14:33 (8)	14 14:47 (8)
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:30	05:11 20:47	05:35 20:31	06:11 19:44	06:48 18:46	06:27 16:53	07:09 16:19	07:34 16:21	14:33 (8)	14 14:47 (8)
28	07:21 16:58	06:37 17:41	05:46 18:18	05:51 19:57	05:16 20:31	05:12 20:47	05:36 20:30	06:13 19:42	06:50 18:44	06:28 16:51	07:10 16:18	07:34 16:21	14:35 (8)	12 14:47 (8)
29	07:20 16:59		05:44 18:19	05:50 19:58	05:15 20:31	05:12 20:47	05:37 20:28	06:14 19:40	06:51 18:42	06:30 16:50	07:11 16:18	07:34 16:22	14:35 (8)	12 14:47 (8)
30	07:19 17:00		05:42 18:21	05:48 20:00	05:15 20:32	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	06:31 16:48	07:12 16:17	07:34 16:23	14:37 (8)	8 14:45 (8)
31	07:18 17:02		05:40 18:22		05:14 20:33		05:40 20:26	06:16 19:37		06:32 16:47		07:34 16:24	14:39 (8)	6 14:45 (8)
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	274		
Total, worst case													246	
Sun reduction													0.35	
Oper. time red.													0.91	
Wind dir. red.													0.62	
Total reduction													0.20	
Total, real													49	

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)

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/24/06 03:39 / 34
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/23/06 22:52/2.4.0.67

SHADOW - Calendar

Calculation: 060123 NorthWest area Shadow receptor: 353 - 353

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:35 16:25	07:17 17:03	06:35 17:43	05:38 18:23	05:47 20:00	05:13 20:34	05:13 20:47	05:41 20:25	06:17 19:35	06:39 (7) 06:45 (7)	06:53 18:38	06:34 16:46	07:13 16:17
2	07:35 16:26	07:16 17:05	06:34 17:44	05:37 18:24	05:45 20:01	05:13 20:35	05:14 20:47	05:42 20:24	06:19 19:33	06:19 18:36	06:55 18:36	06:35 16:44	07:14 16:16
3	07:35 16:27	07:15 17:06	06:32 17:46	05:35 18:26	05:44 20:02	05:12 20:36	05:14 20:46	05:43 20:22	06:20 19:31	06:20 18:34	06:56 18:34	06:36 16:43	07:16 16:16
4	07:35 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:42 20:03	05:12 20:37	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:33	06:38 18:33	06:38 16:41	07:17 16:16
5	07:35 16:29	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:05	05:11 20:38	05:15 20:46	05:45 20:20	06:22 19:27	06:58 18:31	06:39 18:31	06:39 16:40	07:18 16:15
6	07:34 16:30	07:11 17:10	06:27 17:50	06:29 19:29	05:40 20:06	05:11 20:38	05:16 20:46	05:46 20:19	06:23 19:26	07:00 18:29	06:41 18:29	06:41 16:39	07:19 16:15
7	07:34 16:31	07:10 17:12	06:25 17:51	06:27 19:31	05:38 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:24 19:24	07:01 18:27	06:42 18:27	06:42 16:37	07:20 16:15
8	07:34 16:32	07:08 17:13	06:23 17:52	06:26 19:32	05:37 20:08	05:10 20:40	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	06:43 18:25	06:43 16:36	07:21 16:15
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40	05:18 20:45	05:50 20:14	06:27 19:20	07:03 18:23	06:45 18:23	06:45 16:35	07:22 16:15
10	07:33 16:34	07:06 17:16	06:19 17:55	06:22 19:35	05:34 20:11	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	06:46 18:22	06:46 16:34	07:23 16:15
11	07:33 16:35	07:04 17:18	06:18 17:56	06:20 19:36	06:40 (7) 06:46 (7)	05:33 20:12	05:09 20:42	05:52 20:11	06:29 19:29	07:06 18:20	06:47 18:20	06:47 16:33	07:24 16:15
12	07:33 16:37	07:03 17:19	06:16 17:57	06:18 19:37	06:39 (7) 06:51 (7)	05:32 20:13	05:09 20:42	05:54 20:10	06:30 19:14	07:07 18:18	06:49 18:18	06:49 16:31	07:25 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	06:37 (7) 06:53 (7)	05:31 20:14	05:09 20:43	05:55 20:08	4 06:50 (7)	06:32 19:12	07:08 18:16	06:50 16:30	07:25 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	06:35 (7) 06:53 (7)	05:29 20:15	05:09 20:43	05:56 20:07	12 06:41 (7)	06:33 19:10	07:10 18:14	06:52 16:29	07:26 16:15
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	06:33 (7) 06:53 (7)	05:28 20:17	05:09 20:44	05:57 20:05	16 06:54 (7)	06:34 19:09	07:11 18:13	06:53 16:28	07:27 16:15
16	07:31 16:41	06:57 17:25	06:08 18:03	06:11 19:42	06:32 (7) 06:54 (7)	05:27 20:18	05:09 20:44	05:58 20:04	18 06:55 (7)	06:35 19:07	07:12 18:11	06:54 16:27	07:28 16:15
17	07:30 16:43	06:55 17:26	06:06 18:04	06:10 19:43	06:30 (7) 06:54 (7)	05:26 20:19	05:09 20:45	05:59 20:02	20 06:56 (7)	06:36 19:05	07:14 18:09	06:56 16:26	07:28 16:16
18	07:30 16:44	06:54 17:28	06:05 18:05	06:08 19:45	06:28 (7) 06:54 (7)	05:25 20:20	05:09 20:45	06:01 20:01	22 06:57 (7)	06:38 19:03	07:15 18:08	06:57 16:25	07:29 16:16
19	07:29 16:45	06:52 17:29	06:03 18:07	06:06 19:46	06:29 (7) 06:55 (7)	05:24 20:21	05:09 20:46	06:02 19:57	24 06:59 (7)	06:39 19:01	07:16 18:06	06:58 16:24	07:30 16:16
20	07:28 16:47	06:51 17:30	06:01 18:08	06:04 19:47	06:27 (7) 06:55 (7)	05:23 20:22	05:09 20:46	06:03 19:56	24 06:58 (7)	06:40 18:59	07:17 18:04	07:00 16:24	07:30 16:17
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	06:27 (7) 06:53 (7)	05:22 20:23	05:09 20:46	06:04 19:54	26 06:59 (7)	06:41 18:57	07:19 18:03	07:01 16:23	07:31 16:17
22	07:27 16:49	06:47 17:33	05:57 18:10	06:01 19:50	06:28 (7) 06:54 (7)	05:21 20:24	05:10 20:46	06:05 19:52	26 06:58 (7)	06:42 18:55	07:20 18:01	07:02 16:22	07:32 16:18
23	07:26 16:51	06:46 17:35	05:55 18:12	05:59 19:51	06:28 (7) 06:52 (7)	05:20 20:25	05:10 20:47	06:07 19:51	28 06:59 (7)	06:44 18:53	07:21 17:59	07:04 16:21	07:32 16:18
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	06:28 (7) 06:52 (7)	05:19 20:27	05:10 20:47	06:08 19:49	26 06:58 (7)	06:45 18:51	07:23 17:58	07:05 16:20	07:32 16:19
25	07:24 16:53	06:42 17:37	05:51 18:14	05:56 19:53	06:29 (7) 06:51 (7)	05:18 20:28	05:10 20:47	06:09 19:47	26 06:57 (7)	06:46 18:49	07:24 18:56	07:06 16:20	07:33 16:19
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	06:29 (7) 06:49 (7)	05:17 20:29	05:11 20:47	06:10 20:32	24 06:57 (7)	06:47 18:48	07:25 18:48	07:07 16:19	07:33 16:20
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	06:30 (7) 06:48 (7)	05:17 20:30	05:11 20:47	06:11 20:31	22 06:56 (7)	06:48 18:46	07:26 18:46	07:09 16:19	07:34 16:21
28	07:21 16:58	06:37 17:41	05:46 18:18	05:51 19:57	06:32 (7) 06:46 (7)	05:16 20:31	05:12 20:47	06:13 19:42	20 06:55 (7)	06:50 18:44	07:27 18:44	07:10 16:18	07:34 16:21
29	07:20 16:59	06:36 17:41	05:44 18:19	05:50 19:58	06:35 (7) 06:45 (7)	05:15 20:31	05:12 20:47	06:14 19:40	18 06:54 (7)	06:51 18:42	07:28 18:42	07:11 16:17	07:34 16:22
30	07:19 17:00	06:35 18:21	05:42 18:21	05:48 20:00	06:45 (7)	05:15 20:32	05:13 20:47	06:15 19:38	14 06:51 (7)	06:52 18:40	07:29 18:40	07:12 16:17	07:34 16:23
31	07:18 17:02	06:34 18:22	05:40 18:22	05:48 19:59	06:45 (7)	05:15 20:33	05:13 20:47	06:16 19:37	12 06:50 (7)	06:52 18:40	07:30 18:40	07:13 16:18	07:34 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	6	341	288	274
Total, worst case				382				382		6			
Sun reduction				0.55				0.55		0.55			
Oper. time red.				0.91				0.91		0.91			
Wind dir. red.				0.59				0.59		0.59			
Total reduction				0.30				0.30		0.30			
Total, real				113				113		2			

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

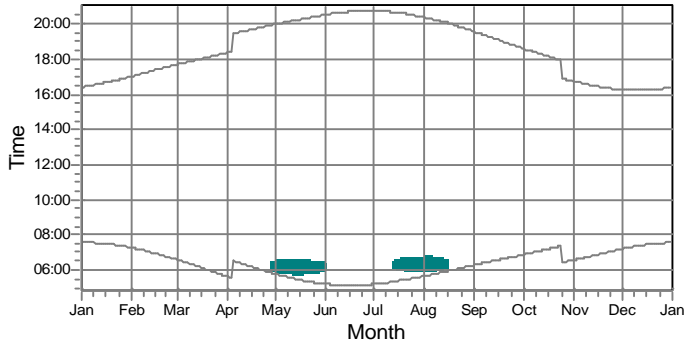
Printed/Page
01/24/06 03:39 / 35
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 22:52/2.4.0.67

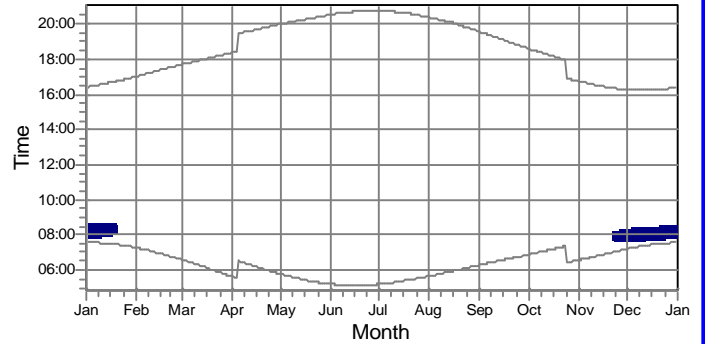
SHADOW - Calendar, graphical

Calculation: 060123 NorthWest area

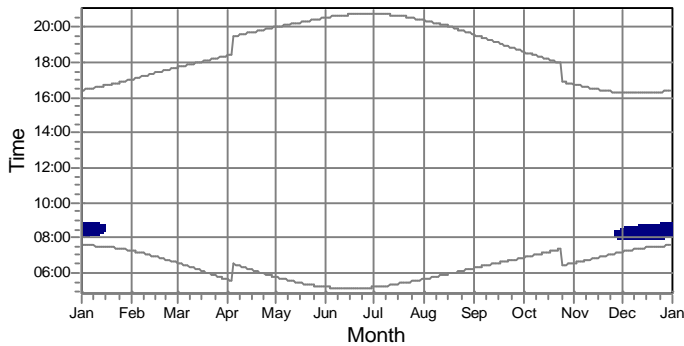
050: 050



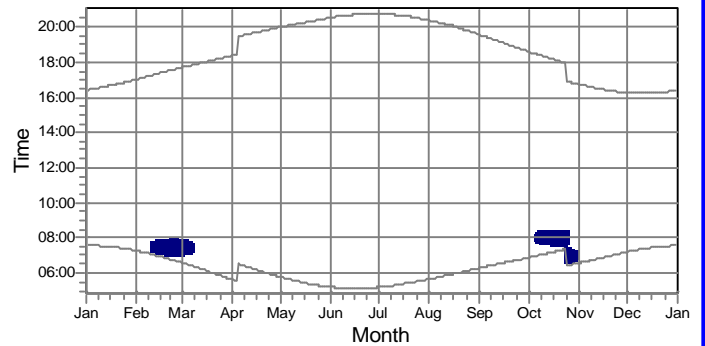
051: 051



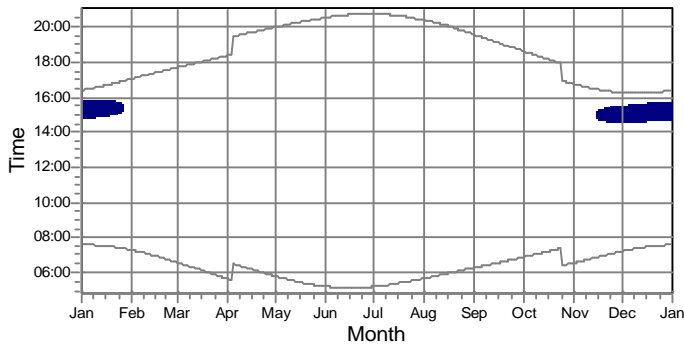
052: 052



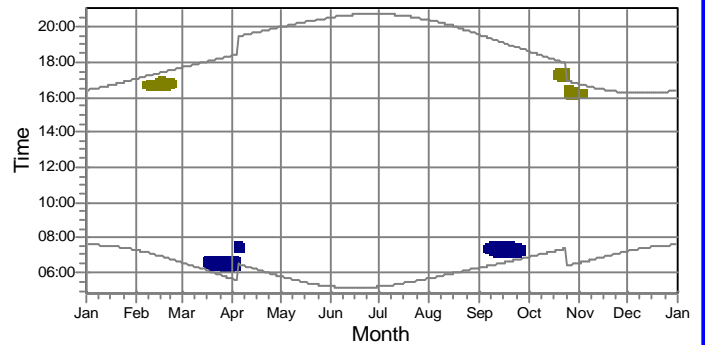
053: 053



054: 054



055: 055



WTGs



Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

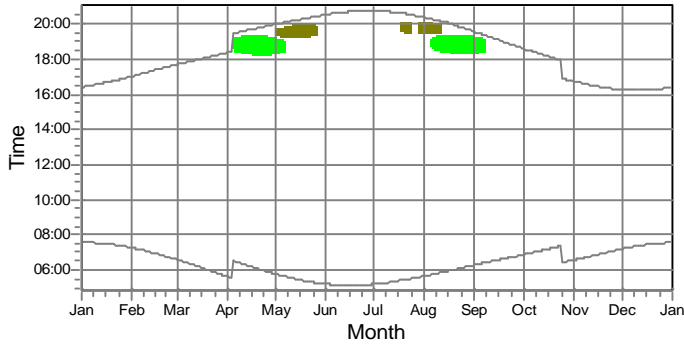
Printed/Page
01/24/06 03:39 / 36
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/23/06 22:52/2.4.0.67

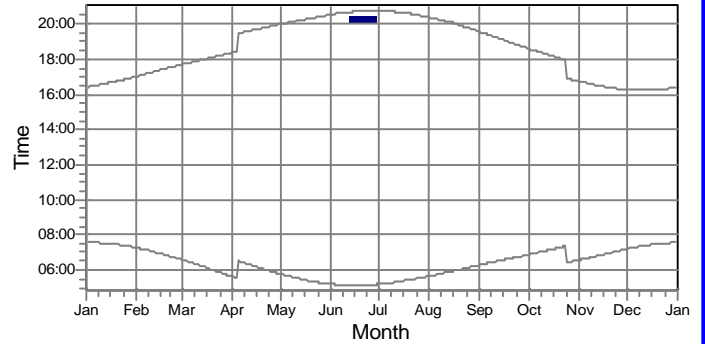
SHADOW - Calendar, graphical

Calculation: 060123 NorthWest area

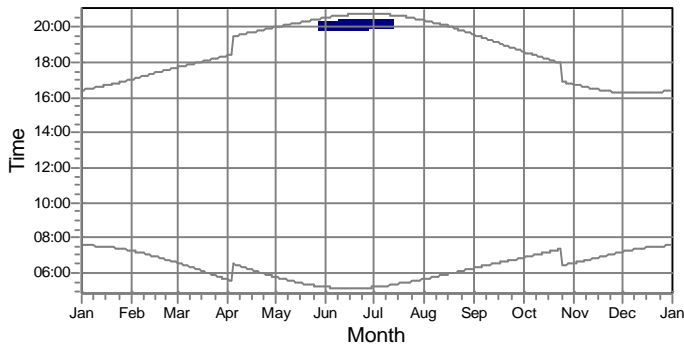
056: 056



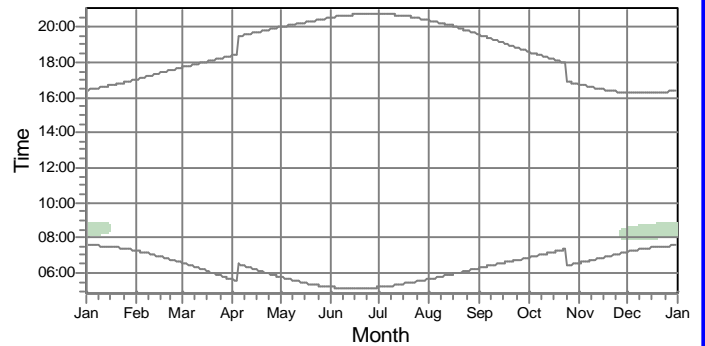
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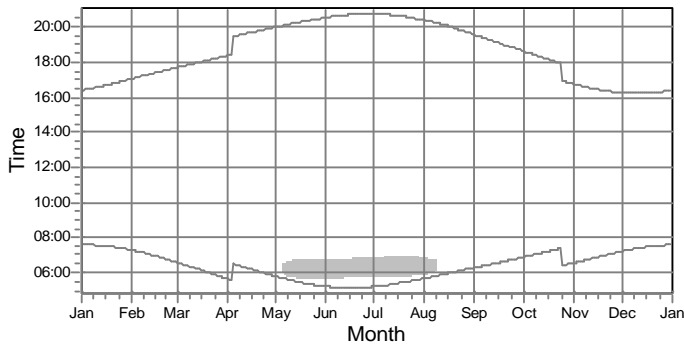
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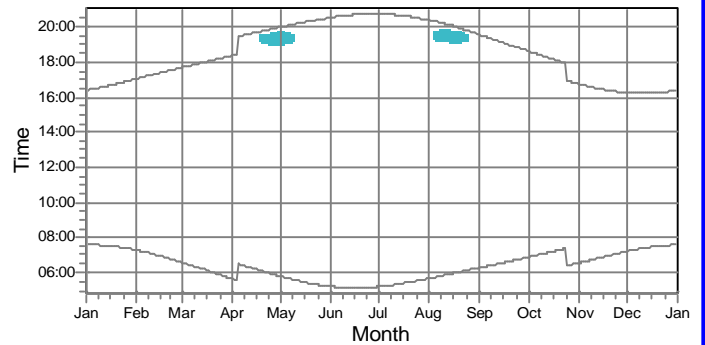
110: 110



113: 113



114: 114



WTGs



Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

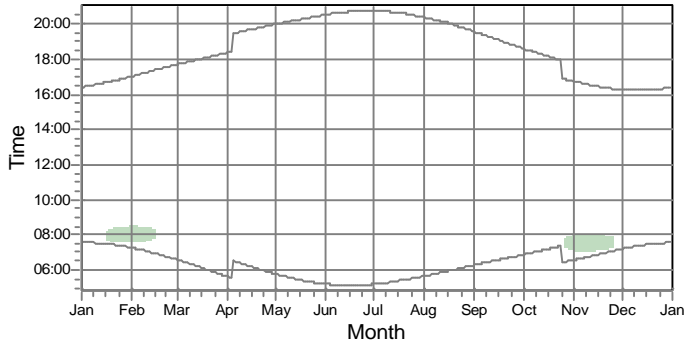
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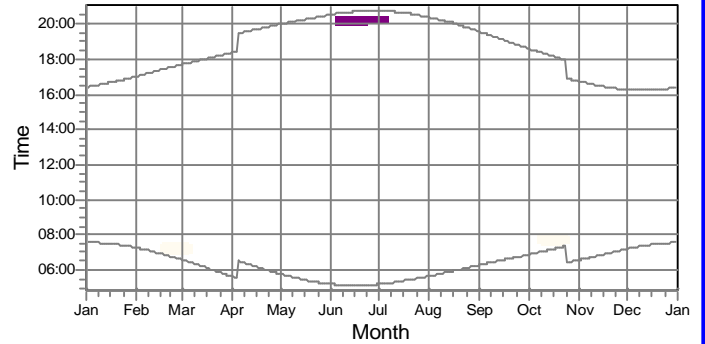
SHADOW - Calendar, graphical

Calculation: 060123 NorthWest area

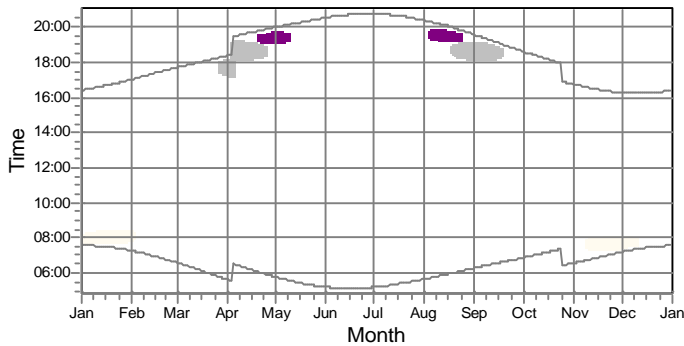
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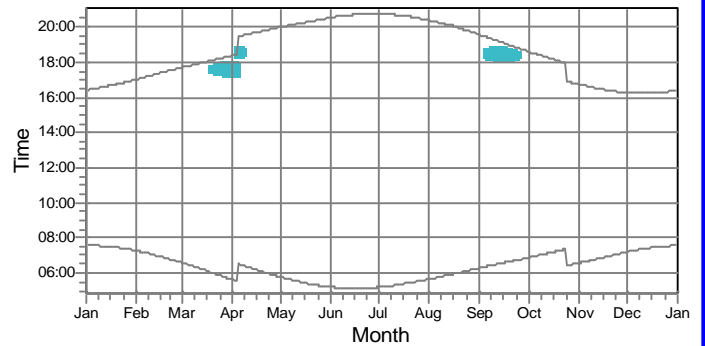
260: 260



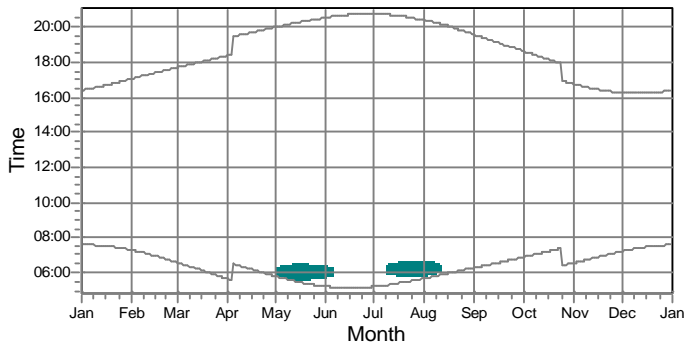
261: 261



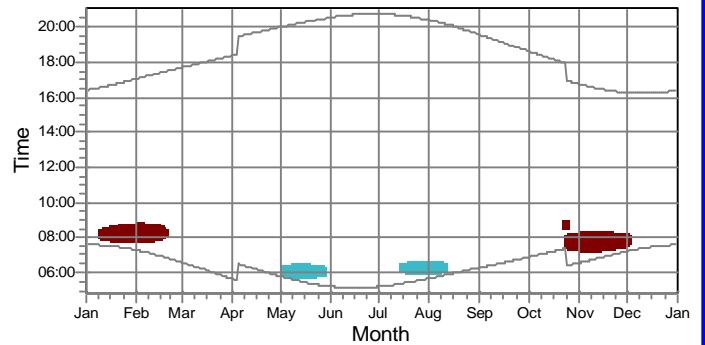
262: 262



264: 264



337: 337



WTGs



Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

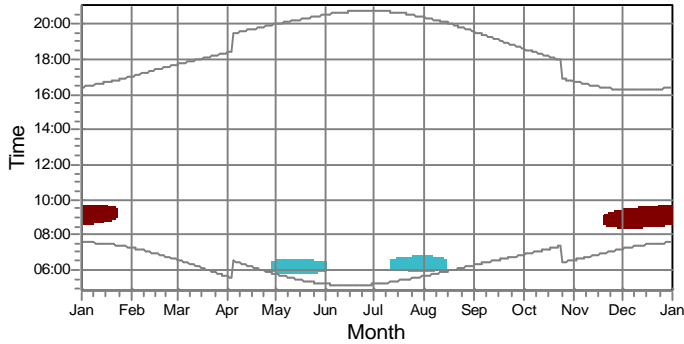
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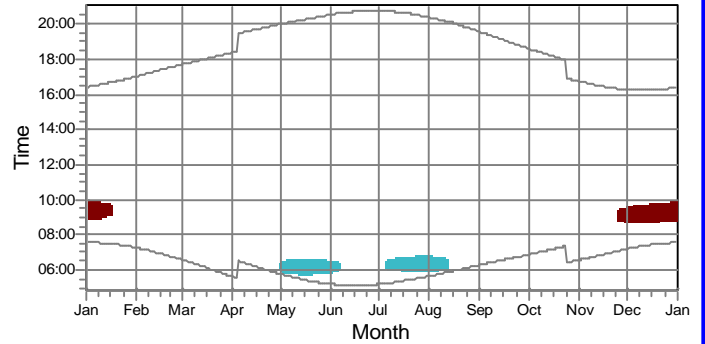
SHADOW - Calendar, graphical

Calculation: 060123 NorthWest area

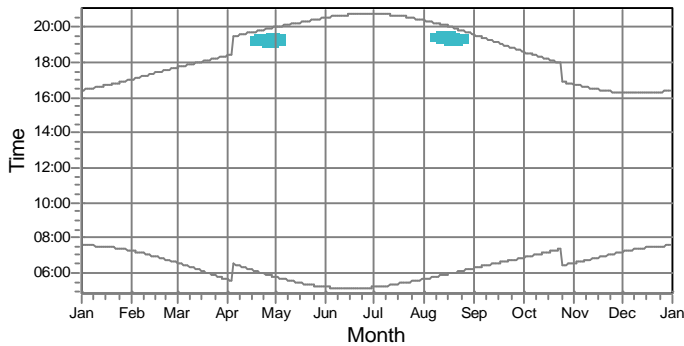
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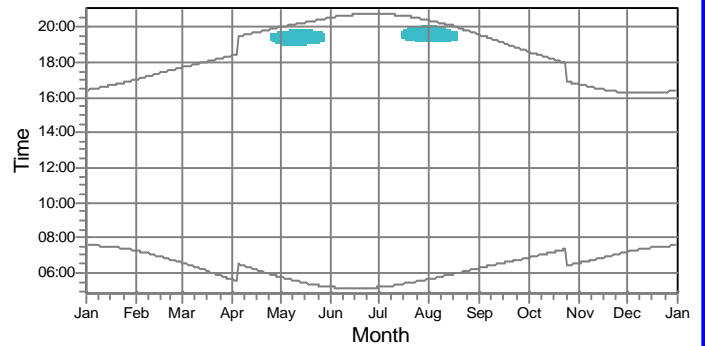
339: 339



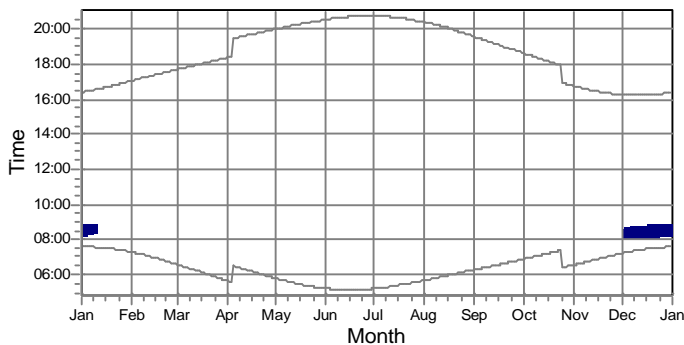
341: 341



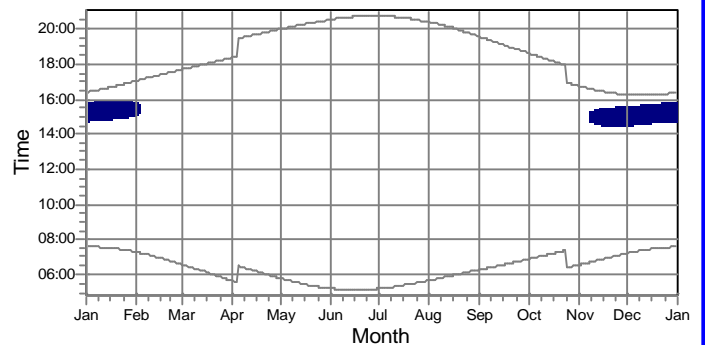
342: 342



343: 343



350: 350



WTGs

028

031

172

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
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Window properties: 1m2 horizontal, 1m above ground
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Directional run-hours applied (91% of time)

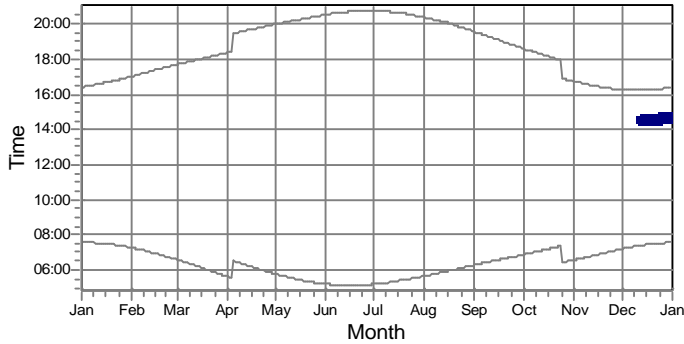
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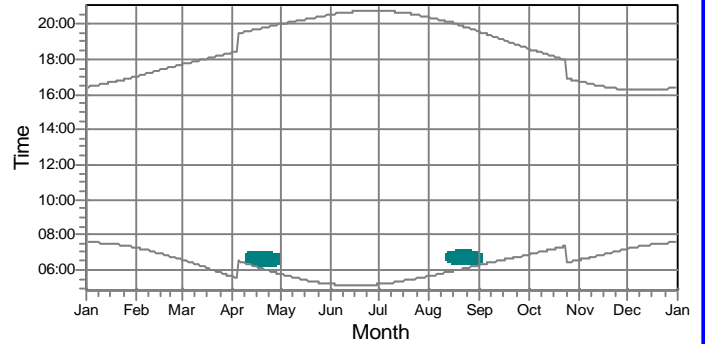
SHADOW - Calendar, graphical

Calculation: 060123 NorthWest area

351: 351



353: 353



WTGs



Project:
060119 Marble River

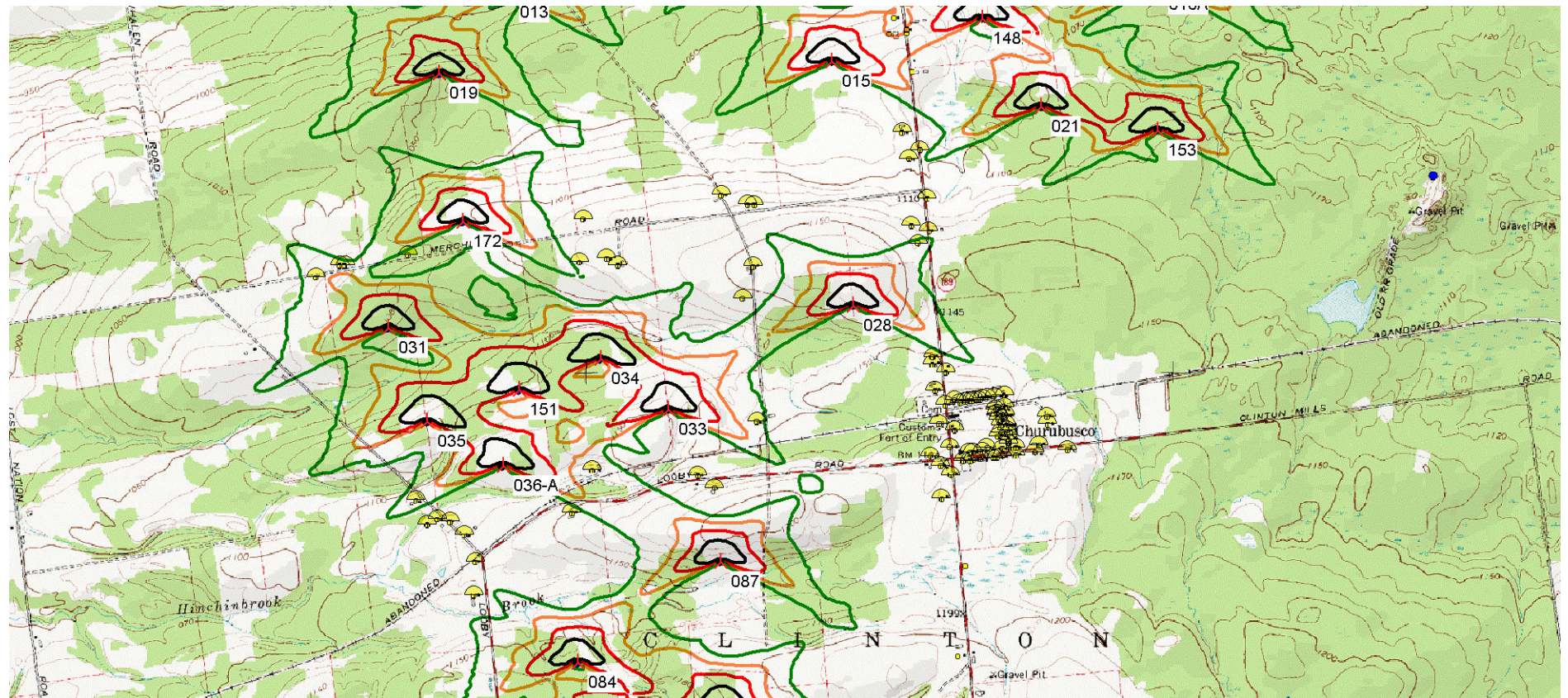
Description:
Marble River Wind Project
Shadow-Flicker, NW part
22 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
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Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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Calculated:
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SHADOW - Bitmap map: 060106 Marble River USGS 50kz13.bmi

Calculation: 060123 NorthWest area File: 060106 Marble River USGS 50kz13.bmi



Map: 060106 Marble River USGS 50kz13, Print scale 1:35,000, Map center UTM NAD27 Zone: 18 East: 583,236 North: 4,978,687

- New WTG
 - Shadow receptor
 - 10
 - 25
 - 50
 - 100
- Isolines showing shadow in Shadow hours/per year. Real value calculation.

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
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SHADOW - Main Result

Calculation: 060120 SouthWest area

Assumptions for shadow calculations

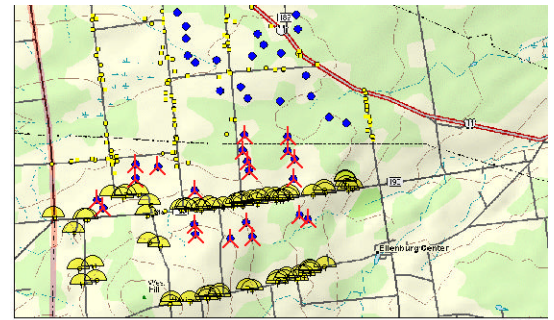
Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35

Operational time

N	NE	E	SE	S	SW	W	NW	Sum
1,850	1,325	800	713	625	663	700	1,275	7,950



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www.delorme.com
Scale 1
1" = 2.37 mi

New WTG
Shadow receptor

WTGs

UTM NAD27 Zone: 18			Row data/Description	WTG type		Power [kW]	Diam. [m]	Height [m]	RPM [RPM]
East	North	Z		Valid	Manufact. Type				
1	583,545	4,971,346	412 067	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
2	584,696	4,971,320	396 070-R	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
3	584,700	4,970,946	400 089-R	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
4	583,792	4,968,643	453 090	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
5	583,619	4,969,032	457 091	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
6	582,254	4,969,875	457 093	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
7	585,252	4,969,144	409 094	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
8	585,040	4,969,250	422 095	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
9	583,509	4,970,939	419 096-S	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
10	583,638	4,970,655	422 097	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
11	583,679	4,970,404	424 098	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
12	584,889	4,970,727	401 100-R	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
13	581,248	4,970,489	432 102-L	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
14	580,659	4,970,535	427 104-L	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
15	580,664	4,970,165	435 105-L	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
16	579,808	4,969,375	451 106-L	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
17	579,645	4,969,577	441 107-L	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
18	584,863	4,970,206	410 109	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
19	582,286	4,968,695	494 157	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
20	583,214	4,968,594	483 161	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
21	582,254	4,968,968	485 200	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7

Shadow receptor-Input

UTM NAD27 Zone: 18			Z	Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	
No.	Name	East							North
171	171	580,020	4,969,685	445	1.0	1.0	1.0	0.0	0.0
172	172	580,968	4,969,192	467	1.0	1.0	1.0	0.0	0.0
174	174	583,007	4,969,436	457	1.0	1.0	1.0	0.0	0.0
175	175	583,274	4,969,464	448	1.0	1.0	1.0	0.0	0.0
176	176	583,459	4,969,556	440	1.0	1.0	1.0	0.0	0.0
177	177	583,954	4,969,633	428	1.0	1.0	1.0	0.0	0.0
178	178	584,182	4,969,704	422	1.0	1.0	1.0	0.0	0.0
179	179	584,398	4,969,702	421	1.0	1.0	1.0	0.0	0.0
180	180	584,404	4,969,636	424	1.0	1.0	1.0	0.0	0.0

Continued on next page...

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, SW part
 21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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Calculated:

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SHADOW - Main Result

Calculation: 060120 SouthWest area

...continued from previous page

UTM NAD27 Zone: 18

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window
				[m]	[m]	[m]	[m]	[°]	[°]
181	181	584,581	4,969,665	427	1.0	1.0	1.0	0.0	0.0
182	182	584,755	4,969,780	427	1.0	1.0	1.0	0.0	0.0
183	183	585,683	4,969,933	404	1.0	1.0	1.0	0.0	0.0
184	184	581,314	4,968,368	494	1.0	1.0	1.0	0.0	0.0
185	185	579,181	4,967,752	471	1.0	1.0	1.0	0.0	0.0
186	186	579,652	4,967,447	493	1.0	1.0	1.0	0.0	0.0
187	187	584,727	4,967,606	431	1.0	1.0	1.0	0.0	0.0
188	188	585,319	4,967,746	423	1.0	1.0	1.0	0.0	0.0
190	190	581,661	4,966,909	552	1.0	1.0	1.0	0.0	0.0
191	191	581,631	4,966,828	554	1.0	1.0	1.0	0.0	0.0
192	192	582,144	4,966,915	539	1.0	1.0	1.0	0.0	0.0
193	193	582,574	4,967,051	521	1.0	1.0	1.0	0.0	0.0
194	194	582,615	4,966,996	520	1.0	1.0	1.0	0.0	0.0
195	195	582,696	4,967,089	516	1.0	1.0	1.0	0.0	0.0
196	196	582,951	4,967,147	502	1.0	1.0	1.0	0.0	0.0
197	197	583,680	4,967,286	467	1.0	1.0	1.0	0.0	0.0
198	198	583,803	4,967,249	461	1.0	1.0	1.0	0.0	0.0
199	199	584,667	4,967,521	433	1.0	1.0	1.0	0.0	0.0
200	200	584,497	4,967,519	436	1.0	1.0	1.0	0.0	0.0
201	201	585,167	4,967,650	426	1.0	1.0	1.0	0.0	0.0
202	202	585,083	4,967,667	427	1.0	1.0	1.0	0.0	0.0
203	203	586,318	4,969,940	373	1.0	1.0	1.0	0.0	0.0
204	204	584,711	4,969,699	427	1.0	1.0	1.0	0.0	0.0
205	205	583,915	4,969,535	431	1.0	1.0	1.0	0.0	0.0
206	206	583,534	4,969,581	438	1.0	1.0	1.0	0.0	0.0
207	207	583,520	4,969,485	443	1.0	1.0	1.0	0.0	0.0
208	208	583,362	4,969,540	443	1.0	1.0	1.0	0.0	0.0
209	209	582,767	4,969,411	463	1.0	1.0	1.0	0.0	0.0
210	210	582,297	4,969,396	470	1.0	1.0	1.0	0.0	0.0
211	211	582,418	4,969,356	470	1.0	1.0	1.0	0.0	0.0
212	212	582,026	4,969,384	470	1.0	1.0	1.0	0.0	0.0
214	214	581,901	4,969,354	469	1.0	1.0	1.0	0.0	0.0
215	215	581,059	4,969,469	458	1.0	1.0	1.0	0.0	0.0
216	216	579,403	4,969,066	455	1.0	1.0	1.0	0.0	0.0
217	217	578,512	4,969,108	434	1.0	1.0	1.0	0.0	0.0
223	223	580,743	4,969,750	448	1.0	1.0	1.0	0.0	0.0
224	224	580,402	4,969,729	450	1.0	1.0	1.0	0.0	0.0
276	276	579,327	4,969,067	453	1.0	1.0	1.0	0.0	0.0
277	277	579,035	4,968,707	451	1.0	1.0	1.0	0.0	0.0
278	278	579,568	4,967,822	479	1.0	1.0	1.0	0.0	0.0
279	279	579,267	4,967,354	486	1.0	1.0	1.0	0.0	0.0
280	280	581,041	4,968,461	489	1.0	1.0	1.0	0.0	0.0
281	281	580,326	4,969,647	450	1.0	1.0	1.0	0.0	0.0
294	294	582,062	4,969,376	470	1.0	1.0	1.0	0.0	0.0
295	295	582,629	4,969,439	463	1.0	1.0	1.0	0.0	0.0
296	296	582,934	4,967,064	504	1.0	1.0	1.0	0.0	0.0
297	297	584,470	4,967,449	437	1.0	1.0	1.0	0.0	0.0
298	298	584,992	4,967,538	427	1.0	1.0	1.0	0.0	0.0
299	299	585,363	4,967,779	422	1.0	1.0	1.0	0.0	0.0
300	300	585,327	4,967,809	422	1.0	1.0	1.0	0.0	0.0
301	301	585,722	4,967,884	407	1.0	1.0	1.0	0.0	0.0
302	302	586,233	4,970,163	381	1.0	1.0	1.0	0.0	0.0
303	303	586,249	4,970,183	381	1.0	1.0	1.0	0.0	0.0
304	304	586,266	4,970,042	376	1.0	1.0	1.0	0.0	0.0
305	305	583,780	4,969,611	432	1.0	1.0	1.0	0.0	0.0
306	306	584,518	4,969,659	425	1.0	1.0	1.0	0.0	0.0
307	307	585,388	4,969,790	412	1.0	1.0	1.0	0.0	0.0
308	308	585,701	4,969,857	404	1.0	1.0	1.0	0.0	0.0
309	309	586,423	4,969,980	369	1.0	1.0	1.0	0.0	0.0

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
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Calculated:
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SHADOW - Main Result

Calculation: 060120 SouthWest area

Calculation Results

No.	Name	Shadow, worst case		Shadow, expected values	
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
171	171	108:44	146	1:00	25:41
172	172	0:00	0	0:00	0:00
174	174	42:00	110	0:50	10:18
175	175	16:50	40	0:32	3:54
176	176	0:00	0	0:00	0:00
177	177	0:00	0	0:00	0:00
178	178	8:58	36	0:22	2:04
179	179	24:26	84	0:28	5:49
180	180	34:54	76	0:46	7:57
181	181	47:40	66	0:52	11:15
182	182	0:00	0	0:00	0:00
183	183	17:34	66	0:26	5:06
184	184	0:00	0	0:00	0:00
185	185	0:00	0	0:00	0:00
186	186	0:00	0	0:00	0:00
187	187	0:00	0	0:00	0:00
188	188	0:00	0	0:00	0:00
190	190	0:00	0	0:00	0:00
191	191	0:00	0	0:00	0:00
192	192	0:00	0	0:00	0:00
193	193	0:00	0	0:00	0:00
194	194	0:00	0	0:00	0:00
195	195	0:00	0	0:00	0:00
196	196	0:00	0	0:00	0:00
197	197	0:00	0	0:00	0:00
198	198	0:00	0	0:00	0:00
199	199	0:00	0	0:00	0:00
200	200	0:00	0	0:00	0:00
201	201	0:00	0	0:00	0:00
202	202	0:00	0	0:00	0:00
203	203	0:00	0	0:00	0:00
204	204	0:00	0	0:00	0:00
205	205	0:00	0	0:00	0:00
206	206	0:00	0	0:00	0:00
207	207	0:00	0	0:00	0:00
208	208	0:00	0	0:00	0:00
209	209	45:52	120	0:34	10:08
210	210	0:00	0	0:00	0:00
211	211	3:42	17	0:16	0:42
212	212	0:32	6	0:06	0:06
214	214	44:30	72	0:44	10:41
215	215	0:00	0	0:00	0:00
216	216	0:00	0	0:00	0:00
217	217	0:00	0	0:00	0:00
223	223	0:00	0	0:00	0:00
224	224	30:14	84	0:32	7:02
276	276	4:20	21	0:16	1:16
277	277	0:00	0	0:00	0:00
278	278	0:00	0	0:00	0:00
279	279	0:00	0	0:00	0:00
280	280	0:00	0	0:00	0:00
281	281	38:44	93	0:38	9:30
294	294	0:00	0	0:00	0:00
295	295	22:40	50	0:34	4:50
296	296	0:00	0	0:00	0:00
297	297	0:00	0	0:00	0:00
298	298	0:00	0	0:00	0:00
299	299	0:00	0	0:00	0:00

Continued on next page...

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, SW part
 21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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01/22/06 00:15 / 4

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Wind Engineers, Inc.
 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated:

01/21/06 09:09/2.4.0.67

SHADOW - Main Result**Calculation:** 060120 SouthWest area

...continued from previous page

No.	Name	Shadow, worst case		Shadow, expected values	
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
300	300	0:00	0	0:00	0:00
301	301	0:00	0	0:00	0:00
302	302	0:00	0	0:00	0:00
303	303	0:00	0	0:00	0:00
304	304	0:00	0	0:00	0:00
305	305	0:00	0	0:00	0:00
306	306	43:36	80	0:44	10:19
307	307	0:00	0	0:00	0:00
308	308	38:14	119	0:26	9:53
309	309	0:00	0	0:00	0:00

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/21/06 09:09/2.4.0.67

SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 171 - 171

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes
Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June						
1	07:34	14:01 (16)	07:17	06:36	16:36 (17)	05:39	05:47	05:14				
	16:25	58	14:59 (16)	17:04	17:43	38	17:14 (17)	18:23	20:00	20:34		
2	07:34	14:03 (16)	07:16	06:34	16:34 (17)	05:37	05:46	05:13				
	16:26	56	14:59 (16)	17:05	17:44	40	17:14 (17)	18:25	20:01	20:35		
3	07:34	14:03 (16)	07:15	06:32	16:33 (17)	05:35	05:44	05:13				
	16:27	58	15:01 (16)	17:07	17:46	44	17:17 (17)	18:26	20:02	20:36		
4	07:34	14:03 (16)	07:13	06:30	16:31 (17)	05:33	05:43	05:12				
	16:28	58	15:01 (16)	17:08	17:47	46	17:17 (17)	18:27	20:03	20:37		
5	07:34	14:05 (16)	07:12	06:29	16:31 (17)	06:31	05:41	05:12				
	16:29	56	15:01 (16)	17:09	17:48	46	17:17 (17)	19:28	20:05	20:37		
6	07:34	14:05 (16)	07:11	06:27	16:29 (17)	06:29	05:40	05:11				
	16:30	56	15:01 (16)	17:11	17:50	48	17:17 (17)	19:30	20:06	20:38		
7	07:34	14:06 (16)	07:10	06:25	16:29 (17)	06:28	05:39	05:11				
	16:31	56	15:02 (16)	17:12	17:51	48	17:17 (17)	19:31	20:07	20:39		
8	07:34	14:06 (16)	07:08	06:23	16:28 (17)	06:26	05:37	05:11				
	16:32	56	15:02 (16)	17:14	17:52	50	17:18 (17)	19:32	20:08	20:40		
9	07:34	14:08 (16)	07:07	06:21	16:28 (17)	06:24	05:36	05:10				
	16:34	54	15:02 (16)	17:15	17:54	50	17:18 (17)	19:33	20:09	20:40		
10	07:33	14:07 (16)	07:06	06:20	16:28 (17)	06:22	05:35	05:10				
	16:35	54	15:01 (16)	17:17	17:55	50	17:18 (17)	19:35	20:11	20:41		
11	07:33	14:09 (16)	07:04	06:18	16:26 (17)	06:20	05:33	05:10				
	16:36	54	15:03 (16)	17:18	17:56	52	17:18 (17)	19:36	20:12	20:42		
12	07:33	14:08 (16)	07:03	06:16	16:26 (17)	06:19	05:32	05:10				
	16:37	54	15:02 (16)	17:19	17:58	52	17:18 (17)	19:37	20:13	20:42		
13	07:32	14:10 (16)	07:01	06:14	16:26 (17)	06:17	05:31	05:10				
	16:38	52	15:02 (16)	17:21	17:59	52	17:18 (17)	19:38	20:14	20:43		
14	07:32	14:11 (16)	07:00	06:12	16:27 (17)	06:15	05:30	05:10				
	16:39	52	15:03 (16)	17:22	18:00	52	17:19 (17)	19:40	20:15	20:43		
15	07:31	14:13 (16)	06:58	06:10	16:27 (17)	06:13	05:29	05:10				
	16:41	50	15:03 (16)	17:24	18:02	50	17:17 (17)	19:41	20:17	20:44		
16	07:31	14:12 (16)	06:57	06:09	16:27 (17)	06:12	05:28	05:10				
	16:42	50	15:02 (16)	17:25	18:03	50	17:17 (17)	19:42	20:18	20:44		
17	07:30	14:13 (16)	06:55	06:07	16:27 (17)	06:10	05:26	05:10				
	16:43	48	15:01 (16)	17:27	18:04	50	17:17 (17)	19:43	20:19	20:45		
18	07:29	14:15 (16)	06:54	06:05	16:27 (17)	06:08	05:25	05:10				
	16:45	46	15:01 (16)	17:28	18:06	48	17:15 (17)	19:45	20:20	20:45		
19	07:29	14:16 (16)	06:52	06:03	16:27 (17)	06:06	05:24	05:10				
	16:46	46	15:02 (16)	17:29	18:07	48	17:15 (17)	19:46	20:21	20:45		
20	07:28	14:17 (16)	06:51	06:01	16:27 (17)	06:05	05:23	05:10				
	16:47	44	15:01 (16)	17:31	18:08	46	17:13 (17)	19:47	20:22	20:46		
21	07:27	14:18 (16)	06:49	05:59	16:27 (17)	06:03	05:22	05:10				
	16:48	42	15:00 (16)	17:32	18:09	46	17:13 (17)	19:48	20:23	20:46		
22	07:27	14:19 (16)	06:47	05:57	16:29 (17)	06:01	05:21	05:10				
	16:50	40	14:59 (16)	17:34	18:11	42	17:11 (17)	19:50	20:24	20:46		
23	07:26	14:20 (16)	06:46	05:55	16:30 (17)	06:00	05:20	05:10				
	16:51	38	14:58 (16)	17:35	18:12	40	17:10 (17)	19:51	20:25	20:46		
24	07:25	14:24 (16)	06:44	16:51 (17)	05:54	16:32 (17)	05:58	05:20				
	16:53	34	14:58 (16)	17:36	10	17:01 (17)	18:13	36	17:08 (17)	19:52	20:26	20:47
25	07:24	14:25 (16)	06:42	16:45 (17)	05:52	16:32 (17)	05:57	05:19				
	16:54	32	14:57 (16)	17:38	20	17:05 (17)	18:14	34	17:06 (17)	19:53	20:27	20:47
26	07:23	14:28 (16)	06:41	16:41 (17)	05:50	16:34 (17)	05:55	05:18				
	16:55	28	14:56 (16)	17:39	26	17:07 (17)	18:16	30	17:04 (17)	19:55	20:28	20:47
27	07:22	14:31 (16)	06:39	16:40 (17)	05:48	16:36 (17)	05:53	05:17				
	16:57	22	14:53 (16)	17:40	30	17:10 (17)	18:17	26	17:02 (17)	19:56	20:29	20:47
28	07:21	14:33 (16)	06:37	16:38 (17)	05:46	16:40 (17)	05:52	05:16				
	16:58	16	14:49 (16)	17:42	34	17:12 (17)	18:18	18	16:58 (17)	19:57	20:30	20:47
29	07:20	14:40 (16)		05:44	16:46 (17)	05:50	05:16	05:13				
	17:00	4	14:44 (16)		18:19	4	16:50 (17)	19:58	20:31	20:47		
30	07:19			05:42		05:49	05:15	05:13				
	17:01			18:21		20:00	20:32	20:47				
31	07:18			05:41			05:14					
	17:02			18:22			20:33					
Potential sun hours	286	291	369		380	-285	-254					
Total, worst case	1314	120	1236									
Sun reduction	0.45	0.45	0.50									
Oper. time red.	0.91	0.91	0.91									
Wind dir. red.	0.62	0.57	0.57									
Total reduction	0.26	0.24	0.26									
Total, real	337	28	323									

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/21/06 09:09/2.4.0.67

SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 171 - 171

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:14 20:47	05:41 20:25	06:18 19:35	06:53 18:38	17:05 (17) 16:46	07:13 16:17
2	05:14 20:47	05:42 20:24	06:19 19:33	06:55 18:37	17:06 (17) 16:45	07:14 16:17
3	05:15 20:46	05:43 20:22	06:20 19:31	06:56 18:35	17:05 (17) 16:43	07:16 16:16
4	05:15 20:46	05:45 20:21	06:21 19:29	06:57 18:33	17:04 (17) 16:42	07:17 16:16
5	05:16 20:46	05:46 20:20	06:22 19:27	06:58 18:31	17:06 (17) 16:40	07:18 16:16
6	05:17 20:46	05:47 20:18	06:24 19:26	07:00 18:29	17:05 (17) 16:39	07:19 16:16
7	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27	17:04 (17) 16:38	07:20 16:15
8	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	17:05 (17) 16:37	07:21 16:15
9	05:19 20:44	05:50 20:14	06:27 19:20	07:03 18:24	17:07 (17) 16:35	07:22 16:15
10	05:20 20:44	05:52 20:13	06:28 19:18	07:05 18:22	17:06 (17) 16:34	07:23 16:15
11	05:20 20:43	05:53 20:11	06:30 19:16	07:06 18:20	17:07 (17) 16:33	07:24 16:15
12	05:21 20:43	05:54 20:10	06:31 19:14	07:07 18:18	17:09 (17) 16:32	07:24 16:15
13	05:22 20:42	05:55 20:08	06:32 19:12	07:09 18:17	17:10 (17) 16:31	07:25 16:15
14	05:23 20:42	05:56 20:07	06:33 19:11	07:10 18:15	17:11 (17) 16:30	07:26 16:16
15	05:24 20:41	05:57 20:05	06:34 19:09	17:30 (17) 07:11	17:13 (17) 16:29	14:12 (16) 07:27
16	05:25 20:40	05:59 20:04	06:35 19:07	18:13 07:12	17:43 (17) 16:28	14:16 (16) 07:28
17	05:26 20:40	06:00 20:02	06:37 19:05	18:14 07:13	17:44 (17) 16:27	14:01 (16) 07:29
18	05:27 20:39	06:01 20:01	06:38 19:03	18:15 07:14	17:45 (17) 16:26	14:29 (16) 07:30
19	05:27 20:38	06:02 19:57	06:39 19:01	18:16 07:15	17:46 (17) 16:25	14:32 (16) 07:31
20	05:28 20:37	06:03 19:56	06:40 18:59	18:17 07:16	17:47 (17) 16:24	14:33 (16) 07:32
21	05:29 20:36	06:05 19:54	06:41 18:57	18:18 07:17	17:48 (17) 16:23	14:34 (16) 07:33
22	05:30 20:36	06:06 19:52	06:43 18:55	18:19 07:18	17:49 (17) 16:22	14:35 (16) 07:34
23	05:31 20:35	06:07 19:51	06:44 18:53	18:20 07:19	17:50 (17) 16:21	14:36 (16) 07:35
24	05:33 20:34	06:08 19:49	06:45 18:52	18:21 07:20	17:51 (17) 16:20	14:37 (16) 07:36
25	05:34 20:33	06:09 19:47	06:46 18:50	18:22 07:21	17:52 (17) 16:19	14:38 (16) 07:37
26	05:35 20:32	06:11 19:45	06:47 18:48	18:23 07:22	17:53 (17) 16:18	14:39 (16) 07:38
27	05:36 20:31	06:12 19:44	06:49 18:46	18:24 07:23	17:54 (17) 16:17	14:40 (16) 07:39
28	05:37 20:30	06:13 19:42	06:50 18:44	18:25 07:24	17:55 (17) 16:16	14:41 (16) 07:40
29	05:38 20:28	06:14 19:40	06:51 18:42	18:26 07:25	17:56 (17) 16:15	14:42 (16) 07:41
30	05:39 20:27	06:15 19:38	06:52 18:40	18:27 07:26	17:57 (17) 16:14	14:43 (16) 07:42
31	05:40 20:26	06:16 19:37		18:28 07:27	17:58 (17) 16:13	14:44 (16) 07:43
Potential sun hours	-272	4	376	341	288	275
Total, worst case			658	718	698	1780
Sun reduction			0.55	0.45	0.35	0.35
Oper. time red.			0.91	0.91	0.91	0.91
Wind dir. red.			0.57	0.57	0.62	0.62
Total reduction			0.29	0.24	0.20	0.20
Total, real			189	169	139	355

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/21/06 09:09/2.4.0.67

SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 174 - 174

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34	07:17	07:55 (5) 06:35	05:39	05:47	05:14
	16:25	17:04	46 16:29 (21) 17:43	18:23	20:01	20:34
2	07:34	07:16	07:56 (5) 06:34	05:37	05:46	05:13
	16:26	17:05	48 16:30 (21) 17:44	18:24	20:01	20:35
3	07:34	07:14	07:56 (5) 06:32	05:35	05:44	05:13
	16:27	17:06	46 16:30 (21) 17:46	18:26	20:02	20:36
4	07:34	07:13	07:57 (5) 06:30	05:33	05:43	05:12
	16:28	17:08	44 16:31 (21) 17:47	18:27	20:03	20:36
5	07:34	07:12	08:00 (5) 06:28	06:31	05:41	05:12
	16:29	17:09	40 16:30 (21) 17:48	19:28	20:04	20:37
6	07:34	07:11	08:00 (5) 06:27	06:29	05:40	05:11
	16:30	17:11	36 16:30 (21) 17:50	19:29	20:06	20:38
7	07:34	07:09	16:07 (21) 06:25	06:27	05:39	05:11
	16:31	17:12	24 16:31 (21) 17:51	19:31	20:07	20:39
8	07:34	07:58 (5) 07:08	16:08 (21) 06:23	06:26	05:37	05:11
	16:32	6 08:04 (5) 17:14	22 16:30 (21) 17:52	19:32	20:08	20:39
9	07:33	07:57 (5) 07:07	16:08 (21) 06:21	06:24	05:36	05:10
	16:33	8 08:05 (5) 17:15	20 16:28 (21) 17:54	19:33	20:09	20:40
10	07:33	07:57 (5) 07:05	16:11 (21) 06:19	06:22	05:35	05:10
	16:35	10 08:07 (5) 17:16	18 16:29 (21) 17:55	19:34	20:10	20:41
11	07:33	07:57 (5) 07:04	16:11 (21) 06:18	06:20	05:33	05:10
	16:36	12 08:09 (5) 17:18	16 16:27 (21) 17:56	19:36	20:12	20:41
12	07:32	07:56 (5) 07:03	16:14 (21) 06:16	06:18	05:32	05:10
	16:37	14 08:10 (5) 17:19	10 16:24 (21) 17:58	19:37	20:13	20:42
13	07:32	07:56 (5) 07:01	06:14	06:17	05:31	05:10
	16:38	16 08:12 (5) 17:21	17:59	19:38	20:14	20:43
14	07:32	07:55 (5) 07:00	06:12	06:15	05:30	05:09
	16:39	18 08:13 (5) 17:22	18:00	19:39	20:15	20:43
15	07:31	07:54 (5) 06:58	06:10	06:13	05:29	05:09
	16:41	20 08:14 (5) 17:24	18:01	19:41	20:16	20:44
16	07:31	07:54 (5) 06:57	06:08	06:11	05:27	05:09
	16:42	22 08:16 (5) 17:25	18:03	19:42	20:18	20:44
17	07:30	07:53 (5) 06:55	06:07	06:10	05:26	05:09
	16:43	22 08:15 (5) 17:26	18:04	19:43	20:19	20:44
18	07:29	07:52 (5) 06:54	06:05	06:08	05:25	05:09
	16:44	24 08:16 (5) 17:28	18:05	19:44	20:20	20:45
19	07:29	07:52 (5) 06:52	06:03	06:06	05:24	05:10
	16:46	26 08:18 (5) 17:29	18:07	19:46	20:21	20:45
20	07:28	07:51 (5) 06:50	06:01	06:05	05:23	05:10
	16:47	28 08:19 (5) 17:31	18:08	19:47	20:22	20:46
21	07:27	07:50 (5) 06:49	05:59	06:03	05:22	05:10
	16:48	28 08:18 (5) 17:32	18:09	19:48	20:23	20:46
22	07:26	07:49 (5) 06:47	05:57	06:01	05:21	05:10
	16:50	30 08:19 (5) 17:33	18:10	19:50	20:24	20:46
23	07:26	07:50 (5) 06:46	05:55	06:00	05:20	05:10
	16:51	30 08:20 (5) 17:35	18:12	19:51	20:25	20:46
24	07:25	07:49 (5) 06:44	05:53	05:58	05:19	05:11
	16:52	30 08:19 (5) 17:36	18:13	19:52	20:26	20:46
25	07:24	07:50 (5) 06:42	05:52	05:56	05:19	05:11
	16:54	40 16:20 (21) 17:38	18:14	19:53	20:27	20:47
26	07:23	07:51 (5) 06:41	05:50	05:55	05:18	05:11
	16:55	44 16:23 (21) 17:39	18:16	19:55	20:28	20:47
27	07:22	07:50 (5) 06:39	05:48	05:53	05:17	05:12
	16:57	46 16:24 (21) 17:40	18:17	19:56	20:29	20:47
28	07:21	07:51 (5) 06:37	05:46	05:52	05:16	05:12
	16:58	48 16:25 (21) 17:42	18:18	19:57	20:30	20:47
29	07:20	07:52 (5)	05:44	05:50	05:16	05:12
	16:59	50 16:28 (21)	18:19	19:58	20:31	20:47
30	07:19	07:53 (5)	05:42	05:49	05:15	05:13
	17:01	50 16:29 (21)	18:21	19:59	20:32	20:47
31	07:18	07:54 (5)	05:40	05:47	05:14	05:13
	17:02	48 16:28 (21)	18:22	05:48	20:33	20:47
Potential sun hours	286	291	369	404	-285	-254
Total, worst case	670	370				350
Sun reduction	0.45	0.45				0.55
Oper. time red.	0.91	0.91				0.91
Wind dir. red.	0.64	0.61				0.64
Total reduction	0.26	0.25				0.32
Total, real	176	92				112

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/22/06 00:15 / 8
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/21/06 09:09/2.4.0.67

SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 174 - 174

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13	20:06 (6)	05:41	06:18	06:53	06:34
	20:47	12 20:18 (6)	20:25	19:35	18:38	15:39 (21)
2	05:14	20:07 (6)	05:42	06:19	06:55	06:35
	20:46	12 20:19 (6)	20:24	19:33	18:36	15:38 (21)
3	05:15	20:07 (6)	05:43	06:20	06:56	06:36
	20:46	10 20:17 (6)	20:22	19:31	18:35	15:37 (21)
4	05:15	20:08 (6)	05:44	06:21	06:57	06:38
	20:46	10 20:18 (6)	20:21	19:29	18:33	15:59 (21)
5	05:16	20:08 (6)	05:46	06:22	06:58	06:39
	20:46	10 20:18 (6)	20:20	19:27	18:31	15:59 (21)
6	05:17	20:09 (6)	05:47	06:23	07:00	06:40
	20:45	8 20:17 (6)	20:18	19:25	18:29	16:00 (21)
7	05:17	20:10 (6)	05:48	06:25	07:01	06:42
	20:45	8 20:18 (6)	20:17	19:24	18:27	16:01 (21)
8	05:18	20:12 (6)	05:49	06:26	07:02	06:43
	20:45	4 20:16 (6)	20:16	19:22	18:25	16:01 (21)
9	05:19	20:13 (6)	05:50	06:27	07:03	06:45
	20:44	4 20:17 (6)	20:14	19:20	18:24	16:00 (21)
10	05:19		05:51	06:28	07:05	06:46
	20:44		20:13	19:18	18:22	16:00 (21)
11	05:20		05:53	06:29	07:06	06:47
	20:43		20:11	19:16	18:20	16:00 (21)
12	05:21		05:54	06:31	07:07	06:49
	20:43		20:10	19:14	18:18	15:59 (21)
13	05:22		05:55	06:32	07:08	06:50
	20:42		20:08	19:12	18:16	15:58 (21)
14	05:23		05:56	06:33	07:10	06:51
	20:42		20:07	19:10	18:15	15:58 (21)
15	05:24		05:57	06:34	07:11	06:53
	20:41		20:05	19:09	18:13	15:57 (21)
16	05:25		05:59	06:35	07:12	06:54
	20:40		20:04	19:07	18:11	15:57 (21)
17	05:25		06:00	06:36	07:13	06:55
	20:40		20:02	19:05	18:09	15:54 (21)
18	05:26		06:01	06:38	07:15	06:57
	20:39		20:00	19:03	18:08	15:53 (5)
19	05:27		06:02	06:39	07:16	06:58
	20:38		19:57	19:01	18:06	15:53 (5)
20	05:28		06:03	06:40	07:17	06:59
	20:37		19:56	18:59	18:04	15:54 (5)
21	05:29		06:04	06:41	07:19	07:01
	20:36		19:54	18:57	18:03	15:54 (5)
22	05:30		06:06	06:42	07:20	07:02
	20:35		19:52	18:55	18:01	15:55 (5)
23	05:31		06:07	06:44	07:21	07:03
	20:35		19:50	18:53	17:59	15:54 (5)
24	05:32		06:08	06:45	07:23	07:05
	20:34		19:49	18:51	17:58	15:54 (5)
25	05:33		06:09	06:46	06:24	07:06
	20:33		19:47	18:50	16:56	15:53 (5)
26	05:34		06:10	06:47	06:25	07:07
	20:32		19:45	18:48	16:55	15:53 (5)
27	05:36		06:12	06:48	06:27	07:08
	20:30		19:44	18:46	16:53	15:54 (5)
28	05:37		06:13	06:50	06:28	07:10
	20:29		19:42	18:44	16:52	15:54 (5)
29	05:38		06:14	06:51	06:29	15:46 (21)
	20:28		19:40	18:42	16:50	15:50 (21)
30	05:39		06:15	06:52	06:31	15:44 (21)
	20:27		19:38	18:40	16:49	15:54 (21)
31	05:40		06:16		06:32	15:41 (21)
	20:26		19:36		16:47	15:57 (21)
Potential sun hours	-272	4	376	341	288	275
Total, worst case	78			30	986	36
Sun reduction	0.58			0.45	0.35	0.35
Oper. time red.	0.91			0.91	0.91	0.91
Wind dir. red.	0.64			0.59	0.63	0.66
Total reduction	0.34			0.24	0.20	0.21
Total, real	26			7	198	8

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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US-RIVERSIDE, CA 92506
Calculated:
01/21/06 09:09/2.4.0.67

SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 175 - 175

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:34 16:25	08:53 (5) 09:21 (5)	07:17 17:04	06:35 17:43	05:39 18:23	05:47 20:01	05:14 20:34	05:13 20:46	05:41 20:25	06:18 19:35	06:53 18:38	07:13 16:46
2	07:34 16:26	08:55 (5) 09:21 (5)	07:14 17:05	06:34 17:44	05:37 18:24	05:46 20:01	05:13 20:35	05:14 20:46	05:42 20:23	06:19 19:33	06:55 18:36	07:14 16:44
3	07:34 16:27	08:55 (5) 09:21 (5)	07:14 17:06	06:32 17:46	05:35 18:26	05:44 20:02	05:13 20:36	05:15 20:46	05:43 20:22	06:20 19:31	06:56 18:35	07:15 16:43
4	07:34 16:28	08:57 (5) 09:21 (5)	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	05:12 20:36	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:33	07:16 16:42
5	07:34 16:29	08:59 (5) 09:21 (5)	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:04	05:12 20:37	05:16 20:46	05:46 20:20	06:22 19:27	06:58 18:31	07:18 16:40
6	07:34 16:30	08:58 (5) 09:21 (5)	07:11 17:10	06:27 17:49	06:29 19:29	05:40 20:06	05:11 20:38	05:17 20:48	05:47 20:18	06:23 19:25	07:00 18:29	07:19 16:39
7	07:34 16:31	09:00 (5) 09:18 (5)	07:09 17:12	06:25 17:51	06:27 19:31	05:39 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27	07:20 16:38
8	07:34 16:32	09:02 (5) 09:18 (5)	07:08 17:14	06:23 17:52	06:26 19:32	05:37 20:08	05:11 20:39	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	07:21 16:36
9	07:33 16:33	09:03 (5) 09:15 (5)	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40	05:19 20:44	05:50 20:14	06:27 19:20	07:03 18:24	07:22 16:35
10	07:33 16:35	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
11	07:33 16:36	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
12	07:33 16:37	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
13	07:33 16:38	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
14	07:33 16:39	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
15	07:33 16:40	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
16	07:33 16:41	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
17	07:33 16:42	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
18	07:33 16:43	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
19	07:33 16:44	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
20	07:33 16:45	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
21	07:33 16:46	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
22	07:33 16:47	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
23	07:33 16:48	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
24	07:33 16:49	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
25	07:33 16:50	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
26	07:33 16:51	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
27	07:33 16:52	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
28	07:33 16:53	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
29	07:33 16:54	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
30	07:33 16:55	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
31	07:33 16:56	09:07 (5) 09:15 (5)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	07:22 16:34
Potential sun hours	286	291	369	404	-285	-254	-272	4	376	341	288	275
Total, worst case	200											810
Sun reduction	0.45											0.35
Oper. time red.	0.91											0.91
Wind dir. red.	0.69											0.69
Total reduction	0.28											0.22
Total, real	56											178

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/21/06 09:09/2.4.0.67

SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 178 - 178

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:04	07:39 (8) 07:57 (8)	06:35 17:43	05:38 18:23	05:47 20:01	05:14 20:34	05:13 20:46	05:41 20:25	06:17 19:35	06:53 18:38	06:33 14 07:22 (8)	07:13 16:17
2	07:34 16:26	07:16 17:05	07:37 (8) 07:55 (8)	06:34 17:44	05:37 18:24	05:46 20:01	05:13 20:35	05:14 20:46	05:42 20:23	06:19 19:33	06:55 18:36	06:35 16 07:24 (8)	07:14 16:17
3	07:34 16:27	07:14 17:06	07:36 (8) 07:56 (8)	06:32 17:46	05:35 18:26	05:44 20:02	05:13 20:36	05:15 20:46	05:43 20:22	06:20 19:31	06:56 18:34	06:36 20 07:25 (8)	07:15 16:16
4	07:34 16:28	07:13 17:08	07:35 (8) 07:57 (8)	06:30 17:47	05:33 18:27	05:43 20:03	05:12 20:36	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:33	06:38 20 07:26 (8)	07:16 16:16
5	07:34 16:29	07:12 17:09	07:36 (8) 07:56 (8)	06:28 17:48	06:31 19:28	05:41 20:04	05:12 20:37	05:16 20:46	05:46 20:20	06:22 19:27	06:58 18:31	06:39 22 07:27 (8)	07:17 16:16
6	07:34 16:30	07:11 17:11	07:34 (8) 07:56 (8)	06:27 17:50	06:29 19:29	05:40 20:06	05:11 20:38	05:16 20:45	05:47 20:18	06:23 19:25	06:59 18:29	06:40 22 07:28 (8)	07:19 16:15
7	07:34 16:31	07:09 17:12	07:35 (8) 07:55 (8)	06:25 17:51	06:27 19:31	05:38 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27	06:42 22 07:29 (8)	07:20 16:15
8	07:34 16:32	07:08 17:14	07:36 (8) 07:56 (8)	06:23 17:52	06:26 19:32	05:37 20:08	05:11 20:39	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	06:43 20 07:30 (8)	07:21 16:15
9	07:33 16:33	07:07 17:15	07:38 (8) 07:54 (8)	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40	05:19 20:44	05:50 20:14	06:27 19:20	07:03 18:23	06:44 18 07:31 (8)	07:22 16:15
10	07:33 16:35	07:05 17:16	07:39 (8) 07:53 (8)	06:19 17:55	06:22 19:34	05:35 20:10	05:10 20:41	05:19 20:42	05:51 20:13	06:28 19:18	07:04 18:22	06:46 18 07:32 (8)	07:23 16:15
11	07:33 16:36	07:04 17:18	07:41 (8) 07:51 (8)	06:18 17:56	06:20 19:36	05:33 20:12	05:10 20:41	05:20 20:43	05:53 20:11	06:29 19:16	07:06 18:20	06:47 16 07:33 (8)	07:23 16:15
12	07:32 16:37	07:03 17:19	07:51 (8) 17:58	06:16 17:58	06:18 19:37	05:32 20:13	05:10 20:42	05:21 20:43	05:54 20:10	06:30 19:14	07:07 18:18	06:49 14 07:34 (8)	07:24 16:15
13	07:32 16:38	07:01 17:21	07:52 (8) 17:59	06:14 17:59	06:17 19:38	05:31 20:14	05:10 20:43	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:16	06:50 12 07:35 (8)	07:25 16:15
14	07:32 16:39	07:00 17:22	07:53 (8) 18:03	06:12 18:03	06:15 19:39	05:30 20:15	05:09 20:43	05:23 20:42	05:56 20:07	06:33 19:10	07:10 18:15	06:51 10 07:36 (8)	07:26 16:15
15	07:31 16:40	06:58 17:24	07:54 (8) 18:01	06:10 18:01	06:13 19:41	05:28 20:16	05:09 20:44	05:24 20:41	05:57 20:05	06:34 19:08	07:11 18:13	06:53 8 07:37 (8)	07:27 16:15
16	07:30 16:42	06:57 17:25	07:55 (8) 18:03	06:08 18:03	06:11 19:42	05:27 20:17	05:09 20:44	05:24 20:40	05:58 20:04	06:35 19:07	07:12 18:11	06:54 4 07:38 (8)	07:28 16:16
17	07:30 16:43	06:55 17:26	07:56 (8) 18:04	06:06 18:04	06:10 19:43	05:26 20:19	05:09 20:44	05:25 20:40	06:00 20:02	06:36 19:05	07:13 18:09	06:55 4 07:39 (8)	07:29 16:16
18	07:29 16:44	06:54 17:28	07:57 (8) 18:05	06:05 18:05	06:08 19:44	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:00	06:38 19:03	07:15 18:08	06:57 16 07:40 (8)	07:30 16:16
19	07:29 16:46	06:52 17:29	07:58 (8) 18:07	06:03 18:07	06:06 19:46	05:24 20:21	05:09 20:45	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16 07:41 (8)	07:31 16:17
20	07:28 16:47	06:50 17:31	07:59 (8) 18:08	06:01 18:08	06:05 19:47	05:23 20:22	05:10 20:45	05:28 20:37	06:03 19:55	06:40 18:59	07:17 18:04	06:59 16 07:42 (8)	07:32 16:17
21	07:27 16:48	06:49 17:32	08:00 (8) 18:09	06:00 18:09	06:03 19:48	05:22 20:23	05:10 20:46	05:29 20:36	06:04 19:54	06:41 18:57	07:19 18:03	07:01 16 07:43 (8)	07:33 16:18
22	07:26 16:50	06:47 17:33	08:01 (8) 18:10	05:57 18:10	06:01 19:49	05:21 20:24	05:10 20:46	06:06 20:35	06:06 19:52	06:42 18:55	07:20 18:01	07:02 16 07:44 (8)	07:34 16:18
23	07:26 16:51	06:46 17:35	08:02 (8) 18:12	05:55 18:12	06:00 19:51	05:20 20:25	05:10 20:46	06:07 20:34	06:07 19:50	06:44 18:53	07:21 17:59	07:03 16 07:45 (8)	07:35 16:19
24	07:25 16:52	06:44 17:36	08:03 (8) 18:13	05:53 18:13	05:58 19:52	05:19 20:26	05:11 20:46	06:08 20:33	06:08 19:49	06:45 18:51	07:23 17:58	07:04 16 07:46 (8)	07:36 16:19
25	07:24 16:54	07:46 (8) 07:50 (8)	08:04 (8) 18:14	05:52 18:14	05:56 19:53	05:19 20:27	05:11 20:46	06:09 20:32	06:09 19:47	06:46 18:49	06:24 18:56	07:06 16 07:47 (8)	07:37 16:20
26	07:23 16:55	07:45 (8) 07:49 (8)	08:05 (8) 18:15	05:50 18:15	05:55 19:54	05:18 20:28	05:11 20:47	06:10 20:31	06:10 19:45	06:47 18:48	06:25 16:55	07:07 16 07:48 (8)	07:38 16:20
27	07:22 16:56	07:44 (8) 07:52 (8)	08:06 (8) 18:17	05:48 18:17	05:53 19:56	05:17 20:29	05:12 20:47	06:12 20:30	06:48 19:44	06:27 18:46	06:27 16:53	07:08 16 07:49 (8)	07:39 16:21
28	07:21 16:58	07:43 (8) 07:53 (8)	08:07 (8) 18:18	05:46 18:18	05:52 19:57	05:16 20:30	05:12 20:47	06:13 20:29	06:50 19:42	06:28 18:44	06:28 16:52	07:09 16 07:50 (8)	07:40 16:22
29	07:20 16:59	07:42 (8) 07:54 (8)	08:08 (8) 18:19	05:44 18:19	05:50 19:58	05:16 20:31	05:12 20:47	06:14 20:28	06:51 19:40	06:29 18:42	06:29 16:50	07:11 16 07:51 (8)	07:41 16:23
30	07:19 17:01	07:41 (8) 07:55 (8)	08:09 (8) 18:21	05:42 18:21	05:49 19:59	05:15 20:32	05:13 20:47	06:15 20:27	06:52 19:38	06:31 18:40	06:31 16:49	07:12 16 07:52 (8)	07:42 16:24
31	07:18 17:02	07:40 (8) 07:56 (8)	08:10 (8) 18:22	05:40 18:22	05:40 20:33	05:14 20:33	05:14 20:46	06:16 20:26	06:32 19:36	06:32 16:47	07:11 (8) 07:21 (8)	07:13 16 07:53 (8)	07:43 16:24
Potential sun hours	286	291	369	404	-285	-254	-272	4	376	341	10	288	275
Total, worst case	68	200								10		260	
Sun reduction	0.45	0.45								0.45		0.35	
Oper. time red.	0.91	0.91								0.91		0.91	
Wind dir. red.	0.63	0.63								0.63		0.63	
Total reduction	0.26	0.26								0.26		0.20	
Total, real	18	52								3		52	

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/22/06 00:15 / 11
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US-RIVERSIDE, CA 92506

Calculated:
01/21/06 09:09/2.4.0.67

SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 179 - 179

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:59 (8) 08:09 (8)	07:17 10	08:07 (8) 08:17 (8)	06:35 17:43	05:38 18:23	05:47 20:01	05:14 20:34	05:13 20:46	05:41 20:25	06:17 19:35	06:53 18:38	06:33 16:46
2	07:34 16:26	07:59 (8) 08:09 (8)	07:16 10	07:14 17:05	06:34 17:44	05:37 18:24	05:46 20:01	05:13 20:35	05:13 20:46	05:42 20:23	06:19 19:33	06:54 18:36	06:35 16:44
3	07:34 16:27	07:59 (8) 08:11 (8)	07:14 12	07:14 17:06	06:32 17:46	05:35 18:26	05:44 20:02	05:13 20:36	05:15 20:46	05:43 20:22	06:20 19:31	06:56 18:34	06:36 16:43
4	07:34 16:28	07:59 (8) 08:13 (8)	07:13 14	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	05:12 20:36	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:33	06:38 16:42
5	07:34 16:29	07:59 (8) 08:13 (8)	07:12 14	07:11 17:09	06:28 17:48	05:31 18:28	05:41 20:04	05:12 20:37	05:16 20:46	05:46 20:20	06:22 19:27	06:58 18:31	06:39 16:40
6	07:34 16:30	07:59 (8) 08:14 (8)	07:11 16	07:11 17:11	06:27 17:50	05:29 18:29	05:40 20:06	05:11 20:38	05:17 20:48	05:47 20:18	06:23 19:25	06:59 18:29	06:40 16:39
7	07:34 16:31	07:59 (8) 08:14 (8)	07:11 16	07:09 17:12	06:25 17:51	05:27 18:31	05:38 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27	06:42 16:38
8	07:34 16:32	07:59 (8) 08:16 (8)	07:11 18	07:08 17:14	06:23 17:52	05:26 18:32	05:37 20:08	05:11 20:39	05:18 20:45	05:49 20:15	06:26 19:22	07:02 18:25	06:43 16:36
9	07:33 16:33	07:57 (8) 08:15 (8)	07:07 18	07:07 17:15	06:21 17:54	05:24 18:33	05:36 20:09	05:10 20:40	05:19 20:44	05:50 20:14	06:27 19:20	07:03 18:23	06:44 16:35
10	07:33 16:34	07:57 (8) 08:17 (8)	07:05 20	07:05 17:16	06:19 17:55	05:22 19:34	05:34 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:04 18:22	06:46 16:34
11	07:33 16:36	07:57 (8) 08:19 (8)	07:04 22	07:04 17:18	06:18 17:56	05:20 19:36	05:33 20:12	05:10 20:41	05:20 20:43	05:53 20:11	06:29 19:16	07:06 18:20	06:47 16:33
12	07:32 16:37	07:56 (8) 08:18 (8)	07:02 22	07:02 17:19	06:16 17:58	05:18 19:37	05:32 20:13	05:10 20:42	05:21 20:43	05:54 20:10	06:30 19:14	07:07 18:18	06:49 16:32
13	07:32 16:38	07:56 (8) 08:20 (8)	07:01 24	07:01 17:21	06:14 17:59	05:17 19:38	05:31 20:14	05:09 20:43	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:16	06:50 16:31
14	07:32 16:39	07:55 (8) 08:21 (8)	07:00 26	07:00 17:22	06:12 18:00	05:15 19:39	05:30 20:15	05:09 20:43	05:23 20:42	05:56 20:07	06:33 19:10	07:10 18:15	06:51 16:29
15	07:31 16:40	07:54 (8) 08:20 (8)	06:58 26	06:58 17:24	06:10 18:01	05:13 19:41	05:28 20:16	05:09 20:44	05:24 20:41	05:57 20:05	06:34 19:08	07:11 18:13	06:53 16:28
16	07:30 16:42	07:54 (8) 08:22 (8)	06:57 28	06:57 17:25	06:08 18:03	05:11 19:42	05:27 20:17	05:09 20:44	05:24 20:40	05:58 20:04	06:35 19:07	07:12 18:11	06:54 16:27
17	07:30 16:43	07:53 (8) 08:21 (8)	06:55 28	06:55 17:26	06:06 18:04	05:10 19:43	05:26 20:19	05:09 20:44	05:25 20:39	06:00 20:02	06:36 19:05	07:13 18:09	06:55 16:26
18	07:29 16:44	07:54 (8) 08:22 (8)	06:54 28	06:54 17:28	06:05 18:05	05:08 19:44	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:00	06:38 19:03	07:15 18:08	06:57 16:26
19	07:29 16:46	07:54 (8) 08:22 (8)	06:52 28	06:52 17:29	06:03 18:07	05:06 19:46	05:24 20:21	05:09 20:45	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:25
20	07:28 16:47	07:55 (8) 08:23 (8)	06:50 28	06:50 17:31	06:01 18:08	05:05 19:47	05:23 20:22	05:10 20:45	05:28 20:37	06:03 19:55	06:40 18:59	07:17 18:04	06:59 16:24
21	07:27 16:48	07:56 (8) 08:24 (8)	06:49 28	06:49 17:32	05:59 18:09	05:03 19:48	05:22 20:23	05:10 20:46	05:29 20:36	06:04 19:54	06:41 18:57	07:19 18:03	07:01 16:23
22	07:26 16:50	07:55 (8) 08:23 (8)	06:47 28	06:47 17:33	05:57 18:10	05:01 19:49	05:21 20:24	05:10 20:46	05:30 20:35	06:06 19:52	06:42 18:55	07:20 18:01	07:02 16:22
23	07:26 16:51	07:56 (8) 08:24 (8)	06:45 28	06:45 17:35	05:55 18:12	05:00 19:51	05:20 20:25	05:10 20:46	05:31 20:34	06:07 19:50	06:44 18:53	07:21 17:59	07:03 16:21
24	07:25 16:52	07:56 (8) 08:23 (8)	06:44 26	06:44 17:36	05:53 18:13	05:05 19:52	05:19 20:26	05:10 20:46	05:32 20:33	06:08 19:49	06:45 18:51	07:23 17:58	07:04 16:21
25	07:24 16:54	07:56 (8) 08:22 (8)	06:42 26	06:42 17:37	05:52 18:14	05:06 19:53	05:19 20:27	05:11 20:46	05:33 20:32	06:09 19:47	06:46 18:49	07:24 18:56	07:06 16:20
26	07:23 16:55	07:57 (8) 08:23 (8)	06:40 26	06:40 17:39	05:50 18:15	05:05 19:54	05:18 20:28	05:11 20:47	05:34 20:31	06:10 19:45	06:47 18:48	07:07 18:55	07:07 16:19
27	07:22 16:56	07:58 (8) 08:22 (8)	06:39 24	06:39 17:40	05:48 18:17	05:03 19:56	05:17 20:29	05:12 20:47	05:35 20:30	06:12 19:43	06:48 18:46	07:08 18:53	07:08 16:19
28	07:21 16:58	07:59 (8) 08:21 (8)	06:37 22	06:37 17:42	05:46 18:18	05:02 19:57	05:16 20:30	05:12 20:47	05:37 20:29	06:13 19:42	06:50 18:44	07:09 18:52	07:09 16:18
29	07:20 16:59	08:00 (8) 08:22 (8)	06:36 22	06:36 17:42	05:44 18:19	05:00 19:58	05:16 20:31	05:12 20:47	05:38 20:28	06:14 19:40	06:51 18:42	07:11 18:50	07:11 16:18
30	07:19 17:01	08:03 (8) 08:21 (8)	06:34 18	06:34 17:42	05:42 18:21	05:08 19:59	05:15 20:32	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	07:12 18:49	07:12 16:17
31	07:18 17:02	08:04 (8) 08:18 (8)	06:33 14	06:33 17:42	05:40 18:22	05:07 19:59	05:14 20:33	05:13 20:47	05:40 20:26	06:16 19:36	06:32 18:47	07:13 18:49	07:13 16:24
Potential sun hours	286	291	369	404	-285	-254	-272	4	376	341	288	275	
Total, worst case	670	10									510	276	
Sun reduction	0.45	0.45									0.35	0.35	
Oper. time red.	0.91	0.91									0.91	0.91	
Wind dir. red.	0.66	0.66									0.66	0.66	
Total reduction	0.27	0.27									0.21	0.21	
Total, real	181	3									107	58	

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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: 060119 Marble River

Description: Marble River Wind Project Shadow-Flicker, SW part 21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)

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Calculated: 01/21/06 09:09/2.4.0.67

SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 180 - 180

Assumptions for shadow calculations

Maximum distance for influence 1,000 m Minimum sun height over horizon for influence 3 ° Day step for calculation 1 days Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time N NE E SE S SW W NW Sum 1,850 1,325 800 713 625 663 700 1,275 7,950

Table with columns for months (January to December) and rows for time intervals (e.g., 07:34, 16:25) and summary statistics (Potential sun hours, Total, worst case, Sun reduction, etc.).

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: 060119 Marble River	Description: Marble River Wind Project Shadow-Flicker, SW part 21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)	Printed/Page: 01/22/06 00:15 / 13 Licensed user: Wind Engineers, Inc. 7660 Whitegate Avenue US-RIVERSIDE, CA 92506 Calculated: 01/21/06 09:09/2.4.0.67
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SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 181 - 181

Assumptions for shadow calculations

Maximum distance for influence	1,000 m	Sun shine probabilities (part of time from sun rise to sun set with sun shine)													
Minimum sun height over horizon for influence	3 °	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Day step for calculation	1 days	0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35		
Time step for calculation	2 minutes	Operational time													
		N	NE	E	SE	S	SW	W	NW	Sum					
		1,850	1,325	800	713	625	663	700	1,275	7,950					

	January	February	March	April	May	June	July	August	September	October	November	December		
1	07:34 16:25	07:59 (7) 08:47 (8)	07:17 17:04	06:35 17:43	05:38 18:23	05:47 20:01	05:14 20:34	05:13 20:46	05:41 20:25	06:17 19:35	06:53 18:38	06:33 16:46	07:13 16:17	07:41 (7) 08:31 (8)
2	07:34 16:26	07:59 (7) 08:47 (8)	07:16 17:05	06:34 17:44	05:37 18:24	05:46 20:01	05:13 20:35	05:14 20:46	05:42 20:23	06:19 19:33	06:54 18:36	06:35 16:44	07:14 16:16	07:40 (7) 08:32 (8)
3	07:34 16:27	07:59 (7) 08:47 (8)	07:14 17:06	06:32 17:46	05:35 18:26	05:44 20:02	05:13 20:36	05:15 20:46	05:43 20:22	06:20 19:31	06:56 18:34	06:36 16:43	07:15 16:16	07:41 (7) 08:33 (8)
4	07:34 16:28	07:59 (7) 08:47 (8)	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	05:12 20:36	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:33	06:38 16:42	07:16 16:16	07:42 (7) 08:32 (8)
5	07:34 16:29	07:59 (7) 08:49 (8)	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:04	05:12 20:37	05:16 20:46	05:46 20:20	06:22 19:27	06:58 18:31	06:39 16:40	07:17 16:16	07:43 (7) 08:33 (8)
6	07:34 16:30	07:58 (7) 08:48 (8)	07:11 17:11	06:27 17:50	06:29 19:29	05:40 20:06	05:11 20:38	05:16 20:48	05:47 20:18	06:23 19:25	06:59 18:29	06:40 16:39	07:19 16:15	07:44 (7) 08:34 (8)
7	07:34 16:31	07:58 (7) 08:48 (8)	07:09 17:12	06:25 17:51	06:27 19:31	05:38 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27	06:42 16:38	07:20 16:15	07:45 (7) 08:35 (8)
8	07:34 16:32	07:58 (7) 08:48 (8)	07:08 17:14	06:23 17:52	06:26 19:32	05:37 20:08	05:11 20:39	05:15 20:45	05:49 20:15	06:26 19:22	07:02 18:25	06:43 16:36	07:21 16:15	07:46 (7) 08:34 (8)
9	07:33 16:33	07:57 (7) 08:49 (8)	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40	05:19 20:44	05:50 20:14	06:27 19:20	07:03 18:23	06:44 16:35	07:21 16:15	07:47 (7) 08:35 (8)
10	07:33 16:34	07:57 (7) 08:49 (8)	07:05 17:16	06:19 17:55	06:22 19:34	05:34 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:04 18:22	06:46 16:34	07:22 16:15	07:48 (7) 08:36 (8)
11	07:33 16:35	07:59 (7) 08:49 (8)	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:10 20:41	05:20 20:43	05:53 20:11	06:29 19:16	07:06 18:20	06:47 16:33	07:23 16:15	07:49 (7) 08:37 (8)
12	07:32 16:36	08:00 (7) 08:48 (8)	07:02 17:19	06:16 17:58	06:18 19:37	05:32 20:13	05:10 20:42	05:21 20:43	05:54 20:10	06:30 19:14	07:07 18:18	06:49 16:32	07:24 16:15	07:50 (7) 08:38 (8)
13	07:32 16:37	08:00 (7) 08:50 (8)	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	05:09 20:43	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:16	06:50 16:31	07:25 16:15	07:51 (7) 08:37 (8)
14	07:32 16:38	08:01 (7) 08:49 (8)	07:00 17:22	06:12 18:00	06:15 19:39	05:30 20:15	05:09 20:43	05:23 20:42	05:56 20:07	06:33 19:10	07:10 18:15	06:51 16:29	07:26 16:15	07:52 (7) 08:38 (8)
15	07:31 16:40	08:02 (7) 08:48 (8)	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:16	05:09 20:44	05:24 20:41	05:57 20:05	06:34 19:08	07:11 18:13	06:53 16:28	07:27 16:15	07:53 (7) 08:39 (8)
16	07:30 16:42	08:04 (7) 08:48 (8)	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:17	05:09 20:44	05:24 20:40	05:58 20:04	06:35 19:07	07:12 18:11	06:54 16:27	07:27 16:16	07:53 (7) 08:39 (8)
17	07:30 16:43	08:03 (7) 08:47 (8)	06:55 17:26	06:06 18:04	06:10 19:43	05:26 20:19	05:09 20:44	05:25 20:39	06:00 20:02	06:36 19:05	07:13 18:09	06:55 16:26	07:28 16:16	07:54 (7) 08:40 (8)
18	07:29 16:44	08:06 (7) 08:46 (8)	06:54 17:28	06:05 18:05	06:08 19:44	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:00	06:38 19:03	07:15 18:08	06:57 16:26	07:29 16:16	07:55 (7) 08:41 (8)
19	07:29 16:45	08:08 (7) 08:48 (8)	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:09 20:45	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:25	07:29 16:15	07:55 (7) 08:41 (8)
20	07:28 16:46	08:11 (7) 08:47 (8)	06:50 17:31	06:01 18:08	06:05 19:47	05:23 20:22	05:10 20:45	05:28 20:37	06:03 19:55	06:40 18:59	07:17 18:04	06:59 16:24	07:30 16:16	07:56 (7) 08:42 (8)
21	07:27 16:48	08:26 (8) 08:44 (8)	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46	05:29 20:36	06:04 19:54	06:41 18:57	07:19 18:03	07:01 16:23	07:31 16:18	07:56 (7) 08:40 (8)
22	07:26 16:50	08:27 (8) 08:43 (8)	06:47 17:33	05:57 18:10	06:01 19:49	05:21 20:24	05:10 20:46	05:30 20:35	06:06 19:52	06:42 18:55	07:20 18:01	07:02 16:22	07:32 16:18	07:57 (7) 08:41 (8)
23	07:26 16:51	08:30 (8) 08:40 (8)	06:45 17:35	05:55 18:12	06:00 19:51	05:20 20:25	05:10 20:46	05:31 20:34	06:07 19:50	06:44 18:53	07:21 17:59	07:03 16:21	07:32 16:19	07:57 (7) 08:43 (8)
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:26	05:10 20:46	05:10 20:46	05:32 20:33	06:08 19:49	06:45 18:51	07:23 17:58	07:04 16:21	07:32 16:19	07:58 (7) 08:44 (8)
25	07:24 16:54	06:42 17:37	05:51 18:14	05:56 19:53	05:19 20:27	05:11 20:46	05:11 20:46	05:33 20:32	06:09 19:47	06:46 18:49	06:24 18:56	07:06 16:20	07:32 16:20	07:58 (7) 08:44 (8)
26	07:23 16:55	06:40 17:39	05:50 18:15	05:55 19:54	05:18 20:28	05:11 20:47	05:11 20:47	05:34 20:31	06:10 19:45	06:47 18:48	06:25 16:55	07:07 16:19	07:33 16:20	07:58 (7) 08:44 (8)
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	05:12 20:47	05:12 20:47	05:35 20:30	06:11 19:43	06:48 18:46	06:27 16:53	07:08 16:19	07:33 16:21	07:57 (7) 08:44 (8)
28	07:21 16:58	06:37 17:42	05:46 18:18	05:52 19:57	05:16 20:30	05:12 20:47	05:12 20:47	05:37 20:29	06:13 19:42	06:50 18:44	06:28 16:52	07:09 16:18	07:33 16:22	07:59 (7) 08:45 (8)
29	07:20 16:59	06:37 17:42	05:44 18:19	05:50 19:58	05:16 20:31	05:12 20:47	05:12 20:47	05:38 20:28	06:14 19:40	06:51 18:42	06:29 16:50	07:11 16:18	07:34 16:23	07:59 (7) 08:45 (8)
30	07:19 17:01	06:37 17:42	05:42 18:21	05:48 19:59	05:15 20:32	05:13 20:47	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	06:31 16:49	07:12 16:17	07:34 16:23	07:59 (7) 08:45 (8)
31	07:18 17:02	06:37 17:42	05:40 18:22	05:46 19:59	05:14 20:33	05:14 20:47	05:14 20:47	05:40 20:26	06:16 19:36	06:32 16:47	07:13 16:18	07:13 16:24	07:34 16:24	07:59 (7) 08:45 (8)
Potential sun hours	286	291	369	404	285	254	272	4	376	341	288	275		
Total, worst case	972										426		1462	
Sun reduction	0.45										0.35		0.35	
Oper. time red.	0.91										0.91		0.91	
Wind dir. red.	0.68										0.68		0.68	
Total reduction	0.28										0.22		0.22	
Total, real	269										92		315	

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:

060119 Marble River

Description:

Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/22/06 00:15 / 14

Licensed user:

Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:

01/21/06 09:09/2.4.0.67

SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 183 - 183

Assumptions for shadow calculations

Maximum distance for influence
Minimum sun height over horizon for influence
Day step for calculation
Time step for calculation

1,000 m
3 °
1 days
2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Table with columns for months (January to December) and rows for time intervals (07:34 to 17:02). Includes summary rows for Potential sun hours, Total, worst case, Sun reduction, Oper. time red., Wind dir. red., Total reduction, and 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) First time (hh:mm) with flicker Last time (hh:mm) with flicker (WTG causing flicker first time) (WTG causing flicker last time)

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, SW part
 21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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01/22/06 00:15 / 15

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Wind Engineers, Inc.
 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated:

01/21/06 09:09/2.4.0.67

SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 209 - 209

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December			
1	07:34	15:21 (21)	07:17	15:37 (21)	06:35	05:39	05:47	05:14	05:41	06:18	06:53	06:34	06:57 (5)	07:13	15:05 (21)
2	07:34	15:21 (21)	07:16	15:40 (21)	06:34	05:37	05:46	05:13	05:44	06:19	06:55	06:35	06:58 (5)	07:14	15:06 (21)
3	07:34	15:21 (21)	07:14	15:42 (21)	06:32	05:35	05:44	05:13	05:43	06:20	06:56	06:36	06:59 (5)	07:15	15:07 (21)
4	07:34	15:23 (21)	07:13	15:44 (21)	06:30	05:33	05:43	05:12	05:45	06:21	06:57	06:38	07:01 (5)	07:16	15:06 (21)
5	07:34	15:23 (21)	07:12	15:46 (21)	06:28	05:31	05:41	05:12	05:46	06:22	06:58	06:39	07:02 (5)	07:18	15:07 (21)
6	07:34	15:20 (21)	07:11	15:48 (21)	06:27	05:30	05:40	05:11	05:47	06:23	07:00	06:40	07:04 (5)	07:19	15:08 (21)
7	07:34	15:20 (21)	07:10	15:50 (21)	06:25	05:28	05:38	05:10	05:48	06:24	07:01	06:42	07:05 (5)	07:20	15:09 (21)
8	07:34	15:22 (21)	07:08	15:52 (21)	06:23	05:26	05:36	05:09	05:49	06:25	07:02	06:43	07:07 (5)	07:21	15:10 (21)
9	07:33	15:21 (21)	07:07	15:54 (21)	06:21	05:24	05:34	05:08	05:50	06:27	07:03	06:45	07:11 (5)	07:22	15:11 (21)
10	07:33	15:23 (21)	07:05	15:56 (21)	06:19	05:22	05:32	05:07	05:51	06:28	07:05	06:46	07:13 (5)	07:23	15:12 (21)
11	07:33	15:25 (21)	07:03	15:58 (21)	06:17	05:20	05:30	05:06	05:53	06:29	07:06	06:47	07:15 (5)	07:24	15:13 (21)
12	07:32	15:23 (21)	07:03	16:00 (21)	06:15	05:18	05:28	05:05	05:54	06:30	07:07	06:49	07:17 (5)	07:25	15:14 (21)
13	07:32	15:24 (21)	07:01	16:02 (21)	06:13	05:16	05:26	05:04	05:55	06:32	07:08	06:50	07:19 (5)	07:26	15:15 (21)
14	07:32	15:24 (21)	07:00	16:04 (21)	06:11	05:14	05:24	05:03	05:56	06:33	07:10	06:51	07:21 (5)	07:27	15:16 (21)
15	07:31	15:25 (21)	06:58	16:06 (21)	06:09	05:12	05:22	05:02	05:57	06:34	07:11	06:53	07:23 (5)	07:28	15:17 (21)
16	07:31	15:27 (21)	06:56	16:08 (21)	06:07	05:10	05:20	05:01	05:59	06:35	07:12	06:54	07:25 (5)	07:29	15:18 (21)
17	07:30	15:28 (21)	06:55	16:10 (21)	06:05	05:08	05:18	05:00	06:00	06:36	07:14	06:55	07:27 (5)	07:30	15:19 (21)
18	07:29	15:29 (21)	06:54	16:12 (21)	06:03	05:06	05:16	05:00	06:01	06:37	07:15	06:57	07:29 (5)	07:31	15:20 (21)
19	07:29	15:30 (21)	06:52	16:14 (21)	06:01	05:04	05:14	05:00	06:02	06:38	07:16	06:58	07:31 (5)	07:32	15:21 (21)
20	07:28	15:31 (21)	06:50	16:16 (21)	05:59	05:02	05:12	05:00	06:03	06:40	07:17	06:59	07:33 (5)	07:33	15:22 (21)
21	07:27	15:32 (21)	06:49	16:18 (21)	05:57	05:00	05:10	05:00	06:04	06:41	07:19	07:01	07:35 (5)	07:34	15:23 (21)
22	07:26	15:33 (21)	06:47	16:20 (21)	05:55	04:58	05:08	05:00	06:05	06:42	07:20	07:02	07:37 (5)	07:35	15:24 (21)
23	07:26	15:34 (21)	06:46	16:22 (21)	05:53	04:56	05:06	05:00	06:06	06:43	07:21	07:03	07:39 (5)	07:36	15:25 (21)
24	07:25	15:35 (21)	06:44	16:24 (21)	05:51	04:54	05:04	05:00	06:07	06:44	07:22	07:04	07:41 (5)	07:37	15:26 (21)
25	07:24	15:36 (21)	06:42	16:26 (21)	05:49	04:52	05:02	05:00	06:08	06:45	07:23	07:05	07:43 (5)	07:38	15:27 (21)
26	07:23	15:37 (21)	06:41	16:28 (21)	05:47	04:50	05:00	05:00	06:09	06:46	07:24	07:06	07:45 (5)	07:39	15:28 (21)
27	07:22	15:38 (21)	06:39	16:30 (21)	05:45	04:48	04:58	05:00	06:10	06:47	07:25	07:07	07:47 (5)	07:40	15:29 (21)
28	07:21	15:39 (21)	06:37	16:32 (21)	05:43	04:46	04:56	05:00	06:11	06:48	07:26	07:08	07:49 (5)	07:41	15:30 (21)
29	07:20	15:40 (21)	06:35	16:34 (21)	05:41	04:44	04:54	05:00	06:12	06:49	07:27	07:09	07:51 (5)	07:42	15:31 (21)
30	07:19	15:41 (21)	06:33	16:36 (21)	05:39	04:42	04:52	05:00	06:13	06:50	07:28	07:10	07:53 (5)	07:43	15:32 (21)
31	07:18	15:42 (21)	06:31	16:38 (21)	05:37	04:40	04:50	05:00	06:14	06:51	07:29	07:11	07:55 (5)	07:44	15:33 (21)
Potential sun hours	286	291	369	404	425	454	479	499	514	524	528	524	511	484	452
Total, worst case	894	268													
Sun reduction	0.45	0.45													
Oper. time red.	0.91	0.91													
Wind dir. red.	0.61	0.61													
Total reduction	0.25	0.25													
Total, real	224	67													

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)

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/21/06 09:09/2.4.0.67

SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 211 - 211

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:04	06:35 17:43	05:39 18:23	05:47 20:00	05:14 20:34	05:14 20:47	05:41 20:25	06:18 19:35	06:53 18:38	06:34 16:46	07:13 16:17	
2	07:34 16:26	07:16 17:05	06:34 17:44	05:37 18:24	05:46 20:01	05:13 20:35	05:13 20:46	05:42 20:24	06:19 19:33	06:55 18:36	06:35 16:44	07:14 16:17	
3	07:34 16:27	07:14 17:06	06:32 17:46	05:35 18:26	05:44 20:02	05:13 20:36	05:15 20:46	05:43 20:22	06:20 19:31	06:56 18:35	06:36 16:43	07:15 16:16	
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	05:12 20:37	05:15 20:46	05:45 20:21	06:21 19:29	06:57 18:33	06:38 16:42	07:16 16:16	
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:04	05:12 20:37	05:16 20:46	05:46 20:20	06:22 19:27	06:58 18:31	06:39 16:40	07:18 16:16	
6	07:34 16:30	07:11 17:11	06:27 17:50	06:29 19:29	05:40 20:06	05:11 20:38	05:17 20:45	05:47 20:18	06:23 19:25	07:00 18:29	06:40 16:39	07:19 16:16	
7	07:34 16:31	07:09 17:12	06:25 17:51	06:28 19:31	05:39 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27	06:42 16:38	07:20 16:15	
8	07:34 16:32	07:08 17:14	06:23 17:52	06:26 19:32	05:37 20:08	05:11 20:40	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	06:43 16:36	07:21 16:15	
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40	05:19 20:44	05:50 20:14	06:27 19:20	07:03 18:24	06:45 16:35	07:22 16:15	
10	07:33 16:35	07:05 17:17	06:19 17:55	06:22 19:34	05:35 20:11	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	06:46 16:34	07:23 16:15	
11	07:33 16:36	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:10 20:41	05:20 20:43	05:53 20:11	06:29 19:16	07:06 18:20	06:47 16:33	07:23 16:15	
12	07:33 16:37	07:03 17:19	06:16 17:58	06:19 19:37	05:32 20:13	05:10 20:42	05:21 20:43	05:54 20:10	06:31 19:14	07:07 18:18	06:49 16:32	07:24 16:15	
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	05:10 20:43	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:16	06:50 16:31	07:25 16:15	
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:39	05:30 20:15	05:10 20:43	05:23 20:42	05:56 20:07	06:33 19:10	07:10 18:15	06:51 16:30	07:26 16:15	13:34 (21)
15	07:31 16:41	06:58 17:24	06:10 18:02	06:13 19:41	05:29 20:16	05:09 20:44	05:24 20:41	05:57 20:05	06:34 19:09	07:11 18:13	06:53 16:29	07:27 16:16	10 13:33 (21)
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	05:09 20:44	05:25 20:40	05:59 20:04	06:35 19:07	07:12 18:11	06:54 16:28	07:28 16:16	12 13:33 (21)
17	07:30 16:43	06:55 17:26	06:07 18:04	06:10 19:43	05:26 20:19	05:09 20:44	05:25 20:40	06:00 20:02	06:36 19:05	07:14 18:09	06:55 16:27	07:28 16:16	14 13:32 (21)
18	07:29 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:00	06:38 19:03	07:15 18:08	06:57 16:26	07:29 16:16	14 13:33 (21)
19	07:29 16:46	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:10 20:45	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:25	07:30 16:17	16 13:31 (21)
20	07:28 16:47	06:50 17:31	06:01 18:08	06:05 19:47	05:23 20:22	05:10 20:46	05:28 20:37	06:03 19:56	06:40 18:59	07:17 18:04	06:59 16:24	07:30 16:17	16 13:32 (21)
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46	05:29 20:36	06:04 19:54	06:41 18:57	07:19 18:03	07:01 16:23	07:31 16:18	16 13:32 (21)
22	07:26 16:50	06:47 17:33	05:57 18:10	06:01 19:50	05:21 20:24	05:10 20:46	05:30 20:35	06:06 19:52	06:42 18:55	07:20 18:01	07:02 16:22	07:31 16:18	16 13:33 (21)
23	07:26 16:51	06:46 17:35	05:55 18:12	06:00 19:51	05:20 20:25	05:10 20:46	05:31 20:35	06:07 19:51	06:44 18:53	07:21 17:59	07:03 16:22	07:32 16:19	16 13:33 (21)
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:26	05:11 20:46	05:32 20:34	06:08 19:49	06:45 18:51	07:23 17:58	07:05 16:21	07:32 16:19	16 13:34 (21)
25	07:24 16:54	06:42 17:38	05:52 18:14	05:56 19:53	05:19 20:27	05:11 20:47	05:33 20:33	06:09 19:47	06:46 18:50	06:24 17:56	07:06 16:20	07:33 16:16	16 13:34 (21)
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	05:18 20:28	05:11 20:47	05:35 20:32	06:10 19:45	06:47 18:48	06:25 17:55	07:07 16:20	07:33 16:16	14 13:36 (21)
27	07:22 16:57	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	05:12 20:47	05:36 20:30	06:12 19:44	06:48 18:46	06:27 16:53	07:08 16:19	07:33 16:21	14 13:37 (21)
28	07:21 16:58	06:37 17:42	05:46 18:18	05:52 19:57	05:16 20:30	05:12 20:47	05:37 20:29	06:13 19:42	06:50 18:44	06:28 16:52	07:10 16:18	07:34 16:22	12 13:39 (21)
29	07:20 16:59		05:44 18:19	05:50 19:58	05:16 20:31	05:13 20:47	05:38 20:28	06:14 19:40	06:51 18:42	06:29 16:50	07:11 16:18	07:34 16:23	8 13:41 (21)
30	07:19 17:01		05:42 18:21	05:49 20:00	05:15 20:32	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	06:31 16:49	07:12 16:17	07:34 16:23	4 13:43 (21)
31	07:18 17:02		05:40 18:22		05:14 20:33		05:40 20:26	06:16 19:36		06:32 16:47		07:34 16:24	
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	275	
Total, worst case												222	
Sun reduction												0.35	
Oper. time red.												0.91	
Wind dir. red.												0.60	
Total reduction												0.19	
Total, real												43	

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/22/06 00:15 / 17
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/21/06 09:09/2.4.0.67

SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 212 - 212

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes
Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:34 16:25	07:17 17:04	06:35 17:43	05:39 18:23	05:47 20:00	05:14 20:34	05:14 20:47	05:41 20:25	06:18 19:35	06:53 18:38	06:34 16:46	07:13 16:17
2	07:34 16:26	07:16 17:05	06:34 17:44	05:37 18:24	05:46 20:01	05:13 20:35	05:13 20:46	05:42 20:24	06:19 19:33	06:55 18:36	06:35 16:44	07:14 16:17
3	07:34 16:27	07:14 17:07	06:32 17:46	05:35 18:26	05:44 20:02	05:13 20:36	05:15 20:46	05:43 20:22	06:20 19:31	06:56 18:35	06:36 16:43	07:15 16:16
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	05:12 20:37	05:15 20:46	05:45 20:21	06:21 19:29	06:57 18:33	06:38 16:42	07:16 16:16
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:04	05:12 20:37	05:16 20:46	05:46 20:20	06:22 19:27	06:58 18:31	06:39 16:40	07:18 16:16
6	07:34 16:30	07:11 17:11	06:27 17:50	06:29 19:29	05:40 20:06	05:11 20:38	05:17 20:45	05:47 20:18	06:23 19:26	07:00 18:29	06:40 16:39	07:19 16:16
7	07:34 16:31	07:09 17:12	06:25 17:51	06:28 19:31	05:39 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27	06:42 16:38	07:20 16:15
8	07:34 16:32	07:08 17:14	06:23 17:52	06:26 19:32	05:37 20:08	05:11 20:40	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	06:43 16:36	07:21 16:15
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40	05:19 20:44	05:50 20:14	06:27 19:20	07:03 18:24	06:45 16:35	07:22 16:15
10	07:33 16:35	07:05 17:17	06:19 17:55	06:22 19:34	05:35 20:11	05:10 20:41	05:19 20:44	05:52 20:13	06:28 19:18	07:05 18:22	06:46 16:34	07:23 16:15
11	07:33 16:36	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:10 20:41	05:20 20:43	05:53 20:11	06:29 19:16	07:06 18:20	06:47 16:33	07:23 16:15
12	07:33 16:37	07:03 17:19	06:16 17:58	06:19 19:37	05:32 20:13	05:10 20:42	05:21 20:43	05:54 20:10	06:31 19:14	07:07 18:18	06:49 16:32	07:24 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	05:10 20:43	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:16	06:50 16:31	07:25 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	05:30 20:15	05:10 20:43	05:23 20:42	05:56 20:07	06:33 19:10	07:10 18:15	06:51 16:30	07:26 16:15
15	07:31 16:41	06:58 17:24	06:10 18:02	06:13 19:41	05:29 20:16	05:09 20:44	05:24 20:41	05:57 20:05	06:34 19:09	07:11 18:13	06:53 16:29	07:27 16:16
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	05:09 20:44	05:25 20:40	05:59 20:04	06:35 19:07	07:12 18:11	06:54 16:28	07:28 16:16
17	07:30 16:43	06:55 17:26	06:07 18:04	06:10 19:43	05:26 20:19	05:09 20:45	05:26 20:40	06:00 20:02	06:37 19:05	07:14 18:09	06:55 16:27	07:28 16:16
18	07:29 16:44	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	05:10 20:45	05:26 20:39	06:01 20:00	06:38 19:03	07:15 18:08	06:57 16:26	07:29 16:16
19	07:29 16:46	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:10 20:45	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:25	07:30 16:17
20	07:28 16:47	06:50 17:31	06:01 18:08	06:05 19:47	05:23 20:22	05:10 20:46	05:28 20:37	06:03 19:56	06:40 18:59	07:17 18:04	06:59 16:24	07:30 16:17
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46	05:29 20:36	06:04 19:54	06:41 18:57	07:19 18:03	07:01 16:23	07:31 16:18
22	07:26 16:50	06:47 17:33	05:57 18:11	06:01 19:50	05:21 20:24	05:10 20:46	05:30 20:35	06:06 19:52	06:42 18:55	07:20 18:01	07:02 16:22	07:31 16:18
23	07:26 16:51	06:46 17:35	05:55 18:12	06:00 19:51	05:20 20:25	05:10 20:46	05:31 20:35	06:07 19:51	06:44 18:53	07:21 18:00	07:03 16:22	07:32 16:19
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:20 20:26	05:11 20:46	05:32 20:34	06:08 19:49	06:45 18:51	07:23 17:58	07:05 16:21	07:32 16:19
25	07:24 16:54	06:42 17:38	05:52 18:14	05:56 19:53	05:19 20:27	05:11 20:47	05:33 20:33	06:09 19:47	06:46 18:50	06:24 18:56	07:06 16:20	07:33 16:20
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	05:18 20:28	05:11 20:47	05:35 20:32	06:10 19:45	06:47 18:48	06:25 18:55	07:07 16:20	07:33 16:20
27	07:22 16:57	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	05:12 20:47	05:36 20:31	06:12 19:44	06:49 18:46	06:27 16:53	07:08 16:19	07:33 16:21
28	07:21 16:58	06:37 17:42	05:46 18:18	05:52 19:57	05:16 20:30	05:12 20:47	05:37 20:29	06:13 19:42	06:50 18:44	06:28 16:52	07:10 16:18	07:34 16:22
29	07:20 16:59		05:44 18:19	05:50 19:58	05:16 20:31	05:13 20:47	05:38 20:28	06:14 19:40	06:51 18:42	06:30 16:50	07:11 16:18	07:34 16:23
30	07:19 17:01		05:42 18:21	05:49 20:00	05:15 20:32	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	06:31 16:49	07:12 16:17	07:34 16:23
31	07:18 17:02		05:40 18:22		05:14 20:33		05:40 20:26	06:16 19:36		06:32 16:47		07:34 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	275
Total, worst case												32
Sun reduction												0.35
Oper. time red.												0.91
Wind dir. red.												0.68
Total reduction												0.22
Total, real												7

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)

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/22/06 00:15 / 18
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/21/06 09:09/2.4.0.67

SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 214 - 214

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes
Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1 07:34	08:35 (21)	07:17	06:35	05:39	05:47	05:14	05:14	05:41	06:18	06:53	06:34	07:13
16:25 42	09:17 (21)	17:04	17:43	18:23	20:00	20:34	20:47	20:25	19:35	18:38	16:46	16:17
2 07:34	08:35 (21)	07:16	06:34	05:37	05:46	05:13	05:14	05:42	06:19	06:55	06:35	07:14
16:26 42	09:17 (21)	17:05	17:44	18:24	20:01	20:35	20:46	20:24	19:33	18:36	16:44	16:17
3 07:34	08:35 (21)	07:14	06:32	05:35	05:44	05:13	05:15	05:43	06:20	06:56	06:36	07:15
16:27 44	09:19 (21)	17:07	17:46	18:26	20:02	20:36	20:46	20:22	19:31	18:35	16:43	16:16
4 07:34	08:37 (21)	07:13	06:30	05:33	05:43	05:12	05:15	05:45	06:21	06:57	06:38	07:17
16:28 42	09:19 (21)	17:08	17:47	18:27	20:03	20:37	20:46	20:21	19:29	18:33	16:42	16:16
5 07:34	08:37 (21)	07:12	06:28	06:31	05:41	05:12	05:16	05:46	06:22	06:58	06:39	07:18
16:29 42	09:19 (21)	17:09	17:48	18:28	20:04	20:37	20:46	20:20	19:27	18:31	16:40	16:16
6 07:34	08:36 (21)	07:11	06:27	06:29	05:40	05:11	05:17	05:47	06:24	07:00	06:40	07:19
16:30 42	09:18 (21)	17:11	17:50	18:29	20:06	20:38	20:45	20:18	19:26	18:29	16:39	16:16
7 07:34	08:38 (21)	07:09	06:25	06:28	05:39	05:11	05:17	05:48	06:25	07:01	06:42	07:20
16:31 42	09:20 (21)	17:12	17:51	18:31	20:07	20:39	20:45	20:17	19:24	18:27	16:38	16:15
8 07:34	08:38 (21)	07:08	06:23	06:26	05:37	05:11	05:18	05:49	06:26	07:02	06:43	07:21
16:32 42	09:20 (21)	17:14	17:52	18:32	20:08	20:40	20:45	20:16	19:22	18:25	16:36	16:15
9 07:34	08:40 (21)	07:07	06:21	06:24	05:36	05:10	05:19	05:50	06:27	07:03	06:45	07:22
16:33 40	09:20 (21)	17:15	17:54	18:33	20:09	20:40	20:44	20:14	19:20	18:24	16:35	16:15
10 07:33	08:39 (21)	07:05	06:19	06:22	05:35	05:10	05:20	05:52	06:28	07:05	06:46	07:23
16:35 40	09:19 (21)	17:17	17:55	18:35	20:11	20:41	20:44	20:13	19:18	18:22	16:34	16:15
11 07:33	08:41 (21)	07:04	06:18	06:20	05:33	05:10	05:20	05:53	06:29	07:06	06:47	07:23
16:36 40	09:21 (21)	17:18	17:56	18:36	20:12	20:41	20:43	20:11	19:16	18:20	16:33	16:15
12 07:33	08:40 (21)	07:03	06:16	06:19	05:32	05:10	05:21	05:54	06:31	07:07	06:49	07:24
16:37 40	09:20 (21)	17:19	17:58	18:37	20:13	20:42	20:43	20:10	19:14	18:18	16:32	16:15
13 07:32	08:42 (21)	07:01	06:14	06:17	05:31	05:10	05:22	05:55	06:32	07:08	06:50	07:25
16:38 38	09:20 (21)	17:21	17:59	18:38	20:14	20:43	20:42	20:08	19:12	18:16	16:31	16:15
14 07:32	08:41 (21)	07:00	06:12	06:15	05:30	05:10	05:23	05:56	06:33	07:10	06:51	07:26
16:39 40	09:21 (21)	17:22	18:00	18:40	20:15	20:43	20:42	20:07	19:11	18:15	16:30	16:15
15 07:31	08:43 (21)	06:58	06:10	06:13	05:29	05:09	05:24	05:57	06:34	07:11	06:53	07:27
16:41 38	09:21 (21)	17:24	18:02	18:41	20:16	20:44	20:41	20:05	19:09	18:13	16:29	16:16
16 07:31	08:44 (21)	06:57	06:08	06:11	05:27	05:09	05:25	05:59	06:35	07:12	06:54	07:28
16:42 36	09:20 (21)	17:25	18:03	18:42	20:18	20:44	20:40	20:04	19:07	18:11	16:28	16:16
17 07:30	08:45 (21)	06:55	06:07	06:10	05:26	05:09	05:26	06:00	06:37	07:14	06:55	07:28
16:43 34	09:19 (21)	17:26	18:04	18:43	20:19	20:45	20:40	20:02	19:05	18:09	16:27	16:16
18 07:29	08:45 (21)	06:54	06:05	06:08	05:25	05:10	05:26	06:01	06:38	07:15	06:57	07:29
16:44 34	09:19 (21)	17:28	18:05	18:45	20:20	20:45	20:39	20:01	19:03	18:08	16:26	16:16
19 07:29	08:46 (21)	06:52	06:03	06:06	05:24	05:10	05:27	06:02	06:39	07:16	06:58	07:29
16:46 34	09:20 (21)	17:29	18:07	18:46	20:21	20:45	20:38	19:57	19:01	18:06	16:25	16:17
20 07:28	08:47 (21)	06:50	06:01	06:05	05:23	05:10	05:28	06:03	06:40	07:17	06:59	07:30
16:47 32	09:19 (21)	17:31	18:08	18:47	20:22	20:46	20:37	19:56	18:59	18:04	16:24	16:17
21 07:27	08:48 (21)	06:49	05:59	06:03	05:22	05:10	05:29	06:05	06:41	07:19	07:01	07:31
16:48 30	09:18 (21)	17:32	18:09	18:48	20:23	20:46	20:36	19:54	18:57	18:03	16:23	16:18
22 07:27	08:49 (21)	06:47	05:57	06:01	05:21	05:10	05:30	06:06	06:42	07:20	07:02	07:31
16:50 28	09:17 (21)	17:33	18:11	18:50	20:24	20:46	20:35	19:52	18:55	18:01	16:22	16:18
23 07:26	08:52 (21)	06:46	05:55	06:00	05:20	05:10	05:31	06:07	06:44	07:21	07:03	07:32
16:51 24	09:16 (21)	17:35	18:12	18:51	20:25	20:46	20:35	19:51	18:53	18:00	16:22	16:18
24 07:25	08:53 (21)	06:44	05:54	05:58	05:20	05:11	05:32	06:08	06:45	07:23	07:05	07:32
16:52 20	09:13 (21)	17:36	18:13	18:52	20:26	20:46	20:34	19:49	18:52	17:58	16:21	16:19
25 07:24	08:56 (21)	06:42	05:52	05:56	05:19	05:11	05:33	06:09	06:46	07:24	07:06	07:33
16:54 16	09:12 (21)	17:38	18:14	18:53	20:27	20:47	20:33	19:47	18:50	16:56	16:20	16:20
26 07:23	08:59 (21)	06:41	05:50	05:55	05:18	05:11	05:35	06:10	06:47	07:25	07:07	07:33
16:55 10	09:09 (21)	17:39	18:16	18:55	20:28	20:47	20:32	19:45	18:48	16:55	16:20	16:20
27 07:22		06:39	05:48	05:53	05:17	05:12	05:36	06:12	06:49	07:27	07:08	07:33
16:57		17:40	18:17	18:56	20:29	20:47	20:31	19:44	18:46	16:53	16:19	16:21
28 07:21		06:37	05:46	05:52	05:16	05:12	05:37	06:13	06:50	07:30	07:11	07:34
16:58		17:42	18:18	18:57	20:30	20:47	20:29	19:42	18:44	16:52	16:18	16:22
29 07:20			05:44	05:50	05:16	05:13	05:38	06:14	06:51	07:31	07:12	07:34
16:59			18:19	18:58	20:31	20:47	20:28	19:40	18:42	16:50	16:18	16:23
30 07:19			05:42	05:49	05:15	05:13	05:39	06:15	06:52	07:32	07:13	07:34
17:01			18:21	19:00	20:32	20:47	20:27	19:38	18:40	16:49	16:17	16:23
31 07:18			05:40		05:14		05:40	06:16		06:32		07:34
17:02			18:22		20:33		20:26	19:36		16:47		16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	275
Total, worst case	912										452	1306
Sun reduction	0.45										0.35	0.35
Oper. time red.	0.91										0.91	0.91
Wind dir. red.	0.69										0.69	0.69
Total reduction	0.28										0.22	0.22
Total, real	257										99	286

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)
	Minutes with flicker		

Project: 060119 Marble River

Description: Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page 01/22/06 00:15 / 19
Licensed user: Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated: 01/21/06 09:09/2.4.0.67

SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 224 - 224

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35

Operational time											
N	NE	E	SE	S	SW	W	NW	Sum			
1,850	1,325	800	713	625	663	700	1,275	7,950			

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:04	16:07 (16) 06:36	05:39	05:47	05:14	05:14	05:41	06:18	06:53	17:47 (17)	16:34	15:39 (16) 07:13
2	07:34 16:26	07:16 17:05	16:08 (16) 06:34	05:37	05:46	05:13	05:14	05:42	06:19	06:55	17:46 (17)	16:35	15:38 (16) 07:14
3	07:34 16:27	07:15 17:04	16:06 (16) 06:32	05:35	05:44	05:13	05:15	05:43	06:20	06:56	17:47 (17)	16:36	15:38 (16) 07:15
4	07:34 16:28	07:13 17:03	16:07 (16) 06:30	05:34	05:43	05:12	05:15	05:45	06:21	06:57	17:46 (17)	16:38	15:37 (16) 07:17
5	07:34 16:29	07:12 17:02	16:08 (16) 06:29	05:34	05:41	05:12	05:16	05:46	06:22	06:58	17:46 (17)	16:39	15:37 (16) 07:18
6	07:34 16:30	07:11 17:01	16:06 (16) 06:27	05:32	05:40	05:11	05:17	05:47	06:24	06:59	17:47 (17)	16:40	15:37 (16) 07:19
7	07:34 16:31	07:10 17:00	16:08 (16) 06:25	05:31	05:39	05:11	05:17	05:48	06:25	07:01	17:46 (17)	16:42	15:37 (16) 07:20
8	07:34 16:32	07:08 16:58	16:08 (16) 06:23	05:30	05:37	05:11	05:18	05:49	06:26	07:02	17:47 (17)	16:43	15:37 (16) 07:21
9	07:34 16:33	07:07 16:57	16:08 (16) 06:21	05:29	05:36	05:10	05:19	05:50	06:27	07:03	17:49 (17)	16:45	15:38 (16) 07:22
10	07:33 16:34	07:06 16:56	16:10 (16) 06:19	05:28	05:35	05:10	05:20	05:52	06:28	07:05	17:50 (17)	16:46	15:38 (16) 07:23
11	07:33 16:35	07:04 16:54	16:10 (16) 06:16	05:27	05:34	05:10	05:21	05:53	06:29	07:06	17:50 (17)	16:47	15:39 (16) 07:24
12	07:33 16:36	07:03 16:53	16:10 (16) 06:16	05:26	05:33	05:10	05:21	05:54	06:31	07:07	17:51 (17)	16:48	15:39 (16) 07:25
13	07:32 16:37	07:01 16:51	16:13 (16) 06:14	05:25	05:32	05:10	05:22	05:55	06:32	07:08	17:52 (17)	16:49	15:40 (16) 07:26
14	07:32 16:38	07:00 16:50	16:15 (16) 06:12	05:24	05:31	05:10	05:23	05:56	06:33	07:10	17:53 (17)	16:50	15:40 (16) 07:27
15	07:31 16:39	06:58 16:48	16:15 (16) 06:10	05:23	05:30	05:10	05:24	05:57	06:34	07:11	17:54 (17)	16:51	15:41 (16) 07:28
16	07:31 16:40	06:57 16:47	16:16 (16) 06:09	05:22	05:29	05:10	05:25	05:58	06:35	07:12	17:55 (17)	16:52	15:41 (16) 07:29
17	07:30 16:41	06:55 16:45	16:18 (16) 06:07	05:21	05:28	05:10	05:26	05:59	06:36	07:13	17:56 (17)	16:53	15:42 (16) 07:30
18	07:30 16:42	06:54 16:44	16:20 (16) 06:05	05:20	05:27	05:10	05:27	06:00	06:37	07:14	17:57 (17)	16:54	15:43 (16) 07:31
19	07:29 16:43	06:53 16:43	16:22 (16) 06:03	05:19	05:26	05:10	05:28	06:01	06:38	07:15	17:58 (17)	16:55	15:44 (16) 07:32
20	07:29 16:44	06:52 16:42	16:23 (16) 06:02	05:18	05:25	05:10	05:29	06:02	06:39	07:16	17:59 (17)	16:56	15:45 (16) 07:33
21	07:28 16:45	06:51 16:41	16:24 (16) 06:01	05:17	05:24	05:10	05:30	06:03	06:40	07:18	18:00 (17)	16:57	15:46 (16) 07:34
22	07:27 16:46	06:50 16:40	16:25 (16) 06:00	05:16	05:23	05:10	05:31	06:04	06:41	07:19	18:01 (17)	16:58	15:47 (16) 07:35
23	07:27 16:47	06:49 16:39	16:26 (16) 05:59	05:15	05:22	05:10	05:32	06:05	06:42	07:20	18:02 (17)	16:59	15:48 (16) 07:36
24	07:26 16:48	06:47 16:37	16:27 (16) 05:58	05:14	05:21	05:10	05:33	06:06	06:43	07:21	18:03 (17)	17:00	15:49 (16) 07:37
25	07:26 16:49	06:46 16:36	16:28 (16) 05:57	05:13	05:20	05:10	05:34	06:07	06:44	07:22	18:04 (17)	17:01	15:50 (16) 07:38
26	07:25 16:50	06:45 16:35	16:29 (16) 05:56	05:12	05:19	05:10	05:35	06:08	06:45	07:23	18:05 (17)	17:02	15:51 (16) 07:39
27	07:25 16:51	06:44 16:34	16:30 (16) 05:55	05:11	05:18	05:11	05:36	06:09	06:46	07:24	18:06 (17)	17:03	15:52 (16) 07:40
28	07:24 16:52	06:43 16:33	16:31 (16) 05:54	05:10	05:17	05:11	05:37	06:10	06:47	07:25	18:07 (17)	17:04	15:53 (16) 07:41
29	07:24 16:53	06:42 16:32	16:32 (16) 05:53	05:09	05:16	05:11	05:38	06:11	06:48	07:26	18:08 (17)	17:05	15:54 (16) 07:42
30	07:23 16:54	06:41 16:31	16:33 (16) 05:52	05:08	05:15	05:11	05:39	06:12	06:49	07:27	18:09 (17)	17:06	15:55 (16) 07:43
31	07:22 16:55	06:40 16:30	16:34 (16) 05:51	05:07	05:14	05:11	05:40	06:13	06:50	07:28	18:10 (17)	17:07	15:56 (16) 07:44
Potential sun hours	286	291	369	380	285	254	272	4	376	341	288	275	
Total, worst case	176	426	306	380	285	254	272	4	376	341	288	275	
Sun reduction	0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35	
Oper. time red.	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	
Wind dir. red.	0.58	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	
Total reduction	0.24	0.24	0.27	0.30	0.30	0.30	0.30	0.30	0.30	0.24	0.18	0.18	
Total, real	42	101	82	82	82	82	82	82	82	82	82	82	

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/22/06 00:15 / 20
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/21/06 09:09/2.4.0.67

SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 276 - 276

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:26	07:17 17:04	06:36 17:43	05:39 18:23	05:47 20:00	05:14 20:34	05:14 20:47	05:44 (16) 05:48 (16)	05:41 20:25	06:18 19:35	06:54 18:38	06:34 16:46	
2	07:34 16:26	07:16 17:05	06:34 17:45	05:37 18:25	05:46 20:01	05:13 20:35	05:13 20:47	05:44 20:24	05:42 19:33	06:19 18:37	06:55 16:45	06:35 16:17	
3	07:35 16:27	07:15 17:07	06:32 17:46	05:35 18:26	05:44 20:02	05:13 20:36	05:15 20:46	05:44 20:22	05:42 19:31	06:20 18:35	06:56 16:43	06:36 16:16	
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	05:12 20:37	05:15 20:46	05:45 20:21	06:21 19:29	06:57 18:33	06:38 16:42	06:17 16:16	
5	07:34 16:29	07:12 17:10	06:29 17:49	06:29 19:28	05:41 20:05	05:12 20:37	05:16 20:46	05:46 20:20	06:22 19:27	06:58 18:31	06:39 16:40	06:18 16:16	
6	07:34 16:30	07:11 17:11	06:27 17:50	06:27 19:30	05:40 20:06	05:12 20:38	05:17 20:46	05:47 20:18	06:24 19:26	07:00 18:29	06:41 16:39	06:19 16:16	
7	07:34 16:31	07:10 17:12	06:25 17:51	06:28 19:31	05:39 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27	06:42 16:38	06:20 16:16	
8	07:34 16:33	07:08 17:14	06:23 17:53	06:26 19:32	05:37 20:08	05:11 20:40	05:18 20:45	05:49 20:16	06:26 19:22	07:02 17:03	06:43 16:45	06:21 16:15	
9	07:34 16:34	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:11 20:40	05:19 20:44	05:50 20:14	06:27 19:20	07:03 18:24	06:45 16:35	06:22 16:15	
10	07:33 16:35	07:06 17:17	06:20 17:55	06:22 19:35	05:35 20:11	05:10 20:41	05:20 20:44	05:52 20:13	06:28 19:18	07:05 18:22	06:46 16:34	06:23 16:15	
11	07:33 16:36	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:10 20:42	05:40 (16) 20:43	05:53 20:11	06:30 19:16	07:06 18:20	06:47 16:33	06:24 16:15	
12	07:33 16:37	07:03 17:20	06:16 17:58	06:19 19:37	05:32 20:13	05:10 20:42	05:38 (16) 20:43	05:54 20:10	06:31 19:14	07:07 18:18	06:49 16:32	06:25 16:15	
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	05:10 20:43	05:38 (16) 20:42	05:55 20:08	06:32 19:13	07:09 18:17	06:50 16:31	06:25 16:15	
14	07:32 16:40	07:00 17:22	06:12 18:00	06:15 19:40	05:30 20:15	05:10 20:43	05:36 (16) 20:42	05:56 20:07	06:33 19:11	07:10 18:15	06:52 16:30	06:26 16:16	
15	07:31 16:41	06:58 17:24	06:10 18:02	06:13 19:41	05:29 20:17	05:10 20:44	05:36 (16) 20:41	05:58 20:05	06:34 19:09	07:11 18:13	06:53 16:29	06:27 16:16	
16	07:31 16:42	06:57 17:25	06:09 18:03	06:12 19:42	05:28 20:18	05:10 20:44	05:36 (16) 20:40	05:59 20:04	06:35 19:07	07:12 18:11	06:54 16:28	06:28 16:16	
17	07:30 16:43	06:55 17:27	06:07 18:04	06:10 19:43	05:26 20:19	05:10 20:45	05:36 (16) 20:40	06:00 20:02	06:37 19:05	07:14 18:10	06:56 16:27	06:28 16:16	
18	07:30 16:45	06:54 17:28	06:05 18:06	06:08 19:45	05:25 20:20	05:10 20:45	05:36 (16) 20:39	06:01 20:01	06:38 19:03	07:15 18:08	06:57 16:26	06:29 16:17	
19	07:29 16:46	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:10 20:45	05:36 (16) 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:25	06:30 16:17	
20	07:28 16:47	06:51 17:31	06:01 18:08	06:05 19:47	05:23 20:22	05:10 20:46	05:36 (16) 20:37	06:03 19:56	06:40 18:59	07:18 18:05	07:00 16:24	06:31 16:17	
21	07:27 16:49	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46	05:37 (16) 20:37	06:05 19:54	06:41 18:57	07:19 18:03	07:01 16:23	06:31 16:18	
22	07:27 16:50	06:47 17:34	05:57 18:11	06:01 19:50	05:21 20:24	05:10 20:46	05:37 (16) 20:36	06:06 19:52	06:43 18:55	07:20 18:01	07:02 16:22	06:31 16:18	
23	07:26 16:51	06:46 17:35	05:56 18:12	06:00 19:51	05:21 20:25	05:10 20:46	05:37 (16) 20:35	06:07 19:51	06:44 18:54	07:22 18:00	07:03 16:22	06:32 16:19	
24	07:25 16:53	06:44 17:36	05:54 18:13	05:58 19:52	05:20 20:26	05:11 20:47	05:37 (16) 20:34	06:08 19:49	06:45 18:52	07:23 17:58	07:05 16:21	06:32 16:19	
25	07:24 16:54	06:42 17:38	05:52 18:14	05:57 19:53	05:19 20:27	05:11 20:47	05:38 (16) 20:33	06:09 19:47	06:46 18:50	06:24 18:56	07:06 16:20	06:33 16:20	
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	05:18 20:28	05:11 20:47	05:38 (16) 20:32	06:11 19:45	06:47 18:48	06:26 18:55	07:07 16:20	06:33 16:21	
27	07:22 16:57	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	05:12 20:47	05:38 (16) 20:31	06:12 19:44	06:49 18:46	06:27 16:53	07:08 16:19	06:33 16:21	
28	07:21 16:58	06:37 17:42	05:46 18:18	05:52 19:57	05:16 20:30	05:12 20:47	05:39 (16) 20:30	06:13 19:42	06:50 18:44	06:28 16:52	07:10 16:19	06:34 16:22	
29	07:20 17:00	06:36 18:20	05:44 18:20	05:50 19:58	05:16 20:31	05:13 20:47	05:41 (16) 20:28	06:14 19:40	06:51 18:42	06:30 16:50	07:11 16:18	06:34 16:23	
30	07:19 17:01	06:35 18:21	05:42 18:21	05:49 20:00	05:15 20:32	05:13 20:47	05:42 (16) 20:27	06:15 19:38	06:52 18:40	06:31 16:49	07:12 16:18	06:34 16:24	
31	07:18 17:02	06:34 18:22	05:41 18:22	05:48 20:00	05:15 20:33	05:15 20:47	05:40 20:26	06:17 19:37	06:32 18:47	06:32 16:47	07:12 16:24	06:34 16:24	
Potential sun hours	286	291	369	380	285	254	256	4	4	376	341	288	275
Total, worst case							256	4					
Sun reduction							0.55	0.58					
Oper. time red.							0.91	0.91					
Wind dir. red.							0.59	0.59					
Total reduction							0.29	0.31					
Total, real							75	1					

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:

Description:

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060119 Marble River

Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

01/22/06 00:15 / 21

Licensed user:

Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:

01/21/06 09:09/2.4.0.67

SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 281 - 281

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Table with columns for months (January to December) and rows for time slots (07:34, 16:25, etc.), showing sun rise/set times and shadow flicker minutes.

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/22/06 00:15 / 22
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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/21/06 09:09/2.4.0.67

SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 295 - 295

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes
Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	14:37 (21) 15:09 (21)	07:17 17:04	06:35 17:43	05:39 18:23	05:47 20:01	05:14 20:34	05:14 20:47	05:41 20:25	06:18 19:35	06:53 18:38	06:34 16:46	14:29 (21) 16:17 22 14:51 (21)
2	07:34 16:26	14:39 (21) 15:09 (21)	07:16 17:05	06:34 17:44	05:37 18:24	05:46 20:01	05:13 20:35	05:14 20:46	05:42 20:24	06:19 19:33	06:55 18:36	06:35 16:44	14:28 (21) 16:17 24 14:52 (21)
3	07:34 16:27	14:39 (21) 15:09 (21)	07:14 17:06	06:32 17:46	05:35 18:26	05:44 20:02	05:13 20:36	05:15 20:46	05:43 20:22	06:20 19:31	06:56 18:35	06:36 16:43	14:29 (21) 16:16 24 14:53 (21)
4	07:34 16:28	14:41 (21) 15:09 (21)	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	05:12 20:36	05:15 20:46	05:45 20:21	06:21 19:29	06:57 18:33	06:38 16:42	14:28 (21) 16:16 26 14:54 (21)
5	07:34 16:29	14:41 (21) 15:09 (21)	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:04	05:12 20:37	05:16 20:46	05:46 20:20	06:22 19:27	06:58 18:31	06:39 16:40	14:27 (21) 16:16 28 14:55 (21)
6	07:34 16:30	14:42 (21) 15:10 (21)	07:11 17:11	06:27 17:50	06:29 19:29	05:40 20:06	05:11 20:38	05:17 20:45	05:47 20:18	06:23 19:25	07:00 18:29	06:40 16:39	14:28 (21) 16:16 28 14:56 (21)
7	07:34 16:31	14:42 (21) 15:10 (21)	07:09 17:12	06:25 17:51	06:28 19:31	05:39 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27	06:42 16:38	14:27 (21) 16:15 28 14:55 (21)
8	07:34 16:32	14:44 (21) 15:10 (21)	07:08 17:14	06:23 17:52	06:26 19:32	05:37 20:08	05:11 20:40	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	06:43 16:36	14:28 (21) 16:15 28 14:56 (21)
9	07:33 16:33	14:45 (21) 15:09 (21)	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40	05:19 20:44	05:50 20:14	06:27 19:20	07:03 18:24	06:45 16:35	14:27 (21) 16:15 30 14:57 (21)
10	07:33 16:35	14:45 (21) 15:09 (21)	07:05 17:16	06:19 17:55	06:22 19:34	05:35 20:11	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22	06:46 16:34	14:28 (21) 16:15 30 14:58 (21)
11	07:33 16:36	14:47 (21) 15:09 (21)	07:04 17:18	06:18 17:56	06:20 19:36	05:33 20:12	05:10 20:41	05:20 20:43	05:53 20:11	06:29 19:16	07:06 18:20	06:47 16:33	14:27 (21) 16:15 32 14:59 (21)
12	07:32 16:37	14:48 (21) 15:08 (21)	07:03 17:19	06:16 17:58	06:18 19:37	05:32 20:13	05:10 20:42	05:21 20:43	05:54 20:10	06:31 19:14	07:07 18:18	06:49 16:32	14:28 (21) 16:15 32 15:00 (21)
13	07:32 16:38	14:52 (21) 15:06 (21)	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	05:10 20:43	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:16	06:50 16:31	14:29 (21) 16:15 32 15:01 (21)
14	07:32 16:39	14:53 (21) 15:05 (21)	07:00 17:22	06:12 18:00	06:15 19:39	05:30 20:15	05:09 20:43	05:23 20:42	05:56 20:07	06:33 19:10	07:10 18:15	06:51 16:30	14:28 (21) 16:15 34 15:02 (21)
15	07:31 16:41	14:57 (21) 15:03 (21)	06:58 17:24	06:10 18:02	06:13 19:41	05:29 20:16	05:09 20:44	05:24 20:41	05:57 20:05	06:34 19:09	07:11 18:13	06:53 16:29	14:29 (21) 16:16 34 15:03 (21)
16	07:31 16:42	15:03 (21)	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:18	05:09 20:44	05:25 20:45	05:59 20:04	06:35 19:07	07:12 18:11	06:54 16:28	14:29 (21) 16:16 32 15:01 (21)
17	07:30 16:43	15:05 (21)	06:55 17:26	06:07 18:04	06:10 19:43	05:26 20:19	05:09 20:44	05:25 20:40	06:00 20:02	06:36 19:05	07:14 18:09	06:55 16:27	14:30 (21) 16:16 32 15:02 (21)
18	07:29 16:44	15:06 (21)	06:54 17:28	06:05 18:05	06:08 19:45	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:00	06:38 19:03	07:15 18:08	06:57 16:26	14:31 (21) 16:16 32 15:03 (21)
19	07:29 16:46	15:07 (21)	06:52 17:29	06:03 18:07	06:06 19:46	05:24 20:21	05:10 20:45	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:25	14:31 (21) 16:17 32 15:03 (21)
20	07:28 16:47	15:08 (21)	06:50 17:31	06:01 18:08	06:05 19:47	05:23 20:22	05:10 20:46	05:28 20:37	06:03 19:56	06:40 18:59	07:17 18:04	06:59 16:24	14:30 (21) 16:17 34 15:04 (21)
21	07:27 16:48	15:09 (21)	06:49 17:32	06:00 18:09	06:03 19:48	05:22 20:23	05:10 20:46	05:29 20:36	06:04 19:54	06:41 18:57	07:19 18:03	07:01 16:23	14:30 (21) 16:18 34 15:04 (21)
22	07:26 16:50	15:10 (21)	06:47 17:33	05:57 18:10	06:01 19:50	05:21 20:24	05:10 20:46	05:30 20:35	06:06 19:52	06:42 18:55	07:20 18:01	07:02 16:22	14:31 (21) 16:18 34 15:05 (21)
23	07:26 16:51	15:11 (21)	06:46 17:35	05:55 18:12	06:00 19:51	05:20 20:25	05:10 20:46	05:31 20:35	06:07 19:51	06:44 18:53	07:21 17:59	07:03 16:22	14:31 (21) 16:19 34 15:05 (21)
24	07:25 16:52	15:12 (21)	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:26	05:11 20:46	05:32 20:34	06:08 19:49	06:45 18:51	07:23 17:58	07:05 16:21	14:34 (21) 16:19 32 15:06 (21)
25	07:24 16:54	15:13 (21)	06:42 17:38	05:52 18:14	05:56 19:53	05:19 20:27	05:11 20:47	05:33 20:33	06:09 19:47	06:46 18:50	07:24 17:56	07:06 16:20	14:34 (21) 16:20 32 15:06 (21)
26	07:23 16:55	15:14 (21)	06:41 17:39	05:50 18:16	05:55 19:55	05:18 20:28	05:11 20:47	05:35 20:32	06:10 19:45	06:47 18:48	07:25 17:55	07:07 16:20	14:34 (21) 16:20 32 15:06 (21)
27	07:22 16:57	15:15 (21)	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	05:12 20:47	05:36 20:30	06:12 19:44	06:48 18:46	07:27 17:53	07:08 16:19	14:35 (21) 16:21 32 15:07 (21)
28	07:21 16:58	15:16 (21)	06:37 17:42	05:46 18:18	05:52 19:57	05:16 20:30	05:12 20:47	05:37 20:29	06:13 19:42	06:50 18:44	07:28 17:52	07:10 16:18	14:35 (21) 16:22 34 15:09 (21)
29	07:20 16:59	15:17 (21)	06:36 17:43	05:45 18:19	05:51 19:58	05:15 20:31	05:13 20:47	05:38 20:28	06:14 19:40	06:51 18:42	07:29 17:51	07:11 16:18	14:36 (21) 16:23 34 15:09 (21)
30	07:19 17:01	15:18 (21)	06:35 17:44	05:44 18:21	05:50 19:59	05:14 20:32	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	07:30 17:50	07:12 16:17	14:37 (21) 16:23 32 15:09 (21)
31	07:18 17:02	15:19 (21)	06:34 17:45	05:43 18:22	05:49 19:59	05:13 20:33	05:13 20:48	05:40 20:26	06:16 19:36	06:53 18:41	07:31 17:49	07:13 16:16	14:37 (21) 16:24 32 15:09 (21)
Potential sun hours	286	291	369	404	-285	-254	-272	4	376	341	288	275	
Total, worst case	352										52	956	
Sun reduction	0.45										0.35	0.35	
Oper. time red.	0.91										0.91	0.91	
Wind dir. red.	0.63										0.63	0.63	
Total reduction	0.26										0.20	0.20	
Total, real	90										10	190	

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/22/06 00:15 / 23
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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/21/06 09:09/2.4.0.67

SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 306 - 306

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:34 16:25	07:59 (8) 17:04	07:17 17:43	06:35 18:23	05:38 20:01	05:47 20:34	05:14 20:46	05:13 20:25	05:41 19:35	06:17 18:38	06:53 16:46	07:13 16:17
2	07:34 16:26	07:59 (8) 17:05	07:16 17:44	06:34 18:24	05:37 20:01	05:46 20:35	05:13 20:46	05:14 20:23	05:42 19:33	06:19 18:36	06:54 16:44	07:14 16:17
3	07:34 16:27	07:59 (8) 17:06	07:14 17:46	06:32 18:26	05:35 20:02	05:44 20:36	05:13 20:46	05:15 20:22	05:43 19:31	06:20 18:34	06:56 16:43	07:11 16:16
4	07:34 16:28	07:59 (8) 17:08	07:13 17:47	06:30 18:27	05:33 20:03	05:43 20:36	05:12 20:46	05:15 20:21	05:44 19:29	06:21 18:33	06:57 16:42	07:11 16:16
5	07:34 16:29	07:59 (8) 17:09	07:12 17:48	06:28 18:28	06:31 20:04	05:41 20:37	05:12 20:46	05:16 20:20	05:46 19:27	06:22 18:31	06:58 16:40	07:11 16:16
6	07:34 16:30	07:58 (8) 17:11	07:11 17:50	06:27 18:29	06:29 20:06	05:40 20:38	05:11 20:45	05:16 20:18	05:47 19:25	06:23 18:29	06:59 16:39	07:11 16:15
7	07:34 16:31	07:58 (8) 17:12	07:09 17:51	06:25 18:31	06:27 20:07	05:38 20:39	05:11 20:45	05:17 20:17	05:48 19:24	06:25 18:27	07:01 16:38	07:11 16:15
8	07:34 16:32	07:58 (8) 17:14	07:08 17:52	06:23 18:32	06:26 20:08	05:37 20:39	05:11 20:45	05:18 20:15	05:49 19:22	06:26 18:25	07:02 16:36	07:11 16:15
9	07:33 16:33	07:57 (7) 17:15	07:07 17:54	06:21 18:33	06:24 20:09	05:36 20:40	05:10 20:44	05:19 20:14	05:50 19:20	06:27 18:23	07:03 16:35	07:11 16:15
10	07:33 16:34	07:57 (7) 17:16	07:05 17:55	06:19 18:34	06:22 20:10	05:34 20:41	05:10 20:44	05:19 20:13	05:51 19:18	06:28 18:22	07:04 16:34	07:11 16:15
11	07:33 16:35	07:57 (7) 17:18	07:04 17:56	06:18 18:36	06:20 19:36	05:33 20:12	05:10 20:43	05:20 20:11	05:53 19:16	06:29 18:20	07:06 16:33	07:11 16:15
12	07:32 16:37	07:56 (7) 17:19	07:02 17:58	06:16 18:37	06:18 19:37	05:32 20:13	05:10 20:42	05:21 20:10	05:54 19:14	06:30 18:18	07:07 16:32	07:11 16:15
13	07:32 16:38	07:56 (7) 17:21	07:01 17:59	06:14 18:38	06:17 19:38	05:31 20:14	05:09 20:43	05:22 20:08	05:55 19:12	06:32 18:16	07:08 16:31	07:11 16:15
14	07:32 16:39	07:55 (7) 17:22	07:00 18:00	06:12 18:39	06:15 19:39	05:30 20:15	05:09 20:43	05:23 20:07	05:56 19:10	06:33 18:15	07:10 16:29	07:11 16:15
15	07:31 16:40	07:54 (7) 17:23	06:58 18:01	06:10 18:41	06:13 19:41	05:28 20:16	05:09 20:44	05:24 20:10	05:57 19:08	06:34 18:13	07:11 16:28	07:11 16:15
16	07:30 16:42	07:54 (7) 17:25	06:57 18:03	06:08 18:42	06:11 19:42	05:27 20:17	05:09 20:44	05:24 20:04	05:58 19:07	06:35 18:11	07:12 16:27	07:11 16:15
17	07:30 16:43	07:53 (7) 17:26	06:55 18:04	06:06 18:43	06:10 19:43	05:26 20:19	05:09 20:44	05:25 20:02	05:56 19:05	06:36 18:09	07:13 16:26	07:11 16:15
18	07:29 16:44	07:52 (7) 17:28	06:54 18:05	06:05 18:44	06:08 19:44	05:25 20:20	05:09 20:45	05:26 20:00	06:01 19:03	06:38 18:08	07:15 16:26	07:11 16:15
19	07:29 16:46	07:52 (7) 17:29	06:52 18:07	06:03 18:46	06:06 19:46	05:24 20:21	05:09 20:45	05:27 20:38	06:02 19:57	06:39 19:01	07:16 16:25	07:11 16:15
20	07:28 16:47	07:53 (7) 17:31	06:50 18:08	06:01 18:47	06:05 19:47	05:23 20:22	05:10 20:45	05:28 20:37	06:03 19:55	06:40 18:59	07:17 16:24	07:11 16:15
21	07:27 16:48	07:54 (7) 17:32	06:49 18:09	06:03 18:48	06:07 19:48	05:22 20:23	05:10 20:46	05:29 20:36	06:04 19:54	06:41 18:57	07:19 16:23	07:11 16:15
22	07:26 16:50	07:55 (7) 17:33	06:47 18:10	06:07 18:49	06:01 19:49	05:21 20:24	05:10 20:46	05:30 20:35	06:06 19:52	06:42 18:55	07:20 16:22	07:11 16:15
23	07:26 16:51	07:56 (7) 17:35	06:45 18:12	06:05 18:51	06:00 19:51	05:20 20:25	05:10 20:46	05:31 20:34	06:07 19:50	06:44 18:53	07:21 16:21	07:11 16:15
24	07:25 16:52	07:57 (7) 17:36	06:44 18:13	06:04 18:52	06:08 19:52	05:19 20:26	05:10 20:46	05:32 20:33	06:08 19:49	06:45 18:51	07:23 16:21	07:11 16:15
25	07:24 16:54	07:58 (7) 17:37	06:42 18:14	06:02 18:53	06:06 19:53	05:19 20:27	05:11 20:46	05:33 20:32	06:09 19:47	06:46 18:49	07:24 16:20	07:11 16:15
26	07:23 16:55	08:01 (7) 17:39	06:40 18:15	06:00 18:54	06:05 19:54	05:18 20:28	05:11 20:47	05:34 20:31	06:10 19:45	06:47 18:48	07:25 16:19	07:11 16:15
27	07:22 16:56	08:10 (8) 17:40	06:39 18:17	06:06 18:56	06:08 19:56	05:17 20:29	05:12 20:47	05:35 20:30	06:11 19:43	06:48 18:46	07:26 16:19	07:11 16:15
28	07:21 16:58	08:13 (8) 17:42	06:37 18:18	06:05 18:57	06:07 19:57	05:16 20:30	05:12 20:47	05:37 20:29	06:13 19:42	06:50 18:44	07:27 16:18	07:11 16:15
29	07:20 16:59	08:14 (8) 18:00	06:37 18:19	06:04 18:58	06:06 19:58	05:16 20:31	05:12 20:47	05:38 20:28	06:14 19:40	06:51 18:42	07:28 16:18	07:11 16:15
30	07:19 17:01	08:17 (8) 18:02	06:37 18:21	06:04 18:59	06:05 19:59	05:15 20:32	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	07:29 16:17	07:11 16:15
31	07:18 17:02	08:27 (8)	06:37 18:22	06:04 19:00	06:05 19:59	05:14 20:33	05:13 20:47	05:40 20:26	06:16 19:36	06:52 16:47	07:30 16:17	07:11 16:15
Potential sun hours	286	291	369	404	-285	-254	-272	4	376	341	288	275
Total, worst case	1036										670	910
Sun reduction	0.45										0.35	0.35
Oper. time red.	0.91										0.91	0.91
Wind dir. red.	0.67										0.67	0.67
Total reduction	0.27										0.21	0.21
Total, real	283										142	194

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/22/06 00:15 / 24
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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/21/06 09:09/2.4.0.67

SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 308 - 308

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34 16:25 26	15:21 (8) 15:47 (8) 17:03	07:17 07:15 17:43	06:35 06:34 17:43	05:38 18:23 20:01	05:47 20:34 18 19:55 (18)
2	07:34 16:26 26	15:21 (8) 15:47 (8) 17:05	07:15 17:44 18:24	06:34 06:32 18:24	05:37 05:35 20:01	05:45 05:44 20:35 18 19:55 (18)
3	07:34 16:27 24	15:23 (8) 15:47 (8) 17:06	07:14 17:46 18:25	06:32 17:46 18:25	05:35 05:33 20:02	05:44 05:43 20:36 16 19:54 (18)
4	07:34 16:28 24	15:23 (8) 15:47 (8) 17:08	07:13 17:47 18:27	06:30 17:47 18:27	05:33 05:31 20:03	05:43 05:41 20:36 14 19:54 (18)
5	07:34 16:29 24	15:22 (8) 15:46 (8) 17:09	07:12 17:48 19:28	06:28 17:48 19:28	06:31 20:04 20:37	05:41 05:39 14 19:53 (18)
6	07:34 16:30 24	15:24 (8) 15:48 (8) 17:11	07:11 17:50 19:29	06:26 17:50 19:29	06:29 20:06 20:38	05:40 05:38 10 19:51 (18)
7	07:34 16:31 24	15:24 (8) 15:48 (8) 17:12	07:09 17:51 19:31	06:25 17:51 19:31	06:27 20:07 20:39	05:38 05:37 8 19:51 (18)
8	07:34 16:32 22	15:26 (8) 15:48 (8) 17:13	07:08 17:52 19:32	06:23 17:52 19:32	06:26 20:08 20:39	05:37 05:36 6 19:50 (18)
9	07:33 16:33 22	15:25 (8) 15:47 (8) 17:15	07:07 17:54 19:33	06:21 17:54 19:33	05:36 20:09 4 19:41 (18)	05:10 20:40 4 19:50 (18)
10	07:33 16:34 22	15:27 (8) 15:49 (8) 17:16	07:05 17:55 19:34	06:19 17:55 19:34	05:34 20:10 8 19:38 (18)	05:10 20:41 8 19:46 (18)
11	07:33 16:36 22	15:27 (8) 15:49 (8) 17:18	07:04 17:56 19:36	06:17 17:56 19:36	05:33 20:12 10 19:37 (18)	05:10 20:42 10 19:47 (18)
12	07:32 16:37 20	15:28 (8) 15:48 (8) 17:19	07:02 17:57 19:37	06:16 17:57 19:37	05:32 20:13 12 19:36 (18)	05:10 20:42 12 19:48 (18)
13	07:32 16:38 18	15:30 (8) 15:48 (8) 17:21	07:01 17:59 19:38	06:14 17:59 19:38	05:31 20:14 14 19:35 (18)	05:09 20:42 14 19:49 (18)
14	07:31 16:39 16	15:31 (8) 15:47 (8) 17:22	07:00 17:22 18:00	06:12 17:22 18:00	05:30 20:15 16 19:34 (18)	05:09 20:43 16 19:50 (18)
15	07:31 16:40 14	15:32 (8) 15:46 (8) 17:23	06:58 17:23 18:01	06:10 17:23 18:01	05:28 20:16 18 19:32 (18)	05:09 20:43 18 19:50 (18)
16	07:30 16:42 12	15:34 (8) 15:46 (8) 17:25	06:57 17:25 18:03	06:08 17:25 18:03	05:27 20:17 18 19:33 (18)	05:09 20:44 18 19:51 (18)
17	07:30 16:43 10	15:35 (8) 15:45 (8) 17:26	06:55 17:26 18:04	06:06 17:26 18:04	05:26 20:19 20 19:32 (18)	05:09 20:44 20 19:52 (18)
18	07:29 16:44 4	15:38 (8) 15:42 (8) 17:28	06:53 17:28 18:05	06:05 17:28 18:05	05:25 20:20 22 19:31 (18)	05:09 20:45 22 19:53 (18)
19	07:29 16:46	06:52 17:29 18:06	06:03 18:06 19:46	06:06 18:06 19:46	05:24 20:21 22 19:32 (18)	05:09 20:45 22 19:54 (18)
20	07:28 16:47	06:50 17:30 18:08	06:01 18:08 19:47	06:04 18:08 19:47	05:23 20:22 24 19:32 (18)	05:10 20:45 24 19:56 (18)
21	07:27 16:48	06:49 17:32 18:09	05:59 18:09 19:48	06:03 18:09 19:48	05:22 20:23 24 19:33 (18)	05:10 20:46 24 19:57 (18)
22	07:26 16:50	06:47 17:33 18:10	05:57 18:10 19:49	06:01 18:10 19:49	05:21 20:24 24 19:32 (18)	05:10 20:46 24 19:56 (18)
23	07:26 16:51	06:45 17:35 18:12	05:55 18:12 19:51	05:59 18:12 19:51	05:20 20:25 24 19:33 (18)	05:10 20:46 24 19:57 (18)
24	07:25 16:52	06:44 17:36 18:13	05:53 18:13 19:52	05:58 18:13 19:52	05:19 20:26 24 19:32 (18)	05:10 20:46 24 19:56 (18)
25	07:24 16:54	06:42 17:37 18:14	05:51 18:14 19:53	05:56 18:14 19:53	05:18 20:27 22 19:33 (18)	05:11 20:46 22 19:55 (18)
26	07:23 16:55	06:40 17:39 18:15	05:50 18:15 19:54	05:55 18:15 19:54	05:18 20:28 24 19:33 (18)	05:11 20:47 24 19:57 (18)
27	07:22 16:56	06:39 17:40 18:17	05:48 18:17 19:56	05:53 18:17 19:56	05:17 20:29 22 19:34 (18)	05:11 20:47 22 19:56 (18)
28	07:21 16:58	06:37 17:41 18:18	05:46 18:18 19:57	05:51 18:18 19:57	05:16 20:30 20 19:35 (18)	05:12 20:47 20 19:55 (18)
29	07:20 16:59	06:35 17:42 18:19	05:44 18:19 19:58	05:50 18:19 19:58	05:15 20:31 20 19:36 (18)	05:12 20:47 20 19:55 (18)
30	07:19 17:01	06:33 17:43 18:20	05:42 18:20 19:59	05:48 18:20 19:59	05:15 20:32 20 19:36 (18)	05:13 20:46 20 19:56 (18)
31	07:18 17:02	06:31 17:44 18:21	05:40 18:21 20:00	05:46 18:21 20:00	05:14 20:33 20 19:37 (18)	05:13 20:46 20 19:56 (18)
Potential sun hours	286	291	369	404	-285	-254
Total, worst case	354				432	108
Sun reduction	0.45				0.55	0.55
Oper. time red.	0.91				0.91	0.91
Wind dir. red.	0.62				0.60	0.60
Total reduction	0.25				0.30	0.30
Total, real	89				131	33

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/21/06 09:09/2.4.0.67

SHADOW - Calendar

Calculation: 060120 SouthWest area Shadow receptor: 308 - 308

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December			
1	05:13 20:46	05:41 20:25	12 19:47 (18) 19:59 (18)	06:17 19:35	06:53 18:38	06:33 16:46	07:13 16:17	15:09 (8) 22 15:31 (8)	
2	05:14 20:46	05:42 20:23	8 19:48 (18) 19:56 (18)	06:19 19:33	06:54 18:36	06:35 16:44	07:14 16:16	15:10 (8) 22 15:32 (8)	
3	05:14 20:46	05:43 20:22	6 19:49 (18) 19:55 (18)	06:20 19:31	06:56 18:34	06:36 16:43	07:15 16:16	15:09 (8) 24 15:33 (8)	
4	05:15 20:46	6 19:50 (18) 19:56 (18)	05:44 20:21	06:21 19:29	06:57 18:33	06:38 16:41	07:16 16:16	15:10 (8) 22 15:32 (8)	
5	05:16 20:46	8 19:48 (18) 19:56 (18)	05:45 20:20	06:22 19:27	06:58 18:31	06:39 16:40	07:17 16:16	15:09 (8) 24 15:33 (8)	
6	05:16 20:45	10 19:47 (18) 19:57 (18)	05:47 20:18	06:23 19:25	06:59 18:29	06:40 16:39	07:18 16:15	15:10 (8) 24 15:34 (8)	
7	05:17 20:45	12 19:48 (18) 20:00 (18)	05:48 20:17	06:24 19:23	07:01 18:27	06:42 16:38	07:19 16:15	15:09 (8) 26 15:35 (8)	
8	05:18 20:45	14 19:46 (18) 20:00 (18)	05:49 20:15	06:26 19:22	07:02 18:25	06:43 16:36	07:20 16:15	15:10 (8) 24 15:34 (8)	
9	05:19 20:44	16 19:45 (18) 20:01 (18)	05:50 20:14	06:27 19:20	07:03 18:23	06:44 16:35	07:21 16:15	15:11 (8) 24 15:35 (8)	
10	05:19 20:44	16 19:46 (18) 20:02 (18)	05:51 20:13	06:28 19:18	07:04 18:22	06:46 16:34	07:22 16:15	15:10 (8) 26 15:36 (8)	
11	05:20 20:43	18 19:45 (18) 20:03 (18)	05:52 20:11	06:29 19:16	07:06 18:20	06:47 16:33	07:23 16:15	15:11 (8) 26 15:37 (8)	
12	05:21 20:43	18 19:45 (18) 20:03 (18)	05:54 20:10	06:30 19:14	07:07 18:18	06:48 16:32	07:24 16:15	15:12 (8) 24 15:36 (8)	
13	05:22 20:42	20 19:44 (18) 20:04 (18)	05:55 20:08	06:32 19:12	07:08 18:16	06:50 16:30	07:25 16:15	15:13 (8) 24 15:37 (8)	
14	05:23 20:41	20 19:43 (18) 20:03 (18)	05:56 20:07	06:33 19:10	07:09 18:14	06:51 16:29	07:26 16:15	15:12 (8) 26 15:38 (8)	
15	05:23 20:41	20 19:44 (18) 20:04 (18)	05:57 20:05	06:34 19:08	07:11 18:13	06:53 16:28	07:27 16:15	15:12 (8) 26 15:38 (8)	
16	05:24 20:40	22 19:43 (18) 20:05 (18)	05:58 20:04	06:35 19:07	07:12 18:11	06:54 16:27	07:27 16:16	15:13 (8) 26 15:39 (8)	
17	05:25 20:39	22 19:44 (18) 20:06 (18)	06:00 20:02	06:36 19:05	07:13 18:09	06:55 16:26	07:28 16:16	15:14 (8) 26 15:40 (8)	
18	05:26 20:39	24 19:43 (18) 20:07 (18)	06:01 20:00	06:38 19:03	07:15 18:08	06:57 16:25	07:29 16:16	15:15 (8) 26 15:41 (8)	
19	05:27 20:38	22 19:43 (18) 20:05 (18)	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:25	07:29 16:17	15:15 (8) 24 15:39 (8)	
20	05:28 20:37	24 19:42 (18) 20:06 (18)	06:03 19:55	06:40 18:59	07:17 18:04	06:59 16:24	07:30 16:17	15:16 (8) 24 15:40 (8)	
21	05:29 20:36	24 19:43 (18) 20:07 (18)	06:04 19:54	06:41 18:57	07:19 18:03	07:01 16:23	07:31 16:17	15:16 (8) 24 15:40 (8)	
22	05:30 20:35	24 19:42 (18) 20:06 (18)	06:05 19:52	06:42 18:55	07:20 18:01	07:02 16:22	07:31 16:18	15:17 (8) 24 15:41 (8)	
23	05:31 20:34	24 19:43 (18) 20:07 (18)	06:07 19:50	06:43 18:53	07:21 17:59	07:03 16:21	07:32 16:18	15:17 (8) 24 15:41 (8)	
24	05:32 20:33	24 19:42 (18) 20:06 (18)	06:08 19:49	06:45 18:51	07:23 17:58	07:04 16:21	15:16 (8) 4 15:20 (8)	07:32 16:19	15:18 (8) 24 15:42 (8)
25	05:33 20:32	22 19:43 (18) 20:05 (18)	06:09 19:47	06:46 18:49	06:24 16:56	07:06 16:20	15:13 (8) 10 15:23 (8)	07:32 16:20	15:18 (8) 24 15:42 (8)
26	05:34 20:31	22 19:42 (18) 20:04 (18)	06:10 19:45	06:47 18:48	06:25 16:55	07:07 16:19	15:12 (8) 12 15:24 (8)	07:33 16:20	15:18 (8) 26 15:44 (8)
27	05:35 20:30	20 19:43 (18) 20:03 (18)	06:11 19:43	06:48 18:46	06:27 16:53	07:08 16:19	15:12 (8) 14 15:26 (8)	07:33 16:21	15:18 (8) 26 15:44 (8)
28	05:37 20:29	18 19:44 (18) 20:02 (18)	06:13 19:42	06:50 18:44	06:28 16:51	07:09 16:18	15:11 (8) 16 15:27 (8)	07:33 16:22	15:19 (8) 26 15:45 (8)
29	05:38 20:28	18 19:43 (18) 20:01 (18)	06:14 19:40	06:51 18:42	06:29 16:50	07:11 16:18	15:10 (8) 18 15:28 (8)	07:34 16:22	15:19 (8) 26 15:45 (8)
30	05:39 20:27	16 19:44 (18) 20:00 (18)	06:15 19:38	06:52 18:40	06:31 16:49	07:12 16:17	15:09 (8) 20 15:29 (8)	07:34 16:23	15:21 (8) 24 15:45 (8)
31	05:40 20:26	14 19:46 (18) 20:00 (18)	06:16 19:36	06:53 16:47	07:13 16:47	07:13 16:17	15:09 (8) 16:24	07:34 24 15:45 (8)	15:21 (8) 24 15:45 (8)
Potential sun hours	-272	4	376	341	288	94	762		
Total, worst case	518	26				0.35	0.35		
Sun reduction	0.58	0.55				0.91	0.91		
Oper. time red.	0.91	0.91				0.62	0.62		
Wind dir. red.	0.60	0.60				0.20	0.20		
Total reduction	0.32	0.30				18	149		
Total, real	165	8							

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)

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

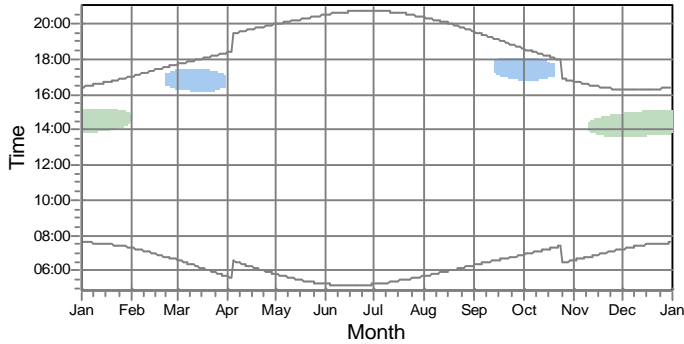
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01/22/06 00:15 / 26
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Calculated:
01/21/06 09:09/2.4.0.67

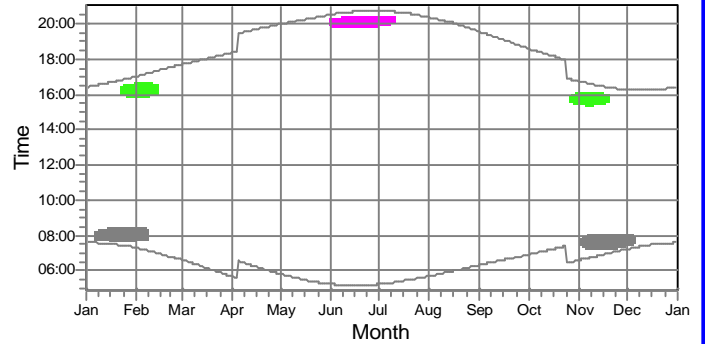
SHADOW - Calendar, graphical

Calculation: 060120 SouthWest area

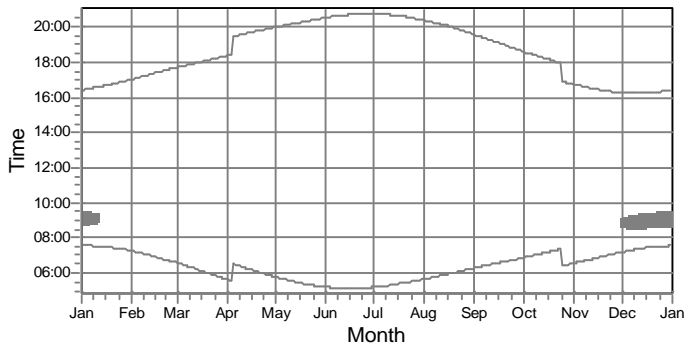
171: 171



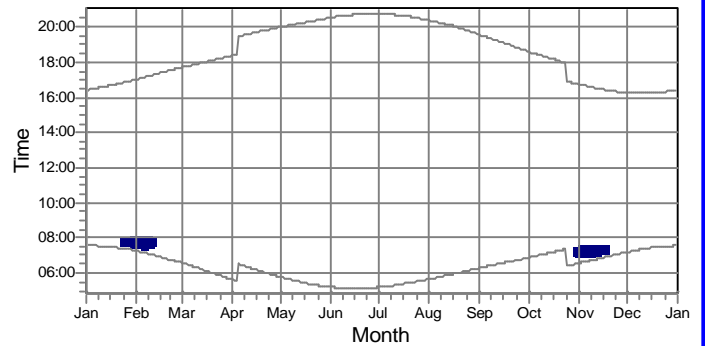
174: 174



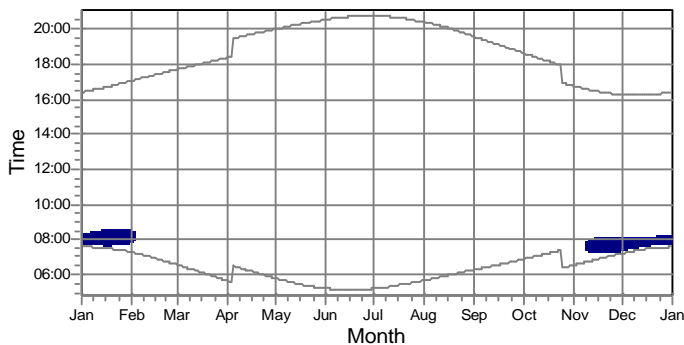
175: 175



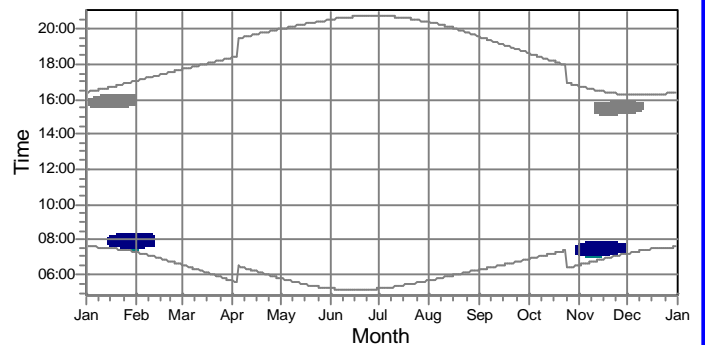
178: 178



179: 179



180: 180



WTGs

	091		094		106-L		200
	093		095		107-L		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

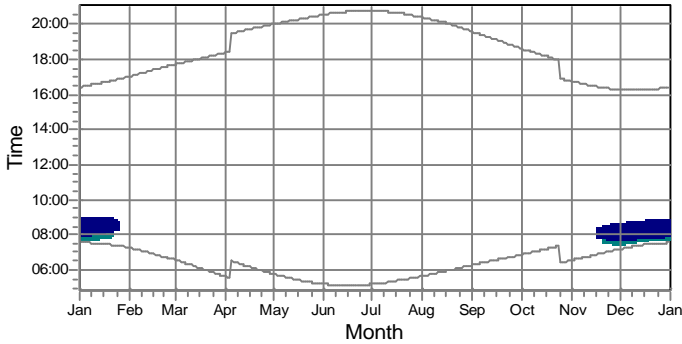
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01/21/06 09:09/2.4.0.67

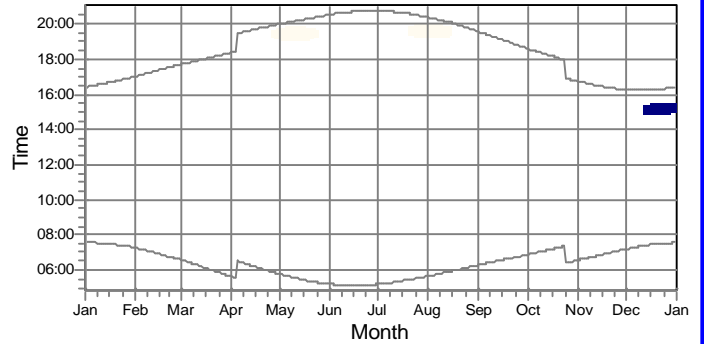
SHADOW - Calendar, graphical

Calculation: 060120 SouthWest area

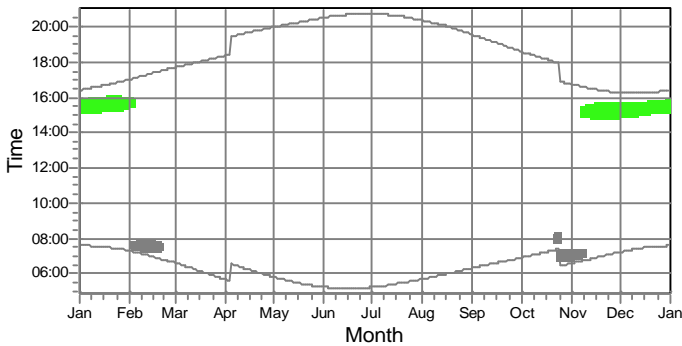
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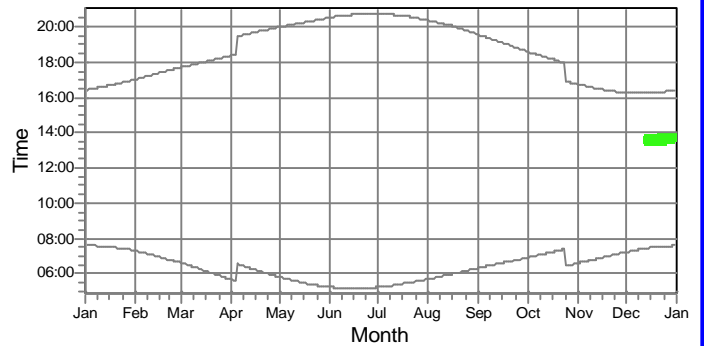
183: 183



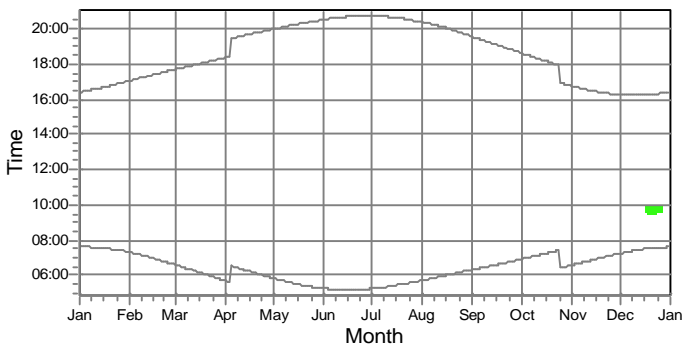
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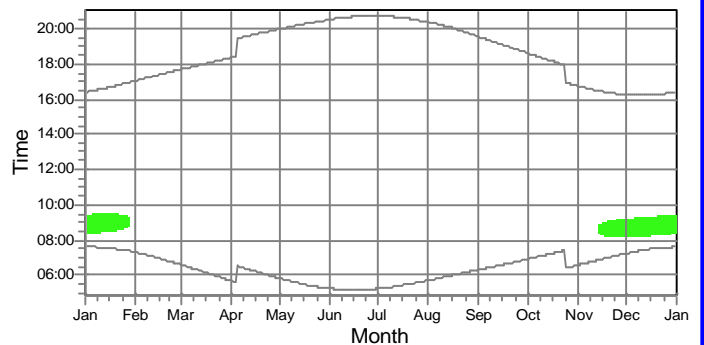
211: 211



212: 212



214: 214



WTGs



Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

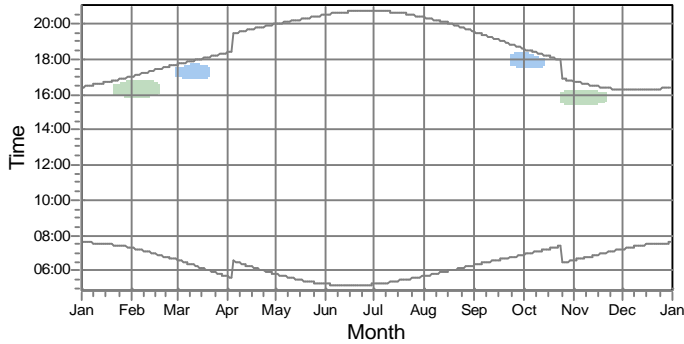
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01/21/06 09:09/2.4.0.67

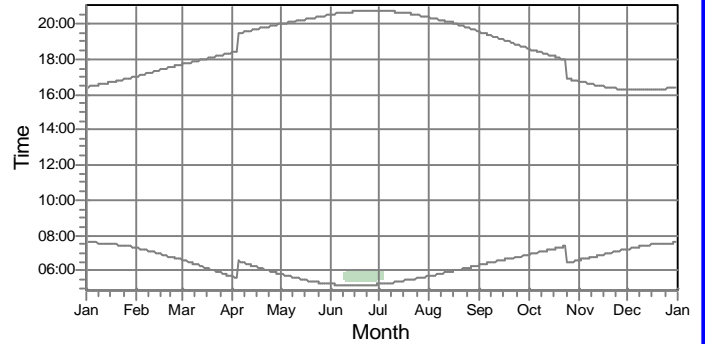
SHADOW - Calendar, graphical

Calculation: 060120 SouthWest area

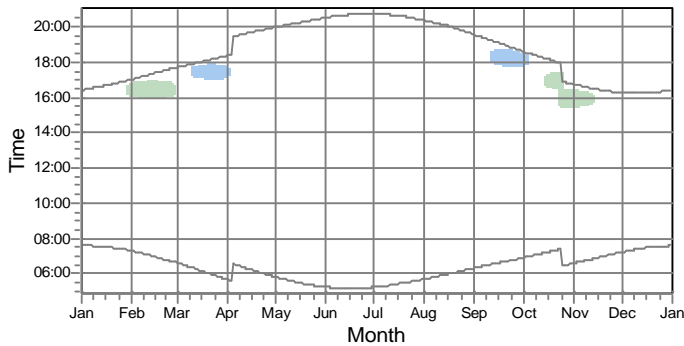
224: 224



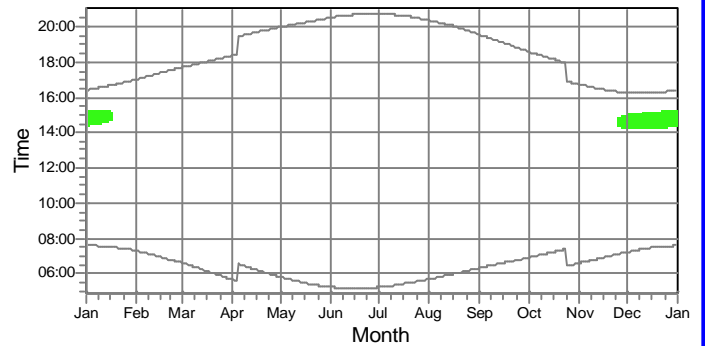
276: 276



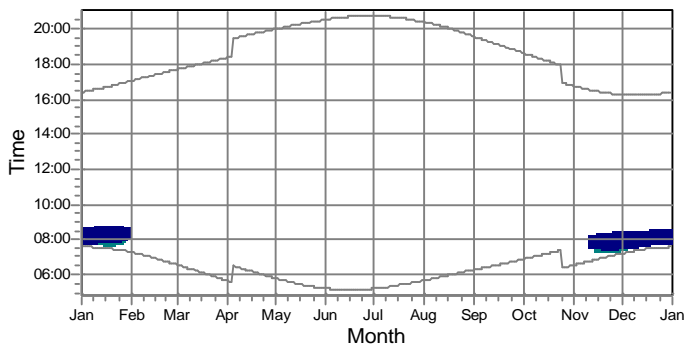
281: 281



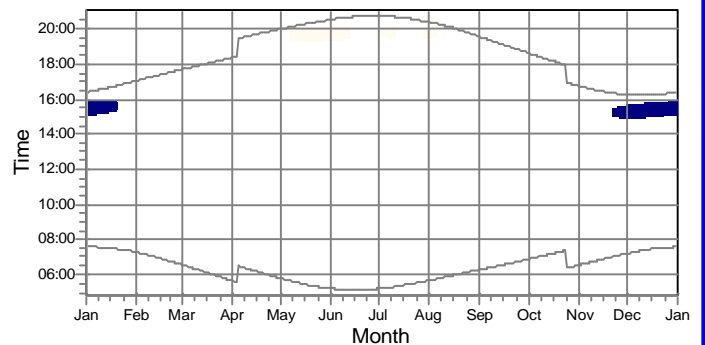
295: 295



306: 306



308: 308



WTGs



Project:
060119 Marble River

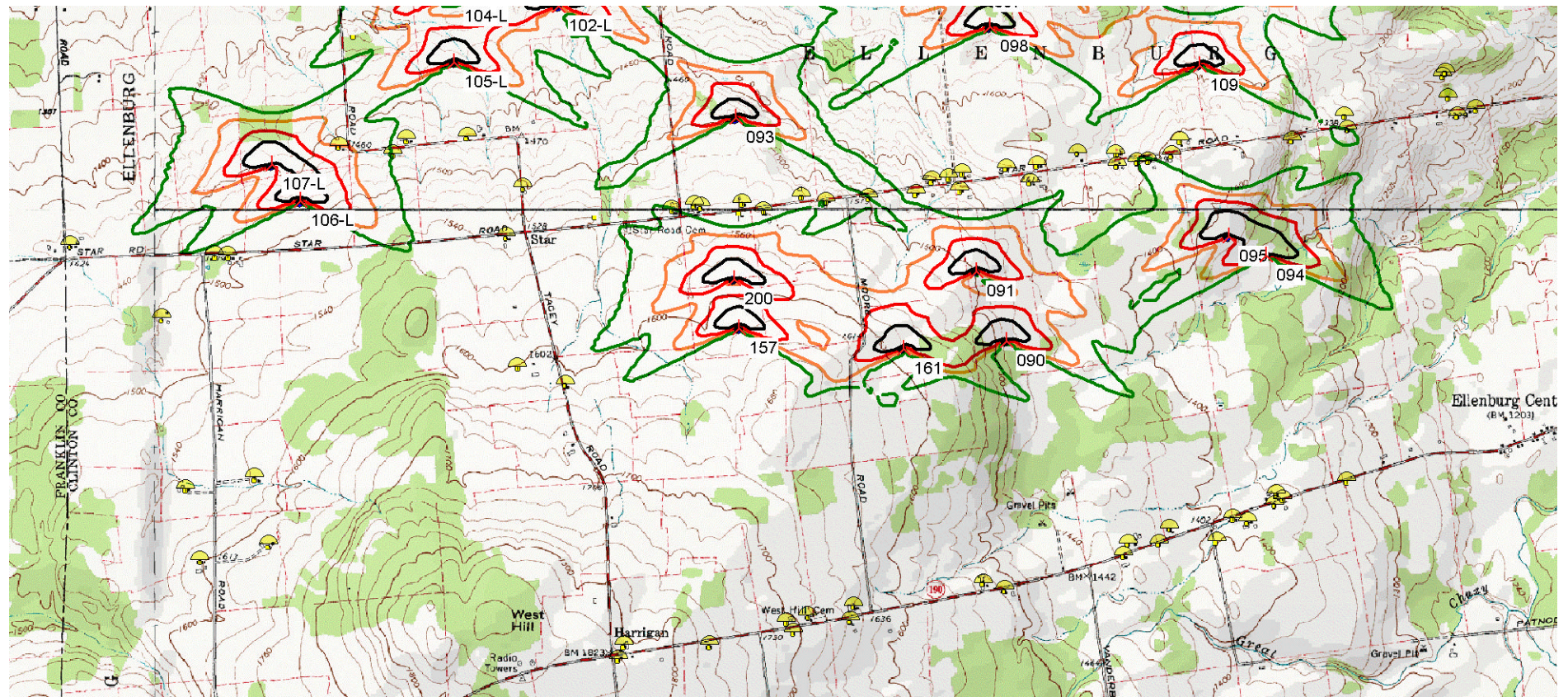
Description:
Marble River Wind Project
Shadow-Flicker, SW part
21 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/21/06 09:09/2.4.0.67

SHADOW - Bitmap map: 060106 Marble River USGS 50kz13.bmi

Calculation: 060120 SouthWest area File: 060106 Marble River USGS 50kz13.bmi



Map: 060106 Marble River USGS 50kz13, Print scale 1:35,000, Map center UTM NAD27 Zone: 18 East: 582,500 North: 4,968,500

▲ New WTG
 ● Shadow receptor
 Isolines showing shadow in Shadow hours/per year. Real value calculation.

— 10
 — 25
 — 50
 — 100

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Main Result

Calculation: 060121 SouthWest area 2

Assumptions for shadow calculations

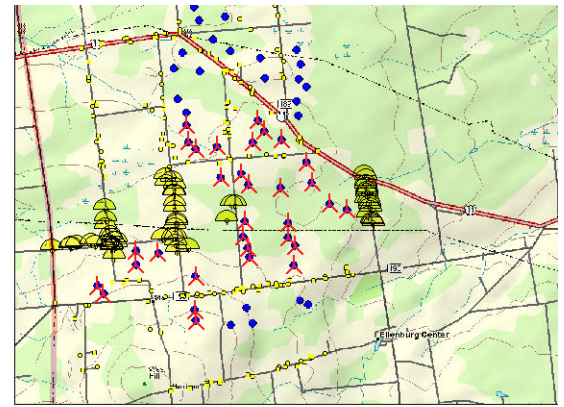
Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35

Operational time

N	NE	E	SE	S	SW	W	NW	Sum
1,850	1,325	800	713	625	663	700	1,275	7,950



Scale 1:200,000

New WTG

Shadow receptor

WTGs

UTM NAD27 Zone: 18			Row data/Description	WTG type		Power [kW]	Diam. [m]	Height [m]	RPM [RPM]
East	North	Z		Valid	Manufact. Type				
1	586,244	4,971,695	395 012	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
2	581,965	4,973,881	382 053	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
3	584,027	4,973,748	404 055	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
4	584,494	4,973,518	408 056	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
5	582,025	4,973,435	385 057	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
6	582,792	4,973,326	396 058	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
7	582,225	4,973,245	389 059	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
8	585,159	4,972,933	402 060	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
9	583,438	4,972,609	404 062	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
10	582,893	4,972,499	404 063	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
11	585,312	4,972,397	392 064	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
12	583,632	4,972,311	400 066	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
13	583,545	4,971,346	412 067	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
14	584,696	4,971,320	396 070-R	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
15	584,482	4,972,239	396 073-W	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
16	583,858	4,974,035	399 074	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
17	584,700	4,970,946	400 089-R	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
18	582,254	4,969,875	457 093	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
19	583,509	4,970,939	419 096-S	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
20	583,638	4,970,655	422 097	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
21	583,679	4,970,404	424 098	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
22	584,889	4,970,727	401 100-R	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
23	581,248	4,970,489	432 102-L	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
24	580,659	4,970,535	427 104-L	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
25	580,664	4,970,165	435 105-L	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
26	579,808	4,969,375	451 106-L	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
27	579,645	4,969,577	441 107-L	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
28	584,863	4,970,206	410 109	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
29	582,286	4,968,695	494 157	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
30	582,254	4,968,968	485 200	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
31	585,793	4,971,835	396 202	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7
32	583,734	4,973,440	404 206	Yes	GAMESA G90/2000	2,000	90.0	78.0	16.7

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Main Result

Calculation: 060121 SouthWest area 2

Shadow receptor-Input

UTM NAD27 Zone: 18

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window
		[m]	[m]	[m]	[m]	[m]	[m]	[°]	[°]
156	156	581,675	4,971,724	407	1.0	1.0	1.0	0.0	0.0
157	157	581,442	4,972,265	399	1.0	1.0	1.0	0.0	0.0
162	162	586,753	4,971,876	380	1.0	1.0	1.0	0.0	0.0
163	163	581,707	4,970,868	419	1.0	1.0	1.0	0.0	0.0
164	164	581,755	4,970,511	429	1.0	1.0	1.0	0.0	0.0
165	165	582,056	4,970,603	422	1.0	1.0	1.0	0.0	0.0
166	166	581,735	4,971,273	412	1.0	1.0	1.0	0.0	0.0
167	167	580,037	4,970,569	427	1.0	1.0	1.0	0.0	0.0
168	168	580,090	4,970,305	429	1.0	1.0	1.0	0.0	0.0
169	169	579,867	4,971,108	416	1.0	1.0	1.0	0.0	0.0
170	170	579,090	4,970,633	417	1.0	1.0	1.0	0.0	0.0
218	218	578,423	4,970,526	412	1.0	1.0	1.0	0.0	0.0
219	219	580,142	4,970,616	427	1.0	1.0	1.0	0.0	0.0
220	220	580,009	4,970,630	426	1.0	1.0	1.0	0.0	0.0
221	221	581,365	4,970,833	422	1.0	1.0	1.0	0.0	0.0
222	222	581,640	4,970,872	420	1.0	1.0	1.0	0.0	0.0
245	245	581,657	4,972,020	402	1.0	1.0	1.0	0.0	0.0
246	246	581,673	4,972,002	403	1.0	1.0	1.0	0.0	0.0
269	269	581,431	4,972,432	396	1.0	1.0	1.0	0.0	0.0
270	270	581,592	4,972,356	398	1.0	1.0	1.0	0.0	0.0
271	271	581,668	4,972,204	400	1.0	1.0	1.0	0.0	0.0
272	272	581,689	4,971,585	409	1.0	1.0	1.0	0.0	0.0
273	273	581,748	4,971,234	412	1.0	1.0	1.0	0.0	0.0
274	274	581,685	4,971,120	412	1.0	1.0	1.0	0.0	0.0
275	275	581,731	4,970,688	422	1.0	1.0	1.0	0.0	0.0
282	282	580,021	4,970,531	427	1.0	1.0	1.0	0.0	0.0
283	283	580,004	4,970,823	427	1.0	1.0	1.0	0.0	0.0
284	284	579,991	4,970,900	423	1.0	1.0	1.0	0.0	0.0
285	285	579,864	4,971,302	412	1.0	1.0	1.0	0.0	0.0
286	286	579,831	4,971,611	409	1.0	1.0	1.0	0.0	0.0
292	292	580,064	4,970,735	427	1.0	1.0	1.0	0.0	0.0
293	293	580,133	4,970,739	427	1.0	1.0	1.0	0.0	0.0
310	310	586,959	4,971,282	373	1.0	1.0	1.0	0.0	0.0
311	311	586,947	4,971,330	374	1.0	1.0	1.0	0.0	0.0
312	312	586,919	4,971,366	376	1.0	1.0	1.0	0.0	0.0
313	313	586,800	4,971,516	382	1.0	1.0	1.0	0.0	0.0
314	314	586,872	4,971,655	376	1.0	1.0	1.0	0.0	0.0
315	315	586,856	4,971,743	377	1.0	1.0	1.0	0.0	0.0
316	316	586,864	4,971,802	377	1.0	1.0	1.0	0.0	0.0
317	317	586,824	4,971,885	379	1.0	1.0	1.0	0.0	0.0
318	318	586,777	4,972,056	379	1.0	1.0	1.0	0.0	0.0
319	319	586,773	4,972,104	378	1.0	1.0	1.0	0.0	0.0
320	320	586,773	4,972,159	377	1.0	1.0	1.0	0.0	0.0
321	321	586,757	4,972,270	375	1.0	1.0	1.0	0.0	0.0
322	322	586,749	4,972,346	373	1.0	1.0	1.0	0.0	0.0
323	323	586,737	4,972,501	372	1.0	1.0	1.0	0.0	0.0
324	324	586,693	4,972,584	373	1.0	1.0	1.0	0.0	0.0
333	333	583,287	4,971,751	404	1.0	1.0	1.0	0.0	0.0
334	334	583,196	4,971,753	405	1.0	1.0	1.0	0.0	0.0
366	366	579,903	4,970,678	424	1.0	1.0	1.0	0.0	0.0
367	367	579,572	4,970,639	420	1.0	1.0	1.0	0.0	0.0
368	368	579,482	4,970,682	419	1.0	1.0	1.0	0.0	0.0
369	369	578,931	4,970,577	415	1.0	1.0	1.0	0.0	0.0
370	370	578,943	4,970,608	415	1.0	1.0	1.0	0.0	0.0
371	371	583,068	4,971,360	415	1.0	1.0	1.0	0.0	0.0

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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US-RIVERSIDE, CA 92506

Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Main Result

Calculation: 060121 SouthWest area 2

Calculation Results

No.	Name	Shadow, worst case		Shadow, expected values	
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
156	156	0:00	0	0:00	0:00
157	157	0:00	0	0:00	0:00
162	162	32:08	77	0:38	8:05
163	163	43:34	96	0:38	9:29
164	164	28:02	54	0:40	8:27
165	165	10:36	33	0:26	3:01
166	166	0:00	0	0:00	0:00
167	167	39:02	96	0:34	10:27
168	168	65:50	143	0:36	18:16
169	169	18:30	74	0:24	4:23
170	170	0:00	0	0:00	0:00
218	218	0:00	0	0:00	0:00
219	219	60:08	122	0:40	15:44
220	220	39:28	109	0:32	10:20
221	221	39:32	78	0:54	8:25
222	222	50:02	84	0:42	10:53
245	245	0:00	0	0:00	0:00
246	246	0:00	0	0:00	0:00
269	269	0:00	0	0:00	0:00
270	270	0:00	0	0:00	0:00
271	271	0:00	0	0:00	0:00
272	272	0:00	0	0:00	0:00
273	273	0:00	0	0:00	0:00
274	274	0:00	0	0:00	0:00
275	275	27:06	52	0:40	6:09
282	282	35:50	90	0:32	9:41
283	283	17:04	53	0:30	4:08
284	284	16:32	46	0:28	3:55
285	285	0:00	0	0:00	0:00
286	286	0:00	0	0:00	0:00
292	292	33:22	87	0:34	8:14
293	293	25:52	65	0:38	6:27
310	310	2:10	16	0:10	0:41
311	311	16:44	47	0:26	5:20
312	312	24:38	59	0:30	7:47
313	313	46:28	104	0:38	14:31
314	314	19:36	46	0:34	6:06
315	315	19:04	44	0:34	5:39
316	316	17:44	42	0:34	4:59
317	317	19:24	44	0:34	4:42
318	318	24:30	56	0:34	5:21
319	319	28:38	68	0:34	6:17
320	320	36:06	80	0:32	7:47
321	321	11:16	36	0:24	2:20
322	322	0:00	0	0:00	0:00
323	323	0:00	0	0:00	0:00
324	324	0:00	0	0:00	0:00
333	333	6:32	24	0:20	1:26
334	334	27:54	54	0:38	6:36
366	366	27:30	86	0:28	7:03
367	367	0:00	0	0:00	0:00
368	368	0:00	0	0:00	0:00
369	369	0:00	0	0:00	0:00
370	370	0:00	0	0:00	0:00
371	371	66:56	123	0:44	18:09

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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US-RIVERSIDE, CA 92506

Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 162 - 162

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:03	06:35 17:43	16:30 (1) 17:06 (1)	05:38 18:23	17:30 (31) 20:01	05:47 20:34	05:13 20:46	05:41 20:25	06:17 19:34	17:10 (1) 17:38 (1)	06:33 16:46	07:13 16:17
2	07:34 16:26	07:15 17:05	06:34 17:44	16:28 (1) 17:06 (1)	05:36 18:24	17:33 (31) 20:01	05:45 20:35	05:13 20:46	05:42 20:23	06:18 19:33	17:08 (1) 17:40 (1)	06:35 16:44	07:14 16:16
3	07:34 16:27	07:14 17:06	06:32 17:45	16:28 (1) 17:07 (1)	05:35 18:25	17:37 (31) 20:02	05:44 20:36	05:14 20:46	05:43 20:22	06:20 19:31	17:07 (1) 17:41 (1)	06:36 16:43	07:15 16:16
4	07:34 16:28	07:13 17:08	06:30 17:47	16:29 (1) 17:07 (1)	05:33 18:27	17:41 (31) 20:03	05:42 20:36	05:15 20:46	05:44 20:21	06:21 19:29	17:06 (1) 17:40 (1)	06:38 16:41	07:16 16:16
5	07:34 16:29	07:12 17:09	06:28 17:48	16:27 (1) 17:05 (1)	06:31 19:28	17:37 (31) 20:04	05:44 20:37	05:15 20:46	05:43 20:20	06:22 19:27	17:05 (1) 17:41 (1)	06:39 16:40	07:17 16:15
6	07:34 16:30	07:11 17:11	06:26 17:49	16:27 (1) 17:05 (1)	06:29 19:29	17:37 (31) 20:06	05:44 20:38	05:16 20:45	05:47 20:18	06:23 19:25	17:05 (1) 17:41 (1)	06:40 16:39	07:18 16:15
7	07:34 16:31	07:09 17:12	06:25 17:51	16:27 (1) 17:05 (1)	06:27 19:31	17:37 (31) 20:08	05:44 20:39	05:17 20:45	05:48 20:17	06:24 19:23	17:04 (1) 17:41 (1)	06:42 16:37	07:19 16:15
8	07:34 16:32	07:08 17:13	06:23 17:52	16:27 (1) 17:05 (1)	06:25 19:32	17:37 (31) 20:10	05:44 20:40	05:18 20:44	05:49 20:14	06:26 19:20	17:03 (1) 17:41 (1)	06:43 16:36	07:20 16:15
9	07:33 16:33	07:07 17:15	06:21 17:53	16:27 (1) 17:03 (1)	06:24 19:33	17:37 (31) 20:12	05:44 20:41	05:18 20:44	05:50 20:14	06:27 19:20	17:02 (1) 17:40 (1)	06:44 16:35	07:21 16:15
10	07:33 16:34	07:05 17:16	06:19 17:55	16:30 (1) 17:04 (1)	06:22 19:34	17:37 (31) 20:14	05:44 20:42	05:19 20:44	05:51 20:13	06:28 19:18	17:02 (1) 17:40 (1)	06:46 16:34	07:22 16:15
11	07:33 16:35	07:04 17:18	06:17 17:56	16:30 (1) 17:02 (1)	06:20 19:36	17:37 (31) 20:16	05:44 20:43	05:20 20:43	05:52 20:11	06:29 19:16	17:03 (1) 17:39 (1)	06:47 16:33	07:23 16:15
12	07:32 16:37	07:02 17:19	06:16 17:57	16:30 (1) 17:00 (1)	06:18 19:37	17:37 (31) 20:18	05:44 20:42	05:21 20:43	05:54 20:10	06:30 19:14	17:02 (1) 17:38 (1)	06:48 16:31	07:24 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	16:32 (1) 16:58 (1)	06:16 19:38	17:37 (31) 20:20	05:44 20:42	05:22 20:42	05:55 20:08	06:32 19:12	17:02 (1) 17:38 (1)	06:50 16:30	07:25 16:15
14	07:31 16:39	06:59 17:22	06:12 18:00	16:32 (1) 16:56 (1)	06:15 19:39	17:37 (31) 20:22	05:44 20:43	05:22 20:41	05:56 20:07	06:33 19:10	17:03 (1) 17:37 (1)	06:51 16:29	07:26 16:15
15	07:31 16:40	06:58 17:23	06:10 18:01	16:34 (1) 16:54 (1)	06:13 19:41	17:37 (31) 20:24	05:44 20:43	05:23 20:41	05:57 20:05	06:34 19:08	17:02 (1) 17:36 (1)	06:53 16:28	07:27 16:15
16	07:30 16:42	06:57 17:25	06:08 18:03	16:38 (1) 16:50 (1)	06:11 19:42	17:37 (31) 20:26	05:44 20:44	05:24 20:40	05:58 20:03	06:35 19:06	17:04 (1) 17:36 (1)	06:54 16:27	07:27 16:16
17	07:30 16:43	06:55 17:26	06:06 18:04	16:50 (1) 19:43	06:10 19:43	17:37 (31) 20:28	05:44 20:44	05:25 20:39	05:59 20:02	06:36 19:05	17:05 (1) 17:33 (1)	06:55 16:26	07:28 16:16
18	07:29 16:44	06:53 17:28	06:04 18:05	16:50 (1) 19:44	06:09 19:44	17:37 (31) 20:30	05:44 20:45	05:26 20:39	06:01 20:00	06:37 19:03	17:06 (1) 18:09 (1)	06:57 16:25	07:29 16:16
19	07:29 16:45	06:52 17:29	06:03 18:06	16:50 (1) 19:46	06:08 19:46	17:37 (31) 20:32	05:44 20:45	05:27 20:39	06:02 20:00	06:39 19:03	17:08 (1) 18:08 (1)	06:58 16:24	07:29 16:16
20	07:28 16:47	06:50 17:30	06:01 18:08	16:50 (1) 19:47	06:07 19:47	17:37 (31) 20:34	05:44 20:46	05:28 20:40	06:03 20:00	06:40 19:03	17:09 (1) 18:08 (1)	06:59 16:24	07:30 16:17
21	07:27 16:48	06:49 17:32	16:42 (1) 18:09	17:39 (31) 19:48	06:03 19:48	17:37 (31) 20:36	05:44 20:46	05:29 20:36	06:04 20:00	06:41 19:03	17:13 (1) 18:08 (1)	07:01 16:23	07:31 16:17
22	07:26 16:49	06:47 17:33	16:38 (1) 18:10	17:35 (31) 19:49	06:01 19:49	17:37 (31) 20:38	05:44 20:46	05:30 20:35	06:05 20:00	06:42 19:05	17:12 (1) 18:09 (1)	07:02 16:22	07:31 16:18
23	07:26 16:51	06:45 17:35	16:36 (1) 18:12	17:33 (31) 19:51	05:59 19:51	17:37 (31) 20:40	05:44 20:46	05:31 20:34	06:07 20:00	06:43 19:05	17:11 (1) 18:08 (1)	07:03 16:21	07:32 16:18
24	07:25 16:52	06:44 17:36	16:35 (1) 18:13	17:31 (31) 19:52	05:58 19:52	17:37 (31) 20:42	05:44 20:46	05:32 20:33	06:08 20:00	06:45 19:05	17:10 (1) 18:07 (1)	07:04 16:21	07:32 16:19
25	07:24 16:54	06:42 17:37	16:33 (1) 18:14	17:31 (31) 19:53	05:56 19:53	17:37 (31) 20:44	05:44 20:46	05:33 20:32	06:09 20:00	06:46 19:05	17:09 (1) 18:06 (1)	07:06 16:20	07:32 16:20
26	07:23 16:55	06:40 17:39	16:31 (1) 18:15	17:30 (31) 19:54	05:55 19:54	17:37 (31) 20:46	05:44 20:47	05:34 20:31	06:10 20:00	06:47 19:05	17:08 (1) 18:05 (1)	07:07 16:19	07:33 16:20
27	07:22 16:56	06:39 17:40	16:31 (1) 18:17	17:30 (31) 19:56	05:53 19:56	17:37 (31) 20:48	05:44 20:47	05:35 20:30	06:11 20:00	06:48 19:05	17:11 (1) 18:04 (1)	07:08 16:19	07:33 16:21
28	07:21 16:58	06:37 17:41	16:30 (1) 18:18	17:30 (31) 19:57	05:51 19:57	17:37 (31) 20:50	05:44 20:47	05:36 20:29	06:13 20:00	06:49 19:05	17:10 (1) 18:03 (1)	07:09 16:18	07:33 16:22
29	07:20 16:59	06:36 17:42	16:29 (1) 18:19	17:30 (31) 19:58	05:50 19:58	17:37 (31) 20:52	05:44 20:47	05:37 20:28	06:14 20:00	06:51 19:05	17:11 (1) 18:02 (1)	07:10 16:18	07:34 16:22
30	07:19 17:01	06:35 17:43	16:28 (1) 18:20	17:30 (31) 19:59	05:48 19:59	17:37 (31) 20:54	05:44 20:46	05:39 20:27	06:15 20:00	06:52 19:05	17:12 (1) 18:01 (1)	07:11 16:17	07:34 16:23
31	07:18 17:02	06:34 17:44	16:27 (1) 18:22	17:30 (31) 20:00	05:46 20:00	17:37 (31) 20:56	05:44 20:46	05:40 20:26	06:16 20:00	06:53 19:05	17:13 (1) 18:00 (1)	07:12 16:16	07:34 16:24
Potential sun hours	286	291	369	404	404	285	254	272	4	376	304	666	274
Total, worst case		214	712	32									
Sun reduction		0.45	0.50	0.55							0.55	0.45	
Oper. time red.		0.91	0.91	0.91							0.91	0.91	
Wind dir. red.		0.56	0.57	0.62							0.60	0.56	
Total reduction		0.23	0.26	0.31							0.30	0.23	
Total, real		49	185	10							91	151	

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/22/06 21:43 / 5
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 163 - 163

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December		
1	07:34 16:25	15:27 (23) 17:04	07:17 17:43	15:33 (23) 17:43	06:35 17:43	05:39 20:00	05:47 20:34	05:14 20:47	05:14 20:25	05:41 19:35	06:18 18:38	06:53 16:46	07:13 15:09 (23)	
2	07:34 16:26	15:27 (23) 17:05	07:16 17:44	15:34 (23) 17:44	06:34 17:44	05:37 20:01	05:46 20:35	05:13 20:46	05:14 20:24	05:42 19:33	06:19 18:36	06:55 16:44	07:14 15:08 (23)	
3	07:34 16:27	15:27 (23) 17:06	07:15 17:46	15:36 (23) 17:46	06:32 17:46	05:35 20:02	05:44 20:36	05:13 20:46	05:15 20:22	05:43 19:31	06:20 18:35	06:56 16:43	07:15 15:09 (23)	
4	07:34 16:28	15:27 (23) 17:07	07:13 17:47	15:37 (23) 17:47	06:30 17:47	05:33 20:03	05:42 20:37	05:12 20:46	05:15 20:21	05:45 19:29	06:21 18:33	06:57 16:42	15:15 (23) 16:16	07:17 15:10 (23)
5	07:34 16:29	15:27 (23) 17:08	07:12 17:48	15:40 (23) 17:48	06:28 17:48	06:31 20:04	05:41 20:37	05:12 20:46	05:16 20:20	05:46 19:27	06:22 18:31	06:58 16:40	15:10 (23) 16:16	07:18 15:11 (23)
6	07:34 16:30	15:26 (23) 17:09	07:11 17:49	15:40 (23) 17:49	06:27 17:49	06:29 20:05	05:40 20:37	05:11 20:46	05:17 20:20	05:47 19:27	06:23 18:31	07:00 16:40	15:08 (23) 16:16	07:19 15:13 (23)
7	07:34 16:31	15:26 (23) 17:10	07:11 17:50	15:45 (23) 17:50	06:25 17:50	06:28 20:06	05:39 20:38	05:11 20:46	05:17 20:18	05:48 19:26	06:25 18:29	07:01 16:39	15:07 (23) 16:16	07:20 15:14 (23)
8	07:34 16:32	15:26 (23) 17:11	07:10 17:51	15:45 (23) 17:51	06:25 17:51	06:28 20:07	05:39 20:39	05:11 20:45	05:17 20:16	05:48 19:22	06:25 18:25	07:01 16:36	15:05 (23) 16:15	07:21 15:15 (23)
9	07:34 16:33	15:26 (23) 17:12	07:10 17:52	15:45 (23) 17:52	06:25 17:52	06:28 20:08	05:39 20:40	05:11 20:45	05:17 20:16	05:48 19:22	06:25 18:25	07:01 16:36	15:05 (23) 16:15	07:21 15:15 (23)
10	07:34 16:34	15:26 (23) 17:13	07:10 17:53	15:45 (23) 17:53	06:25 17:53	06:28 20:09	05:39 20:41	05:11 20:44	05:17 20:14	05:48 19:20	06:25 18:24	07:01 16:35	15:05 (23) 16:15	07:22 15:16 (23)
11	07:34 16:35	15:26 (23) 17:14	07:10 17:54	15:45 (23) 17:54	06:25 17:54	06:28 20:10	05:39 20:42	05:11 20:43	05:17 20:13	05:48 19:18	06:25 18:22	07:01 16:34	15:05 (23) 16:15	07:23 15:17 (23)
12	07:34 16:36	15:26 (23) 17:15	07:10 17:55	15:45 (23) 17:55	06:25 17:55	06:28 20:11	05:39 20:43	05:11 20:42	05:17 20:12	05:48 19:16	06:25 18:20	07:01 16:33	15:05 (23) 16:15	07:24 15:18 (23)
13	07:34 16:37	15:26 (23) 17:16	07:10 17:56	15:45 (23) 17:56	06:25 17:56	06:28 20:12	05:39 20:44	05:11 20:41	05:17 20:11	05:48 19:14	06:25 18:18	07:01 16:32	15:05 (23) 16:15	07:25 15:19 (23)
14	07:34 16:38	15:26 (23) 17:17	07:10 17:57	15:45 (23) 17:57	06:25 17:57	06:28 20:13	05:39 20:45	05:11 20:40	05:17 20:10	05:48 19:12	06:25 18:16	07:01 16:31	15:05 (23) 16:15	07:26 15:20 (23)
15	07:34 16:39	15:26 (23) 17:18	07:10 17:58	15:45 (23) 17:58	06:25 17:58	06:28 20:14	05:39 20:46	05:11 20:39	05:17 20:09	05:48 19:11	06:25 18:15	07:01 16:30	15:05 (23) 16:15	07:27 15:21 (23)
16	07:34 16:40	15:26 (23) 17:19	07:10 17:59	15:45 (23) 17:59	06:25 17:59	06:28 20:15	05:39 20:47	05:11 20:38	05:17 20:08	05:48 19:10	06:25 18:14	07:01 16:29	15:05 (23) 16:16	07:28 15:22 (23)
17	07:34 16:41	15:26 (23) 17:20	07:10 18:00	15:45 (23) 18:00	06:25 18:00	06:28 20:16	05:39 20:48	05:11 20:37	05:17 20:07	05:48 19:09	06:25 18:13	07:01 16:28	15:05 (23) 16:16	07:29 15:23 (23)
18	07:34 16:42	15:26 (23) 17:21	07:10 18:01	15:45 (23) 18:01	06:25 18:01	06:28 20:17	05:39 20:49	05:11 20:36	05:17 20:06	05:48 19:08	06:25 18:12	07:01 16:27	15:05 (23) 16:16	07:30 15:24 (23)
19	07:34 16:43	15:26 (23) 17:22	07:10 18:02	15:45 (23) 18:02	06:25 18:02	06:28 20:18	05:39 20:50	05:11 20:35	05:17 20:05	05:48 19:07	06:25 18:11	07:01 16:26	15:05 (23) 16:16	07:31 15:25 (23)
20	07:34 16:44	15:26 (23) 17:23	07:10 18:03	15:45 (23) 18:03	06:25 18:03	06:28 20:19	05:39 20:51	05:11 20:34	05:17 20:04	05:48 19:06	06:25 18:10	07:01 16:25	15:05 (23) 16:16	07:32 15:26 (23)
21	07:34 16:45	15:26 (23) 17:24	07:10 18:04	15:45 (23) 18:04	06:25 18:04	06:28 20:20	05:39 20:52	05:11 20:33	05:17 20:03	05:48 19:05	06:25 18:09	07:01 16:24	15:05 (23) 16:16	07:33 15:27 (23)
22	07:34 16:46	15:26 (23) 17:25	07:10 18:05	15:45 (23) 18:05	06:25 18:05	06:28 20:21	05:39 20:53	05:11 20:32	05:17 20:02	05:48 19:04	06:25 18:08	07:01 16:23	15:05 (23) 16:16	07:34 15:28 (23)
23	07:34 16:47	15:26 (23) 17:26	07:10 18:06	15:45 (23) 18:06	06:25 18:06	06:28 20:22	05:39 20:54	05:11 20:31	05:17 20:01	05:48 19:03	06:25 18:07	07:01 16:22	15:05 (23) 16:16	07:35 15:29 (23)
24	07:34 16:48	15:26 (23) 17:27	07:10 18:07	15:45 (23) 18:07	06:25 18:07	06:28 20:23	05:39 20:55	05:11 20:30	05:17 20:00	05:48 19:02	06:25 18:06	07:01 16:21	15:05 (23) 16:16	07:36 15:30 (23)
25	07:34 16:49	15:26 (23) 17:28	07:10 18:08	15:45 (23) 18:08	06:25 18:08	06:28 20:24	05:39 20:56	05:11 20:29	05:17 19:59	05:48 19:01	06:25 18:05	07:01 16:20	15:05 (23) 16:16	07:37 15:31 (23)
26	07:34 16:50	15:26 (23) 17:29	07:10 18:09	15:45 (23) 18:09	06:25 18:09	06:28 20:25	05:39 20:57	05:11 20:28	05:17 19:58	05:48 19:00	06:25 18:04	07:01 16:19	15:05 (23) 16:16	07:38 15:32 (23)
27	07:34 16:51	15:26 (23) 17:30	07:10 18:10	15:45 (23) 18:10	06:25 18:10	06:28 20:26	05:39 20:58	05:11 20:27	05:17 19:57	05:48 18:59	06:25 18:03	07:01 16:18	15:05 (23) 16:16	07:39 15:33 (23)
28	07:34 16:52	15:26 (23) 17:31	07:10 18:11	15:45 (23) 18:11	06:25 18:11	06:28 20:27	05:39 20:59	05:11 20:26	05:17 19:56	05:48 18:58	06:25 18:02	07:01 16:17	15:05 (23) 16:16	07:40 15:34 (23)
29	07:34 16:53	15:26 (23) 17:32	07:10 18:12	15:45 (23) 18:12	06:25 18:12	06:28 20:28	05:39 21:00	05:11 20:25	05:17 19:55	05:48 18:57	06:25 18:01	07:01 16:16	15:05 (23) 16:16	07:41 15:35 (23)
30	07:34 16:54	15:26 (23) 17:33	07:10 18:13	15:45 (23) 18:13	06:25 18:13	06:28 20:29	05:39 21:01	05:11 20:24	05:17 19:54	05:48 18:56	06:25 18:00	07:01 16:15	15:05 (23) 16:16	07:42 15:36 (23)
31	07:34 16:55	15:26 (23) 17:34	07:10 18:14	15:45 (23) 18:14	06:25 18:14	06:28 20:30	05:39 21:02	05:11 20:23	05:17 19:53	05:48 18:55	06:25 17:59	07:01 16:14	15:05 (23) 16:16	07:43 15:37 (23)
Potential sun hours	286	291	369	380	285	254	272	4	376	341	288	856	620	
Total, worst case	986	152										856	620	
Sun reduction	0.45	0.45										0.35	0.35	
Oper. time red.	0.91	0.91										0.91	0.91	
Wind dir. red.	0.61	0.61										0.61	0.61	
Total reduction	0.25	0.25										0.19	0.19	
Total, real	245	38										166	120	

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/22/06 21:43 / 6
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 164 - 164

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:04	06:35 17:43	05:39 18:23	17:09 (23) 20:00	05:47 20:34	05:14 20:47	05:41 20:25	06:18 19:35	18:10 (23) 18:38	06:53 16:46	07:13 16:17	
2	07:34 16:26	07:16 17:05	06:34 17:44	05:37 18:24	17:09 (23) 20:01	05:46 20:35	05:13 20:46	05:42 20:24	06:19 19:33	18:09 (23) 18:36	06:55 16:44	07:14 16:17	
3	07:34 16:27	07:14 17:07	06:32 17:46	05:35 18:26	17:09 (23) 20:02	05:44 20:36	05:13 20:46	05:43 20:22	06:20 19:31	18:08 (23) 18:35	06:56 16:43	07:15 16:16	
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:27	17:09 (23) 20:03	05:43 20:37	05:12 20:46	05:45 20:21	06:21 19:29	18:07 (23) 18:33	06:57 16:42	07:17 16:16	
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	18:09 (23) 20:05	05:41 20:37	05:16 20:46	05:46 20:20	06:22 19:27	18:06 (23) 18:31	06:58 16:40	07:18 16:16	
6	07:34 16:30	07:11 17:11	06:27 17:50	06:29 19:29	18:09 (23) 20:06	05:40 20:38	05:17 20:46	05:47 20:18	06:23 19:26	18:05 (23) 18:29	07:00 16:39	07:19 16:16	
7	07:34 16:31	07:09 17:12	06:25 17:51	06:28 19:31	18:10 (23) 20:07	05:39 20:39	05:17 20:45	05:48 20:17	06:25 19:24	18:04 (23) 18:27	07:01 16:38	07:20 16:15	
8	07:34 16:32	07:08 17:14	06:23 17:52	06:26 19:32	18:10 (23) 20:08	05:37 20:40	05:18 20:45	05:49 20:16	06:26 19:22	18:04 (23) 18:25	07:02 16:36	07:21 16:15	
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	18:10 (23) 20:09	05:36 20:40	05:19 20:44	05:50 20:14	06:27 19:20	18:03 (23) 18:24	07:03 16:35	07:22 16:15	
10	07:33 16:35	07:05 17:17	06:19 17:55	06:22 19:35	18:10 (23) 20:11	05:35 20:41	05:19 20:44	05:51 20:13	06:28 19:18	18:02 (23) 18:22	07:05 16:34	07:23 16:15	
11	07:33 16:36	07:04 17:18	06:18 17:56	06:20 19:36	18:10 (23) 20:12	05:33 20:42	05:19 20:43	05:53 20:11	06:29 19:16	18:01 (23) 18:20	07:06 16:33	07:24 16:15	
12	07:33 16:37	07:03 17:19	06:16 17:58	06:19 19:37	18:13 (23) 20:13	05:32 20:42	05:21 20:43	05:54 20:10	06:31 19:14	18:02 (23) 18:18	07:07 16:32	07:24 16:15	
13	07:32 16:38	07:01 17:21	06:14 17:59	06:17 19:38	18:13 (23) 20:14	05:31 20:43	05:22 20:42	05:55 20:08	06:32 19:12	18:01 (23) 18:16	07:08 16:31	07:25 16:15	
14	07:32 16:39	07:00 17:22	06:12 18:00	06:15 19:40	18:15 (23) 20:15	05:30 20:43	05:23 20:42	05:56 20:07	06:33 19:11	18:02 (23) 18:15	07:10 16:30	07:26 16:15	
15	07:31 16:41	06:58 17:24	06:10 18:02	06:13 19:41	18:17 (23) 20:16	05:29 20:44	05:24 20:41	05:57 20:05	06:34 19:09	18:02 (23) 18:13	07:11 16:29	07:27 16:16	
16	07:31 16:42	06:57 17:25	06:08 18:03	06:11 19:42	18:24 (23) 20:18	05:27 20:44	05:25 20:40	05:59 20:04	06:35 19:07	18:03 (23) 18:11	07:12 16:28	07:28 16:16	
17	07:30 16:43	06:55 17:26	06:07 18:04	06:10 19:43	18:28 (23) 20:19	05:26 20:45	05:25 20:40	06:00 20:02	06:37 19:05	18:02 (23) 18:09	07:14 16:27	07:28 16:16	
18	07:29 16:44	06:54 17:28	06:05 18:05	06:08 19:45	18:33 (23) 20:20	05:25 20:45	05:26 20:39	06:01 20:01	06:38 19:03	18:03 (23) 18:35 (23)	07:15 18:08	07:29 16:16	
19	07:29 16:46	06:52 17:29	06:03 18:07	06:06 19:46	18:39 (23) 20:21	05:24 20:45	05:27 20:38	06:02 19:57	06:39 19:01	18:04 (23) 18:32 (23)	07:16 18:06	07:30 16:17	
20	07:28 16:47	06:51 17:31	06:01 18:08	06:05 19:47	18:39 (23) 20:22	05:23 20:46	05:28 20:37	06:03 19:56	06:40 18:59	18:05 (23) 18:31 (23)	07:17 18:04	07:30 16:17	
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	17:27 (23) 20:23	06:03 20:46	05:29 20:36	06:04 19:54	06:41 18:57	18:09 (23) 18:23 (23)	07:19 18:03	07:31 16:18	
22	07:27 16:50	06:47 17:33	05:57 18:11	06:01 19:50	17:23 (23) 20:24	06:01 20:46	05:21 20:36	06:06 19:52	06:42 18:55	18:10 (23) 18:24 (23)	07:20 18:01	07:32 16:18	
23	07:26 16:51	06:46 17:35	05:55 18:12	06:00 19:51	17:20 (23) 20:25	06:00 20:46	05:31 20:35	06:07 19:51	06:44 18:53	18:24 (23) 18:01	07:21 16:22	07:32 16:19	
24	07:25 16:52	06:44 17:36	05:54 18:13	05:58 19:52	17:18 (23) 20:26	05:19 20:47	05:32 20:34	06:08 19:49	06:45 18:52	18:24 (23) 17:58	07:23 16:21	07:32 16:19	
25	07:24 16:54	06:42 17:38	05:52 18:14	05:56 19:53	17:16 (23) 20:27	05:19 20:47	05:33 20:33	06:09 19:47	06:46 18:50	18:24 (23) 18:01	07:24 16:22	07:33 16:20	
26	07:23 16:55	06:41 17:39	05:50 18:16	05:55 19:55	17:14 (23) 20:28	05:18 20:47	05:11 20:32	06:10 19:45	06:47 18:48	18:24 (23) 18:01	07:25 16:23	07:33 16:20	
27	07:22 16:57	06:39 17:40	05:48 18:17	05:53 19:56	17:14 (23) 20:29	05:17 20:47	05:12 20:31	06:12 19:44	06:49 18:46	18:26 (23) 18:35 (23)	07:26 16:24	07:33 16:21	
28	07:21 16:58	06:37 17:42	05:46 18:18	05:52 19:57	17:12 (23) 20:30	05:16 20:47	05:37 20:29	06:13 19:42	06:50 18:44	18:19 (23) 18:38 (23)	07:27 16:25	07:34 16:22	
29	07:20 16:59	06:36 18:19	05:44 18:19	05:50 19:58	17:10 (23) 20:31	05:15 20:47	05:38 20:28	06:14 19:40	06:51 18:42	18:16 (23) 18:38 (23)	07:28 16:26	07:34 16:23	
30	07:19 17:01	06:35 18:21	05:42 18:21	05:49 20:00	17:10 (23) 20:32	05:15 20:47	05:39 20:27	06:15 19:38	06:52 18:40	18:13 (23) 18:39 (23)	07:29 16:27	07:34 16:23	
31	07:18 17:02	06:34 18:22	05:40 18:22	05:47 19:59	17:11 (23) 20:33	05:14 20:48	05:40 20:26	06:16 19:37	06:53 18:40 (23)	18:12 (23) 18:40 (23)	07:30 16:28	07:34 16:24	
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	752	341	288	275
Total, worst case			330	504				96					
Sun reduction			0.50	0.55				0.55		0.55			
Oper. time red.			0.91	0.91						0.91			
Wind dir. red.			0.62	0.62				0.62		0.62			
Total reduction			0.28	0.31				0.31		0.31			
Total, real			92	155				30		231			

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 165 - 165

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes
 Sun shine probabilities (part of time from sun rise to sun set with sun shine)
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
 Operational time
 N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:04	06:35 17:43	05:39 18:23	05:47 20:00	05:14 20:34	05:13 20:47	05:41 20:25	06:18 19:35	06:53 18:38	17:59 (23)	06:34 16:46	07:13 16:17
2	07:34 16:26	07:16 17:05	06:34 17:44	05:37 18:24	05:46 20:01	05:13 20:35	05:14 20:46	05:42 20:24	06:19 19:33	06:55 18:36	18:00 (23)	06:35 16:44	07:14 16:17
3	07:34 16:27	07:14 17:06	06:32 17:46	05:35 18:26	05:44 20:02	05:13 20:36	05:15 20:46	05:43 20:22	06:20 19:31	06:56 18:35	18:05 (23)	06:36 16:43	07:15 16:16
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	05:12 20:37	05:15 20:46	05:45 20:21	06:21 19:29	06:57 18:33	18:09 (23)	06:38 16:42	07:17 16:16
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:04	05:12 20:37	05:16 20:46	05:46 20:20	06:22 19:27	06:58 18:31		06:39 16:40	07:18 16:16
6	07:34 16:30	07:11 17:11	06:27 17:50	06:29 19:29	05:40 20:06	05:11 20:38	05:17 20:45	05:47 20:18	06:23 19:26	07:00 18:29		06:40 16:39	07:19 16:15
7	07:34 16:31	07:09 17:12	06:25 17:51	06:28 19:31	05:39 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27		06:42 16:38	07:20 16:15
8	07:34 16:32	07:08 17:14	06:23 17:52	06:26 19:32	05:37 20:08	05:11 20:40	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25		06:43 16:36	07:21 16:15
9	07:34 16:33	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40	05:19 20:44	05:50 20:14	06:27 19:20	07:03 18:24		06:45 16:35	07:22 16:15
10	07:33 16:35	07:05 17:17	06:19 17:55	06:22 19:35	05:35 20:11	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:05 18:22		06:46 16:34	07:23 16:15
11	07:33 16:36	07:04 17:18	06:18 17:56	17:24 (23) 06:20	05:33 19:36	05:10 20:12	05:20 20:43	05:53 20:11	06:29 19:16	07:06 18:20		06:47 16:33	07:24 16:15
12	07:33 16:37	07:03 17:19	06:16 17:58	17:20 (23) 06:19	05:32 19:37	05:10 20:13	05:21 20:43	05:54 20:10	06:31 19:14	07:07 18:18		06:49 16:32	07:24 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	17:18 (23) 06:17	05:31 19:38	05:10 20:14	05:22 20:43	05:55 20:08	06:32 19:12	07:08 18:16		06:50 16:31	07:25 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	17:16 (23) 06:15	05:30 19:40	05:09 20:15	05:23 20:43	05:56 20:07	06:33 19:10	07:10 18:15		06:51 16:30	07:26 16:15
15	07:31 16:41	06:58 17:24	06:10 18:02	17:15 (23) 06:13	05:29 19:41	05:09 20:16	05:24 20:44	05:57 20:05	06:34 19:09	07:11 18:13		06:53 16:29	07:27 16:16
16	07:31 16:42	06:57 17:25	06:08 18:03	17:15 (23) 06:11	05:27 19:42	05:09 20:18	05:25 20:44	05:59 20:04	06:35 19:07	07:12 18:11		06:54 16:28	07:28 16:16
17	07:30 16:43	06:55 17:26	06:07 18:04	17:15 (23) 06:10	05:26 19:43	05:09 20:19	05:25 20:40	06:00 20:02	06:37 19:05	07:14 18:09	18:10 (23)	06:55 16:27	07:28 16:16
18	07:29 16:44	06:54 17:28	06:05 18:05	17:13 (23) 06:08	05:25 19:45	05:09 20:20	05:26 20:45	06:01 20:39	06:38 19:03	07:15 18:08	18:05 (23)	06:57 16:26	07:29 16:16
19	07:29 16:46	06:52 17:29	06:03 18:07	17:13 (23) 06:06	05:24 19:46	05:10 20:21	05:27 20:45	06:02 19:57	06:39 19:01	07:16 18:06	18:19 (23)	06:58 16:25	07:30 16:17
20	07:28 16:47	06:50 17:31	06:01 18:08	17:13 (23) 06:05	05:23 19:47	05:10 20:22	05:28 20:37	06:03 19:56	06:40 18:59	07:17 18:04	18:20 (23)	06:59 16:24	07:30 16:17
21	07:27 16:48	06:49 17:32	05:59 18:09	17:13 (23) 06:03	05:22 19:48	05:10 20:23	05:29 20:36	06:04 19:54	06:41 18:57	07:19 18:03	18:01 (23)	07:01 16:23	07:31 16:18
22	07:27 16:50	06:47 17:33	05:57 18:11	17:13 (23) 06:01	05:21 19:50	05:10 20:24	05:30 20:36	06:06 19:52	06:42 18:55	07:20 18:01	17:58 (23)	07:02 16:22	07:31 16:18
23	07:26 16:51	06:46 17:35	05:55 18:12	17:15 (23) 06:00	05:20 19:51	05:10 20:25	05:31 20:46	06:07 19:51	06:44 18:53	07:21 17:59	17:57 (23)	07:03 16:22	07:32 16:19
24	07:25 16:52	06:44 17:36	05:53 18:13	17:16 (23) 05:58	05:19 19:52	05:11 20:26	05:32 20:46	06:08 19:49	06:45 18:51	07:23 17:58	17:56 (23)	07:05 16:21	07:32 16:19
25	07:24 16:54	06:42 17:38	05:52 18:14	17:18 (23) 05:56	05:19 19:53	05:11 20:27	05:33 20:33	06:09 19:47	06:46 18:50	07:24 18:21	17:57 (23)	07:06 16:20	07:33 16:20
26	07:23 16:55	06:41 17:39	05:50 18:16	17:20 (23) 05:55	05:18 19:55	05:11 20:28	05:35 20:32	06:10 19:45	06:47 18:48	07:25 18:20	17:56 (23)	07:07 16:20	07:33 16:20
27	07:22 16:57	06:39 17:40	05:48 18:17	17:28 (23) 05:53	05:17 19:56	05:12 20:29	05:36 20:47	06:12 20:31	06:49 19:44	07:26 18:46	17:56 (23)	07:08 16:19	07:33 16:21
28	07:21 16:58	06:37 17:42	05:46 18:18	05:52 19:57	05:16 20:30	05:12 20:47	05:37 20:29	06:13 19:42	06:50 18:44	07:27 18:52	18:19 (23)	07:10 16:18	07:34 16:22
29	07:20 16:59	06:36 18:19	05:44 18:19	05:50 19:58	05:16 20:31	05:12 20:47	05:38 20:28	06:14 19:40	06:51 18:42	07:28 18:50	17:56 (23)	07:11 16:18	07:34 16:23
30	07:19 17:01	06:35 18:21	05:42 18:21	05:49 20:00	05:15 20:32	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	07:29 18:49	17:57 (23)	07:12 16:17	07:34 16:23
31	07:18 17:02	06:34 18:22	05:40 18:22	05:48 20:33	05:14 20:26	05:14 20:33	05:40 20:26	06:16 19:37	06:52 16:47	07:30 16:47	18:15 (23)	07:13 16:17	07:34 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341		288	275
Total, worst case			314						290		32		
Sun reduction			0.50						0.55		0.45		
Oper. time red.			0.91						0.91		0.91		
Wind dir. red.			0.60						0.60		0.60		
Total reduction			0.27						0.30		0.25		
Total, real			86						87		8		

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)
	Minutes with flicker		

Project: 060119 Marble River

Description: Marble River Wind Project Shadow-Flicker, SW part 2 32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)

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Calculated: 01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 167 - 167

Assumptions for shadow calculations

Maximum distance for influence 1,000 m Minimum sun height over horizon for influence 3 ° Day step for calculation 1 days Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Table with 12 columns (Jan-Dec) and 1 row of probabilities: 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time table with 12 columns (N-Sum) and 1 row of values: 1,850 1,325 800 713 625 663 700 1,275 7,950

Main shadow calculation table with columns for months (January-December) and rows for sun rise/set times and reduction percentages.

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

Matrix for table layout with columns: 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:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, SW part 2
 32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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Calculated:

01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 168 - 168

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	
1	07:34 16:25	07:17 17:04	06:36 17:43	07:00 (25) 18:23	05:39 20:00	05:47 20:34	05:55 (24) 06:27 (24)
2	07:34 16:26	07:16 17:05	06:34 17:44	06:58 (25) 18:25	05:37 20:01	05:46 20:35	05:57 (24) 06:27 (24)
3	07:35 16:27	07:15 17:07	06:32 17:46	06:57 (25) 18:26	05:35 20:02	05:44 20:36	05:56 (24) 06:26 (24)
4	07:34 16:28	07:13 17:08	06:30 17:47	06:57 (25) 18:27	05:33 20:03	05:43 20:37	05:58 (24) 06:26 (24)
5	07:34 16:29	07:12 17:09	06:29 17:48	06:55 (25) 19:28	06:31 20:05	05:41 16 06:19 (24)	05:12 05:58 (24) 06:26 (24)
6	07:34 16:30	07:11 17:11	06:27 17:50	06:53 (25) 19:30	06:29 20:06	05:40 20 06:21 (24)	05:11 05:59 (24) 06:25 (24)
7	07:34 16:31	07:10 17:12	06:25 17:51	06:53 (25) 19:31	06:28 20:07	05:39 22 06:22 (24)	05:11 05:59 (24) 06:25 (24)
8	07:34 16:32	07:08 17:14	06:23 17:52	06:54 (25) 19:32	06:26 20:08	05:37 24 06:23 (24)	05:11 06:25 (24) 06:00 (24)
9	07:34 16:33	07:07 17:15	06:21 17:54	06:52 (25) 19:33	06:24 20:09	05:36 26 06:24 (24)	05:10 06:24 (24) 06:00 (24)
10	07:33 16:33	07:06 17:17	06:20 17:55	06:52 (25) 19:35	06:22 20:11	05:35 28 06:24 (24)	05:10 06:24 (24) 06:02 (24)
11	07:33 16:36	07:04 17:18	06:18 17:56	06:52 (25) 19:36	06:20 20:12	05:33 30 06:25 (24)	05:10 06:24 (24) 06:02 (24)
12	07:33 16:37	07:03 17:19	06:16 17:58	06:52 (25) 19:37	06:19 20:13	05:32 32 06:26 (24)	05:10 06:24 (24) 06:02 (24)
13	07:32 16:38	07:01 17:21	06:14 17:59	06:52 (25) 19:38	06:17 20:14	05:31 32 06:27 (24)	05:10 06:24 (24) 06:02 (24)
14	07:32 16:39	07:00 17:22	06:12 18:00	06:53 (25) 19:40	06:15 20:15	05:30 34 06:28 (24)	05:10 06:24 (24) 06:02 (24)
15	07:31 16:41	06:58 17:24	06:10 18:02	06:53 (25) 19:41	06:13 20:17	05:29 34 06:27 (24)	05:10 06:24 (24) 06:04 (24)
16	07:31 16:42	06:57 17:25	06:09 18:03	06:55 (25) 19:42	06:12 20:18	05:27 34 06:28 (24)	05:10 06:24 (24) 06:04 (24)
17	07:30 16:43	06:55 17:27	06:07 18:04	06:55 (25) 19:43	06:10 20:19	05:26 36 06:29 (24)	05:10 06:24 (24) 06:04 (24)
18	07:30 16:45	06:54 17:28	06:05 18:05	06:57 (25) 19:45	06:08 20:20	05:25 36 06:28 (24)	05:10 06:24 (24) 06:04 (24)
19	07:29 16:46	06:52 17:29	06:03 18:07	06:59 (25) 19:46	06:06 20:21	05:24 36 06:29 (24)	05:10 06:24 (24) 06:04 (24)
20	07:28 16:47	06:51 17:31	06:01 18:08	07:03 (25) 19:47	06:05 20:22	05:23 36 06:28 (24)	05:10 06:24 (24) 06:04 (24)
21	07:27 16:48	06:49 17:32	05:59 18:09	07:11 (25) 19:48	06:03 20:23	05:22 36 06:29 (24)	05:10 06:24 (24) 06:04 (24)
22	07:27 16:50	06:47 17:34	05:57 18:11	05:57 19:50	06:01 20:24	05:21 36 06:28 (24)	05:10 06:25 (24) 06:05 (24)
23	07:26 16:51	06:46 17:35	05:55 18:12	06:00 19:51	05:20 20:25	05:20 34 06:27 (24)	05:10 06:25 (24) 06:05 (24)
24	07:25 16:53	06:44 17:36	05:54 18:13	05:58 19:52	05:20 20:26	05:20 36 06:28 (24)	05:11 06:25 (24) 06:05 (24)
25	07:24 16:54	06:42 17:38	05:52 18:14	05:57 19:53	05:19 20:27	05:19 34 06:28 (24)	05:11 06:26 (24) 06:06 (24)
26	07:23 16:55	06:41 17:39	07:11 (25) 4 07:15 (25)	05:50 18:16	05:18 19:55	05:18 34 06:27 (24)	05:11 06:26 (24) 06:06 (24)
27	07:22 16:57	06:39 17:40	07:06 (25) 14 07:20 (25)	05:48 18:17	05:17 19:56	05:17 34 06:28 (24)	05:12 06:26 (24) 06:06 (24)
28	07:21 16:58	06:37 17:42	07:02 (25) 20 07:22 (25)	05:46 18:18	05:16 19:57	05:16 34 06:28 (24)	05:12 06:27 (24) 06:05 (24)
29	07:20 16:59		05:44 18:19	05:44 19:58	05:16 20:31	05:15 32 06:27 (24)	05:13 06:27 (24) 06:05 (24)
30	07:19 17:01		05:42 18:21	05:49 20:00	05:15 20:32	05:14 32 06:26 (24)	05:13 06:26 (24) 06:06 (24)
31	07:18 17:02		05:41 18:22	05:41 20:00	05:14 20:33	05:14 32 06:28 (24)	06:06 (24) 06:28 (24)
Potential sun hours	286	291	369	380	-285	860	688
Total, worst case		38	572			860	688
Sun reduction		0.45	0.50			0.55	0.55
Oper. time red.		0.91	0.91			0.91	0.91
Wind dir. red.		0.62	0.62			0.54	0.54
Total reduction		0.25	0.28			0.27	0.27
Total, real		10	162			235	188

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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 168 - 168

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:14 20:47	06:06 (24) 20:25	05:41 20:25	06:05 (24) 19:35	06:18 19:35	06:53 18:38
2	05:14 20:47	06:05 (24) 20:24	05:42 20:24	06:06 (24) 19:33	06:19 19:33	06:55 18:37
3	05:15 20:46	06:05 (24) 20:22	05:43 20:22	06:07 (24) 19:31	06:20 19:31	06:56 18:35
4	05:15 20:46	06:06 (24) 20:21	05:45 20:21	06:08 (24) 19:29	06:21 19:29	06:57 18:33
5	05:16 20:46	06:05 (24) 20:20	05:46 20:20	06:09 (24) 19:27	06:22 19:27	06:58 18:31
6	05:17 20:46	06:05 (24) 20:18	05:47 20:18	06:10 (24) 19:26	06:24 19:26	07:00 18:29
7	05:17 20:45	06:04 (24) 20:17	05:48 20:17	06:11 (24) 19:24	06:25 19:24	07:01 18:27
8	05:18 20:45	06:05 (24) 20:16	05:49 20:16	06:13 (24) 19:22	06:26 19:22	07:02 18:25
9	05:19 20:44	06:03 (24) 20:14	05:50 20:14	06:16 (24) 19:20	06:27 19:20	07:03 18:24
10	05:20 20:44	06:04 (24) 20:13	05:52 20:13	06:18 (24) 19:18	06:28 19:18	07:05 18:22
11	05:20 20:43	06:05 (24) 20:11	05:53 20:11	06:20 (24) 19:16	06:29 19:16	07:06 18:20
12	05:21 20:43	06:04 (24) 20:10	05:54 20:10	06:22 (24) 19:14	06:31 19:14	07:07 18:18
13	05:22 20:42	06:04 (24) 20:08	05:55 20:08	06:24 (24) 19:12	06:32 19:12	07:09 18:17
14	05:23 20:42	06:03 (24) 20:07	05:56 20:07	06:26 (24) 19:11	06:33 19:11	07:10 18:15
15	05:24 20:41	06:04 (24) 20:05	05:57 20:05	06:28 (24) 19:09	06:34 19:09	07:11 18:13
16	05:25 20:40	06:03 (24) 20:04	05:59 20:04	06:30 (24) 19:07	06:35 19:07	07:12 18:11
17	05:26 20:40	06:04 (24) 20:02	06:00 20:02	06:32 (24) 19:05	06:37 19:05	07:14 18:10
18	05:27 20:39	06:03 (24) 20:01	06:01 20:01	06:34 (24) 19:03	06:38 19:03	07:15 18:08
19	05:27 20:38	06:04 (24) 19:57	06:02 19:57	06:36 (24) 19:01	06:39 19:01	07:16 18:06
20	05:28 20:37	06:03 (24) 19:56	06:03 19:56	06:38 (24) 18:59	06:40 18:59	07:18 18:04
21	05:29 20:36	06:04 (24) 19:54	06:05 19:54	06:40 (24) 18:57	06:41 18:57	07:19 18:03
22	05:30 20:36	06:03 (24) 19:52	06:06 19:52	06:42 (24) 18:55	06:43 18:55	07:20 18:01
23	05:31 20:35	06:04 (24) 19:51	06:07 19:51	06:44 (24) 18:53	06:44 18:53	07:22 18:00
24	05:33 20:34	06:03 (24) 19:49	06:08 19:49	06:45 (24) 18:52	07:23 18:52	07:23 18:00
25	05:34 20:33	06:04 (24) 19:47	06:09 19:47	06:46 (24) 18:50	07:24 18:50	07:24 18:00
26	05:35 20:32	06:03 (24) 19:45	06:11 19:45	06:47 (24) 18:48	07:25 18:48	07:25 18:00
27	05:36 20:31	06:04 (24) 19:44	06:12 19:44	06:49 (24) 18:46	07:26 18:46	07:26 18:00
28	05:37 20:30	06:03 (24) 19:42	06:13 19:42	06:50 (24) 18:44	07:27 18:44	07:27 18:00
29	05:38 20:28	06:04 (24) 19:40	06:14 19:40	06:51 (24) 18:42	07:28 18:42	07:28 18:00
30	05:39 20:27	06:05 (24) 19:38	06:15 19:38	06:52 (24) 18:40	07:29 18:40	07:29 18:00
31	05:40 20:26	06:04 (24) 19:37	06:16 19:37	06:54 (24) 18:38	07:30 18:38	07:30 18:00
Potential sun hours	-272	4	376	341	288	275
Total, worst case	974	204	172	442		
Sun reduction	0.58	0.55	0.55	0.45		
Oper. time red.	0.91	0.91	0.91	0.91		
Wind dir. red.	0.54	0.54	0.62	0.62		
Total reduction	0.29	0.27	0.31	0.25		
Total, real	280	56	54	113		

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)

Project:

Description:

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060119 Marble River

Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 169 - 169

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Table with 12 columns for months (January to December) and rows for time intervals (07:34 to 17:02). Includes summary rows for Potential sun hours, Total, worst case, Sun reduction, Oper. time red., Wind dir. red., Total reduction, and Total, real.

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

Matrix with 5 columns: 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:

060119 Marble River

Description:

Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 219 - 219

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3°
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Monthly shadow calculation table with columns for months (Jan-Dec) and rows for time steps (07:30-17:02), including potential sun hours and various reduction factors.

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

Matrix for daily table layout: Day in month, Sun rise/set, Minutes with flicker, First/Last time with flicker, WTG causing flicker times.

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 220 - 220

Assumptions for shadow calculations

Maximum distance for influence
Minimum sun height over horizon for influence
Day step for calculation
Time step for calculation

1,000 m
3 °
1 days
2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34	07:59 (25) 07:17	08:07 (25) 06:36	05:39	05:47	05:14
	16:25	8 08:07 (25) 17:04	14 08:21 (25) 17:43	18:23	20:00	20:34
2	07:35	07:59 (25) 07:16	08:10 (25) 06:34	05:37	05:46	05:13
	16:26	10 08:09 (25) 17:05	8 08:18 (25) 17:44	18:25	20:01	20:35
3	07:35	07:59 (25) 07:15	06:32	05:35	05:44	05:13
	16:27	12 08:11 (25) 17:07	17:46	18:26	20:02	20:36
4	07:34	07:59 (25) 07:13	06:30	05:33	05:43	05:12
	16:28	12 08:11 (25) 17:08	17:47	18:27	20:03	20:37
5	07:34	07:59 (25) 07:12	06:29	06:31	05:41	05:12
	16:29	14 08:13 (25) 17:09	17:48	19:28	20:05	20:37
6	07:34	07:59 (25) 07:11	06:27	06:29	05:40	05:11
	16:30	16 08:15 (25) 17:11	17:50	19:30	20:06	20:38
7	07:34	07:58 (25) 07:10	06:25	06:47 (24) 06:28	05:39	05:11
	16:31	16 08:14 (25) 17:12	17:51	10 06:57 (24) 19:31	20:07	20:39
8	07:34	07:58 (25) 07:08	06:23	06:44 (24) 06:26	05:37	05:11
	16:32	18 08:16 (25) 17:14	17:52	16 07:00 (24) 19:32	20:08	20:40
9	07:34	07:58 (25) 07:07	06:21	06:42 (24) 06:24	05:36	05:10
	16:33	20 08:18 (25) 17:15	17:54	20 07:02 (24) 19:33	20:09	20:40
10	07:33	07:57 (25) 07:06	06:20	06:40 (24) 06:22	05:35	05:10
	16:35	20 08:17 (25) 17:17	17:55	24 07:04 (24) 19:35	20:11	20:41
11	07:33	07:57 (25) 07:04	06:18	06:38 (24) 06:20	05:33	05:10
	16:36	22 08:19 (25) 17:18	17:56	26 07:04 (24) 19:36	20:12	20:42
12	07:33	07:56 (25) 07:03	06:16	06:36 (24) 06:19	05:32	05:10
	16:37	24 08:20 (25) 17:19	17:58	28 07:04 (24) 19:37	20:13	20:42
13	07:32	07:56 (25) 07:01	06:14	06:36 (24) 06:17	05:31	05:10
	16:38	24 08:20 (25) 17:21	17:59	28 07:04 (24) 19:38	20:14	20:43
14	07:32	07:57 (25) 07:00	06:12	06:35 (24) 06:15	05:30	05:10
	16:39	24 08:21 (25) 17:22	18:00	30 07:05 (24) 19:40	20:15	20:43
15	07:31	07:57 (25) 06:58	06:10	06:35 (24) 06:13	05:29	05:10
	16:41	26 08:23 (25) 17:24	18:02	30 07:05 (24) 19:41	20:17	20:44
16	07:31	07:56 (25) 06:57	06:09	06:33 (24) 06:12	05:27	05:10
	16:42	26 08:22 (25) 17:25	18:03	32 07:05 (24) 19:42	20:18	20:44
17	07:30	07:57 (25) 06:55	06:07	06:33 (24) 06:10	05:26	05:10
	16:43	26 08:23 (25) 17:27	18:04	32 07:05 (24) 19:43	20:19	20:45
18	07:30	07:57 (25) 06:54	06:05	06:33 (24) 06:08	05:25	05:10
	16:44	28 08:25 (25) 17:28	18:05	32 07:05 (24) 19:45	20:20	20:45
19	07:29	07:58 (25) 06:52	06:03	06:33 (24) 06:06	05:24	05:10
	16:46	26 08:24 (25) 17:29	18:07	30 07:03 (24) 19:46	20:21	20:45
20	07:28	07:57 (25) 06:51	06:01	06:33 (24) 06:05	05:23	05:10
	16:47	28 08:25 (25) 17:31	18:08	30 07:03 (24) 19:47	20:22	20:46
21	07:27	07:58 (25) 06:49	05:59	06:33 (24) 06:03	05:22	05:10
	16:48	26 08:24 (25) 17:32	18:09	28 07:01 (24) 19:48	20:23	20:46
22	07:27	07:57 (25) 06:47	05:57	06:33 (24) 06:01	05:21	05:10
	16:50	28 08:25 (25) 17:34	18:11	26 06:59 (24) 19:50	20:24	20:46
23	07:26	07:59 (25) 06:46	05:55	06:36 (24) 06:00	05:20	05:10
	16:51	26 08:25 (25) 17:35	18:12	24 07:00 (24) 19:51	20:25	20:46
24	07:25	08:00 (25) 06:44	05:54	06:36 (24) 05:58	05:20	05:11
	16:53	26 08:26 (25) 17:36	18:13	20 06:56 (24) 19:52	20:26	20:47
25	07:24	07:59 (25) 06:42	05:52	06:38 (24) 05:56	05:19	05:11
	16:54	26 08:25 (25) 17:38	18:14	16 06:54 (24) 19:53	20:27	20:47
26	07:23	08:00 (25) 06:41	05:50	06:42 (24) 05:55	05:18	05:11
	16:55	26 08:26 (25) 17:39	18:16	8 06:50 (24) 19:55	20:28	20:47
27	07:22	08:01 (25) 06:39	05:48	05:53	05:17	05:12
	16:57	24 08:25 (25) 17:40	18:17	19:56	20:29	20:47
28	07:21	08:01 (25) 06:37	05:46	05:52	05:16	05:12
	16:58	22 08:23 (25) 17:42	18:18	19:57	20:30	20:47
29	07:20	08:02 (25)	05:44	05:50	05:16	05:13
	16:59	22 08:24 (25)	18:19	19:58	20:31	20:47
30	07:19	08:03 (25)	05:42	05:49	05:15	05:13
	17:01	20 08:23 (25)	18:21	20:00	20:32	20:47
31	07:18	08:04 (25)	05:41		05:14	
	17:02	18 08:22 (25)	18:22		20:33	
Potential sun hours	286	291	369	380	-285	-254
Total, worst case	664	22	490			
Sun reduction	0.45	0.45	0.50			
Oper. time red.	0.91	0.91	0.91			
Wind dir. red.	0.66	0.66	0.63			
Total reduction	0.27	0.27	0.28			
Total, real	181	6	140			

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 220 - 220

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:14 20:47	05:41 20:25	06:18 19:35	06:53 18:38	07:15 (24) 07:45 (24)	06:34 16:46
2	05:14 20:47	05:42 20:24	06:19 19:33	06:55 18:37	07:16 (24) 07:44 (24)	06:35 16:44
3	05:15 20:46	05:43 20:22	06:20 19:31	06:56 18:35	07:17 (24) 07:41 (24)	06:36 16:43
4	05:15 20:46	05:45 20:21	06:21 19:29	06:57 18:33	07:18 (24) 07:40 (24)	06:38 16:42
5	05:16 20:46	05:46 20:20	06:22 19:27	06:58 18:31	07:20 (24) 07:38 (24)	06:39 16:40
6	05:17 20:46	05:47 20:18	06:24 19:26	07:00 18:29	07:21 (24) 07:35 (24)	06:41 16:39
7	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27	07:26 (24) 07:30 (24)	06:42 16:38
8	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	06:43 16:37	06:43 16:15
9	05:19 20:44	05:50 20:14	06:27 19:20	07:03 18:24	06:45 16:35	07:40 (25) 16:15
10	05:20 20:44	05:52 20:13	06:28 19:18	07:05 18:22	06:46 16:34	07:23 16:15
11	05:20 20:44	05:53 20:11	06:30 19:16	07:06 18:20	06:47 16:33	07:24 16:15
12	05:21 20:43	05:54 20:10	06:31 19:14	07:07 18:18	06:49 16:32	07:24 16:15
13	05:22 20:42	05:55 20:08	06:32 19:12	07:09 18:17	06:50 16:31	07:25 16:15
14	05:23 20:42	05:56 20:07	06:33 19:11	07:10 18:15	06:52 16:30	07:26 16:15
15	05:24 20:41	05:57 20:05	06:34 19:09	07:11 18:13	06:53 16:29	07:27 16:16
16	05:25 20:40	05:59 20:04	06:35 19:07	07:12 18:11	06:54 16:28	07:28 16:16
17	05:26 20:40	06:00 20:02	06:37 19:05	07:14 18:10	06:56 16:27	07:28 16:16
18	05:27 20:39	06:01 20:01	06:38 19:03	07:15 18:08	06:57 16:26	07:29 16:16
19	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:25	07:30 16:17
20	05:28 20:37	06:03 19:56	06:40 18:59	07:18 18:04	07:00 16:24	07:30 16:17
21	05:29 20:37	06:05 19:54	06:41 18:57	07:19 18:03	07:01 16:23	07:31 16:18
22	05:30 20:36	06:06 19:52	06:43 18:55	07:20 18:01	07:02 16:22	07:31 16:18
23	05:31 20:35	06:07 19:51	06:44 18:53	07:22 18:00	07:03 16:22	07:32 16:19
24	05:32 20:34	06:08 19:49	06:45 18:52	07:23 17:58	07:05 16:21	07:32 16:19
25	05:34 20:33	06:09 19:47	06:46 18:50	07:24 17:56	07:06 16:20	07:33 16:20
26	05:35 20:32	06:11 19:45	06:47 18:48	07:26 17:55	07:07 16:20	07:33 16:21
27	05:36 20:31	06:12 19:44	06:49 18:46	07:27 17:53	07:08 16:19	07:33 16:21
28	05:37 20:30	06:13 19:42	06:50 18:44	07:28 17:52	07:10 16:18	07:34 16:22
29	05:38 20:28	06:14 19:40	06:51 18:42	07:29 17:50	07:11 16:18	07:34 16:23
30	05:39 20:27	06:15 19:38	06:52 18:40	07:30 17:49	07:12 16:18	07:34 16:23
31	05:40 20:26	06:16 19:37		06:32 16:47		07:34 16:24
Potential sun hours	-272	4	376	341	288	275
Total, worst case			356	140	520	176
Sun reduction			0.55	0.45	0.35	0.35
Oper. time red.			0.91	0.91	0.91	0.91
Wind dir. red.			0.63	0.63	0.66	0.66
Total reduction			0.31	0.26	0.21	0.21
Total, real			111	36	110	37

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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: **060119 Marble River**

Description: Marble River Wind Project
 Shadow-Flicker, SW part 2
 32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

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 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated: 01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 221 - 221

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
 N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	13:13 (23) 15:41 (25)	07:17 17:04	06:36 17:43	05:39 18:23	05:47 20:00	05:14 20:34	05:14 20:47	05:41 20:25	06:18 19:35	06:53 18:38	06:34 16:46	07:13 16:17
2	07:34 16:26	13:15 (23) 15:41 (25)	07:16 17:05	06:34 17:44	05:37 18:24	05:46 20:01	05:13 20:35	05:14 20:46	05:42 20:24	06:19 19:33	06:55 18:36	06:35 16:44	07:14 16:17
3	07:34 16:27	13:17 (23) 15:41 (25)	07:15 17:07	06:32 17:46	05:35 18:26	05:44 20:02	05:13 20:36	05:15 20:46	05:43 20:22	06:20 19:31	06:56 18:35	06:36 16:43	07:15 16:16
4	07:34 16:28	13:19 (23) 15:41 (25)	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	05:12 20:37	05:15 20:46	05:45 20:21	06:21 19:29	06:57 18:33	06:38 16:42	07:17 16:16
5	07:34 16:29	13:21 (23) 15:41 (25)	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:05	05:12 20:37	05:16 20:46	05:46 20:20	06:22 19:27	06:58 18:31	06:39 16:40	07:18 16:16
6	07:34 16:30	13:25 (23) 15:41 (25)	07:11 17:11	06:27 17:50	06:29 19:30	05:40 20:06	05:11 20:38	05:17 20:46	05:47 20:18	06:24 19:26	07:00 18:29	06:41 16:39	07:19 16:16
7	07:34 16:31	15:28 (25) 15:40 (25)	07:10 17:12	06:25 17:51	06:28 19:31	05:39 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27	06:42 16:38	07:20 16:15
8	07:34 16:32	15:40 (25) 15:40 (25)	07:08 17:14	06:23 17:52	06:26 19:32	05:37 20:08	05:11 20:40	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	06:43 16:36	07:21 16:15
9	07:34 16:33	15:30 (25) 15:40 (25)	07:07 17:15	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40	05:19 20:44	05:50 20:14	06:27 19:20	07:03 18:24	06:45 16:35	07:22 16:15
10	07:33 16:35	15:33 (25) 15:39 (25)	07:05 17:17	06:20 17:55	06:22 19:35	05:35 20:11	05:10 20:41	05:19 20:44	05:52 20:13	06:28 19:18	07:05 18:22	06:46 16:34	07:23 16:15
11	07:33 16:36	15:39 (25) 17:04	07:05 17:18	06:20 17:56	06:20 19:36	05:33 20:12	05:10 20:42	05:19 20:43	05:53 20:11	06:29 19:16	07:06 18:20	06:47 16:33	07:24 16:15
12	07:33 16:37	17:03 17:19	07:03 17:19	06:16 17:58	06:19 19:37	05:32 20:13	05:10 20:42	05:21 20:43	05:54 20:10	06:31 19:14	07:07 18:18	06:49 16:32	07:24 16:15
13	07:32 16:38	17:03 17:21	07:01 17:21	06:14 17:59	06:17 19:38	05:31 20:14	05:10 20:43	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:16	06:50 17:18 (24)	07:25 16:15
14	07:32 16:39	17:22 18:00	07:00 18:00	06:12 18:00	06:15 19:40	05:30 20:15	05:10 20:43	05:23 20:42	05:56 20:07	06:33 19:11	07:10 18:15	06:50 17:30 (24)	07:26 16:15
15	07:31 16:41	18:00 18:00	06:58 18:00	06:10 18:02	06:13 19:41	05:29 20:16	05:09 20:44	05:24 20:05	05:57 20:05	06:34 19:09	07:11 18:13	06:53 17:11 (24)	07:27 16:16
16	07:31 16:42	18:00 18:00	06:57 18:00	06:08 18:03	06:12 19:42	05:27 20:18	05:09 20:44	05:25 20:04	05:59 20:04	06:35 19:07	07:12 18:11	06:54 17:10 (24)	07:28 16:16
17	07:30 16:43	18:00 18:00	06:55 18:00	06:07 18:04	06:10 19:43	05:26 20:19	05:09 20:45	05:25 20:40	06:00 20:02	06:37 19:05	07:14 18:09	06:55 17:07 (24)	07:28 16:16
18	07:29 16:44	18:00 18:00	06:54 18:00	06:05 18:05	06:08 19:45	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:01	06:38 19:03	07:15 18:08	06:57 17:33 (24)	07:29 16:16
19	07:29 16:46	18:00 18:00	06:52 18:00	06:03 18:07	06:06 19:46	05:24 20:21	05:10 20:45	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 17:32 (24)	07:30 16:17
20	07:28 16:47	18:00 18:00	06:51 18:00	06:01 18:08	06:05 19:47	05:23 20:22	05:10 20:46	05:28 20:37	06:03 19:56	06:40 18:59	07:18 18:04	06:59 17:31 (24)	07:30 16:17
21	07:27 16:48	18:00 18:00	06:49 18:00	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46	05:29 20:36	06:05 19:54	06:41 18:57	07:19 18:03	07:01 17:33 (24)	07:31 16:18
22	07:27 16:50	18:00 18:00	06:47 18:00	05:57 18:11	06:01 19:50	05:21 20:24	05:10 20:46	05:30 20:36	06:06 19:52	06:43 18:55	07:20 18:01	07:02 17:32 (24)	07:31 16:18
23	07:26 16:51	18:00 18:00	06:46 18:00	05:55 18:12	06:00 19:51	05:20 20:25	05:10 20:46	05:31 20:35	06:07 19:51	06:44 18:53	07:21 18:00	07:03 17:32 (24)	07:32 16:19
24	07:25 16:52	18:00 18:00	06:44 18:00	05:54 18:13	05:58 19:52	05:19 20:26	05:11 20:47	05:32 20:34	06:08 19:49	06:45 18:52	07:23 18:00	07:05 17:32 (24)	07:32 16:19
25	07:24 16:54	18:00 18:00	06:42 18:00	05:52 18:14	05:56 19:53	05:19 20:27	05:11 20:47	05:33 20:33	06:09 19:47	06:46 18:50	07:24 18:00	07:06 17:32 (24)	07:33 16:19
26	07:23 16:55	18:00 18:00	06:41 18:00	05:50 18:16	05:55 19:55	05:18 20:28	05:11 20:47	05:35 20:32	06:10 19:45	06:47 18:48	07:25 18:00	07:07 17:32 (24)	07:33 16:20
27	07:22 16:57	18:00 18:00	06:39 18:00	05:48 18:17	05:53 19:56	05:17 20:29	05:12 20:47	05:36 20:31	06:12 19:44	06:49 18:46	07:26 18:00	07:08 17:32 (24)	07:33 16:21
28	07:21 16:58	18:00 18:00	06:37 18:00	05:46 18:18	05:52 19:57	05:16 20:30	05:12 20:47	05:37 20:30	06:13 19:42	06:50 18:44	07:27 18:00	07:09 17:32 (24)	07:34 16:22
29	07:20 16:59	18:00 18:00	06:35 18:00	05:44 18:19	05:50 19:58	05:15 20:31	05:13 20:47	05:38 20:28	06:14 19:40	06:51 18:42	07:28 18:00	07:11 17:32 (24)	07:34 16:23
30	07:19 17:01	18:00 18:00	06:33 18:00	05:42 18:21	05:49 20:00	05:15 20:32	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	07:29 18:00	07:12 17:32 (24)	07:34 16:23
31	07:18 17:02	18:00 18:00	06:31 18:00	05:40 18:22	05:47 19:59	05:14 20:33	05:13 20:47	05:40 20:26	06:16 19:37	06:53 18:40	07:30 18:00	07:13 17:32 (24)	07:34 16:24
Potential sun hours	286	291	369	380	285	254	272	4	376	341	288	275	
Total, worst case	260	400									398	1314	
Sun reduction	0.45	0.45									0.45	0.35	
Oper. time red.	0.91	0.91									0.91	0.91	
Wind dir. red.	0.62	0.54									0.54	0.62	
Total reduction	0.26	0.22									0.22	0.20	
Total, real	66	89									89	261	

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:

060119 Marble River

Description:

Marble River Wind Project Shadow-Flicker, SW part 2 32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)

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01/22/06 21:43 / 16

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Calculated:

01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 222 - 222

Assumptions for shadow calculations

Maximum distance for influence 1,000 m Minimum sun height over horizon for influence 3 ° Day step for calculation 1 days Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time N NE E SE S SW W NW Sum 1,850 1,325 800 713 625 663 700 1,275 7,950

Table with 12 columns for months (January to December) and rows for each day of the month, showing sun rise and set times, and summary rows for total hours and reduction. Includes a table layout section at the bottom.

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

Table with 5 columns: 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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/22/06 21:43 / 17
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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 275 - 275

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:04	06:35 17:43	16:20 (23) 18:23	05:39 20:00	05:47 20:34	05:14 20:47	05:14 20:25	05:41 19:35	06:18 18:38	06:53 18:38	06:34 16:46	07:13 16:17
2	07:34 16:26	07:16 17:05	06:34 17:44	16:20 (23) 18:24	05:37 20:01	05:46 20:35	05:13 20:46	05:14 20:24	05:42 19:33	06:19 18:36	06:55 18:36	17:10 (23) 16:44	06:35 16:17
3	07:34 16:27	07:14 17:06	06:32 17:46	16:21 (23) 18:26	05:35 20:02	05:44 20:36	05:13 20:46	05:15 20:22	05:43 19:31	05:43 18:35	06:56 18:35	17:07 (23) 16:43	06:36 16:16
4	07:34 16:28	07:13 17:08	06:30 17:47	16:21 (23) 18:27	05:33 20:03	05:43 20:37	05:12 20:46	05:15 20:21	05:45 19:29	06:21 18:33	06:57 18:33	17:04 (23) 16:42	06:38 16:16
5	07:34 16:29	07:12 17:09	06:28 17:48	16:21 (23) 18:28	06:31 20:05	05:41 20:37	05:12 20:46	05:16 20:20	05:46 19:27	06:22 18:31	06:58 18:31	17:02 (23) 16:40	06:39 16:16
6	07:34 16:30	07:11 17:11	06:27 17:50	16:21 (23) 18:29	06:29 20:06	05:40 20:38	05:11 20:46	05:17 20:18	05:47 19:26	06:23 18:29	07:00 18:29	16:59 (23) 16:39	06:40 16:16
7	07:34 16:31	07:09 17:12	06:25 17:51	16:23 (23) 18:30	06:28 20:07	05:39 20:39	05:11 20:45	05:17 20:17	05:48 19:24	06:25 18:27	07:01 18:27	16:58 (23) 16:38	06:42 16:15
8	07:34 16:32	07:08 17:14	06:23 17:52	16:24 (23) 18:31	06:26 20:08	05:37 20:40	05:11 20:45	05:18 20:16	05:49 19:22	06:26 18:25	07:02 18:25	16:57 (23) 16:36	06:43 16:15
9	07:34 16:33	07:07 17:15	06:21 17:54	16:26 (23) 18:32	06:24 20:09	05:36 20:40	05:10 20:44	05:19 20:14	05:50 19:20	06:27 18:24	07:03 18:24	16:57 (23) 16:35	06:45 16:15
10	07:33 16:35	07:05 17:17	06:19 17:55	16:28 (23) 18:33	06:22 20:11	05:35 20:41	05:10 20:44	05:19 20:13	05:51 19:18	06:28 18:22	07:05 18:22	16:54 (23) 16:34	06:46 16:15
11	07:33 16:36	07:04 17:18	06:18 17:56	16:30 (23) 18:36	06:20 20:12	05:33 20:42	05:10 20:43	05:20 20:11	05:53 19:16	06:29 18:20	07:06 18:20	16:53 (23) 16:33	06:47 16:15
12	07:33 16:37	07:03 17:19	06:16 17:58	16:34 (23) 18:37	06:19 20:13	05:32 20:42	05:10 20:43	05:21 20:10	05:54 19:14	06:31 18:18	07:07 18:18	16:53 (23) 16:32	06:49 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	16:40 (23) 18:38	06:17 20:14	05:31 20:43	05:10 20:42	05:22 20:08	05:55 19:12	06:32 18:16	07:08 18:16	16:54 (23) 16:31	06:50 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	16:40 (23) 18:39	06:15 20:15	05:30 20:43	05:09 20:42	05:23 20:07	05:56 19:11	06:33 18:15	07:10 18:15	16:53 (23) 16:30	06:51 16:15
15	07:31 16:41	06:58 17:24	16:33 (23) 18:02	06:10 18:02	06:13 20:16	05:29 20:44	05:09 20:41	05:24 20:05	05:57 19:09	06:34 18:13	07:11 18:13	16:53 (23) 16:29	06:53 16:16
16	07:31 16:42	06:57 17:25	16:30 (23) 18:03	06:08 18:03	06:11 20:18	05:27 20:44	05:09 20:40	05:25 20:04	05:59 19:07	06:35 18:11	07:12 18:11	16:52 (23) 16:28	06:54 16:16
17	07:30 16:43	06:55 17:26	16:28 (23) 18:04	06:07 18:04	06:10 20:19	05:26 20:45	05:09 20:40	05:25 20:02	05:59 19:05	06:35 18:09	07:12 18:09	16:52 (23) 16:27	06:54 16:16
18	07:29 16:44	06:54 17:28	16:27 (23) 18:05	06:05 18:05	06:08 20:20	05:25 20:45	05:09 20:39	05:26 20:01	06:01 19:03	06:38 18:08	07:15 18:08	16:53 (23) 16:26	06:57 16:16
19	07:29 16:46	06:52 17:29	16:25 (23) 18:07	06:03 18:07	06:06 20:21	05:24 20:45	05:10 20:38	05:27 19:57	06:02 19:01	06:39 18:06	07:16 18:06	16:52 (23) 16:25	06:58 16:17
20	07:28 16:47	06:51 17:31	16:23 (23) 18:08	06:01 18:08	06:05 20:22	05:23 20:46	05:10 20:37	05:28 19:56	06:03 18:59	06:40 18:04	07:17 18:04	16:53 (23) 16:24	06:59 16:17
21	07:27 16:48	06:49 17:32	16:24 (23) 18:09	05:59 18:09	06:03 20:23	05:22 20:46	05:10 20:36	05:29 19:54	06:04 18:57	06:41 18:03	07:19 18:03	16:55 (23) 16:23	07:01 16:18
22	07:27 16:50	06:47 17:33	16:22 (23) 18:11	05:57 18:11	06:01 20:24	05:21 20:46	05:10 20:36	06:06 19:52	06:06 18:55	06:42 18:01	07:20 18:01	16:54 (23) 16:22	07:02 16:18
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24	07:25 16:52	06:44 17:36	16:21 (23) 18:13	05:54 18:13	05:58 20:26	05:19 20:47	05:11 20:34	05:32 19:49	06:08 18:52	06:45 17:58	07:23 17:58	16:57 (23) 16:21	07:05 16:19
25	07:24 16:54	06:42 17:38	16:21 (23) 18:14	05:52 18:14	05:56 20:27	05:19 20:47	05:11 20:33	06:09 19:47	06:09 18:50	06:46 18:56	06:24 18:56	15:58 (23) 16:20	07:06 16:20
26	07:23 16:55	06:41 17:39	16:19 (23) 18:16	05:50 18:16	05:55 20:28	05:18 20:47	05:11 20:32	06:10 19:45	06:10 18:48	06:47 18:48	06:25 18:48	16:00 (23) 16:20	07:07 16:20
27	07:22 16:57	06:39 17:40	16:20 (23) 18:17	05:48 18:17	05:53 20:29	05:17 20:47	05:12 20:31	06:12 19:44	06:12 18:46	06:49 18:46	06:27 18:46	16:03 (23) 16:19	07:08 16:21
28	07:21 16:58	06:37 17:42	16:20 (23) 18:18	05:46 18:18	05:52 20:30	05:16 20:47	05:12 20:29	06:13 19:42	06:50 18:44	06:50 18:44	06:28 18:44	16:15 (23) 16:19	07:10 16:21
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30	07:19 17:01	06:35 17:40	16:18 (23) 18:20	05:42 18:20	05:49 20:32	05:15 20:47	05:13 20:27	06:15 19:38	06:52 18:40	06:31 18:40	06:31 18:40	16:17 (23) 16:19	07:12 16:23
31	07:18 17:02	06:34 17:39	16:17 (23) 18:21	05:40 18:21	05:48 20:33	05:14 20:46	05:12 20:26	06:16 19:37	06:53 18:37	06:32 18:37	06:32 18:37	16:17 (23) 16:24	07:13 16:24
Potential sun hours	286	291	369	380	285	254	272	4	376	341	820	288	275
Total, worst case		452	354								820		
Sun reduction		0.45	0.50								0.45		
Oper. time red.		0.91	0.91								0.91		
Wind dir. red.		0.54	0.54								0.54		
Total reduction		0.22	0.25								0.22		
Total, real		100	87								182		

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)

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/22/06 21:43 / 18
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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 282 - 282

Assumptions for shadow calculations

Maximum distance for influence

Minimum sun height over horizon for influence

Day step for calculation

Time step for calculation

1,000 m

3 °

1 days

2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35

Operational time

N	NE	E	SE	S	SW	W	NW	Sum
1,850	1,325	800	713	625	663	700	1,275	7,950

	January	February	March	April	May	June
1	07:34 16:25	07:17 17:04	07:43 (25) 08:11 (25)	06:36 17:43	05:39 18:23	06:05 (24) 20:00
2	07:35 16:26	07:16 17:05	07:42 (25) 08:10 (25)	06:34 17:44	05:37 18:25	06:05 (24) 20:01
3	07:35 16:27	07:15 17:07	07:42 (25) 08:10 (25)	06:32 17:46	05:35 18:26	06:03 (24) 20:02
4	07:34 16:28	07:13 17:08	07:43 (25) 08:11 (25)	06:30 17:47	05:33 18:27	06:03 (24) 20:03
5	07:34 16:29	07:12 17:09	07:42 (25) 08:12 (25)	06:29 17:48	06:31 19:28	07:03 (24) 20:05
6	07:34 16:30	07:11 17:11	07:43 (25) 08:11 (25)	06:27 17:50	06:29 19:30	07:04 (24) 20:06
7	07:34 16:31	07:10 17:12	07:43 (25) 08:11 (25)	06:25 17:51	06:28 19:31	07:06 (24) 20:07
8	07:34 16:32	07:08 17:14	07:44 (25) 08:12 (25)	06:23 17:52	06:26 19:32	07:06 (24) 20:08
9	07:34 16:34	07:07 17:15	07:44 (25) 08:10 (25)	06:21 17:54	06:24 19:33	07:06 (24) 20:09
10	07:33 16:35	07:06 17:17	07:45 (25) 08:09 (25)	06:20 17:55	06:22 19:35	07:08 (24) 20:11
11	07:33 16:36	07:04 17:18	07:46 (25) 08:10 (25)	06:18 17:56	06:20 19:36	07:11 (24) 20:12
12	07:33 16:37	07:03 17:19	07:46 (25) 08:08 (25)	06:16 17:58	06:19 19:37	07:23 (24) 20:13
13	07:32 16:38	07:01 17:21	07:49 (25) 08:07 (25)	06:14 17:59	06:17 19:38	07:24 (24) 20:14
14	07:32 16:39	07:00 17:22	07:49 (25) 08:05 (25)	06:12 18:00	06:15 19:40	07:25 (24) 20:15
15	07:31 16:41	06:58 17:24	07:52 (25) 08:02 (25)	06:10 18:02	06:13 19:41	07:26 (24) 20:17
16	07:31 16:42	06:57 17:25	06:09 18:03	06:09 18:03	06:12 19:42	07:27 (24) 20:18
17	07:30 16:43	06:55 17:27	06:07 18:04	06:10 18:04	06:10 19:43	07:28 (24) 20:19
18	07:30 16:45	06:54 17:28	06:05 18:05	06:08 18:05	06:08 19:45	07:29 (24) 20:20
19	07:29 16:46	06:52 17:29	06:03 18:07	06:06 18:07	06:06 19:46	07:30 (24) 20:21
20	07:28 16:47	06:51 17:31	06:01 18:08	06:05 18:08	06:05 19:47	07:31 (24) 20:22
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 18:09	06:03 19:48	07:32 (24) 20:23
22	07:27 16:50	06:47 17:34	05:57 18:11	06:21 (24) 06:25 (24)	06:01 19:50	07:33 (24) 20:24
23	07:26 16:51	07:53 (25) 07:57 (25)	06:46 17:35	05:55 18:12	06:16 (24) 06:32 (24)	06:00 19:51
24	07:25 16:53	07:50 (25) 08:00 (25)	06:44 17:36	05:54 18:13	06:14 (24) 06:34 (24)	05:58 19:52
25	07:24 16:54	07:47 (25) 08:03 (25)	06:42 17:38	05:52 18:14	06:12 (24) 06:34 (24)	05:56 19:53
26	07:23 16:55	07:46 (25) 08:04 (25)	06:41 17:39	05:50 18:16	06:10 (24) 06:36 (24)	05:55 19:55
27	07:22 16:57	07:45 (25) 08:07 (25)	06:39 17:40	05:48 18:17	06:08 (24) 06:36 (24)	05:53 19:56
28	07:21 16:58	07:43 (25) 08:07 (25)	06:37 17:42	05:46 18:18	06:06 (24) 06:36 (24)	05:52 19:57
29	07:20 16:59	07:44 (25) 08:08 (25)	06:35 17:43	05:44 18:19	06:06 (24) 06:36 (24)	05:50 19:58
30	07:19 17:01	07:43 (25) 08:09 (25)	06:33 17:44	05:42 18:21	06:04 (24) 06:36 (24)	05:49 20:00
31	07:18 17:02	07:42 (25) 08:10 (25)	06:31 17:45	05:41 18:22	06:05 (24) 06:37 (24)	05:47 20:01
Potential sun hours	286	291	369	380	380	-285
Total, worst case	172	366	240	290	290	-254
Sun reduction	0.45	0.45	0.50	0.55	0.55	
Oper. time red.	0.91	0.91	0.91	0.91	0.91	
Wind dir. red.	0.64	0.64	0.62	0.62	0.62	
Total reduction	0.26	0.26	0.28	0.31	0.31	
Total, real	45	96	68	90	90	

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/22/06 21:43 / 19
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 282 - 282

Assumptions for shadow calculations

Maximum distance for influence
Minimum sun height over horizon for influence
Day step for calculation
Time step for calculation

1,000 m
3 °
1 days
2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:14 20:47	05:41 20:25	06:18 19:35	07:10 (24) 18:38	06:53 16:46	07:13 (25) 16:17
2	05:14 20:47	05:42 20:24	06:19 19:33	07:07 (24) 18:37	06:55 16:44	07:12 (25) 16:17
3	05:15 20:46	05:43 20:22	06:20 19:31	07:04 (24) 18:35	06:56 16:43	07:14 (25) 16:16
4	05:15 20:46	05:45 20:21	06:21 19:29	07:03 (24) 18:33	06:57 16:42	07:13 (25) 16:16
5	05:16 20:46	05:46 20:20	06:22 19:27	07:02 (24) 18:31	06:58 16:40	07:13 (25) 16:16
6	05:17 20:46	05:47 20:18	06:24 19:26	06:59 (24) 18:29	07:00 16:39	07:12 (25) 16:16
7	05:17 20:45	05:48 20:17	06:25 19:24	06:58 (24) 18:27	07:01 16:38	07:12 (25) 16:15
8	05:18 20:45	05:49 20:16	06:26 19:22	06:58 (24) 18:25	07:02 16:37	07:13 (25) 16:15
9	05:19 20:44	05:50 20:14	06:27 19:20	06:57 (24) 18:24	07:03 16:35	07:12 (25) 16:15
10	05:20 20:44	05:52 20:13	06:28 19:18	06:58 (24) 18:22	07:05 16:34	07:14 (25) 16:15
11	05:20 20:44	05:53 20:11	06:30 19:16	06:57 (24) 18:20	07:06 16:33	07:13 (25) 16:15
12	05:21 20:43	05:54 20:10	06:31 19:14	06:56 (24) 18:18	07:07 16:32	07:15 (25) 16:15
13	05:22 20:42	05:55 20:08	06:32 19:12	06:57 (24) 18:17	07:09 16:31	07:16 (25) 16:15
14	05:23 20:42	05:56 20:07	06:33 19:11	06:56 (24) 18:15	07:10 16:30	07:16 (25) 16:15
15	05:24 20:41	05:57 20:05	06:34 19:09	06:56 (24) 18:13	07:11 16:29	07:17 (25) 16:16
16	05:25 20:40	05:59 20:04	06:35 19:07	06:57 (24) 18:11	07:12 16:28	07:19 (25) 16:16
17	05:26 20:40	06:00 20:02	06:37 19:05	06:58 (24) 18:10	07:14 16:27	07:20 (25) 16:16
18	05:27 20:39	06:01 20:01	06:38 19:03	06:59 (24) 18:08	07:15 16:26	07:24 (25) 16:16
19	05:27 20:38	06:02 19:57	06:39 19:01	07:00 (24) 18:06	07:16 16:25	07:27 (25) 16:17
20	05:28 20:37	06:03 19:56	06:40 18:59	07:01 (24) 18:04	07:18 16:24	07:30 16:17
21	05:29 20:37	06:05 19:54	06:41 18:57	07:05 (24) 18:03	07:19 16:23	07:31 16:18
22	05:30 20:36	06:06 19:52	06:43 18:55	07:20 18:01	07:02 16:22	07:31 16:18
23	05:31 20:35	06:07 19:51	06:44 18:53	07:22 18:00	07:03 16:22	07:32 16:19
24	05:32 20:34	06:08 19:49	06:45 18:52	07:23 17:58	07:05 16:21	07:32 16:19
25	05:34 20:33	06:09 19:47	06:46 18:50	06:24 18:56	07:06 16:20	07:33 16:20
26	05:35 20:32	06:11 19:45	06:47 18:48	06:26 18:55	07:07 16:20	07:33 16:21
27	05:36 20:31	06:12 19:44	06:49 18:46	06:27 18:53	07:08 16:19	07:33 16:21
28	05:37 20:30	06:13 19:42	06:50 18:44	06:28 18:52	07:10 16:18	07:34 16:22
29	05:38 20:28	06:14 19:40	06:51 18:42	06:30 18:50	07:11 16:18	07:34 16:23
30	05:39 20:27	06:15 19:38	06:52 18:40	06:31 18:49	07:12 16:18	07:34 16:23
31	05:40 20:26	06:16 19:37		06:32 18:47	07:15 (25) 16:17	07:34 16:24
Potential sun hours	-272	4	376	341	288	275
Total, worst case			536	92	454	
Sun reduction			0.55	0.45	0.35	
Oper. time red.			0.91	0.91	0.91	
Wind dir. red.			0.62	0.64	0.64	
Total reduction			0.31	0.26	0.20	
Total, real			166	24	93	

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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: 060119 Marble River	Description: Marble River Wind Project Shadow-Flicker, SW part 2 32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)	Printed/Page: 01/22/06 21:43 / 20 Licensed user: Wind Engineers, Inc. 7660 Whitegate Avenue US-RIVERSIDE, CA 92506 Calculated: 01/22/06 19:41/2.4.0.67
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SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 283 - 283

Assumptions for shadow calculations

Maximum distance for influence	1,000 m	Sun shine probabilities (part of time from sun rise to sun set with sun shine)													
Minimum sun height over horizon for influence	3 °	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Day step for calculation	1 days	0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35		
Time step for calculation	2 minutes	Operational time													
		N	NE	E	SE	S	SW	W	NW	Sum					
		1,850	1,325	800	713	625	663	700	1,275	7,950					

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:04	06:36 17:43	05:39 18:23	05:47 20:00	05:14 20:34	05:14 20:47	05:41 20:25	06:18 19:35	06:53 18:38	06:34 16:46	06:57 (24) 07:21 (24)	07:13 16:17
2	07:35 16:26	07:16 17:05	06:34 17:44	05:37 18:25	05:46 20:01	05:13 20:35	05:14 20:47	05:42 20:24	06:19 19:33	06:55 18:37	06:35 16:44	06:58 (24) 07:00 (24)	07:14 16:17
3	07:35 16:27	07:15 17:07	06:32 17:46	05:35 18:26	05:44 20:02	05:13 20:36	05:15 20:46	05:43 20:22	06:20 19:31	06:56 18:35	06:36 16:43	07:00 (24) 07:18 (24)	07:16 16:16
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:43 20:03	05:12 20:37	05:15 20:46	05:45 20:21	06:21 19:29	06:57 18:33	06:38 16:42	07:01 (24) 07:16 (24)	07:17 16:16
5	07:34 16:29	07:12 17:09	07:34 (24) 07:42 (24)	06:29 17:48	06:31 19:28	05:41 20:05	05:12 20:37	05:16 20:46	05:46 20:20	06:22 19:27	06:58 16:40	07:03 (24) 07:15 (24)	07:18 16:16
6	07:34 16:30	07:11 17:11	07:33 (24) 07:45 (24)	06:27 17:50	06:29 19:30	05:40 20:06	05:17 20:38	05:17 20:46	05:47 20:18	06:24 19:26	07:00 16:39	07:04 (24) 07:10 (24)	07:19 16:16
7	07:34 16:31	07:10 17:12	07:31 (24) 07:47 (24)	06:25 17:51	06:28 19:31	05:39 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:25 19:24	07:01 16:38	07:07 (24) 07:12 (24)	07:19 16:15
8	07:34 16:32	07:08 17:14	07:30 (24) 07:48 (24)	06:23 17:52	06:26 19:32	05:37 20:08	05:11 20:40	05:18 20:45	05:49 20:16	06:26 19:22	07:02 16:37	06:43 16:35	06:43 16:15
9	07:34 16:34	07:07 17:15	07:28 (24) 07:50 (24)	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40	05:19 20:44	05:50 20:14	06:27 19:20	07:03 16:34	06:45 16:35	07:22 16:15
10	07:33 16:35	07:06 17:17	07:27 (24) 07:51 (24)	06:20 17:55	06:22 19:35	05:35 20:11	05:10 20:44	05:20 20:44	05:52 20:13	06:28 19:18	07:05 16:34	06:46 16:34	07:23 16:15
11	07:33 16:36	07:04 17:18	07:26 (24) 07:52 (24)	06:18 17:56	06:20 19:36	05:33 20:12	05:10 20:42	05:20 20:44	05:53 20:11	06:30 19:16	07:06 16:32	06:47 16:30	07:24 16:15
12	07:33 16:37	07:03 17:19	07:24 (24) 07:52 (24)	06:16 17:58	06:19 19:37	05:32 20:13	05:10 20:43	05:21 20:43	05:54 20:10	06:31 19:14	07:07 16:31	06:49 16:31	07:24 16:15
13	07:32 16:38	07:01 17:21	07:25 (24) 07:53 (24)	06:14 17:59	06:17 19:38	05:31 20:14	05:10 20:43	05:22 20:42	05:55 20:08	06:32 19:12	07:09 16:31	06:50 16:31	07:25 16:15
14	07:32 16:39	07:00 17:22	07:23 (24) 07:53 (24)	06:12 18:00	06:15 19:40	05:30 20:15	05:10 20:43	05:23 20:42	05:56 20:07	06:33 19:11	07:10 16:30	06:51 16:30	07:26 16:15
15	07:31 16:41	06:58 17:24	07:24 (24) 07:54 (24)	06:10 18:02	06:13 19:41	05:29 20:17	05:10 20:44	05:24 20:41	05:57 20:05	06:34 19:09	07:11 16:31	06:53 16:29	07:27 16:16
16	07:31 16:42	06:57 17:25	07:24 (24) 07:52 (24)	06:09 18:03	06:12 19:42	05:27 20:18	05:09 20:44	05:25 20:40	05:59 20:04	06:35 19:07	07:12 18:11	06:54 08:12 (24)	07:28 16:28
17	07:30 16:43	06:55 17:27	07:22 (24) 07:52 (24)	06:07 18:04	06:10 19:43	05:26 20:19	05:10 20:45	05:26 20:40	06:00 19:05	06:37 18:10	07:14 16:30	06:56 08:01 (24)	07:28 16:16
18	07:30 16:44	06:54 17:28	07:23 (24) 07:53 (24)	06:05 18:05	06:08 19:45	05:25 20:20	05:10 20:45	05:27 20:39	06:01 20:01	06:38 19:03	07:15 18:08	06:57 08:17 (24)	07:29 16:26
19	07:29 16:46	06:52 17:29	07:23 (24) 07:51 (24)	06:03 18:07	06:06 19:46	05:24 20:21	05:10 20:45	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 08:18 (24)	07:30 16:25
20	07:28 16:47	06:51 17:31	07:24 (24) 07:52 (24)	06:01 18:08	06:05 19:47	05:23 20:22	05:10 20:46	05:28 20:37	06:03 19:56	06:40 18:59	07:18 18:04	06:58 08:20 (24)	07:30 16:24
21	07:27 16:48	06:49 17:32	07:24 (24) 07:50 (24)	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46	05:29 20:37	06:05 19:54	06:41 18:57	07:19 18:03	07:55 (24) 08:21 (24)	07:31 16:23
22	07:27 16:50	06:47 17:34	07:26 (24) 07:48 (24)	05:57 18:11	06:01 19:50	05:21 20:24	05:10 20:46	05:30 20:36	06:06 19:52	06:43 18:55	07:20 18:01	07:54 (24) 08:22 (24)	07:31 16:22
23	07:26 16:51	06:46 17:35	07:27 (24) 07:49 (24)	05:55 18:12	06:00 19:51	05:20 20:25	05:10 20:46	05:31 20:35	06:07 19:51	06:44 18:53	07:22 18:00	07:54 (24) 08:22 (24)	07:32 16:19
24	07:25 16:53	06:44 17:36	07:27 (24) 07:45 (24)	05:54 18:13	05:58 19:52	05:20 20:26	05:11 20:47	05:32 20:34	06:08 19:49	06:45 18:52	07:23 17:58	07:53 (24) 08:23 (24)	07:32 16:21
25	07:24 16:54	06:42 17:38	07:31 (24) 07:41 (24)	05:52 18:14	05:56 19:53	05:19 20:27	05:11 20:47	05:34 20:33	06:09 19:47	06:46 18:50	06:24 16:56	06:53 (24) 07:23 (24)	07:06 16:20
26	07:23 16:55	06:41 17:39	07:41 (24)	05:50 18:16	05:55 19:55	05:18 20:28	05:11 20:47	05:35 20:32	06:11 19:45	06:47 18:48	06:26 16:55	06:52 (24) 07:22 (24)	07:07 16:20
27	07:22 16:57	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	05:12 20:47	05:36 20:31	06:12 19:44	06:49 18:46	06:27 16:53	07:08 16:31	06:53 (24) 07:21 (24)	07:33 16:19
28	07:21 16:58	06:37 17:42	05:46 18:18	05:52 19:57	05:16 20:30	05:12 20:47	05:37 20:30	06:13 19:42	06:50 18:44	06:28 16:52	06:28 16:30	06:53 (24) 07:23 (24)	07:34 16:18
29	07:20 16:59	06:36 17:42	05:44 18:19	05:50 19:58	05:16 20:31	05:13 20:47	05:38 20:28	06:14 19:40	06:51 18:42	06:30 16:50	06:30 16:50	06:52 (24) 07:22 (24)	07:34 16:17
30	07:19 17:01	06:35 17:41	05:42 18:21	05:49 20:00	05:15 20:32	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	06:31 16:49	06:31 16:49	06:54 (24) 07:22 (24)	07:34 16:17
31	07:18 17:02	06:34 17:40	05:41 18:22	05:48 20:03	05:14 20:33	05:14 20:46	05:40 20:26	06:16 19:37	06:32 16:47	06:32 16:47	06:32 16:47	06:55 (24) 07:21 (24)	07:34 16:24
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	275	
Total, worst case		480								394	96	54	
Sun reduction		0.45								0.45	0.35	0.35	
Oper. time red.		0.91								0.91	0.91	0.91	
Wind dir. red.		0.61								0.61	0.61	0.69	
Total reduction		0.25								0.25	0.19	0.22	
Total, real		120								98	19	12	

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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01/22/06 21:43 / 21
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Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 284 - 284

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:04	07:39 (24) 08:05 (24)	06:36 17:43	05:39 18:23	05:47 20:00	05:14 20:34	05:14 20:47	05:41 20:25	06:18 19:35	06:53 18:38	06:34 16:46	07:09 (24) 16:17
2	07:35 16:26	07:16 17:05	07:40 (24) 08:06 (24)	06:34 17:44	05:37 18:25	05:46 20:01	05:13 20:35	05:14 20:47	05:42 20:24	06:19 19:33	06:55 18:37	06:35 16:44	07:08 (24) 16:17
3	07:35 16:27	07:15 17:07	07:38 (24) 08:06 (24)	06:32 17:46	05:35 18:26	05:44 20:02	05:13 20:36	05:15 20:46	05:43 20:22	06:20 19:31	06:56 18:35	06:36 16:43	07:36 (24) 16:16
4	07:34 16:28	07:13 17:08	07:39 (24) 08:07 (24)	06:30 17:47	05:33 18:27	05:43 20:03	05:12 20:37	05:15 20:46	05:45 20:21	06:21 19:29	06:57 18:33	06:38 16:42	07:09 (24) 16:16
5	07:34 16:29	07:12 17:09	07:38 (24) 08:06 (24)	06:29 17:48	06:31 19:28	05:41 20:05	05:12 20:37	05:16 20:46	05:46 20:20	06:22 19:27	06:58 18:31	06:39 16:40	07:09 (24) 16:16
6	07:34 16:30	07:11 17:11	07:39 (24) 08:07 (24)	06:27 17:50	06:29 19:30	05:40 20:06	05:11 20:38	05:17 20:46	05:47 20:18	06:24 19:26	07:00 18:29	06:41 16:39	07:08 (24) 16:16
7	07:34 16:31	07:10 17:12	07:39 (24) 08:07 (24)	06:25 17:51	06:28 19:31	05:39 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27	06:42 16:38	07:10 (24) 16:15
8	07:34 16:32	07:08 17:14	07:40 (24) 08:06 (24)	06:23 17:52	06:26 19:32	05:37 20:08	05:11 20:40	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	06:43 16:37	07:09 (24) 16:15
9	07:34 16:34	07:07 17:15	07:38 (24) 08:06 (24)	06:21 17:54	06:24 19:33	05:36 20:09	05:10 20:40	05:19 20:44	05:50 20:14	06:27 19:20	07:03 18:24	06:45 16:35	07:08 (24) 16:15
10	07:33 16:35	07:06 17:17	07:39 (24) 08:05 (24)	06:20 17:55	06:22 19:35	05:35 20:11	05:10 20:41	05:20 20:44	05:52 20:13	06:28 19:18	07:05 18:22	06:46 16:34	07:10 (24) 16:15
11	07:33 16:36	07:04 17:18	07:42 (24) 08:06 (24)	06:18 17:56	06:20 19:36	05:33 20:12	05:10 20:42	05:20 20:44	05:53 20:11	06:30 19:16	07:06 18:20	06:47 16:33	07:11 (24) 16:15
12	07:33 16:37	07:03 17:19	07:42 (24) 08:04 (24)	06:16 17:58	06:19 19:37	05:32 20:13	05:10 20:42	05:21 20:43	05:54 20:10	06:31 19:14	07:07 18:18	06:49 16:32	07:13 (24) 16:15
13	07:32 16:38	07:01 17:21	07:43 (24) 08:03 (24)	06:14 17:59	06:17 19:38	05:31 20:14	05:10 20:43	05:22 20:42	05:55 20:08	06:32 19:12	07:09 18:17	06:50 16:31	07:14 (24) 16:15
14	07:32 16:39	07:00 17:22	07:45 (24) 08:01 (24)	06:12 18:00	06:15 19:40	05:30 20:15	05:10 20:43	05:23 20:42	05:56 20:07	06:33 19:11	07:10 18:15	06:52 16:30	07:16 (24) 16:15
15	07:31 16:41	06:58 17:24	07:46 (24) 08:00 (24)	06:10 18:02	06:13 19:41	05:29 20:17	05:10 20:44	05:24 20:41	05:57 20:05	06:34 19:09	07:11 18:13	06:53 16:29	07:17 (24) 16:16
16	07:31 16:42	06:57 17:25	07:52 (24) 07:56 (24)	06:09 18:03	06:12 19:42	05:27 20:18	05:09 20:44	05:25 20:40	05:59 20:04	06:35 19:07	07:12 18:11	06:54 16:28	07:19 (24) 16:16
17	07:30 16:43	06:55 17:27	07:56 (24)	06:07 18:04	06:10 19:43	05:26 20:19	05:10 20:45	05:26 20:40	06:00 20:02	06:37 19:05	07:14 18:10	06:56 16:27	07:20 (24) 16:16
18	07:30 16:44	06:54 17:28		06:05 18:06	06:08 19:45	05:25 20:20	05:10 20:45	05:27 20:39	06:01 20:01	06:38 19:03	07:15 18:08	06:57 16:26	07:28 (24) 16:16
19	07:29 16:46	06:52 17:29		06:03 18:07	06:06 19:46	05:24 20:21	05:10 20:45	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:25	07:30 (24) 16:17
20	07:28 16:47	06:51 17:31		06:01 18:08	06:05 19:47	05:23 20:22	05:10 20:46	05:28 20:37	06:03 19:56	06:40 18:59	07:18 18:04	07:00 16:24	07:31 (24) 16:17
21	07:27 16:48	06:49 17:32		06:03 18:09	06:03 19:48	05:22 20:23	05:10 20:46	05:29 20:37	06:05 19:54	06:41 18:57	07:19 18:03	07:01 16:23	07:31 (24) 16:18
22	07:27 16:50	06:47 17:34		06:01 18:11	06:01 19:50	05:21 20:24	05:10 20:46	05:30 20:36	06:06 19:52	06:43 18:55	07:20 18:01	07:02 16:22	07:31 (24) 16:18
23	07:26 16:51	06:46 17:35		06:00 18:12	06:00 19:51	05:20 20:25	05:10 20:46	05:31 20:35	06:07 19:51	06:44 18:53	07:22 18:00	07:03 16:22	07:32 (24) 16:19
24	07:25 16:53	06:44 17:36		05:54 18:13	05:54 19:52	05:20 20:26	05:11 20:47	05:32 20:34	06:08 19:49	06:45 18:52	07:23 17:58	07:05 16:21	07:32 (24) 16:19
25	07:24 16:54	06:42 17:38	07:47 (24) 07:55 (24)	06:42 18:14	05:52 19:53	05:19 20:27	05:11 20:47	05:34 20:33	06:09 19:47	06:46 18:50	06:24 18:56	07:06 16:20	07:33 (24) 16:20
26	07:23 16:55	06:41 17:39	07:46 (24) 07:58 (24)	06:41 18:16	05:50 19:55	05:18 20:28	05:11 20:47	05:35 20:32	06:11 19:45	06:47 18:48	06:26 18:55	07:18 (24) 16:20	07:07 (24) 16:21
27	07:22 16:57	06:39 17:40	07:45 (24) 07:59 (24)	06:39 18:17	05:53 19:56	05:17 20:29	05:12 20:47	05:36 20:31	06:12 19:44	06:49 18:46	06:27 16:53	07:15 (24) 16:19	07:08 (24) 16:21
28	07:21 16:58	06:37 18:02	07:44 (24) 08:02 (24)	06:37 17:42	05:46 18:18	05:16 19:57	05:12 20:30	05:37 20:42	06:13 19:42	06:50 18:44	06:28 16:52	07:13 (24) 16:18	07:10 (24) 16:22
29	07:20 16:59	06:36 18:03	07:42 (24) 08:02 (24)	06:36 17:42	05:44 18:19	05:16 19:58	05:13 20:31	05:38 20:28	06:14 19:40	06:51 18:42	06:30 16:50	07:12 (24) 16:18	07:11 (24) 16:23
30	07:19 17:01	06:35 18:04	07:41 (24) 08:03 (24)	06:35 17:42	05:42 18:21	05:15 20:00	05:13 20:32	05:39 20:27	06:15 19:38	06:52 18:40	06:31 16:49	07:10 (24) 16:17	07:12 (24) 16:23
31	07:18 17:02	06:34 18:04	07:40 (24) 08:04 (24)	06:34 17:42	05:41 18:22	05:14 20:33	05:14 20:33	05:40 20:26	06:16 19:37	06:32 16:47	06:30 16:47	07:09 (24) 16:24	07:34 (24) 16:24
Potential sun hours	286	291	369	380	285	254	272	4	376	341	110	288	392
Total, worst case											110		392
Sun reduction	0.45	0.45									0.45		0.35
Oper. time red.	0.91	0.91									0.91		0.91
Wind dir. red.	0.64	0.64									0.64		0.64
Total reduction	0.26	0.26									0.26		0.20
Total, real	31	97									29		79

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)
	Minutes with flicker		

Project: 060119 Marble River	Description: Marble River Wind Project Shadow-Flicker, SW part 2 32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)	Printed/Page: 01/22/06 21:43 / 22 Licensed user: Wind Engineers, Inc. 7660 Whitegate Avenue US-RIVERSIDE, CA 92506 Calculated: 01/22/06 19:41/2.4.0.67
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SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 292 - 292

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December		
1	07:34	08:19 (25)	07:17	06:36	07:06 (24)	05:39	05:47	05:14	05:41	06:18	06:53	06:34	07:13	08:15 (25)
2	07:35	08:21 (25)	07:16	06:34	07:06 (24)	05:37	05:46	05:13	05:41	06:19	06:55	06:35	07:14	08:12 (25)
3	07:35	08:21 (25)	07:15	06:32	07:07 (24)	05:35	05:44	05:13	05:41	06:20	06:56	06:36	07:16	08:11 (25)
4	07:34	08:23 (25)	07:13	06:30	07:09 (24)	05:33	05:43	05:12	05:41	06:21	06:57	06:37	07:17	08:10 (25)
5	07:34	08:23 (25)	07:12	06:29	07:09 (24)	05:31	05:41	05:12	05:41	06:22	06:58	06:38	07:18	08:12 (25)
6	07:34	08:25 (25)	07:11	06:27	07:09 (24)	05:29	05:40	05:11	05:41	06:24	07:00	06:41	07:19	08:11 (25)
7	07:34	08:26 (25)	07:10	06:25	07:11 (24)	05:28	05:39	05:11	05:41	06:25	07:01	06:42	07:20	08:10 (25)
8	07:34	08:26 (25)	07:08	06:23	07:14 (24)	05:26	05:37	05:11	05:41	06:26	07:02	06:43	07:21	08:11 (25)
9	07:34	08:28 (25)	07:07	06:21	07:16 (24)	05:24	05:36	05:10	05:41	06:27	07:03	06:44	07:22	08:10 (25)
10	07:33	08:29 (25)	07:06	06:20	07:26 (24)	05:22	05:35	05:10	05:41	06:28	07:05	06:45	07:23	08:11 (25)
11	07:33	08:31 (25)	07:04	06:18	07:30 (24)	05:20	05:33	05:10	05:41	06:30	07:06	06:46	07:24	08:12 (25)
12	07:33	08:33 (25)	07:03	06:16	07:33 (24)	05:19	05:32	05:10	05:41	06:31	07:07	06:47	07:25	08:10 (25)
13	07:32	08:35 (25)	07:01	06:14	07:37 (24)	05:17	05:31	05:10	05:41	06:32	07:09	06:48	07:26	08:11 (25)
14	07:32	08:37 (25)	07:00	06:12	07:40 (24)	05:15	05:30	05:10	05:41	06:33	07:10	06:49	07:27	08:12 (25)
15	07:31	08:39 (25)	06:58	06:10	07:44 (24)	05:13	05:29	05:10	05:41	06:34	07:11	06:50	07:28	08:13 (25)
16	07:31	08:41 (25)	06:57	06:09	07:47 (24)	05:12	05:27	05:09	05:25	06:35	07:12	06:51	07:29	08:14 (25)
17	07:30	08:43 (25)	06:55	06:07	07:50 (24)	05:10	05:26	05:10	05:26	06:36	07:13	06:52	07:30	08:15 (25)
18	07:30	08:45 (25)	06:54	06:05	07:53 (24)	05:08	05:25	05:10	05:26	06:37	07:14	06:53	07:31	08:16 (25)
19	07:29	08:47 (25)	06:52	06:03	07:56 (24)	05:06	05:24	05:10	05:26	06:38	07:15	06:54	07:32	08:17 (25)
20	07:28	08:49 (25)	06:51	06:01	07:59 (24)	05:05	05:23	05:10	05:26	06:39	07:16	06:55	07:33	08:18 (25)
21	07:27	08:51 (25)	06:49	05:59	08:02 (24)	05:03	05:22	05:10	05:26	06:40	07:17	06:56	07:34	08:19 (25)
22	07:27	08:53 (25)	06:47	05:57	08:05 (24)	05:02	05:21	05:10	05:26	06:41	07:18	06:57	07:35	08:20 (25)
23	07:26	08:55 (25)	06:46	05:55	08:08 (24)	05:00	05:20	05:10	05:26	06:42	07:19	06:58	07:36	08:21 (25)
24	07:25	08:57 (25)	06:44	05:54	08:11 (24)	04:59	05:19	05:10	05:26	06:43	07:20	06:59	07:37	08:22 (25)
25	07:24	08:59 (25)	06:42	05:52	08:14 (24)	04:57	05:17	05:10	05:26	06:44	07:21	07:00	07:38	08:23 (25)
26	07:23	09:01 (25)	06:41	05:50	08:17 (24)	04:56	05:16	05:10	05:26	06:45	07:22	07:01	07:39	08:24 (25)
27	07:22	09:03 (25)	06:39	05:48	08:20 (24)	04:54	05:15	05:10	05:26	06:46	07:23	07:02	07:40	08:25 (25)
28	07:21	09:05 (25)	06:37	05:46	08:23 (24)	04:53	05:14	05:10	05:26	06:47	07:24	07:03	07:41	08:26 (25)
29	07:20	09:07 (25)	06:36	05:44	08:26 (24)	04:51	05:13	05:10	05:26	06:48	07:25	07:04	07:42	08:27 (25)
30	07:19	09:09 (25)	06:35	05:43	08:29 (24)	04:50	05:12	05:10	05:26	06:49	07:26	07:05	07:43	08:28 (25)
31	07:18	09:11 (25)	06:34	05:41	08:32 (24)	04:49	05:11	05:10	05:26	06:50	07:27	07:06	07:44	08:29 (25)
Potential sun hours	286	291	350	380	424	468	512	556	600	644	688	732	776	820
Total, worst case	192	350	224	380	285	254	272	4	376	341	578	288	275	658
Sun reduction	0.45	0.45	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Oper. time red.	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Wind dir. red.	0.68	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61
Total reduction	0.28	0.25	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Total, real	54	88	63	424	468	512	556	600	644	688	732	776	820	144

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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: **060119 Marble River**

Description: Marble River Wind Project
 Shadow-Flicker, SW part 2
 32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

Printed/Page: 01/22/06 21:43 / 23
 Licensed user: **Wind Engineers, Inc.**
 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated: 01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 293 - 293

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
 N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:04	06:36 17:43	07:16 (24) 18:23	05:39 20:00	05:47 20:34	05:14 20:47	05:14 20:25	05:41 19:35	06:18 18:38	06:53 18:38	06:34 16:46	07:13 16:17
2	07:35 16:26	07:16 17:05	06:34 17:44	07:16 (24) 18:25	05:37 20:01	05:46 20:35	05:13 20:47	05:14 20:24	05:42 19:33	06:19 18:37	06:55 18:37	06:35 16:44	07:14 16:17
3	07:35 16:27	07:15 17:07	06:32 17:46	07:19 (24) 18:26	05:35 20:02	05:44 20:36	05:13 20:46	05:15 20:22	05:43 19:31	06:20 18:35	06:56 18:35	06:36 16:43	07:16 16:16
4	07:34 16:28	07:13 17:08	06:30 17:47	07:19 (24) 18:27	05:33 20:03	05:43 20:37	05:12 20:46	05:15 20:21	05:45 19:29	06:21 18:33	06:57 18:33	06:38 16:42	07:17 16:16
5	07:34 16:29	07:12 17:09	06:29 17:48	07:21 (24) 18:28	06:31 20:05	05:41 20:37	05:12 20:46	05:16 20:20	05:46 19:27	06:22 18:31	06:58 18:31	06:39 16:40	07:18 16:16
6	07:34 16:30	07:11 17:11	06:27 17:50	07:23 (24) 19:30	06:29 20:06	05:40 20:38	05:11 20:46	05:17 20:18	05:47 19:26	06:24 18:29	07:00 18:29	06:41 16:39	07:19 16:16
7	07:34 16:31	07:10 17:12	06:25 17:51	07:25 (24) 19:31	06:28 20:07	05:39 20:39	05:11 20:45	05:17 20:17	05:48 19:24	06:25 18:27	07:01 18:27	06:42 16:38	07:20 16:15
8	07:34 16:32	07:08 17:14	06:23 17:52	07:27 (24) 19:32	06:26 20:08	05:37 20:40	05:11 20:45	05:18 20:16	05:49 19:22	06:26 18:25	07:02 18:25	06:43 16:37	07:21 16:15
9	07:34 16:34	07:07 17:15	06:21 17:54	07:29 (24) 19:33	06:24 20:09	05:36 20:40	05:10 20:44	05:19 20:14	06:27 19:20	07:03 18:24	07:32 18:24	06:45 16:35	07:22 16:15
10	07:33 16:35	07:06 17:17	06:20 17:55	07:31 (24) 19:35	06:22 20:11	05:35 20:41	05:10 20:44	05:20 20:13	06:28 19:18	07:05 18:22	07:34 18:22	06:46 16:34	07:23 16:15
11	07:33 16:36	07:04 17:18	06:18 17:56	07:32 (24) 19:36	06:18 20:12	05:33 20:42	05:10 20:44	05:20 20:11	06:29 19:16	07:06 18:20	07:36 18:20	06:47 16:33	07:24 16:15
12	07:33 16:37	07:03 17:19	06:16 17:58	07:34 (24) 19:37	06:16 20:13	05:32 20:42	05:10 20:43	05:21 20:10	06:31 19:14	07:07 18:18	07:37 18:18	06:49 16:32	07:25 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	07:35 (24) 19:38	06:15 20:14	05:31 20:43	05:10 20:42	05:22 20:08	06:32 19:12	07:09 18:17	07:38 18:17	06:50 16:31	07:25 16:15
14	07:32 16:39	07:00 17:22	06:12 18:00	07:36 (24) 19:40	06:15 20:15	05:30 20:43	05:10 20:42	05:23 20:07	06:33 19:11	07:10 18:15	07:39 18:15	06:52 16:30	07:26 16:15
15	07:31 16:41	06:58 17:24	06:10 18:02	07:37 (24) 19:41	06:13 20:17	05:29 20:44	05:10 20:41	05:24 20:05	06:34 19:09	07:11 18:13	07:40 18:13	06:53 16:29	07:27 16:16
16	07:31 16:42	06:57 17:25	06:09 18:03	07:38 (24) 19:42	06:12 20:18	05:27 20:44	05:10 20:40	05:25 20:04	06:35 19:07	07:12 18:11	07:41 18:11	06:54 16:28	07:28 16:16
17	07:30 16:43	06:55 17:27	06:07 18:04	07:39 (24) 19:43	06:11 20:19	05:26 20:45	05:10 20:40	05:26 20:02	06:36 19:05	07:14 18:10	07:42 18:10	06:56 16:27	07:29 16:16
18	07:30 16:44	06:54 17:28	06:05 18:05	07:40 (24) 19:45	06:08 20:20	05:25 20:45	05:10 20:39	05:26 20:01	06:38 19:03	07:15 18:08	07:43 18:08	06:57 16:26	07:30 16:16
19	07:29 16:46	06:52 17:29	06:03 18:07	07:41 (24) 19:46	06:06 20:21	05:24 20:45	05:10 20:38	06:02 19:57	06:39 19:01	07:16 18:06	07:44 18:06	06:58 16:25	07:31 16:17
20	07:28 16:47	06:51 17:31	06:01 18:08	07:42 (24) 19:47	06:05 20:22	05:23 20:46	05:10 20:37	06:03 19:56	06:40 18:59	07:18 18:04	07:45 18:04	07:00 16:24	07:32 16:17
21	07:27 16:48	06:49 17:32	05:59 18:09	07:43 (24) 19:48	06:03 20:23	05:22 20:46	05:10 20:37	06:05 19:54	06:41 18:57	07:19 18:03	07:46 18:03	07:01 16:23	07:33 16:18
22	07:27 16:50	06:47 17:34	05:57 18:11	07:44 (24) 19:50	06:01 20:24	05:21 20:46	05:10 20:36	06:06 19:52	06:43 18:55	07:20 18:01	07:47 18:01	07:02 16:22	07:34 16:18
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24	07:25 16:53	06:44 17:36	05:54 18:13	07:46 (24) 19:52	05:58 20:26	05:20 20:47	05:11 20:34	06:08 19:49	06:45 18:52	07:23 17:58	07:49 18:00	07:05 16:21	07:36 16:19
25	07:24 16:54	06:42 17:38	05:52 18:14	07:47 (24) 19:53	05:56 20:27	05:19 20:47	05:11 20:33	06:09 19:47	06:46 18:50	07:24 18:56	07:50 18:56	07:06 16:20	07:37 16:20
26	07:23 16:55	06:41 17:39	05:50 18:16	07:48 (24) 19:55	05:55 20:28	05:18 20:47	05:11 20:32	06:11 19:45	06:47 18:48	07:25 18:48	07:51 18:48	07:07 16:19	07:38 16:21
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28	07:21 16:58	06:37 17:42	05:46 18:18	07:50 (24) 19:57	05:52 20:30	05:16 20:47	05:12 20:30	06:13 19:42	06:50 18:44	07:27 18:44	07:53 18:44	07:10 16:18	07:40 16:22
29	07:20 16:59		05:44 18:19		05:50 19:58	05:16 20:31	05:13 20:47	06:14 19:40	06:51 18:42	06:30 18:42	06:54 18:42	07:11 16:18	07:41 16:23
30	07:19 17:01		05:42 18:21		05:49 20:00	05:15 20:32	05:13 20:47	06:15 19:38	06:52 18:40	06:31 18:40	06:58 18:40	07:12 16:17	07:42 16:23
31	07:18 17:02		05:41 18:22		05:48 20:33	05:14 20:46	05:12 20:37	06:16 19:37	06:32 18:37	06:32 18:37	07:01 18:37	07:13 16:17	07:43 16:24
Potential sun hours	286	291	369	380	285	254	272	4	376	341	732	288	275
Total, worst case		546	172								732		102
Sun reduction		0.45	0.50							0.45			0.35
Oper. time red.		0.91	0.91							0.91			0.91
Wind dir. red.		0.61	0.61							0.61			0.69
Total reduction		0.25	0.28							0.25			0.22
Total, real		136	47							182			22

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/22/06 21:43 / 24
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 310 - 310

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:03	06:35 17:43	05:38 18:23	05:47 20:01	05:13 20:34	05:13 20:46	05:41 20:25	06:17 19:34	06:53 18:38	06:33 16:46	07:13 16:17	
2	07:34 16:26	07:15 17:05	06:33 17:44	05:36 18:24	05:45 20:01	05:13 20:35	05:14 20:46	05:42 20:23	06:18 19:33	06:54 18:36	06:35 16:44	07:14 16:16	
3	07:34 16:27	07:14 17:06	06:32 17:45	05:35 18:25	05:44 20:02	05:12 20:36	05:14 20:46	05:43 20:22	06:20 19:31	06:56 18:34	06:36 16:43	07:15 16:16	
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:42 20:03	05:12 20:36	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:32	06:37 16:41	07:16 16:16	
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:04	05:11 20:37	05:16 20:46	05:45 20:19	06:22 19:27	06:58 18:31	06:39 16:40	07:17 16:15	
6	07:34 16:30	07:11 17:11	06:26 17:49	06:29 19:29	05:40 20:05	05:11 20:38	05:16 20:45	05:47 20:18	06:23 19:25	06:59 18:29	06:40 16:39	07:18 16:15	
7	07:34 16:31	07:09 17:12	06:25 17:51	06:27 19:30	05:38 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:24 19:23	07:01 18:27	06:42 16:37	07:19 16:15	
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9	07:33 16:33	07:07 17:15	06:21 17:53	06:24 19:33	05:36 20:09	05:10 20:40	05:18 20:44	05:50 20:14	06:27 19:20	07:03 18:23	06:44 16:35	07:21 16:15	
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15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:16	05:09 20:43	20:03 (1) 20:09 (1)	05:23 20:41	05:57 20:05	06:34 19:08	07:11 18:13	06:53 16:28	07:27 16:15
16	07:30 16:42	06:56 17:25	06:08 18:03	06:11 19:42	05:27 20:17	05:09 20:44	20:03 (1) 20:09 (1)	05:24 20:40	05:58 20:03	06:35 19:06	07:12 18:11	06:54 16:27	07:27 16:16
17	07:30 16:43	06:55 17:26	06:06 18:04	06:09 19:43	05:26 20:19	05:09 20:44	20:02 (1) 20:12 (1)	05:25 20:39	05:59 20:02	06:36 19:05	07:13 18:09	06:55 16:26	07:28 16:16
18	07:29 16:44	06:53 17:28	06:04 18:05	06:08 19:44	05:25 20:20	05:09 20:45	20:02 (1) 20:12 (1)	05:26 20:39	06:01 20:00	06:37 19:03	07:15 18:08	06:57 16:25	07:29 16:16
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20	07:28 16:47	06:50 17:30	06:01 18:08	06:04 19:47	05:23 20:22	05:09 20:45	20:02 (1) 20:12 (1)	05:28 20:37	06:03 19:55	06:40 18:59	07:17 18:04	06:59 16:24	07:30 16:17
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46	20:02 (1) 20:12 (1)	05:29 20:36	06:04 19:54	06:41 18:57	07:19 18:02	07:01 16:23	07:31 16:17
22	07:26 16:49	06:47 17:33	05:57 18:10	06:01 19:49	05:21 20:24	05:10 20:46	20:02 (1) 20:12 (1)	05:30 20:35	06:05 19:52	06:42 18:55	07:20 18:01	07:02 16:22	07:31 16:18
23	07:25 16:51	06:45 17:35	05:55 18:12	05:59 19:51	05:20 20:25	05:10 20:46	20:03 (1) 20:13 (1)	05:31 20:34	06:07 19:50	06:43 18:53	07:21 17:59	07:03 16:21	07:32 16:18
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:26	05:10 20:46	20:03 (1) 20:13 (1)	05:32 20:33	06:08 19:49	06:45 18:51	07:23 17:58	07:04 16:21	07:32 16:19
25	07:24 16:54	06:42 17:37	05:51 18:14	05:56 19:53	05:18 20:27	05:11 20:46	20:03 (1) 20:13 (1)	05:33 20:32	06:09 19:47	06:46 18:49	06:24 18:56	07:06 16:20	07:32 16:20
26	07:23 16:55	06:40 17:39	05:49 18:15	05:55 19:54	05:18 20:28	05:11 20:46	20:06 (1) 20:14 (1)	05:34 20:31	06:10 19:45	06:47 18:47	06:25 16:54	07:07 16:19	07:33 16:20
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	05:11 20:47	20:06 (1) 20:12 (1)	05:35 20:30	06:11 19:43	06:48 18:46	06:27 16:53	07:08 16:19	07:33 16:21
28	07:21 16:58	06:37 17:41	05:46 18:18	05:51 19:57	05:16 20:30	05:12 20:47	20:06 (1) 20:12 (1)	05:36 20:29	06:13 19:42	06:49 18:44	06:28 16:51	07:09 16:18	07:33 16:22
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31	07:18 17:02		05:40 18:22	05:44 19:59	05:14 20:33			05:40 20:26	06:16 19:36	06:32 16:47		07:34 16:24	
Potential sun hours	286	291	369	404	-285	-254	-272	4	376	341	288	275	
Total, worst case						130							
Sun reduction						0.55							
Oper. time red.						0.91							
Wind dir. red.						0.64							
Total reduction						0.32							
Total, real						42							

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/22/06 21:43 / 25
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 311 - 311

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:03	06:35 17:43	05:38 18:23	05:47 20:01	05:13 20:34	19:47 (1) 20:46	05:13 20:25	19:48 (1) 20:25	06:17 19:34	06:53 18:38	06:33 16:46	07:13 16:17
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6	07:34 16:30	07:11 17:11	06:26 17:49	06:29 19:29	05:40 20:05	05:11 20:38	19:45 (1) 20:45	05:16 20:18	19:51 (1) 20:18	06:23 19:25	06:59 18:29	06:40 16:39	07:18 16:15
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21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46	19:46 (1) 20:36	05:29 20:02	06:04 19:54	06:41 18:57	07:19 18:02	07:01 16:23	07:31 16:17
22	07:26 16:49	06:47 17:33	05:57 18:10	06:01 19:49	05:21 20:24	05:10 20:46	19:46 (1) 20:35	05:30 20:02	06:05 19:52	06:42 18:55	07:20 18:01	07:02 16:22	07:31 16:18
23	07:25 16:51	06:45 17:35	05:55 18:12	05:59 19:51	05:20 20:25	05:10 20:46	19:47 (1) 20:34	05:31 20:03	06:07 19:50	06:43 18:53	07:21 17:59	07:03 16:21	07:32 16:18
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:26	05:10 20:46	19:47 (1) 20:33	05:32 20:04	06:08 19:49	06:45 18:51	07:23 17:58	07:04 16:21	07:32 16:19
25	07:24 16:54	06:42 17:37	05:51 18:14	05:56 19:53	05:18 20:27	05:11 20:46	19:47 (1) 20:32	05:33 20:05	06:09 19:47	06:46 18:49	06:24 18:56	07:06 16:20	07:32 16:20
26	07:23 16:55	06:40 17:39	05:49 18:15	05:55 19:54	05:18 20:28	05:11 20:46	19:48 (1) 20:31	05:34 20:06	06:10 19:45	06:47 18:47	06:25 16:54	07:07 16:19	07:33 16:20
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	05:11 20:47	19:48 (1) 20:30	05:35 20:03	06:11 19:43	06:48 18:46	06:27 16:53	07:08 16:19	07:33 16:21
28	07:21 16:58	06:37 17:41	05:46 18:18	05:51 19:57	05:16 20:30	05:12 20:47	19:48 (1) 20:29	05:36 20:04	06:13 19:42	06:49 18:44	06:28 16:51	07:09 16:18	07:33 16:22
29	07:20 16:59	06:36 18:19	05:44 18:19	05:50 19:58	05:15 20:31	05:12 20:47	19:47 (1) 20:28	05:37 20:05	06:14 19:40	06:51 18:42	06:29 16:50	07:11 16:18	07:34 16:22
30	07:19 17:01	06:35 18:20	05:42 19:59	05:48 20:32	05:15 20:32	05:13 20:46	19:50 (1) 20:27	05:13 20:06	06:15 19:38	06:52 18:40	06:31 16:48	07:12 16:17	07:34 16:23
31	07:18 17:02	06:34 18:22	05:40 18:22	05:47 20:33	05:14 20:33	05:14 20:47	19:47 (1) 20:26	05:14 20:07	06:16 19:36	06:32 16:47	06:32 16:24	07:34 16:24	07:34 16:24
Potential sun hours	286	291	369	404	-285	-254	710	264	4	376	341	288	275
Total, worst case					30		710	264					
Sun reduction					0.55		0.55	0.58					
Oper. time red.					0.91		0.91	0.91					
Wind dir. red.					0.63		0.63	0.63					
Total reduction					0.31		0.31	0.33					
Total, real					9		223	88					

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/22/06 21:43 / 26
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 312 - 312

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:34 16:25	07:17 17:03	06:35 17:43	05:38 18:23	05:47 20:01	05:13 20:34	19:37 (1) 20:46	19:42 (1) 20:25	06:17 19:34	06:53 18:38	06:33 16:46	07:13 16:17
2	07:34 16:26	07:15 17:05	06:33 17:44	05:36 18:24	05:45 20:01	05:13 20:35	19:36 (1) 20:46	19:40 (1) 20:23	06:18 19:33	06:54 18:36	06:35 16:44	07:14 16:16
3	07:34 16:27	07:14 17:06	06:32 17:45	05:35 18:25	05:44 20:02	05:12 20:36	19:36 (1) 20:46	19:41 (1) 20:22	06:20 19:31	06:56 18:34	06:36 16:43	07:15 16:16
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:42 20:03	05:12 20:36	19:36 (1) 20:46	19:42 (1) 20:21	06:21 19:29	06:57 18:32	06:37 16:41	07:16 16:16
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:04	05:11 20:37	19:37 (1) 20:46	19:42 (1) 20:19	06:22 19:27	06:58 18:31	06:39 16:40	07:17 16:15
6	07:34 16:30	07:11 17:11	06:26 17:49	06:29 19:29	05:40 20:05	05:11 20:38	19:37 (1) 20:45	19:43 (1) 20:18	06:23 19:25	06:59 18:29	06:40 16:39	07:18 16:15
7	07:34 16:31	07:09 17:12	06:25 17:51	06:27 19:30	05:38 20:07	05:11 20:39	19:37 (1) 20:45	19:44 (1) 20:17	06:24 19:23	07:01 18:27	06:42 16:37	07:19 16:15
8	07:34 16:32	07:08 17:13	06:23 17:52	06:25 19:32	05:37 20:08	05:10 20:39	19:36 (1) 20:45	19:44 (1) 20:15	06:26 19:22	07:02 18:25	06:43 16:36	07:20 16:15
9	07:33 16:33	07:07 17:15	06:21 17:53	06:24 19:33	05:36 20:09	05:10 20:40	19:36 (1) 20:44	19:43 (1) 20:14	06:27 19:20	07:03 18:23	06:44 16:35	07:21 16:15
10	07:33 16:34	07:05 17:16	06:19 17:55	06:22 19:34	05:34 20:10	05:10 20:41	19:36 (1) 20:44	19:44 (1) 20:13	06:28 19:18	07:04 18:22	06:46 16:34	07:22 16:15
11	07:33 16:35	07:04 17:18	06:17 17:56	06:20 19:36	05:33 20:12	05:10 20:41	19:38 (1) 20:43	19:44 (1) 20:11	06:29 19:16	07:06 18:20	06:47 16:33	07:23 16:15
12	07:32 16:37	07:02 17:19	06:16 17:57	06:18 19:37	05:32 20:13	05:09 20:42	19:38 (1) 20:43	19:45 (1) 20:10	06:30 19:14	07:07 18:18	06:48 16:31	07:24 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	06:16 19:38	05:31 20:14	05:09 20:42	19:38 (1) 20:42	19:46 (1) 20:08	06:32 19:12	07:08 18:16	06:50 16:30	07:25 16:15
14	07:31 16:39	06:59 17:22	06:12 18:00	06:15 19:39	05:29 20:15	05:09 20:43	19:37 (1) 20:41	19:47 (1) 20:07	06:33 19:10	07:09 18:14	06:51 16:29	07:26 16:15
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:16	05:09 20:43	19:37 (1) 20:41	19:48 (1) 20:05	06:34 19:08	07:11 18:13	06:53 16:28	07:27 16:15
16	07:30 16:42	06:56 17:25	06:08 18:03	06:11 19:42	05:27 20:17	05:09 20:44	19:37 (1) 20:40	19:49 (1) 20:03	06:35 19:06	07:12 18:11	06:54 16:27	07:27 16:16
17	07:30 16:43	06:55 17:26	06:06 18:04	06:09 19:43	05:26 20:19	05:09 20:44	19:38 (1) 20:39	19:50 (1) 20:02	06:36 19:05	07:13 18:09	06:55 16:26	07:28 16:16
18	07:29 16:44	06:53 17:28	06:04 18:05	06:08 19:44	05:25 20:20	05:09 20:45	19:38 (1) 20:39	19:50 (1) 20:00	06:37 19:03	07:15 18:08	06:57 16:25	07:29 16:16
19	07:29 16:45	06:52 17:29	06:03 18:06	06:06 19:46	05:24 20:21	05:09 20:45	19:38 (1) 20:38	19:51 (1) 19:57	06:39 19:01	07:16 18:06	06:58 16:24	07:29 16:16
20	07:28 16:47	06:50 17:30	06:01 18:08	06:04 19:47	05:23 20:22	05:09 20:45	19:38 (1) 20:37	19:54 (1) 20:02	06:40 18:59	07:17 18:04	06:59 16:24	07:30 16:17
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46	19:38 (1) 20:36	20:02 (1) 19:54	06:04 18:57	07:19 18:02	07:01 16:23	07:31 16:17
22	07:26 16:49	06:47 17:33	05:57 18:10	06:01 19:49	05:21 20:24	05:10 20:46	19:38 (1) 20:35	06:05 19:52	06:42 18:55	07:20 18:01	07:02 16:22	07:31 16:18
23	07:25 16:51	06:45 17:35	05:55 18:12	05:59 19:51	05:20 20:25	19:47 (1) 19:51 (1)	05:10 20:46	06:07 19:50	06:43 18:53	07:21 17:59	07:03 16:21	07:32 16:18
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:26	19:44 (1) 19:54 (1)	05:10 20:46	06:08 19:49	06:45 18:51	07:23 17:58	07:04 16:21	07:32 16:19
25	07:24 16:54	06:42 17:37	05:51 18:14	05:56 19:53	05:18 20:27	19:41 (1) 19:55 (1)	05:11 20:46	06:09 19:47	06:46 18:49	06:24 18:56	07:06 16:20	07:32 16:20
26	07:23 16:55	06:40 17:39	05:50 18:15	05:55 19:54	05:18 20:28	19:41 (1) 19:57 (1)	05:11 20:46	06:10 19:45	06:47 18:47	06:25 18:54	07:07 16:19	07:33 16:20
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	19:40 (1) 19:58 (1)	05:11 20:47	06:11 19:43	06:48 18:46	06:27 16:53	07:08 16:19	07:33 16:21
28	07:21 16:58	06:37 17:41	05:46 18:18	05:51 19:57	05:16 20:30	19:39 (1) 19:59 (1)	05:12 20:47	06:13 19:42	06:49 18:44	06:28 16:51	07:09 16:18	07:33 16:22
29	07:20 16:59	06:36 18:19	05:44 18:19	05:50 19:58	05:15 20:31	19:39 (1) 20:01 (1)	05:12 20:47	06:14 19:40	06:51 18:42	06:29 16:50	07:11 16:18	07:34 16:22
30	07:19 17:01	06:35 18:20	05:42 18:20	05:48 19:59	05:15 20:32	19:38 (1) 20:00 (1)	05:13 20:46	06:15 19:38	06:52 18:40	06:31 16:48	07:12 16:17	07:34 16:23
31	07:18 17:02	06:34 18:22	05:40 18:22	05:44 20:33	05:14 20:34	19:37 (1) 20:01 (1)	05:14 20:46	06:16 19:36	06:32 16:47	07:12 16:24	07:34 16:24	
Potential sun hours	286	291	369	404	-285	-254	-272	4	376	341	288	275
Total, worst case					150	862	466					
Sun reduction					0.55	0.55	0.58					
Oper. time red.					0.91	0.91	0.91					
Wind dir. red.					0.62	0.62	0.62					
Total reduction					0.31	0.31	0.33					
Total, real					47	268	153					

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/22/06 21:43 / 27
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 313 - 313

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:03	06:35 17:43	05:38 18:23	05:47 20:01	19:16 (1) 20:34	05:13 20:34	19:07 (1) 20:46	19:18 (1) 20:25	19:13 (1) 19:34	06:17 18:38	06:53 16:46	06:33 16:17
2	07:34 16:26	07:15 17:05	06:34 17:44	05:36 18:24	05:45 20:01	19:12 (1) 20:35	05:13 20:35	19:06 (1) 20:46	19:18 (1) 20:23	19:12 (1) 19:33	06:18 18:36	06:54 16:44	06:35 16:16
3	07:34 16:27	07:14 17:06	06:32 17:45	05:35 18:25	05:44 20:02	19:09 (1) 20:36	05:12 20:36	19:08 (1) 20:46	19:17 (1) 20:22	19:13 (1) 19:31	06:20 18:34	06:56 16:43	06:36 16:16
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5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:04	19:06 (1) 20:37	05:11 20:37	19:09 (1) 20:46	19:16 (1) 20:20	19:13 (1) 19:27	06:22 18:31	06:58 16:40	06:39 16:15
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7	07:34 16:31	07:09 17:12	06:25 17:51	06:27 19:30	05:38 20:07	19:04 (1) 20:39	05:11 20:39	19:11 (1) 20:45	19:16 (1) 20:17	19:15 (1) 19:23	06:24 18:27	07:01 16:37	06:42 16:15
8	07:34 16:32	07:08 17:13	06:23 17:52	06:25 19:32	05:37 20:08	19:02 (1) 20:39	05:10 20:39	19:10 (1) 20:45	19:16 (1) 20:15	19:16 (1) 19:22	06:26 18:25	07:02 16:36	06:43 16:15
9	07:33 16:33	07:07 17:15	06:21 17:53	06:24 19:33	05:36 20:09	19:03 (1) 20:40	05:10 20:40	19:12 (1) 20:44	19:15 (1) 20:14	19:17 (1) 19:20	06:27 18:23	07:03 16:35	06:44 16:15
10	07:33 16:34	07:05 17:16	06:19 17:55	06:22 19:34	05:34 20:10	19:02 (1) 20:41	05:10 20:41	19:12 (1) 20:44	19:16 (1) 20:13	19:18 (1) 19:18	06:28 18:22	07:04 16:34	06:46 16:15
11	07:33 16:35	07:04 17:18	06:17 17:56	06:20 19:36	05:33 20:12	19:01 (1) 20:41	05:10 20:41	19:14 (1) 20:43	19:14 (1) 20:11	19:22 (1) 19:16	06:29 18:20	07:06 16:33	06:47 16:15
12	07:32 16:37	07:02 17:19	06:16 17:57	06:18 19:37	05:32 20:13	19:02 (1) 20:42	05:09 20:42	19:14 (1) 20:43	19:13 (1) 20:10	19:25 (1) 19:14	06:30 18:18	07:07 16:31	06:48 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	06:16 19:38	05:31 20:14	19:01 (1) 20:42	05:09 20:42	19:16 (1) 20:42	19:14 (1) 20:08	06:32 19:12	07:08 18:16	06:50 16:30	07:25 16:15
14	07:31 16:39	06:59 17:22	06:12 18:00	06:15 19:39	05:29 20:15	19:01 (1) 20:43	05:09 20:43	19:15 (1) 20:41	19:13 (1) 20:07	06:33 19:10	07:09 18:14	06:51 16:29	07:26 16:15
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:16	19:00 (1) 20:43	05:09 20:43	19:15 (1) 20:41	19:14 (1) 20:05	06:34 19:08	07:11 18:13	06:53 16:28	07:27 16:15
16	07:30 16:42	06:56 17:25	06:08 18:03	06:11 19:42	05:27 20:17	19:01 (1) 20:44	05:09 20:44	19:17 (1) 20:40	19:13 (1) 20:03	06:35 19:06	07:12 18:11	06:54 16:27	07:27 16:16
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19	07:29 16:45	06:52 17:29	06:03 18:06	06:06 19:46	05:24 20:21	19:00 (1) 20:45	05:09 20:45	19:18 (1) 20:38	19:11 (1) 19:57	06:39 19:01	07:16 18:06	06:58 16:24	07:29 16:16
20	07:28 16:47	06:50 17:30	06:01 18:08	06:04 19:47	05:23 20:22	19:01 (1) 20:45	05:09 20:45	19:18 (1) 20:37	19:12 (1) 19:55	06:40 18:59	07:17 18:04	06:59 16:24	07:30 16:17
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	19:01 (1) 20:46	05:10 20:46	19:18 (1) 20:36	19:11 (1) 19:54	06:41 18:57	07:19 18:02	07:01 16:23	07:31 16:17
22	07:26 16:49	06:47 17:33	05:57 18:10	06:01 19:49	05:21 20:24	19:02 (1) 20:46	05:10 20:46	19:18 (1) 20:35	19:12 (1) 19:52	06:42 18:55	07:20 18:01	07:02 16:22	07:31 16:18
23	07:25 16:51	06:45 17:35	05:55 18:12	06:03 19:51	05:20 20:25	19:03 (1) 20:46	05:10 20:46	19:19 (1) 20:34	19:11 (1) 19:50	06:43 18:53	07:21 17:59	07:03 16:21	07:32 16:18
24	07:25 16:52	06:44 17:36	05:53 18:13	06:05 19:52	05:19 20:26	19:02 (1) 20:46	05:10 20:46	19:19 (1) 20:33	19:12 (1) 19:49	06:45 18:51	07:23 17:58	07:04 16:21	07:32 16:19
25	07:24 16:54	06:42 17:37	05:51 18:14	06:05 19:53	05:18 20:27	19:03 (1) 20:46	05:11 20:46	19:19 (1) 20:32	19:11 (1) 19:47	06:46 18:49	07:24 17:56	07:06 16:20	07:32 16:20
26	07:23 16:55	06:40 17:39	05:50 18:15	06:05 19:54	05:18 20:28	19:03 (1) 20:47	05:11 20:47	19:20 (1) 20:31	19:12 (1) 19:45	06:47 18:47	06:25 16:54	07:07 16:19	07:33 16:20
27	07:22 16:56	06:39 17:40	05:48 18:17	06:05 19:56	05:17 20:29	19:04 (1) 20:47	05:11 20:47	19:18 (1) 20:30	19:11 (1) 19:43	06:48 18:46	06:27 16:53	07:08 16:19	07:33 16:21
28	07:21 16:58	06:37 17:41	05:46 18:18	06:05 19:57	05:16 20:30	19:03 (1) 20:47	05:12 20:47	19:18 (1) 20:29	19:10 (1) 19:42	06:49 18:44	06:28 16:51	07:09 16:18	07:33 16:22
29	07:20 16:59	06:36 17:42	05:44 18:19	06:04 19:58	05:15 20:31	19:05 (1) 20:47	05:12 20:47	19:19 (1) 20:28	19:11 (1) 19:40	06:51 18:42	06:29 16:50	07:11 16:18	07:34 16:22
30	07:19 17:01	06:35 18:20	05:42 18:20	06:04 19:59	05:15 20:32	19:06 (1) 20:46	05:13 20:46	19:17 (1) 20:27	19:12 (1) 19:38	06:52 18:40	06:31 16:48	07:12 16:17	07:34 16:23
31	07:18 17:02	06:34 18:22	05:40 18:22	06:04 20:33	05:14 20:33	19:05 (1) 20:33	05:14 20:33	19:18 (1) 20:26	19:11 (1) 19:36	06:32 16:47	07:13 16:47	07:34 16:24	
Potential sun hours	286	291	369	404	-285	-254	-272	4	376	341	288	275	
Total, worst case					986	544		944		314			
Sun reduction					0.55	0.55		0.58		0.55			
Oper. time red.					0.91	0.91		0.91		0.91			
Wind dir. red.					0.61	0.61		0.61		0.61			
Total reduction					0.31	0.31		0.32		0.31			
Total, real					303	167		305		96			

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/22/06 21:43 / 28
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 314 - 314

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:03	06:35 17:43	05:38 18:23	05:47 20:01	05:13 20:34	05:13 20:46	05:41 20:25	06:17 19:34	18:27 (1) 18:59 (1)	06:53 18:38	06:33 16:46	07:13 16:17
2	07:34 16:26	07:15 17:05	06:34 17:44	05:36 18:24	05:45 20:01	05:13 20:35	05:14 20:46	05:42 20:23	06:18 19:33	18:26 (1) 18:58 (1)	06:54 18:36	06:35 16:44	07:14 16:16
3	07:34 16:27	07:14 17:06	06:32 17:45	05:35 18:25	05:35 20:02	05:12 20:36	05:14 20:46	05:43 20:22	06:20 19:31	18:28 (1) 18:58 (1)	06:56 18:34	06:36 16:43	07:15 16:16
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:33 20:03	05:12 20:36	05:15 20:46	05:44 20:21	06:21 19:29	18:29 (1) 18:57 (1)	06:57 18:32	06:37 16:41	07:16 16:16
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	06:31 22	05:41 18:57 (1)	05:16 20:37	05:45 20:20	06:22 19:27	18:28 (1) 18:56 (1)	06:58 18:31	06:39 16:40	07:17 16:15
6	07:34 16:30	07:11 17:11	06:26 17:49	06:29 19:29	06:29 24	05:40 18:57 (1)	05:11 20:38	05:47 20:18	06:23 19:25	18:29 (1) 18:53 (1)	06:59 18:29	06:40 16:39	07:18 16:15
7	07:34 16:31	07:09 17:12	06:25 17:51	06:27 19:30	06:27 28	05:38 18:59 (1)	05:11 20:39	05:48 20:17	06:24 19:23	18:30 (1) 18:52 (1)	07:01 18:27	06:42 16:37	07:19 16:15
8	07:34 16:32	07:08 17:13	06:23 17:52	06:25 19:32	06:25 28	05:37 19:00 (1)	05:10 20:08	05:49 20:39	06:26 19:22	18:33 (1) 18:49 (1)	07:02 18:25	06:43 16:36	07:20 16:15
9	07:33 16:33	07:07 17:15	06:21 17:53	06:24 19:33	06:24 30	05:36 18:30 (1)	05:10 20:09	05:50 20:14	06:27 19:20	18:34 (1) 18:44 (1)	07:03 18:23	06:44 16:35	07:21 16:15
10	07:33 16:34	07:05 17:16	06:19 17:55	06:22 19:34	06:22 32	05:34 18:28 (1)	05:10 20:10	05:51 20:13	06:28 19:18	07:04 18:22	06:46 16:34	07:22 16:15	
11	07:33 16:35	07:04 17:18	06:17 17:56	06:20 19:36	06:20 32	05:33 18:28 (1)	05:10 20:12	05:52 20:11	06:29 19:16	07:06 18:20	06:47 16:33	07:23 16:15	
12	07:32 16:37	07:02 17:19	06:16 17:57	06:18 19:37	06:18 32	05:32 18:28 (1)	05:09 20:13	05:54 20:10	06:30 19:14	07:07 18:18	06:48 16:31	07:24 16:15	
13	07:32 16:38	07:01 17:21	06:14 17:59	06:16 19:38	06:16 34	05:31 18:27 (1)	05:09 20:14	05:55 20:08	06:32 19:12	07:08 18:16	06:50 16:30	07:25 16:15	
14	07:31 16:39	06:59 17:22	06:12 18:00	06:15 19:39	06:15 32	05:29 18:27 (1)	05:09 20:15	05:56 20:07	06:33 19:10	07:09 18:14	06:51 16:29	07:26 16:15	
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	06:13 32	05:28 18:27 (1)	05:09 20:16	05:57 20:05	06:34 19:08	07:11 18:13	06:53 16:28	07:27 16:15	
16	07:30 16:42	06:56 17:25	06:08 18:03	06:11 19:42	06:11 32	05:27 18:28 (1)	05:09 20:17	05:58 20:03	06:35 19:06	07:12 18:11	06:54 16:27	07:27 16:16	
17	07:30 16:43	06:55 17:26	06:06 18:04	06:09 19:43	06:09 30	05:26 18:28 (1)	05:09 20:19	05:59 20:02	06:36 19:05	07:13 18:09	06:55 16:26	07:28 16:16	
18	07:29 16:44	06:53 17:28	06:04 18:05	06:08 19:44	06:08 30	05:25 18:28 (1)	05:09 20:20	06:01 20:00	06:37 19:03	07:15 18:08	06:57 16:25	07:29 16:16	
19	07:29 16:45	06:52 17:29	06:03 18:06	06:06 19:46	06:06 28	05:24 18:28 (1)	05:09 20:21	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:24	07:29 16:16	
20	07:28 16:47	06:50 17:30	06:01 18:08	06:04 19:47	06:04 26	05:23 18:29 (1)	05:09 20:22	06:03 19:55	06:40 18:59	07:17 18:04	06:59 16:24	07:30 16:17	
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	06:03 26	05:22 18:29 (1)	05:10 20:23	06:04 19:54	06:41 18:59 (1)	07:19 18:02	07:01 16:23	07:31 16:17	
22	07:26 16:49	06:47 17:33	05:57 18:10	06:01 19:49	06:01 22	05:21 18:32 (1)	05:10 20:24	06:05 19:52	06:42 19:00 (1)	07:20 18:55	07:02 18:01	07:31 16:18	
23	07:25 16:51	06:45 17:35	05:55 18:12	05:59 19:51	05:59 20	05:20 18:32 (1)	05:10 20:25	06:07 19:50	06:43 18:53 (1)	07:21 17:59	07:03 16:21	07:32 16:18	
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:58 14	05:19 18:34 (1)	05:10 20:26	06:08 19:49	06:45 18:51 (1)	07:23 17:58	07:04 16:21	07:32 16:19	
25	07:24 16:54	06:42 17:37	05:51 18:14	05:56 19:53	05:56 8	05:18 18:45 (1)	05:11 20:27	06:09 19:47	06:46 18:30 (1)	07:24 17:58	07:06 16:20	07:32 16:20	
26	07:23 16:55	06:40 17:39	05:50 18:15	05:55 19:54	05:55 20	05:18 20:28	05:11 20:47	06:10 20:31	06:47 19:45	07:25 18:30 (1)	07:07 16:54	07:33 16:19	
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:53 20	05:17 20:29	05:11 20:47	06:11 20:30	06:48 19:43	07:26 18:30 (1)	07:08 16:53	07:33 16:21	
28	07:21 16:58	06:37 17:41	05:46 18:18	05:51 19:57	05:51 20	05:16 20:30	05:12 20:47	06:13 20:29	06:49 19:02 (1)	07:27 18:29 (1)	07:09 16:51	07:33 16:22	
29	07:20 16:59	06:36 17:41	05:44 18:19	05:50 19:58	05:50 20	05:15 20:31	05:12 20:47	06:14 20:28	06:51 19:40	07:28 18:28 (1)	07:11 16:50	07:34 16:22	
30	07:19 17:01	06:35 18:20	05:42 18:20	05:48 19:59	05:48 20	05:13 20:32	05:13 20:46	06:15 20:27	06:52 19:38	07:29 19:01 (1)	07:12 16:48	07:34 16:23	
31	07:18 17:02	06:34 18:22	05:40 18:22	05:45 19:59	05:45 20	05:14 20:33	05:14 20:26	06:16 19:36	06:53 19:00 (1)	07:30 18:28 (1)	07:13 16:47	07:34 16:24	
Potential sun hours	286	291	369	404	-285	-254	-272	4	376	341	288	274	
Total, worst case				586				368	222				
Sun reduction				0.55				0.55	0.55				
Oper. time red.				0.91				0.91	0.91				
Wind dir. red.				0.62				0.62	0.62				
Total reduction				0.31				0.31	0.31				
Total, real				182				115	69				

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/22/06 21:43 / 29
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 315 - 315

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
 N NE E SE S SW W NW Sum
 1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:34 16:25	07:17 17:03	06:35 17:43	05:38 18:23	17:08 (1) 17:40 (1)	05:47 20:01	05:13 20:34	05:13 20:46	05:41 20:25	06:17 19:34	06:53 18:38	06:33 16:46
2	07:34 16:26	07:15 17:05	06:34 17:44	05:36 18:24	17:09 (1) 17:41 (1)	05:45 20:01	05:13 20:35	05:14 20:46	05:42 20:23	06:18 19:33	06:54 18:36	06:35 16:44
3	07:34 16:27	07:14 17:06	06:32 17:45	05:35 18:25	17:09 (1) 17:39 (1)	05:44 20:02	05:12 20:36	05:14 20:46	05:43 20:22	06:20 19:31	18:16 (1) 18:26 (1)	06:56 18:34
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:27	17:09 (1) 17:37 (1)	05:42 20:03	05:12 20:36	05:15 20:46	05:44 20:21	06:21 19:29	18:11 (1) 18:29 (1)	06:57 18:32
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	18:09 (1) 18:37 (1)	05:41 20:04	05:11 20:37	05:16 20:46	05:45 20:20	06:22 19:27	18:08 (1) 18:30 (1)	06:58 18:31
6	07:34 16:30	07:11 17:11	06:26 17:49	06:29 19:29	18:11 (1) 18:35 (1)	05:40 20:05	05:11 20:38	05:17 20:45	05:47 20:18	06:23 19:25	18:07 (1) 18:31 (1)	06:59 18:29
7	07:34 16:31	07:09 17:12	06:25 17:51	06:27 19:30	18:11 (1) 18:33 (1)	05:38 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:24 19:23	18:06 (1) 18:32 (1)	07:01 18:27
8	07:34 16:32	07:08 17:13	06:23 17:52	06:25 19:32	18:14 (1) 18:32 (1)	05:37 20:08	05:10 20:39	05:18 20:45	05:49 20:15	06:26 19:22	18:03 (1) 18:31 (1)	07:02 18:25
9	07:33 16:33	07:07 17:15	06:21 17:53	06:24 19:33	18:18 (1) 18:28 (1)	05:36 20:09	05:10 20:40	05:18 20:44	05:50 20:14	06:27 19:20	18:02 (1) 18:32 (1)	07:03 18:23
10	07:33 16:34	07:05 17:16	06:19 17:55	06:22 19:34	05:34 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 20:13	19:18 18:34 (1)	18:02 (1) 18:34 (1)	07:04 18:22
11	07:33 16:35	07:04 17:18	06:17 17:56	06:20 19:36	05:33 20:12	05:10 20:41	05:20 20:43	05:52 20:11	06:29 19:16	19:32 18:33 (1)	18:01 (1) 18:33 (1)	07:06 18:20
12	07:32 16:37	07:02 17:19	06:16 17:57	06:18 19:37	05:32 20:13	05:09 20:42	05:21 20:43	05:54 20:10	06:30 19:14	19:30 18:32 (1)	18:00 (1) 18:32 (1)	07:07 18:18
13	07:32 16:38	07:01 17:21	06:14 17:59	06:16 19:38	05:31 20:14	05:09 20:42	05:22 20:08	05:55 20:08	06:32 19:12	19:34 18:33 (1)	17:59 (1) 18:33 (1)	07:08 18:16
14	07:31 16:39	06:59 17:22	06:12 18:00	06:15 19:39	05:29 20:15	05:09 20:43	05:22 20:07	05:56 20:07	06:33 19:10	19:34 18:32 (1)	17:58 (1) 18:32 (1)	07:09 18:14
15	07:31 16:40	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:16	05:09 20:43	05:23 20:05	05:57 19:08	06:34 19:08	19:32 18:31 (1)	17:59 (1) 18:31 (1)	07:11 18:13
16	07:30 16:42	06:56 17:25	06:08 18:03	06:11 19:42	05:27 20:17	05:09 20:44	05:24 20:40	05:58 20:03	06:35 19:06	19:32 18:30 (1)	17:58 (1) 18:30 (1)	07:12 18:11
17	07:30 16:43	06:55 17:26	06:06 18:04	06:09 19:43	05:26 20:19	05:09 20:44	05:25 20:39	05:59 20:02	06:36 19:05	19:33 18:30 (1)	17:58 (1) 18:09	07:13 18:09
18	07:29 16:44	06:53 17:28	06:04 18:05	06:08 19:44	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:00	06:37 19:03	19:33 18:29 (1)	17:59 (1) 18:07	07:15 18:07
19	07:29 16:45	06:52 17:29	06:03 18:06	06:06 19:46	05:24 20:21	05:09 20:45	05:27 20:38	06:02 19:57	06:39 19:01	19:34 18:28 (1)	18:00 (1) 18:06	07:16 18:06
20	07:28 16:47	06:50 17:30	06:01 18:08	06:04 19:47	05:23 20:22	05:09 20:45	05:28 20:37	06:03 19:55	06:40 18:59	19:35 18:27 (1)	17:59 (1) 18:04	07:17 18:04
21	07:27 16:48	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46	05:29 20:36	06:04 19:54	06:41 18:57	19:36 18:24 (1)	18:00 (1) 18:02	07:19 18:02
22	07:26 16:49	06:47 17:33	05:57 18:10	06:01 19:49	05:21 20:24	05:10 20:46	05:30 20:35	06:05 19:52	06:42 18:55	19:37 18:23 (1)	18:01 (1) 18:01	07:20 18:01
23	07:25 16:51	06:45 17:35	05:55 18:12	05:59 19:51	05:20 20:25	05:10 20:46	05:31 20:34	06:07 19:50	06:43 18:53	19:38 18:21 (1)	18:05 (1) 17:59	07:21 18:01
24	07:25 16:52	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:26	05:10 20:46	05:32 20:33	06:08 19:49	06:45 18:51	19:39 18:16 (1)	18:08 (1) 17:58	07:23 18:01
25	07:24 16:54	06:42 17:37	05:51 18:14	05:56 19:53	05:18 20:27	05:11 20:46	05:33 20:32	06:09 19:47	06:46 18:49	19:40 18:16	06:24 18:56	07:06 18:20
26	07:23 16:55	06:40 17:39	05:50 18:15	05:55 19:54	05:18 20:28	05:11 20:47	05:34 20:31	06:10 19:45	06:47 18:47	19:41 18:47	06:25 18:54	07:07 18:19
27	07:22 16:56	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	05:11 20:47	05:35 20:30	06:11 19:43	06:48 18:46	19:42 18:46	06:27 16:53	07:08 18:19
28	07:21 16:58	06:37 17:41	05:46 18:18	05:51 19:57	05:16 20:30	05:12 20:47	05:36 20:29	06:13 19:42	06:49 18:44	19:43 18:44	06:28 16:51	07:09 18:18
29	07:20 16:59	06:36 18:19	05:44 18:19	05:50 19:58	05:15 20:31	05:12 20:47	05:37 20:28	06:14 19:40	06:51 18:42	19:44 18:42	06:29 16:50	07:11 18:18
30	07:19 17:01	06:35 18:20	05:42 18:20	05:48 19:59	05:15 20:32	05:13 20:46	05:39 20:27	06:15 19:38	06:52 18:40	19:45 18:40	06:31 16:48	07:12 18:17
31	07:18 17:02	06:34 18:22	05:40 18:22	05:48 19:59	05:14 20:33	05:14 20:46	05:40 20:26	06:16 19:36	06:52 19:36	19:46 19:36	06:32 16:47	07:34 18:24
Potential sun hours	286	291	369	404	-285	-254	-272	4	376	341	288	274
Total, worst case			346	224					574			
Sun reduction			0.50	0.55					0.55			
Oper. time red.			0.91	0.91					0.91			
Wind dir. red.			0.61	0.61					0.61			
Total reduction			0.28	0.31					0.31			
Total, real			96	68					175			

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/22/06 21:43 / 30
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506
Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 316 - 316

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:03	06:35 17:43	05:38 18:23	05:47 20:01	05:13 20:34	05:13 20:46	05:41 20:25	06:17 19:34	06:53 18:38	17:44 (1) 18:06 (1)	06:33 16:46	07:13 16:17
2	07:34 16:26	07:15 17:05	06:34 17:44	05:36 18:24	05:45 20:01	05:13 20:35	05:14 20:46	05:42 20:23	06:18 19:33	06:54 18:36	17:46 (1) 18:04 (1)	06:35 16:44	07:14 16:16
3	07:34 16:27	07:14 17:06	06:32 17:45	05:35 18:25	05:44 20:02	05:12 20:36	05:14 20:46	05:43 20:22	06:20 19:31	06:56 18:34	17:47 (1) 18:01 (1)	06:36 16:43	07:15 16:16
4	07:34 16:28	07:13 17:08	06:30 17:47	05:33 18:27	05:42 20:03	05:12 20:36	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:32	17:52 (1) 17:56 (1)	06:37 16:41	07:16 16:16
5	07:34 16:29	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:04	05:11 20:37	05:16 20:46	05:45 20:20	06:22 19:27	06:58 18:31		06:39 16:40	07:17 16:15
6	07:34 16:30	07:11 17:11	06:26 17:49	06:29 19:29	05:40 20:05	05:11 20:38	05:16 20:45	05:47 20:18	06:23 19:25	06:59 18:29		06:40 16:39	07:18 16:15
7	07:34 16:31	07:09 17:12	06:25 17:51	06:27 19:30	05:38 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:24 19:23	07:01 18:27		06:42 16:37	07:19 16:15
8	07:34 16:32	07:08 17:13	06:23 17:52	06:25 19:32	05:37 20:08	05:10 20:39	05:10 20:45	05:49 20:15	06:26 19:22	07:02 18:25		06:43 16:36	07:20 16:15
9	07:33 16:33	07:07 17:15	06:21 17:53	06:24 19:33	05:36 20:09	05:10 20:40	05:18 20:44	05:50 20:14	06:27 19:20	07:03 18:23		06:44 16:35	07:21 16:15
10	07:33 16:34	07:05 17:16	06:19 17:55	17:12 (1) 17:22 (1)	06:22 19:34	05:34 20:10	05:19 20:41	05:51 20:13	06:28 19:18	07:04 18:22		06:46 16:34	07:22 16:15
11	07:33 16:35	07:04 17:18	06:17 17:56	17:08 (1) 17:24 (1)	06:20 19:36	05:33 20:12	05:10 20:41	05:52 20:11	06:29 19:16	07:06 18:20		06:47 16:33	07:23 16:15
12	07:32 16:37	07:02 17:19	06:16 17:57	17:06 (1) 17:26 (1)	06:18 19:37	05:32 20:13	05:09 20:42	05:54 20:10	06:30 19:14	07:07 18:18		06:48 16:31	07:24 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	17:04 (1) 17:28 (1)	06:16 19:38	05:31 20:14	05:09 20:42	05:55 20:08	06:32 19:12	07:08 18:16		06:50 16:30	07:25 16:15
14	07:31 16:39	06:59 17:22	06:12 18:00	17:02 (1) 17:28 (1)	06:15 19:39	05:29 20:15	05:09 20:43	05:56 20:07	06:33 19:10	07:09 18:14	17:54 (1) 18:08 (1)	06:51 16:29	07:26 16:15
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16	07:30 16:42	06:56 17:25	06:08 18:03	17:00 (1) 17:30 (1)	06:11 19:42	05:27 20:17	05:09 20:44	05:58 20:03	06:35 19:06	07:12 18:11	17:50 (1) 18:12 (1)	06:54 16:27	07:27 16:16
17	07:30 16:43	06:55 17:26	06:06 18:04	16:59 (1) 17:31 (1)	06:09 19:43	05:26 20:19	05:09 20:44	05:59 20:02	06:36 19:05	07:13 18:09	17:48 (1) 18:14 (1)	06:55 16:26	07:28 16:16
18	07:29 16:44	06:53 17:28	06:04 18:05	16:59 (1) 17:31 (1)	06:08 19:44	05:25 20:20	05:09 20:45	06:01 20:00	06:37 19:03	07:15 18:07	18:08 (1) 18:13 (1)	06:57 16:25	07:29 16:16
19	07:29 16:45	06:52 17:29	06:03 18:06	16:57 (1) 17:31 (1)	06:06 19:46	05:24 20:21	05:09 20:45	06:02 19:57	06:39 19:01	07:16 18:06	17:44 (1) 18:14 (1)	06:58 16:24	07:29 16:16
20	07:28 16:47	06:50 17:30	06:01 18:08	16:57 (1) 17:31 (1)	06:04 19:47	05:23 20:22	05:09 20:45	06:03 20:37	06:40 19:55	07:17 18:04	17:43 (1) 18:15 (1)	06:59 16:24	07:30 16:17
21	07:27 16:48	06:49 17:32	05:59 18:09	16:57 (1) 17:29 (1)	06:03 19:48	05:22 20:23	05:10 20:46	06:04 19:54	06:41 18:57	07:19 18:02	17:42 (1) 18:14 (1)	07:01 16:23	07:31 16:17
22	07:26 16:49	06:47 17:33	05:57 18:10	16:57 (1) 17:29 (1)	06:01 19:49	05:21 20:24	05:10 20:46	06:05 20:35	06:42 18:55	07:20 18:01	17:41 (1) 18:13 (1)	07:02 16:22	07:31 16:18
23	07:25 16:51	06:45 17:35	05:55 18:12	16:57 (1) 17:27 (1)	05:59 19:51	05:20 20:25	05:10 20:46	06:07 20:34	06:43 19:50	07:21 18:53	17:41 (1) 18:15 (1)	07:03 16:21	07:32 16:18
24	07:25 16:52	06:44 17:36	05:53 18:13	16:57 (1) 17:27 (1)	05:58 19:52	05:19 20:26	05:10 20:46	06:08 20:33	06:45 19:49	07:23 18:51	17:42 (1) 18:14 (1)	07:04 16:21	07:32 16:19
25	07:24 16:54	06:42 17:37	05:51 18:14	16:57 (1) 17:25 (1)	05:56 19:53	05:18 20:27	05:11 20:46	06:09 20:32	06:46 19:47	07:24 18:49	17:41 (1) 18:13 (1)	07:06 16:20	07:32 16:20
26	07:23 16:55	06:40 17:39	05:50 18:15	17:00 (1) 17:26 (1)	05:55 19:54	05:18 20:28	05:11 20:47	06:10 20:31	06:47 19:45	07:25 18:47	17:40 (1) 18:12 (1)	07:07 16:19	07:33 16:20
27	07:22 16:56	06:39 17:40	05:48 18:17	17:00 (1) 17:24 (1)	05:53 19:56	05:17 20:29	05:11 20:47	06:11 20:30	06:48 19:43	07:27 18:46	17:41 (1) 18:11 (1)	07:08 16:19	07:33 16:21
28	07:21 16:58	06:37 17:41	05:46 18:18	17:02 (1) 17:22 (1)	05:51 19:57	05:16 20:30	05:12 20:47	06:13 20:29	06:49 19:42	07:28 18:44	17:41 (1) 18:11 (1)	07:09 16:18	07:33 16:22
29	07:20 16:59		05:44 18:19	17:04 (1) 17:18 (1)	05:50 19:58	05:15 20:31	05:12 20:47	06:14 19:40	06:51 18:42	07:29 18:42	17:42 (1) 18:10 (1)	07:11 16:18	07:34 16:22
30	07:19 17:01		05:42 18:20	17:08 (1) 17:14 (1)	05:48 19:59	05:13 20:32	05:13 20:46	06:15 20:27	06:52 19:38	07:30 18:40	17:43 (1) 18:07 (1)	07:12 16:17	07:34 16:23
31	07:18 17:02		05:40 18:22		05:44 20:33			06:16 20:26		07:31 19:36		07:34 16:24	
Potential sun hours	286	291	369	404	-285	-254	-272	4	376	341	288	274	
Total, worst case			530						476		58		
Sun reduction			0.50						0.55		0.45		
Oper. time red.			0.91						0.91		0.91		
Wind dir. red.			0.60						0.60		0.60		
Total reduction			0.27						0.30		0.24		
Total, real			144						142		14		

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/22/06 21:43 / 31
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 317 - 317

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:03	06:35 17:43	16:38 (1) 17:10 (1)	05:38 18:23	05:47 20:01	05:13 20:34	05:13 20:46	05:41 20:25	06:17 19:34	06:53 18:38	17:18 (1) 16:46	06:33 16:17
2	07:34 16:26	07:15 17:05	06:34 17:44	16:38 (1) 17:10 (1)	05:36 18:24	05:45 20:01	05:13 20:35	05:14 20:46	05:42 20:23	06:18 19:33	06:54 18:36	17:18 (1) 16:44	06:35 16:16
3	07:34 16:27	07:14 17:06	06:32 17:45	16:36 (1) 17:10 (1)	05:35 18:25	05:44 20:02	05:12 20:36	05:14 20:46	05:43 20:22	06:20 19:31	06:56 18:34	17:15 (1) 16:43	06:36 16:16
4	07:34 16:28	07:13 17:08	06:30 17:47	16:37 (1) 17:11 (1)	05:33 18:27	05:42 20:03	05:12 20:36	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:32	17:14 (1) 16:41	06:38 16:16
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6	07:34 16:30	07:11 17:11	06:26 17:49	16:37 (1) 17:11 (1)	06:29 19:29	05:40 20:06	05:11 20:38	05:16 20:45	05:47 20:18	06:23 19:25	06:59 18:29	17:13 (1) 16:39	06:40 16:15
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8	07:34 16:32	07:08 17:13	06:23 17:52	16:37 (1) 17:09 (1)	06:25 19:32	05:37 20:08	05:10 20:39	05:18 20:45	05:49 20:15	06:26 19:22	07:02 18:25	17:11 (1) 16:36	06:43 16:15
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10	07:33 16:34	07:05 17:16	06:19 17:55	16:38 (1) 17:08 (1)	06:22 19:34	05:34 20:10	05:10 20:41	05:19 20:44	05:51 20:13	06:28 19:18	07:04 18:22	17:12 (1) 16:34	06:46 16:15
11	07:33 16:35	07:04 17:18	06:17 17:56	16:38 (1) 17:06 (1)	06:20 19:36	05:33 20:12	05:10 20:41	05:20 20:43	05:52 20:11	06:29 19:16	07:06 18:20	17:11 (1) 16:33	06:47 16:15
12	07:32 16:37	07:02 17:19	06:16 17:57	16:38 (1) 17:06 (1)	06:18 19:37	05:32 20:13	05:09 20:42	05:21 20:43	05:54 20:10	06:30 19:14	07:07 18:18	17:12 (1) 16:31	06:48 16:15
13	07:32 16:38	07:01 17:21	06:14 17:59	16:40 (1) 17:04 (1)	06:16 19:38	05:31 20:14	05:09 20:42	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:16	17:12 (1) 16:30	06:50 16:15
14	07:31 16:39	06:59 17:22	06:12 18:00	16:42 (1) 17:02 (1)	06:15 19:39	05:29 20:15	05:09 20:43	05:22 20:41	05:56 20:07	06:33 19:10	07:09 18:14	17:13 (1) 16:29	06:51 16:15
15	07:31 16:40	06:58 17:23	06:10 18:01	16:44 (1) 16:58 (1)	06:13 19:41	05:28 20:16	05:09 20:43	05:23 20:41	05:57 20:05	06:34 19:08	07:11 18:13	17:12 (1) 16:28	06:53 16:15
16	07:30 16:42	06:56 17:25	06:08 18:03	16:48 (1) 16:54 (1)	06:11 19:42	05:27 20:17	05:09 20:44	05:24 20:40	05:58 20:03	06:35 19:06	07:12 18:11	17:14 (1) 16:27	06:54 16:16
17	07:30 16:43	06:55 17:26	06:06 18:04	16:54 (1) 18:04	06:11 19:43	05:27 20:19	05:09 20:44	05:25 20:39	05:59 20:02	06:36 19:05	07:13 18:09	17:15 (1) 16:26	06:55 16:16
18	07:29 16:44	06:53 17:28	06:04 18:05	18:04 19:44	06:08 19:44	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:00	06:37 19:03	07:15 18:07	17:18 (1) 16:25	06:57 16:16
19	07:29 16:45	06:52 17:29	06:03 18:06	18:05 19:46	06:03 19:46	05:24 20:21	05:09 20:45	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	17:30 (1) 16:24	06:58 16:16
20	07:28 16:47	06:50 17:30	06:01 18:08	18:06 19:47	06:04 19:47	05:23 20:22	05:09 20:45	05:28 20:37	06:03 19:55	06:40 18:59	07:17 18:04	17:30 (1) 16:24	06:59 16:17
21	07:27 16:48	06:49 17:32	06:03 18:09	18:07 19:48	06:03 19:48	05:22 20:23	05:10 20:46	05:29 20:36	06:04 19:54	06:41 18:57	07:19 18:02	17:31 (1) 16:23	07:01 16:17
22	07:26 16:49	06:47 17:33	06:03 18:10	18:08 19:49	06:01 19:49	05:21 20:24	05:10 20:46	05:30 20:35	06:05 19:52	06:42 18:55	07:20 18:01	17:32 (1) 16:22	07:02 16:18
23	07:26 16:51	06:45 17:35	12 18:12	16:48 (1) 17:00 (1)	05:55 18:12	05:59 19:51	05:10 20:25	05:31 20:34	06:07 19:50	06:43 18:53	07:21 17:59	17:33 (1) 16:21	07:03 16:18
24	07:25 16:52	06:44 17:36	16 18:13	16:47 (1) 17:03 (1)	05:53 18:13	05:58 19:52	05:10 20:26	05:32 20:33	06:08 19:49	06:45 18:51	07:23 17:58	17:34 (1) 16:21	07:04 16:19
25	07:24 16:54	06:42 17:37	22 18:14	16:43 (1) 17:05 (1)	05:51 18:14	05:56 19:53	05:11 20:26	05:33 20:32	06:09 19:47	06:46 18:49	06:24 18:56	17:35 (1) 16:20	07:06 16:20
26	07:23 16:55	06:40 17:39	26 18:15	16:41 (1) 17:07 (1)	05:50 18:15	05:55 19:54	05:18 20:28	05:11 20:47	05:34 20:31	06:10 19:45	06:47 18:47	17:36 (1) 16:19	07:07 16:20
27	07:22 16:56	06:39 17:40	26 18:17	16:41 (1) 17:07 (1)	05:48 18:17	05:53 19:56	05:17 20:29	05:11 20:47	06:11 19:43	06:48 18:46	06:27 16:53	17:37 (1) 16:19	07:08 16:21
28	07:21 16:58	06:37 17:41	30 18:18	16:40 (1) 17:10 (1)	05:46 18:18	05:51 19:57	05:16 20:30	05:12 20:47	06:13 19:42	06:49 18:44	17:27 (1) 16:51	17:38 (1) 16:18	07:09 16:22
29	07:20 16:59			05:44 18:19	05:45 18:19	05:50 19:58	05:15 20:31	05:12 20:47	06:14 19:40	06:51 18:42	17:22 (1) 16:50	17:39 (1) 16:18	07:11 16:22
30	07:19 17:01			05:42 18:20	05:43 18:20	05:48 19:59	05:15 20:32	05:13 20:46	06:15 19:38	06:52 18:40	17:21 (1) 17:43 (1)	17:40 (1) 16:48	07:12 16:23
31	07:18 17:02			05:40 18:22	05:41 18:22	05:14 20:33	05:10 20:26	05:40 20:36	06:16 19:16	06:32 16:47			07:34 16:24
Potential sun hours	286	291	369	404	-285	-254	-272	4	376		341	288	274
Total, worst case		132	444						54		534		
Sun reduction		0.45	0.50						0.55		0.45		
Oper. time red.		0.91	0.91						0.91		0.91		
Wind dir. red.		0.56	0.56						0.56		0.56		
Total reduction		0.23	0.26						0.28		0.23		
Total, real		30	114						15		123		

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)

Project:

060119 Marble River

Description:

Marble River Wind Project
 Shadow-Flicker, SW part 2
 32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
 Shadow / no-shadow (worst case intensity wise)
 Window properties: 1m2 horizontal, 1m above ground
 1000 meter max shadow distance applied along with default 3° inclination
 Sunshine probabilities applied (pdf plots)
 Directional run-hours applied (91% of time)

Printed/Page

01/22/06 21:43 / 32

Licensed user:

Wind Engineers, Inc.
 7660 Whitegate Avenue
 US-RIVERSIDE, CA 92506

Calculated:

01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 318 - 318

Assumptions for shadow calculations

Maximum distance for influence

1,000 m

Minimum sun height over horizon for influence

3 °

Day step for calculation

1 days

Time step for calculation

2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.45	0.50	0.55	0.55	0.55	0.58	0.55	0.55	0.45	0.35	0.35

Operational time

N	NE	E	SE	S	SW	W	NW	Sum
1,850	1,325	800	713	625	663	700	1,275	7,950

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:34 16:25	07:17 17:03	15:51 (1) 16:23 (1)	06:35 17:43	05:38 18:23	05:47 20:01	05:13 20:34	05:13 20:46	05:41 20:25	06:17 19:34	06:53 18:38	15:22 (1) 16:17
2	07:34 16:26	07:15 17:05	15:49 (1) 16:23 (1)	06:34 17:44	05:36 18:24	05:45 20:01	05:13 20:35	05:14 20:46	05:42 20:23	06:18 19:33	06:54 18:36	15:22 (1) 16:16
3	07:34 16:27	07:14 17:06	15:50 (1) 16:24 (1)	06:32 17:45	05:35 18:25	05:44 20:02	05:12 20:36	05:14 20:46	05:43 20:22	06:20 19:31	06:56 18:34	15:21 (1) 16:16
4	07:34 16:28	07:13 17:08	15:51 (1) 16:23 (1)	06:30 17:47	05:33 18:27	05:42 20:03	05:12 20:36	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:32	15:21 (1) 16:16
5	07:34 16:29	07:12 17:09	15:52 (1) 16:24 (1)	06:28 17:48	06:31 19:28	05:41 20:04	05:11 20:37	05:16 20:46	05:45 20:20	06:22 19:27	06:58 18:31	15:20 (1) 16:15
6	07:34 16:30	07:11 17:11	15:52 (1) 16:24 (1)	06:26 17:49	06:29 19:29	05:40 20:06	05:11 20:38	05:16 20:45	05:47 20:18	06:23 19:25	06:59 18:29	15:22 (1) 16:15
7	07:34 16:31	07:09 17:12	15:51 (1) 16:23 (1)	06:25 17:51	06:27 19:31	05:38 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:24 19:23	07:01 18:27	15:21 (1) 16:15
8	07:34 16:32	07:08 17:13	15:51 (1) 16:23 (1)	06:23 17:52	06:25 19:32	05:37 20:08	05:10 20:39	05:18 20:45	05:49 20:15	06:26 19:22	07:02 18:25	15:21 (1) 16:15
9	07:33 16:33	07:07 17:15	15:54 (1) 16:22 (1)	06:21 17:53	06:24 19:33	05:36 20:09	05:10 20:40	05:18 20:44	05:50 20:14	06:27 19:20	07:03 18:23	15:20 (1) 16:15
10	07:33 16:34	07:05 17:16	15:55 (1) 16:23 (1)	06:19 17:55	06:22 19:34	05:34 20:10	05:10 20:41	05:19 20:42	05:51 20:13	06:28 19:18	07:04 18:22	15:22 (1) 16:15
11	07:33 16:35	07:04 17:18	15:55 (1) 16:21 (1)	06:17 17:56	06:20 19:36	05:33 20:12	05:10 20:41	05:20 20:43	05:52 20:11	06:29 19:16	07:06 18:20	15:21 (1) 16:15
12	07:32 16:37	07:02 17:19	15:56 (1) 16:20 (1)	06:16 17:57	06:18 19:37	05:32 20:13	05:09 20:42	05:21 20:43	05:54 20:10	06:30 19:14	07:07 18:18	15:23 (1) 16:15
13	07:32 16:38	07:01 17:21	15:58 (1) 16:18 (1)	06:14 17:59	06:16 19:38	05:31 20:14	05:09 20:42	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:16	15:22 (1) 16:15
14	07:31 16:39	07:00 17:22	16:01 (1) 16:17 (1)	06:12 18:00	06:15 19:39	05:29 20:15	05:09 20:43	05:22 20:41	05:56 20:07	06:33 19:10	07:09 18:14	15:24 (1) 16:15
15	07:31 16:40	06:58 17:23	16:03 (1) 16:13 (1)	06:10 18:01	06:13 19:41	05:28 20:16	05:09 20:43	05:23 20:41	05:57 20:05	06:34 19:08	07:11 18:13	15:23 (1) 16:15
16	07:30 16:42	06:57 17:25	16:03 (1) 18:03	06:08 18:03	06:11 19:42	05:27 20:17	05:09 20:44	05:24 20:40	05:58 20:03	06:35 19:06	07:12 18:11	15:24 (1) 16:16
17	07:30 16:43	06:55 17:26	16:06 (1) 18:04	06:09 18:04	06:09 19:43	05:26 20:19	05:09 20:44	05:25 20:39	05:59 20:02	06:36 19:05	07:13 18:09	15:26 (1) 16:16
18	07:29 16:44	06:53 17:28	16:04 (1) 18:05	06:08 18:05	06:08 19:44	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:00	06:37 19:03	07:15 18:08	15:27 (1) 16:16
19	07:29 16:45	15:58 (1) 16:08 (1)	06:52 17:29	06:03 18:06	06:06 19:46	05:24 20:21	05:09 20:45	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	15:27 (1) 16:16
20	07:28 16:47	15:57 (1) 16:11 (1)	06:50 17:30	06:01 18:08	06:04 19:47	05:23 20:22	05:09 20:45	05:28 20:37	06:03 19:55	06:40 18:59	07:17 18:04	15:28 (1) 16:17
21	07:27 16:48	15:56 (1) 16:12 (1)	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46	05:29 20:36	06:04 19:54	06:41 18:57	07:19 18:02	15:30 (1) 16:17
22	07:26 16:49	15:53 (1) 16:15 (1)	06:47 17:33	05:57 18:10	06:01 19:49	05:21 20:24	05:10 20:46	05:30 20:35	06:05 19:52	06:42 18:55	07:20 18:01	15:33 (1) 16:18
23	07:26 16:51	15:52 (1) 16:16 (1)	06:45 17:35	05:55 18:12	05:59 19:51	05:20 20:25	05:10 20:46	05:31 20:34	06:07 19:50	06:43 18:53	07:21 17:59	15:34 (1) 16:18
24	07:25 16:52	15:53 (1) 16:17 (1)	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:26	05:10 20:46	05:32 20:33	06:08 19:49	06:45 18:51	07:23 17:58	15:44 (1) 16:19
25	07:24 16:54	15:52 (1) 16:18 (1)	06:42 17:37	05:51 18:14	05:56 19:53	05:18 20:27	05:11 20:46	05:33 20:32	06:09 19:47	06:46 18:49	06:24 18:56	15:45 (1) 16:20
26	07:23 16:55	15:51 (1) 16:19 (1)	06:40 17:39	05:50 18:15	05:55 19:54	05:18 20:28	05:11 20:47	05:34 20:31	06:10 19:45	06:47 18:47	06:25 16:54	15:46 (1) 16:20
27	07:22 16:56	15:50 (1) 16:20 (1)	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	05:11 20:47	05:35 20:30	06:11 19:43	06:48 18:46	06:27 16:53	15:33 (1) 16:21
28	07:21 16:58	15:51 (1) 16:21 (1)	06:37 17:41	05:46 18:18	05:51 19:57	05:16 20:30	05:12 20:47	05:36 20:29	06:13 19:42	06:49 18:44	06:28 16:51	15:29 (1) 16:18
29	07:20 16:59	15:50 (1) 16:22 (1)	06:36 17:41	05:44 18:19	05:50 19:58	05:15 20:31	05:12 20:47	05:37 20:28	06:14 19:40	06:51 18:42	06:29 16:50	15:28 (1) 16:18
30	07:19 17:01	15:51 (1) 16:23 (1)	06:35 17:41	05:42 18:20	05:48 19:59	05:15 20:32	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	06:31 16:48	15:25 (1) 16:17
31	07:18 17:02	15:50 (1) 16:22 (1)	06:34 17:41	05:40 18:22	05:47 19:59	05:14 20:33	05:14 20:47	05:40 20:26	06:16 19:36	06:32 16:47	15:25 (1) 16:17	15:25 (1) 16:24
Potential sun hours	286	291	369	404	-285	-254	-272	4	376	341	288	274
Total, worst case	320	412								98	640	
Sun reduction	0.45	0.45								0.45	0.35	
Oper. time red.	0.91	0.91								0.91	0.91	
Wind dir. red.	0.59	0.59								0.59	0.59	
Total reduction	0.24	0.24								0.24	0.19	
Total, real	78	100								24	121	

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/22/06 21:43 / 33
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 319 - 319

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34 16:25	07:17 17:03	15:41 (1) 16:11 (1)	06:35 17:43	05:38 18:23	05:47 20:01	05:13 20:34	05:13 20:46	05:41 20:25	06:17 19:34	06:53 18:38	06:33 16:46	07:13 16:17
2	07:34 16:26	07:15 17:05	15:41 (1) 16:09 (1)	06:34 17:44	05:36 18:24	05:45 20:01	05:13 20:35	05:14 20:46	05:42 20:23	06:18 19:33	06:54 18:36	06:35 16:44	07:14 16:16
3	07:34 16:27	07:14 17:06	15:44 (1) 16:08 (1)	06:32 17:45	05:35 18:25	05:44 20:02	05:12 20:36	05:14 20:46	05:43 20:22	06:20 19:31	06:56 18:34	06:36 16:43	07:15 16:16
4	07:34 16:28	07:13 17:08	15:45 (1) 16:07 (1)	06:30 17:47	05:33 18:27	05:42 20:03	05:12 20:36	05:15 20:46	05:44 20:21	06:21 19:29	06:57 18:32	06:38 16:41	15:21 (1) 16:16
5	07:34 16:29	15:42 (1) 15:50 (1)	07:12 17:09	06:28 17:48	06:31 19:28	05:41 20:04	05:11 20:37	05:16 20:46	05:45 20:20	06:22 19:27	06:58 18:31	06:39 16:40	15:18 (1) 16:15
6	07:34 16:30	15:42 (1) 15:52 (1)	07:11 17:11	06:26 17:49	06:29 19:29	05:40 20:06	05:11 20:38	05:16 20:45	05:47 20:18	06:23 19:25	06:59 18:29	06:40 16:39	15:15 (1) 16:15
7	07:34 16:31	15:40 (1) 15:54 (1)	07:09 17:12	06:25 17:51	06:27 19:31	05:38 20:07	05:11 20:39	05:17 20:45	05:48 20:17	06:24 19:23	07:01 18:27	06:42 16:37	15:15 (1) 16:15
8	07:34 16:32	15:40 (1) 15:56 (1)	07:08 17:13	06:23 17:52	06:25 19:32	05:37 20:08	05:10 20:39	05:18 20:45	05:49 20:15	06:26 19:22	07:02 18:25	06:43 16:36	15:13 (1) 16:15
9	07:33 16:33	15:39 (1) 15:57 (1)	07:07 17:15	06:21 17:53	06:24 19:33	05:36 20:09	05:10 20:40	05:18 20:44	05:50 20:14	06:27 19:20	07:03 18:23	06:44 16:35	15:12 (1) 16:15
10	07:33 16:34	15:39 (1) 15:59 (1)	07:05 17:16	06:19 17:55	06:22 19:34	05:34 20:10	05:10 20:41	05:19 20:42	05:51 20:13	06:28 19:18	07:04 18:22	06:46 16:34	15:12 (1) 16:15
11	07:33 16:35	15:39 (1) 16:01 (1)	07:04 17:18	06:17 17:56	06:20 19:36	05:33 20:12	05:10 20:41	05:20 20:43	05:52 20:11	06:29 19:16	07:06 18:20	06:47 16:33	15:11 (1) 16:15
12	07:32 16:37	15:38 (1) 16:00 (1)	07:02 17:19	06:16 17:57	06:18 19:37	05:32 20:13	05:09 20:42	05:21 20:43	05:54 20:10	06:30 19:14	07:07 18:18	06:48 16:31	15:11 (1) 16:15
13	07:32 16:38	15:38 (1) 16:02 (1)	07:01 17:21	06:14 17:59	06:16 19:38	05:31 20:14	05:09 20:42	05:22 20:42	05:55 20:08	06:32 19:12	07:08 18:16	06:50 16:30	15:12 (1) 16:15
14	07:31 16:39	15:37 (1) 16:03 (1)	07:00 17:22	06:12 18:00	06:15 19:39	05:29 20:15	05:09 20:43	05:22 20:41	05:56 20:07	06:33 19:10	07:09 18:14	06:51 16:29	15:12 (1) 16:15
15	07:31 16:40	15:36 (1) 16:04 (1)	06:58 17:23	06:10 18:01	06:13 19:41	05:28 20:16	05:09 20:43	05:23 20:41	05:57 20:05	06:34 19:08	07:11 18:13	06:53 16:28	15:11 (1) 16:15
16	07:30 16:42	15:38 (1) 16:06 (1)	06:57 17:25	06:08 18:03	06:11 19:42	05:27 20:17	05:09 20:44	05:24 20:40	05:58 20:03	06:35 19:06	07:12 18:11	06:54 16:27	15:10 (1) 16:16
17	07:30 16:43	15:37 (1) 16:05 (1)	06:55 17:26	06:06 18:04	06:09 19:43	05:26 20:19	05:09 20:44	05:25 20:39	05:59 20:02	06:36 19:05	07:13 18:09	06:55 16:26	15:12 (1) 16:16
18	07:29 16:44	15:38 (1) 16:06 (1)	06:53 17:28	06:04 18:05	06:08 19:44	05:25 20:20	05:09 20:45	05:26 20:39	06:01 20:00	06:37 19:03	07:15 18:07	06:57 16:25	15:11 (1) 16:16
19	07:29 16:45	15:38 (1) 16:08 (1)	06:52 17:29	06:03 18:06	06:06 19:46	05:24 20:21	05:09 20:45	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:24	15:11 (1) 16:16
20	07:28 16:47	15:37 (1) 16:09 (1)	06:50 17:30	06:01 18:08	06:04 19:47	05:23 20:22	05:09 20:45	05:28 20:37	06:03 19:55	06:40 18:59	07:17 18:04	06:59 16:24	15:12 (1) 16:17
21	07:27 16:48	15:36 (1) 16:08 (1)	06:49 17:32	05:59 18:09	06:03 19:48	05:22 20:23	05:10 20:46	05:29 20:36	06:04 19:54	06:41 18:57	07:19 18:02	07:01 16:23	15:14 (1) 16:17
22	07:26 16:49	15:37 (1) 16:09 (1)	06:47 17:33	05:57 18:10	06:01 19:49	05:21 20:24	05:10 20:46	05:30 20:35	06:05 19:52	06:42 18:55	07:20 18:01	07:02 16:22	15:13 (1) 16:18
23	07:26 16:51	15:36 (1) 16:10 (1)	06:45 17:35	05:55 18:12	05:59 19:51	05:20 20:25	05:10 20:46	05:31 20:34	06:07 19:50	06:43 18:53	07:21 17:59	07:03 16:21	15:14 (1) 16:18
24	07:25 16:52	15:37 (1) 16:09 (1)	06:44 17:36	05:53 18:13	05:58 19:52	05:19 20:26	05:10 20:46	05:32 20:33	06:08 19:49	06:45 18:51	07:23 17:58	07:04 16:21	15:14 (1) 16:19
25	07:24 16:54	15:38 (1) 16:10 (1)	06:42 17:37	05:51 18:14	05:56 19:53	05:18 20:27	05:11 20:46	05:33 20:32	06:09 19:47	06:46 18:49	06:24 18:56	07:06 16:20	15:15 (1) 16:19
26	07:23 16:55	15:37 (1) 16:11 (1)	06:40 17:39	05:50 18:15	05:55 19:54	05:18 20:28	05:11 20:47	05:34 20:31	06:10 19:45	06:47 18:47	06:25 18:54	07:07 16:19	15:16 (1) 16:20
27	07:22 16:56	15:38 (1) 16:10 (1)	06:39 17:40	05:48 18:17	05:53 19:56	05:17 20:29	05:11 20:47	05:35 20:30	06:11 19:43	06:48 18:46	06:27 18:53	07:08 16:19	15:18 (1) 16:21
28	07:21 16:58	15:39 (1) 16:11 (1)	06:37 17:41	05:46 18:18	05:51 19:57	05:16 20:30	05:12 20:47	05:36 20:29	06:13 19:42	06:49 18:44	06:28 18:51	07:09 16:18	15:17 (1) 16:22
29	07:20 16:59	15:40 (1) 16:10 (1)		05:44 18:19	05:50 19:58	05:15 20:31	05:12 20:47	05:37 20:28	06:14 19:40	06:51 18:42	06:29 18:50	07:11 16:18	15:18 (1) 16:22
30	07:19 17:01	15:39 (1) 16:11 (1)		05:42 18:20	05:48 19:59	05:15 20:32	05:13 20:47	05:39 20:27	06:15 19:38	06:52 18:40	06:31 18:48	07:12 16:17	15:19 (1) 16:23
31	07:18 17:02	15:40 (1) 16:10 (1)		05:40 18:22	05:49 19:36	05:14 20:33		05:40 20:26	06:16 19:36	06:32 18:47		07:13 16:24	15:21 (1) 16:24
Potential sun hours	286	291	369	404	-285	-254	-272	4	376	341	288	274	
Total, worst case	708	152									750	108	
Sun reduction	0.45	0.45									0.35	0.35	
Oper. time red.	0.91	0.91									0.91	0.91	
Wind dir. red.	0.60	0.60									0.60	0.60	
Total reduction	0.25	0.25									0.19	0.19	
Total, real	175	38									144	21	

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)
	Minutes with flicker		

Project:

Description:

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060119 Marble River

Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

01/22/06 21:43 / 34

Licensed user:

Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:

01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 320 - 320

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time

N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

Table with columns for months (January to December) and rows for days (1-31) showing sun rise and set times. Includes summary rows for Potential sun hours, Total, worst case, Sun reduction, Oper. time red., Wind dir. red., Total reduction, and Total, real.

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

Matrix with columns: 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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

Printed/Page
01/22/06 21:43 / 35
Licensed user:
Wind Engineers, Inc.
7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 321 - 321

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:34	15:01 (1)	07:17	06:35	05:38	05:47	05:13	05:13	05:41	06:17	06:53	06:33	07:13
	16:25	20	15:21 (1)	17:03	17:43	18:23	20:01	20:34	20:25	19:34	18:38	16:46	16:17
2	07:34	15:01 (1)	07:15	06:34	05:36	05:45	05:13	05:14	05:42	06:18	06:54	06:35	07:14
	16:26	20	15:21 (1)	17:05	17:44	18:24	20:01	20:35	20:46	19:33	18:36	16:44	16:16
3	07:34	15:03 (1)	07:14	06:32	05:35	05:44	05:12	05:14	05:43	06:20	06:56	06:36	07:15
	16:27	18	15:21 (1)	17:06	17:45	18:25	20:02	20:36	20:46	19:31	18:34	16:43	16:16
4	07:34	15:03 (1)	07:13	06:30	05:33	05:42	05:12	05:15	05:44	06:21	06:57	06:38	07:16
	16:28	18	15:21 (1)	17:08	17:47	18:27	20:03	20:36	20:46	19:29	18:32	16:41	16:16
5	07:34	15:04 (1)	07:12	06:28	06:31	05:41	05:11	05:16	05:45	06:22	06:58	06:39	07:17
	16:29	14	15:18 (1)	17:09	17:48	18:28	20:04	20:37	20:46	19:27	18:31	16:40	16:15
6	07:34	15:06 (1)	07:11	06:26	06:29	05:40	05:11	05:16	05:47	06:23	06:59	06:40	07:18
	16:30	12	15:18 (1)	17:11	17:49	18:29	20:06	20:38	20:45	19:25	18:29	16:39	16:15
7	07:34	15:08 (1)	07:09	06:25	06:27	05:38	05:11	05:17	05:48	06:24	07:01	06:42	07:19
	16:31	10	15:18 (1)	17:12	17:51	18:31	20:07	20:39	20:45	19:23	18:27	16:37	16:15
8	07:34	15:10 (1)	07:08	06:23	06:25	05:37	05:10	05:18	05:49	06:26	07:02	06:43	07:20
	16:32	8	15:18 (1)	17:13	17:52	18:32	20:08	20:39	20:45	19:22	18:25	16:36	16:15
9	07:33		07:07	06:21	06:24	05:36	05:10	05:18	05:50	06:27	07:03	06:44	07:21
	16:33		17:15	17:53	18:33	20:09	20:40	20:44	20:14	19:20	18:23	16:35	16:15
10	07:33		07:05	06:19	06:22	05:34	05:10	05:19	05:51	06:28	07:04	06:46	07:22
	16:34		17:16	17:55	18:34	20:10	20:41	20:44	20:13	19:18	18:22	16:34	16:15
11	07:33		07:04	06:17	06:20	05:33	05:10	05:20	05:52	06:29	07:06	06:47	07:23
	16:35		17:18	17:56	18:36	20:12	20:41	20:43	20:11	19:16	18:20	16:33	16:15
12	07:32		07:02	06:16	06:18	05:32	05:09	05:21	05:54	06:30	07:07	06:48	07:24
	16:37		17:19	17:57	18:37	20:13	20:42	20:43	20:10	19:14	18:18	16:31	16:15
13	07:32		07:01	06:14	06:16	05:31	05:09	05:22	05:55	06:32	07:08	06:50	07:25
	16:38		17:21	17:59	18:38	20:14	20:42	20:42	20:08	19:12	18:16	16:30	16:15
14	07:31		07:00	06:12	06:15	05:29	05:09	05:22	05:56	06:33	07:09	06:51	07:26
	16:39		17:22	18:00	18:39	20:15	20:43	20:42	20:07	19:10	18:14	16:29	16:15
15	07:31		06:58	06:10	06:13	05:28	05:09	05:23	05:57	06:34	07:11	06:53	07:27
	16:40		17:23	18:01	18:41	20:16	20:43	20:41	20:05	19:08	18:13	16:28	16:15
16	07:30		06:57	06:08	06:11	05:27	05:09	05:24	05:58	06:35	07:12	06:54	07:27
	16:42		17:25	18:03	18:42	20:17	20:44	20:40	20:03	19:06	18:11	16:27	16:15
17	07:30		06:55	06:06	06:09	05:26	05:09	05:25	05:59	06:36	07:13	06:55	07:28
	16:43		17:26	18:04	18:43	20:19	20:44	20:39	20:02	19:05	18:09	16:26	16:16
18	07:29		06:53	06:04	06:08	05:25	05:09	05:26	06:01	06:37	07:15	06:57	07:29
	16:44		17:28	18:05	18:44	20:20	20:45	20:39	20:00	19:03	18:07	16:25	16:16
19	07:29		06:52	06:03	06:06	05:24	05:09	05:27	06:02	06:39	07:16	06:58	07:29
	16:45		17:29	18:06	18:46	20:21	20:45	20:38	19:57	19:01	18:06	16:24	16:16
20	07:28		06:50	06:01	06:04	05:23	05:09	05:28	06:03	06:40	07:17	06:59	07:30
	16:47		17:30	18:08	18:47	20:22	20:45	20:37	19:55	18:59	18:04	16:24	16:17
21	07:27		06:49	05:59	06:03	05:22	05:10	05:29	06:04	06:41	07:19	07:01	07:31
	16:48		17:32	18:09	18:48	20:23	20:46	20:36	19:54	18:57	18:02	16:23	16:17
22	07:26		06:47	05:57	06:01	05:21	05:10	05:30	06:05	06:42	07:20	07:02	07:31
	16:49		17:33	18:10	18:49	20:24	20:46	20:35	19:52	18:55	18:01	16:22	16:18
23	07:26		06:45	05:55	05:59	05:20	05:10	05:31	06:07	06:43	07:21	07:03	07:32
	16:51		17:35	18:12	18:51	20:25	20:46	20:34	19:50	18:53	17:59	16:21	16:18
24	07:25		06:44	05:53	05:58	05:19	05:10	05:32	06:08	06:45	07:23	07:04	07:32
	16:52		17:36	18:13	18:52	20:26	20:46	20:33	19:49	18:51	17:58	16:21	16:19
25	07:24		06:42	05:51	05:56	05:18	05:11	05:33	06:09	06:46	06:24	07:06	07:32
	16:54		17:37	18:14	18:53	20:27	20:46	20:32	19:47	18:49	18:56	16:20	16:19
26	07:23		06:40	05:50	05:55	05:18	05:11	05:34	06:10	06:47	06:25	07:07	07:33
	16:55		17:39	18:15	18:54	20:28	20:47	20:31	19:45	18:47	18:54	16:19	16:20
27	07:22		06:39	05:48	05:53	05:17	05:11	05:35	06:11	06:48	06:27	07:08	07:33
	16:56		17:40	18:17	18:56	20:29	20:47	20:30	19:43	18:46	18:53	16:19	16:21
28	07:21		06:37	05:46	05:51	05:16	05:12	05:36	06:13	06:49	06:28	07:09	07:33
	16:58		17:41	18:18	18:57	20:30	20:47	20:29	19:42	18:44	18:51	16:18	16:22
29	07:20			05:44	05:50	05:15	05:12	05:37	06:14	06:51	06:29	07:11	07:34
	16:59			18:19	18:58	20:31	20:47	20:28	19:40	18:42	18:50	16:18	16:22
30	07:19			05:42	05:48	05:15	05:13	05:39	06:15	06:52	06:31	07:12	07:34
	17:01			18:20	18:59	20:32	20:47	20:27	19:38	18:40	18:48	16:17	16:23
31	07:18			05:40	05:46	05:14		05:40	06:16	06:32		07:34	14:59 (1)
	17:02			18:22	19:01	20:33		20:26	19:36	16:47		16:24	20
Potential sun hours	286	291	369	404	-285	-254	-272	4	376	341	288	274	
Total, worst case		120										556	
Sun reduction		0.45										0.35	
Oper. time red.		0.91										0.91	
Wind dir. red.		0.62										0.62	
Total reduction		0.25										0.20	
Total, real		31										110	

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 333 - 333

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes
Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35
Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June	July	August	September	October	November	December		
1	07:34	09:29 (13)	07:17	06:35	05:38	05:47	05:14	05:13	05:41	06:17	06:53	06:34	07:13	
	16:25	10 09:39 (13)	17:04	17:43	18:23	20:00	20:34	20:47	20:25	19:35	18:38	16:46	16:17	
2	07:34	09:31 (13)	07:16	06:34	05:37	05:46	05:13	05:14	05:42	06:19	06:55	06:35	07:14	
	16:26	6 09:37 (13)	17:05	17:44	18:24	20:01	20:35	20:46	20:24	19:33	18:36	16:44	16:16	
3	07:34		07:14	06:32	05:35	05:44	05:13	05:15	05:43	06:20	06:56	06:36	07:15	
	16:27		17:06	17:46	18:26	20:02	20:36	20:46	20:22	19:31	18:35	16:43	16:16	
4	07:34		07:13	06:30	05:33	05:43	05:12	05:15	05:44	06:21	06:57	06:38	07:17	
	16:28		17:08	17:47	18:27	20:03	20:37	20:46	20:21	19:29	18:33	16:42	16:16	
5	07:34		07:12	06:28	06:31	05:41	05:12	05:16	05:46	06:22	06:58	06:39	07:18	
	16:29		17:09	17:48	18:28	20:04	20:37	20:46	20:20	19:27	18:31	16:40	16:16	
6	07:34		07:11	06:27	06:29	05:40	05:11	05:16	05:47	06:23	07:00	06:40	07:19	
	16:30		17:11	17:50	18:29	20:06	20:38	20:45	20:18	19:25	18:29	16:39	16:15	
7	07:34		07:09	06:25	06:27	05:38	05:11	05:17	05:48	06:25	07:01	06:42	07:20	
	16:31		17:12	17:51	18:31	20:07	20:39	20:45	20:17	19:24	18:27	16:38	16:15	
8	07:34		07:08	06:23	06:26	05:37	05:11	05:18	05:49	06:26	07:02	06:43	07:21	
	16:32		17:14	17:52	18:32	20:08	20:40	20:45	20:16	19:22	18:25	16:36	16:15	
9	07:34		07:07	06:21	06:24	05:36	05:10	05:19	05:50	06:27	07:03	06:45	07:22	
	16:33		17:15	17:54	18:33	20:09	20:40	20:44	20:14	19:20	18:23	16:35	16:15	
10	07:33		07:05	06:19	06:22	05:34	05:10	05:19	05:51	06:28	07:05	06:46	07:23	09:20 (13)
	16:34		17:16	17:55	18:34	20:11	20:41	20:44	20:13	19:18	18:22	16:34	16:15	4 09:24 (13)
11	07:33		07:04	06:18	06:20	05:33	05:10	05:20	05:53	06:29	07:06	06:47	07:23	09:19 (13)
	16:36		17:18	17:56	18:36	20:12	20:41	20:43	20:11	19:16	18:20	16:33	16:15	8 09:27 (13)
12	07:33		07:03	06:16	06:18	05:32	05:10	05:21	05:54	06:31	07:07	06:49	07:24	09:18 (13)
	16:37		17:19	17:58	18:37	20:13	20:42	20:43	20:10	19:14	18:18	16:32	16:15	12 09:30 (13)
13	07:32		07:01	06:14	06:17	05:31	05:09	05:22	05:55	06:32	07:08	06:50	07:25	09:17 (13)
	16:38		17:21	17:59	18:38	20:14	20:43	20:42	20:08	19:12	18:16	16:31	16:15	14 09:31 (13)
14	07:32		07:00	06:12	06:15	05:30	05:09	05:23	05:56	06:33	07:10	06:51	07:26	09:16 (13)
	16:39		17:22	18:00	18:39	20:15	20:43	20:42	20:07	19:10	18:15	16:29	16:15	18 09:34 (13)
15	07:31		06:58	06:10	06:13	05:28	05:09	05:24	05:57	06:34	07:11	06:53	07:27	09:17 (13)
	16:40		17:24	18:01	18:41	20:16	20:44	20:41	20:05	19:09	18:13	16:28	16:15	18 09:35 (13)
16	07:31		06:57	06:08	06:11	05:27	05:09	05:24	05:58	06:35	07:12	06:54	07:28	09:17 (13)
	16:42		17:25	18:03	18:42	20:18	20:44	20:40	20:04	19:07	18:11	16:27	16:16	18 09:35 (13)
17	07:30		06:55	06:07	06:10	05:26	05:09	05:25	06:00	06:36	07:14	06:55	07:28	09:16 (13)
	16:43		17:26	18:04	18:43	20:19	20:45	20:40	20:02	19:05	18:09	16:26	16:16	20 09:36 (13)
18	07:29		06:54	06:05	06:08	05:25	05:09	05:26	06:01	06:38	07:15	06:57	07:29	09:17 (13)
	16:44		17:28	18:05	18:45	20:20	20:45	20:39	20:00	19:03	18:08	16:26	16:16	20 09:37 (13)
19	07:29		06:52	06:03	06:06	05:24	05:09	05:27	06:02	06:39	07:16	06:58	07:30	09:17 (13)
	16:46		17:29	18:07	18:46	20:21	20:45	20:38	19:57	19:01	18:06	16:25	16:17	20 09:37 (13)
20	07:28		06:50	06:01	06:05	05:23	05:10	05:28	06:03	06:40	07:17	06:59	07:30	09:18 (13)
	16:47		17:31	18:08	18:47	20:22	20:46	20:37	19:56	18:59	18:04	16:24	16:17	20 09:38 (13)
21	07:27		06:49	05:59	06:03	05:22	05:10	05:29	06:04	06:41	07:19	07:01	07:31	09:18 (13)
	16:48		17:32	18:09	18:48	20:23	20:46	20:36	19:54	18:57	18:03	16:23	16:17	20 09:38 (13)
22	07:26		06:47	05:57	06:01	05:21	05:10	05:30	06:06	06:42	07:20	07:02	07:31	09:19 (13)
	16:50		17:33	18:10	18:50	20:24	20:46	20:35	19:52	18:55	18:01	16:22	16:18	20 09:39 (13)
23	07:26		06:46	05:55	06:00	05:20	05:10	05:31	06:07	06:44	07:21	07:03	07:32	09:19 (13)
	16:51		17:35	18:12	18:51	20:25	20:46	20:35	19:51	18:53	17:59	16:21	16:19	20 09:39 (13)
24	07:25		06:44	05:53	05:58	05:19	05:10	05:32	06:08	06:45	07:23	07:05	07:32	09:20 (13)
	16:52		17:36	18:13	18:52	20:26	20:46	20:34	19:49	18:51	17:58	16:21	16:19	20 09:40 (13)
25	07:24		06:42	05:52	05:56	05:19	05:11	05:33	06:09	06:46	06:24	07:06	07:33	09:20 (13)
	16:54		17:37	18:14	18:53	20:27	20:47	20:33	19:47	18:50	17:56	16:20	16:20	20 09:40 (13)
26	07:23		06:41	05:50	05:55	05:18	05:11	05:34	06:10	06:47	06:25	07:07	07:33	09:20 (13)
	16:55		17:39	18:16	18:55	20:28	20:47	20:32	19:45	18:48	17:55	16:19	16:20	20 09:40 (13)
27	07:22		06:39	05:48	05:53	05:17	05:12	05:35	06:12	06:48	06:27	07:08	07:33	09:21 (13)
	16:56		17:40	18:17	18:56	20:29	20:47	20:31	19:44	18:46	17:53	16:19	16:21	20 09:41 (13)
28	07:21		06:37	05:46	05:52	05:16	05:12	05:37	06:13	06:50	06:28	07:10	07:34	09:22 (13)
	16:58		17:42	18:18	18:57	20:30	20:47	20:29	19:42	18:44	17:52	16:18	16:22	18 09:41 (13)
29	07:20			05:44	05:50	05:16	05:12	05:38	06:14	06:51	06:29	07:11	07:34	09:23 (13)
	16:59			18:19	18:58	20:31	20:47	20:28	19:40	18:42	17:50	16:18	16:22	18 09:41 (13)
30	07:19			05:42	05:49	05:15	05:13	05:39	06:15	06:52	06:31	07:12	07:34	09:23 (13)
	17:01			18:21	19:00	20:32	20:47	20:27	19:38	18:40	16:49	16:17	16:23	14 09:39 (13)
31	07:18			05:40		05:14		05:40	06:16		06:32		07:34	09:23 (13)
	17:02			18:22		20:33		20:26	19:36		16:47		16:24	14 09:39 (13)
Potential sun hours	286	291	369	380	-285	-254	-272	4	376	341	288	274		
Total, worst case	16												376	
Sun reduction	0.45												0.35	
Oper. time red.	0.91												0.91	
Wind dir. red.	0.69												0.69	
Total reduction	0.28												0.22	
Total, real	4												82	

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)
	Minutes with flicker		

Project: 060119 Marble River

Description: Marble River Wind Project Shadow-Flicker, SW part 2 32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers Shadow / no-shadow (worst case intensity wise) Window properties: 1m2 horizontal, 1m above ground 1000 meter max shadow distance applied along with default 3° inclination Sunshine probabilities applied (pdf plots) Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 334 - 334

Assumptions for shadow calculations

Maximum distance for influence 1,000 m Minimum sun height over horizon for influence 3 ° Day step for calculation 1 days Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time N NE E SE S SW W NW Sum 1,850 1,325 800 713 625 663 700 1,275 7,950

Table with 12 columns for months (January to December) and rows for each day (1-31) showing sun rise and set times in (hh:mm) format. Includes summary rows for Potential sun hours, Total, worst case, Sun reduction, Oper. time red., Wind dir. red., Total reduction, and 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 (WTG causing flicker first time) Last time (hh:mm) with flicker (WTG causing flicker last time)

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 366 - 366

Assumptions for shadow calculations

Maximum distance for influence
Minimum sun height over horizon for influence
Day step for calculation
Time step for calculation

1,000 m
3 °
1 days
2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June
1	07:34	07:17	08:01 (25)	06:36	05:39	05:47
	16:25	17:04	08:13 (25)	17:43	18:23	20:00
2	07:35	07:16	08:04 (25)	06:34	05:37	05:46
	16:26	17:05	08:10 (25)	17:44	18:25	20:01
3	07:35	07:15		06:32	06:53 (24)	05:35
	16:27	17:07		17:46	18:26	20:02
4	07:34	07:13		06:30	06:51 (24)	05:33
	16:28	17:08		17:47	18:27	20:03
5	07:34	07:12		06:29	06:49 (24)	06:31
	16:29	17:09		17:48	18:28	20:05
6	07:34	07:11		06:27	06:47 (24)	06:29
	16:30	17:11		17:50	18:30	20:06
7	07:34	07:10		06:25	06:45 (24)	06:28
	16:31	17:12		17:51	18:31	20:07
8	07:34	07:58 (25)	07:08	06:23	06:44 (24)	06:26
	16:32	08:04 (25)	17:14	17:52	18:32	20:08
9	07:34	07:58 (25)	07:07	06:21	06:42 (24)	06:24
	16:34	08:06 (25)	17:15	17:54	18:33	20:09
10	07:33	07:57 (25)	07:06	06:20	06:42 (24)	06:22
	16:35	08:07 (25)	17:17	17:55	18:35	20:11
11	07:33	07:57 (25)	07:04	06:18	06:42 (24)	06:20
	16:36	08:09 (25)	17:18	17:56	18:36	20:12
12	07:33	07:56 (25)	07:03	06:16	06:42 (24)	06:19
	16:37	08:10 (25)	17:19	17:58	18:37	20:13
13	07:32	07:56 (25)	07:01	06:14	06:42 (24)	06:17
	16:38	08:12 (25)	17:21	17:59	18:38	20:14
14	07:32	07:55 (25)	07:00	06:12	06:43 (24)	06:15
	16:39	08:11 (25)	17:22	18:00	18:39	20:15
15	07:31	07:55 (25)	06:58	06:10	06:43 (24)	06:13
	16:41	08:13 (25)	17:24	18:02	18:40	20:16
16	07:31	07:54 (25)	06:57	06:09	06:43 (24)	06:12
	16:42	08:14 (25)	17:25	18:03	18:41	20:17
17	07:30	07:53 (25)	06:55	06:07	06:45 (24)	06:10
	16:43	08:15 (25)	17:27	18:04	18:42	20:18
18	07:30	07:53 (25)	06:54	06:05	06:47 (24)	06:08
	16:45	08:15 (25)	17:28	18:06	18:43	20:19
19	07:29	07:52 (25)	06:52	06:03	06:49 (24)	06:06
	16:46	08:16 (25)	17:29	18:07	18:44	20:20
20	07:28	07:53 (25)	06:51	06:01	06:50 (24)	06:05
	16:47	08:17 (25)	17:31	18:08	18:45	20:21
21	07:27	07:52 (25)	06:49	05:59	06:51 (24)	06:03
	16:48	08:18 (25)	17:32	18:09	18:46	20:22
22	07:27	07:53 (25)	06:47	05:57	06:52 (24)	06:01
	16:50	08:19 (25)	17:34	18:11	18:47	20:23
23	07:26	07:55 (25)	06:46	05:55	06:53 (24)	06:00
	16:51	08:20 (25)	17:35	18:12	18:48	20:24
24	07:25	07:54 (25)	06:44	05:54	06:54 (24)	05:58
	16:53	08:21 (25)	17:36	18:13	18:49	20:25
25	07:24	07:55 (25)	06:42	05:52	06:55 (24)	05:57
	16:54	08:22 (25)	17:37	18:14	18:50	20:26
26	07:23	07:56 (25)	06:41	05:50	06:56 (24)	05:55
	16:55	08:23 (25)	17:38	18:15	18:51	20:27
27	07:22	07:55 (25)	06:39	05:48	06:57 (24)	05:53
	16:57	08:24 (25)	17:40	18:17	18:52	20:28
28	07:21	07:56 (25)	06:37	05:46	06:58 (24)	05:51
	16:58	08:25 (25)	17:42	18:18	18:53	20:29
29	07:20	07:56 (25)		05:44	06:59 (24)	05:49
	16:59	08:26 (25)		18:19	18:54	20:30
30	07:19	07:57 (25)		05:42	07:00 (24)	05:47
	17:01	08:27 (25)		18:21	18:55	20:31
31	07:18	08:00 (25)		05:41		05:46
	17:02	08:14 (25)		18:22		20:32
Potential sun hours	286	291	369	380	-285	-254
Total, worst case	450	18	354			
Sun reduction	0.45	0.45	0.50			
Oper. time red.	0.91	0.91	0.91			
Wind dir. red.	0.66	0.66	0.62			
Total reduction	0.27	0.27	0.28			
Total, real	121	5	101			

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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7660 Whitegate Avenue
US-RIVERSIDE, CA 92506

Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 366 - 366

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December		
1	05:14 20:47	05:41 20:25	06:18 19:35	06:53 18:38	07:21 (24) 07:47 (24)	06:34 16:46	07:13 16:17	07:39 (25) 07:51 (25)
2	05:14 20:47	05:42 20:24	06:19 19:33	06:55 18:37	07:20 (24) 07:48 (24)	06:35 16:44	07:14 16:17	07:40 (25) 07:50 (25)
3	05:15 20:46	05:43 20:22	06:20 19:31	06:56 18:35	07:19 (24) 07:47 (24)	06:36 16:43	07:16 16:16	07:41 (25) 07:49 (25)
4	05:15 20:46	05:45 20:21	06:21 19:29	06:57 18:33	07:20 (24) 07:46 (24)	06:38 16:42	07:17 16:16	07:42 (25) 07:48 (25)
5	05:16 20:46	05:46 20:20	06:22 19:27	06:58 18:31	07:20 (24) 07:46 (24)	06:39 16:40	07:18 16:16	07:18 16:16
6	05:17 20:46	05:47 20:18	06:24 19:26	07:00 18:29	07:21 (24) 07:45 (24)	06:41 16:39	07:19 16:16	07:19 16:16
7	05:17 20:45	05:48 20:17	06:25 19:24	07:01 18:27	07:22 (24) 07:44 (24)	06:42 16:38	07:20 16:15	07:20 16:15
8	05:18 20:45	05:49 20:16	06:26 19:22	07:02 18:25	07:23 (24) 07:43 (24)	06:43 16:37	07:21 16:15	07:21 16:15
9	05:19 20:44	05:50 20:14	06:27 19:20	07:03 18:24	07:25 (24) 07:41 (24)	06:45 16:35	07:22 16:15	07:22 16:15
10	05:20 20:44	05:52 20:13	06:28 19:18	07:05 18:22	07:26 (24) 07:38 (24)	06:46 16:34	07:23 16:15	07:23 16:15
11	05:20 20:44	05:53 20:11	06:30 19:16	07:06 18:20	07:27 (24) 07:35 (24)	06:47 16:33	07:24 16:15	07:24 16:15
12	05:21 20:43	05:54 20:10	06:31 19:14	07:07 18:18	06:49 16:32	06:49 16:32	07:24 16:15	07:24 16:15
13	05:22 20:42	05:55 20:08	06:32 19:13	07:09 18:17	06:50 16:31	06:50 16:31	07:25 16:15	07:25 16:15
14	05:23 20:42	05:56 20:07	06:33 19:11	07:10 18:15	06:52 16:30	06:52 16:30	07:26 16:15	07:26 16:15
15	05:24 20:41	05:57 20:05	06:34 19:09	07:11 18:13	06:53 16:29	06:53 16:29	07:27 16:16	07:27 16:16
16	05:25 20:40	05:59 20:04	06:35 19:07	07:12 18:11	06:54 16:28	06:54 16:28	07:28 16:16	07:28 16:16
17	05:26 20:40	06:00 20:02	06:37 19:05	07:14 18:10	06:56 16:27	06:56 16:27	07:28 16:16	07:28 16:16
18	05:27 20:39	06:01 20:01	06:38 19:03	07:15 18:08	06:57 16:26	06:57 16:26	07:29 16:16	07:29 16:16
19	05:27 20:38	06:02 19:57	06:39 19:01	07:16 18:06	06:58 16:25	06:58 16:25	07:30 16:17	07:30 16:17
20	05:28 20:37	06:03 19:56	06:40 18:59	07:18 18:05	07:00 16:24	07:00 16:24	07:30 16:17	07:30 16:17
21	05:29 20:37	06:05 19:54	06:41 18:57	07:19 18:03	07:01 16:23	07:01 16:23	07:31 16:18	07:31 16:18
22	05:30 20:36	06:06 19:52	06:43 18:55	07:20 18:01	07:02 16:22	07:02 16:22	07:31 16:18	07:31 16:18
23	05:31 20:35	06:07 19:51	06:44 18:54	07:22 18:00	07:03 16:22	07:03 16:22	07:32 16:19	07:32 16:19
24	05:32 20:34	06:08 19:49	06:45 18:52	07:23 17:58	07:05 16:21	07:05 16:21	07:32 16:19	07:32 16:19
25	05:34 20:33	06:09 19:47	06:46 18:50	07:29 (24) 07:41 (24)	06:24 16:20	06:24 16:20	07:33 16:20	07:33 16:20
26	05:35 20:32	06:11 19:45	06:47 18:48	07:27 (24) 07:45 (24)	06:26 16:20	06:26 16:20	07:33 16:21	07:33 16:21
27	05:36 20:31	06:12 19:44	06:49 18:46	07:26 (24) 07:46 (24)	06:27 16:19	06:27 16:19	07:34 16:21	07:34 16:21
28	05:37 20:30	06:13 19:42	06:50 18:44	07:23 (24) 07:47 (24)	06:28 16:18	06:28 16:18	07:34 16:22	07:34 16:22
29	05:38 20:28	06:14 19:40	06:51 18:42	07:22 (24) 07:46 (24)	06:30 16:18	06:30 16:18	07:34 16:23	07:34 16:23
30	05:39 20:27	06:15 19:38	06:52 18:40	07:21 (24) 07:47 (24)	06:31 16:18	06:31 16:18	07:34 16:24	07:34 16:24
31	05:40 20:26	06:16 19:37		06:32 16:47			07:34 16:24	07:34 16:24
Potential sun hours	-272	4	376	341	288	275		
Total, worst case			124	236	432	36		
Sun reduction			0.55	0.45	0.35	0.35		
Oper. time red.			0.91	0.91	0.91	0.91		
Wind dir. red.			0.62	0.62	0.66	0.66		
Total reduction			0.31	0.26	0.21	0.21		
Total, real			39	60	91	8		

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

Day in month	Sun rise (hh:mm)	Minutes with flicker	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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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US-RIVERSIDE, CA 92506
Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 371 - 371

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes
Sun shine probabilities (part of time from sun rise to sun set with sun shine)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	January	February	March	April	May	June		
1	07:34	08:17 (19)	07:17	06:35	05:39	06:11 (13)	05:47	05:14
	16:25	38 08:55 (19)	17:04	17:43	18:23	42 06:53 (13)	20:00	20:34
2	07:34	08:19 (19)	07:16	06:34	05:37	06:09 (13)	05:46	05:13
	16:26	36 08:55 (19)	17:05	17:44	18:24	44 06:53 (13)	20:01	20:35
3	07:34	08:19 (19)	07:14	06:32	05:35	06:09 (13)	05:44	05:13
	16:27	36 08:55 (19)	17:06	17:46	18:26	42 06:51 (13)	20:02	20:36
4	07:34	08:19 (19)	07:13	06:30	05:33	06:09 (13)	05:43	05:12
	16:28	36 08:55 (19)	17:08	17:47	18:27	42 06:51 (13)	20:03	20:37
5	07:34	08:21 (19)	07:12	06:28	06:31	07:09 (13)	05:41	05:12
	16:29	36 08:57 (19)	17:09	17:48	19:28	42 07:51 (13)	20:04	20:37
6	07:34	08:20 (19)	07:11	06:27	06:29	07:09 (13)	05:40	05:11
	16:30	36 08:56 (19)	17:11	17:50	19:29	40 07:49 (13)	20:06	20:38
7	07:34	08:20 (19)	07:09	06:25	06:27	07:10 (13)	05:38	05:11
	16:31	36 08:56 (19)	17:12	17:51	19:31	38 07:48 (13)	20:07	20:39
8	07:34	08:22 (19)	07:08	06:23	06:26	07:10 (13)	05:37	05:11
	16:32	34 08:56 (19)	17:14	17:52	19:32	38 07:48 (13)	20:08	20:40
9	07:34	08:22 (19)	07:07	06:21	06:24	07:12 (13)	05:36	05:10
	16:33	36 08:58 (19)	17:15	17:54	19:33	34 07:46 (13)	20:09	20:40
10	07:33	08:23 (19)	07:05	06:19	06:22	07:12 (13)	05:35	05:10
	16:35	34 08:57 (19)	17:16	17:55	19:34	32 07:44 (13)	20:11	20:41
11	07:33	08:23 (19)	07:04	06:18	06:20	07:12 (13)	05:33	05:10
	16:36	34 08:57 (19)	17:18	17:56	19:36	30 07:42 (13)	20:12	20:41
12	07:33	08:24 (19)	07:03	06:16	06:18	07:15 (13)	05:32	05:10
	16:37	32 08:56 (19)	17:19	17:58	19:37	26 07:41 (13)	20:13	20:42
13	07:32	08:26 (19)	07:01	06:14	06:17	07:17 (13)	05:31	05:09
	16:38	32 08:58 (19)	17:21	17:59	19:38	22 07:39 (13)	20:14	20:43
14	07:32	08:25 (19)	07:00	06:12	06:15	07:19 (13)	05:30	05:09
	16:39	32 08:57 (19)	17:22	18:00	19:39	16 07:35 (13)	20:15	20:43
15	07:31	08:27 (19)	06:58	06:10	06:13	07:23 (13)	05:28	05:09
	16:41	30 08:57 (19)	17:24	18:01	19:41	6 07:29 (13)	20:16	20:44
16	07:31	08:28 (19)	06:57	06:08	06:11		05:27	05:09
	16:42	28 08:56 (19)	17:25	18:03	19:42		20:18	20:44
17	07:30	08:29 (19)	06:55	06:07	06:10		05:26	05:09
	16:43	26 08:55 (19)	17:26	18:04	19:43		20:19	20:45
18	07:29	08:29 (19)	06:54	06:05	06:08		05:25	05:09
	16:44	26 08:55 (19)	17:28	18:05	19:45		20:20	20:45
19	07:29	08:30 (19)	06:52	06:03	06:29 (13)	06:06	05:24	05:09
	16:46	24 08:54 (19)	17:29	18:07	14 06:43 (13)	19:46	20:21	20:45
20	07:28	08:33 (19)	06:50	06:01	06:25 (13)	06:05	05:23	05:10
	16:47	20 08:53 (19)	17:31	18:08	22 06:47 (13)	19:47	20:22	20:46
21	07:27	08:34 (19)	06:49	05:59	06:21 (13)	06:03	05:22	05:10
	16:48	18 08:52 (19)	17:32	18:09	28 06:49 (13)	19:48	20:23	20:46
22	07:26	08:35 (19)	06:47	05:57	06:19 (13)	06:01	05:21	05:10
	16:50	16 08:51 (19)	17:33	18:10	30 06:49 (13)	19:50	20:24	20:46
23	07:26	08:38 (19)	06:46	05:55	06:17 (13)	06:00	05:20	05:10
	16:51	10 08:48 (19)	17:35	18:12	34 06:51 (13)	19:51	20:25	20:46
24	07:25		06:44	05:53	06:16 (13)	05:58	05:19	05:11
	16:52		17:36	18:13	36 06:52 (13)	19:52	20:26	20:46
25	07:24		06:42	05:52	06:16 (13)	05:56	05:19	05:11
	16:54		17:37	18:14	36 06:52 (13)	19:53	20:27	20:47
26	07:23		06:41	05:50	06:14 (13)	05:55	05:18	05:11
	16:55		17:39	18:16	40 06:54 (13)	19:55	20:28	20:47
27	07:22		06:39	05:48	06:12 (13)	05:53	05:17	05:12
	16:57		17:40	18:17	42 06:54 (13)	19:56	20:29	20:47
28	07:21		06:37	05:46	06:12 (13)	05:52	05:16	05:12
	16:58		17:42	18:18	42 06:54 (13)	19:57	20:30	20:47
29	07:20			05:44	06:12 (13)	05:50	05:16	05:12
	16:59			18:19	42 06:54 (13)	19:58	20:31	20:47
30	07:19			05:42	06:10 (13)	05:49	05:15	05:13
	17:01			18:21	44 06:54 (13)	20:00	20:32	20:47
31	07:18			05:40	06:10 (13)		05:14	
	17:02			18:22	42 06:52 (13)		20:33	
Potential sun hours	286	291	369	380	494	-285	-254	
Total, worst case	686		452		494			
Sun reduction	0.45		0.50		0.55			
Oper. time red.	0.91		0.91		0.91			
Wind dir. red.	0.68		0.62		0.62			
Total reduction	0.28		0.28		0.31			
Total, real	193		129		155			

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

Day in month	Sun rise (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:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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Calculated:
01/22/06 19:41/2.4.0.67

SHADOW - Calendar

Calculation: 060121 SouthWest area 2 Shadow receptor: 371 - 371

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 2 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.45 0.50 0.55 0.55 0.55 0.58 0.55 0.55 0.45 0.35 0.35

Operational time
N NE E SE S SW W NW Sum
1,850 1,325 800 713 625 663 700 1,275 7,950

	July	August	September	October	November	December
1	05:13 20:47	05:41 20:25	06:17 19:35	07:11 (13) 07:41 (13)	06:53 18:38	06:34 16:46
2	05:14 20:46	05:42 20:24	06:19 19:33	07:11 (13) 07:43 (13)	06:55 18:36	06:35 16:44
3	05:15 20:46	05:43 20:22	06:20 19:31	07:10 (13) 07:44 (13)	06:56 18:35	06:36 16:43
4	05:15 20:46	05:44 20:21	06:21 19:29	07:07 (13) 07:45 (13)	06:57 18:33	06:38 16:42
5	05:16 20:46	05:46 20:20	06:22 19:27	07:06 (13) 07:44 (13)	06:58 18:31	06:39 16:40
6	05:16 20:45	05:47 20:18	06:23 19:25	07:05 (13) 07:45 (13)	07:00 18:29	06:40 16:39
7	05:17 20:45	05:48 20:17	06:25 19:24	07:04 (13) 07:46 (13)	07:01 18:27	06:42 16:38
8	05:18 20:45	05:49 20:16	06:26 19:22	07:03 (13) 07:45 (13)	07:02 18:25	06:43 16:36
9	05:19 20:44	05:50 20:14	06:27 19:20	07:03 (13) 07:47 (13)	07:03 18:24	06:45 16:35
10	05:19 20:44	05:51 20:13	06:28 19:18	07:04 (13) 07:46 (13)	07:05 18:22	06:46 16:34
11	05:20 20:43	05:53 20:11	06:29 19:16	07:03 (13) 07:45 (13)	07:06 18:20	06:47 16:33
12	05:21 20:43	05:54 20:10	06:31 19:14	07:02 (13) 07:44 (13)	07:07 18:18	06:49 16:32
13	05:22 20:42	05:55 20:08	06:32 19:12	07:01 (13) 07:45 (13)	07:08 18:16	06:50 16:31
14	05:23 20:42	05:56 20:07	06:33 19:10	07:02 (13) 07:44 (13)	07:10 18:15	06:51 16:30
15	05:24 20:41	05:57 20:05	06:34 19:09	07:01 (13) 07:43 (13)	07:11 18:13	06:53 16:28
16	05:24 20:40	05:58 20:04	06:35 19:07	07:03 (13) 07:43 (13)	07:12 18:11	06:54 16:27
17	05:25 20:40	06:00 20:02	06:36 19:05	07:02 (13) 07:42 (13)	07:14 18:09	06:55 16:26
18	05:26 20:39	06:01 20:00	06:38 19:03	07:03 (13) 07:41 (13)	07:15 18:08	06:57 16:26
19	05:27 20:38	06:02 19:57	06:39 19:01	07:02 (13) 07:38 (13)	07:16 18:06	06:58 16:25
20	05:28 20:37	06:03 19:56	06:40 18:59	07:03 (13) 07:37 (13)	07:17 18:04	06:59 16:24
21	05:29 20:36	06:04 19:54	06:41 18:57	07:04 (13) 07:36 (13)	07:19 18:03	07:01 16:23
22	05:30 20:35	06:06 19:52	06:42 18:55	07:06 (13) 07:34 (13)	07:20 18:01	07:02 16:22
23	05:31 20:35	06:07 19:51	06:44 18:53	07:09 (13) 07:31 (13)	07:21 17:59	07:03 16:21
24	05:32 20:34	06:08 19:49	06:45 18:51	07:10 (13) 07:28 (13)	07:23 17:58	07:05 16:21
25	05:33 20:33	06:09 19:47	06:46 18:50	07:15 (13) 07:21 (13)	06:24 16:56	07:06 16:20
26	05:34 20:32	06:10 19:45	06:47 18:48	06:25 16:55	07:07 16:19	07:07 16:19
27	05:36 20:31	06:12 19:44	06:48 18:46	06:27 16:53	07:08 16:19	07:08 16:19
28	05:37 20:29	06:13 19:42	06:50 18:44	06:28 16:52	07:10 16:18	07:10 16:18
29	05:38 20:28	06:14 19:40	06:51 18:42	06:29 16:50	07:11 16:18	07:11 16:18
30	05:39 20:27	06:15 19:38	06:52 18:40	06:31 16:49	07:12 16:17	07:12 16:17
31	05:40 20:26	06:16 19:36	06:53 18:38	06:32 16:47	07:13 16:17	07:13 16:17
Potential sun hours	-272	4	376	341	288	275
Total, worst case		74	888		290	1132
Sun reduction		0.55	0.55		0.35	0.35
Oper. time red.		0.91	0.91		0.91	0.91
Wind dir. red.		0.62	0.62		0.68	0.68
Total reduction		0.31	0.31		0.22	0.22
Total, real		23	278		64	248

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)
	Minutes with flicker		

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

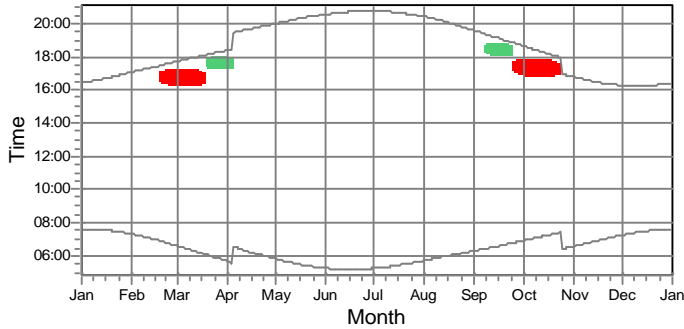
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US-RIVERSIDE, CA 92506

Calculated:
01/22/06 19:41/2.4.0.67

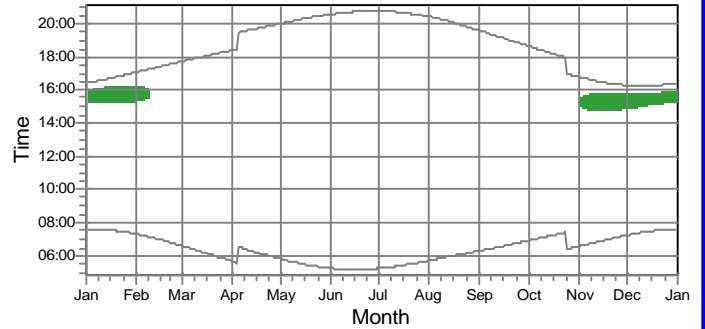
SHADOW - Calendar, graphical

Calculation: 060121 SouthWest area 2

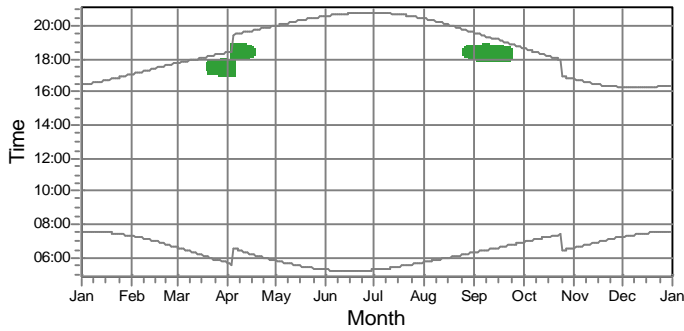
162: 162



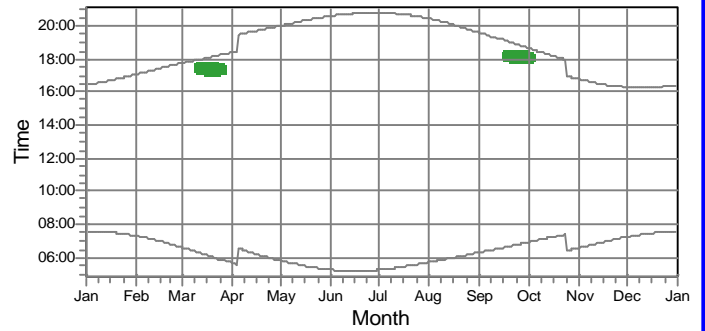
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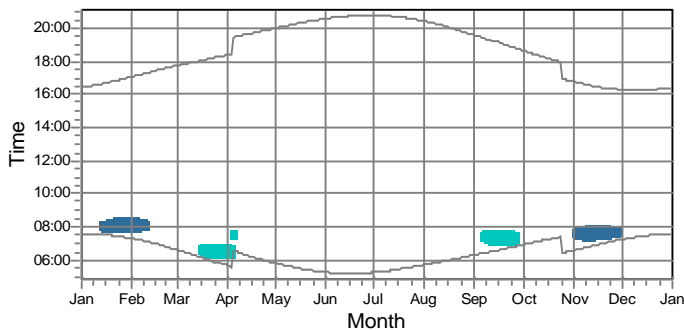
164: 164



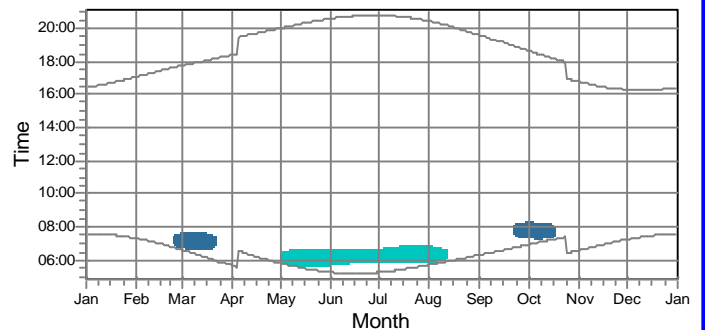
165: 165



167: 167



168: 168



WTGs



Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

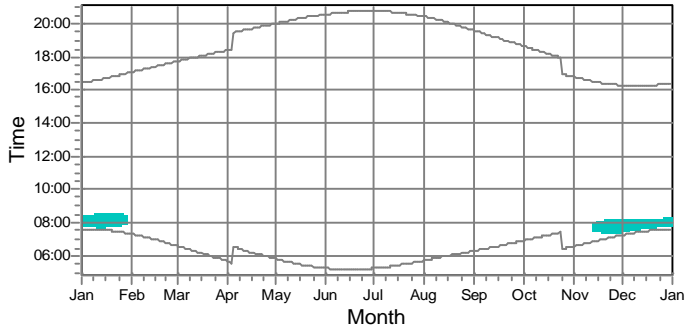
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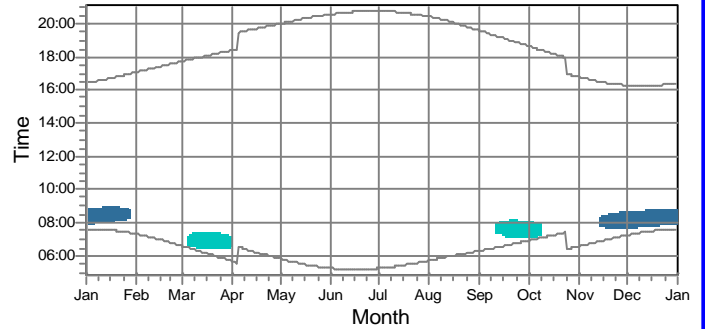
SHADOW - Calendar, graphical

Calculation: 060121 SouthWest area 2

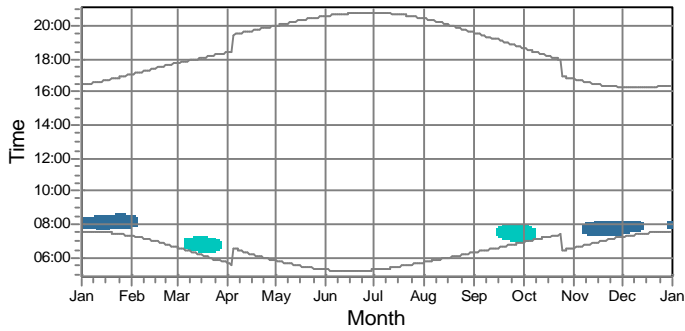
169: 169



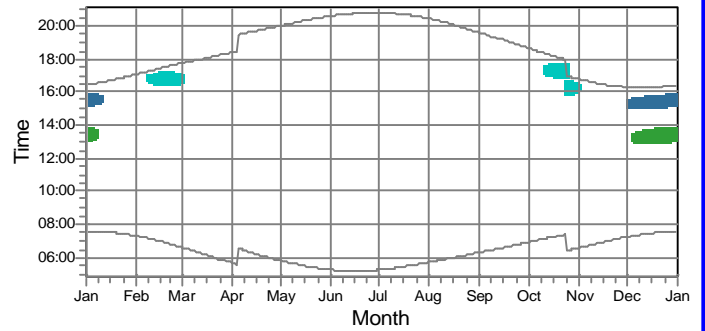
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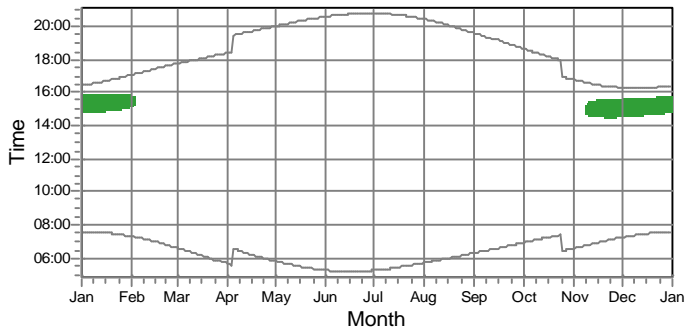
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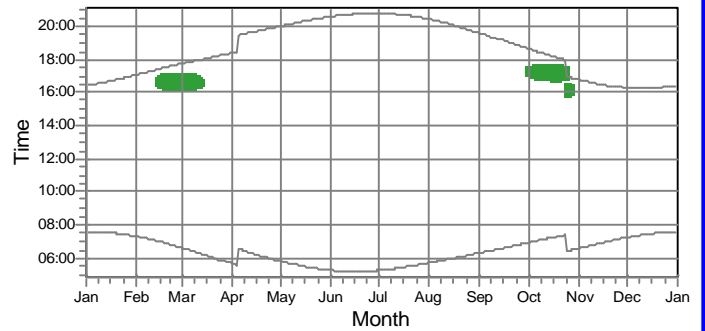
221: 221



222: 222



275: 275



WTGs



102-L



104-L



105-L

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

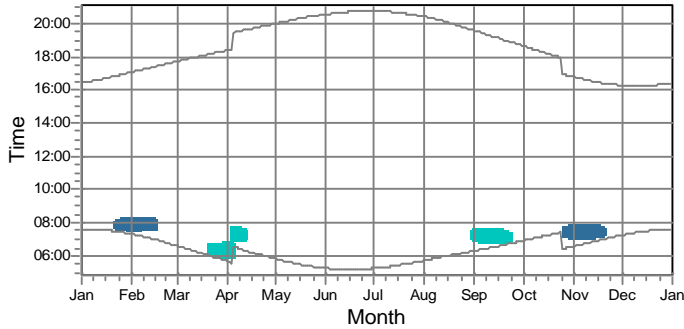
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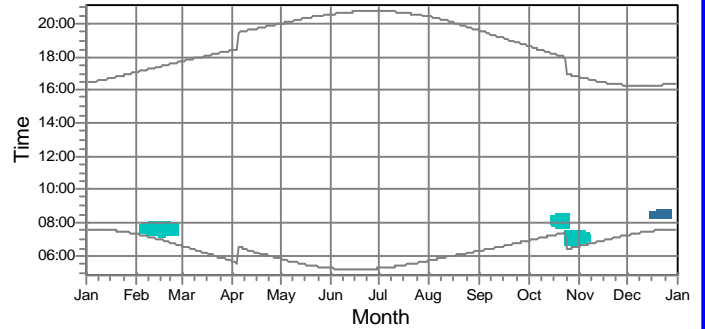
SHADOW - Calendar, graphical

Calculation: 060121 SouthWest area 2

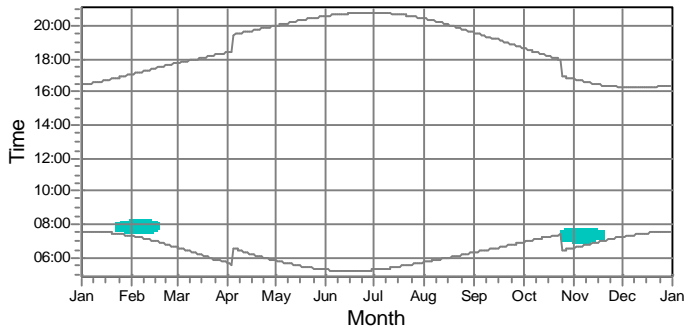
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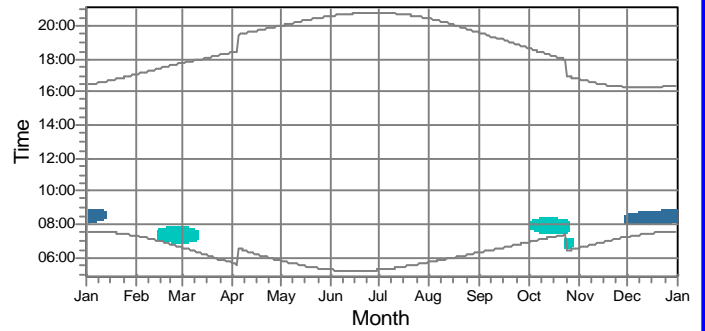
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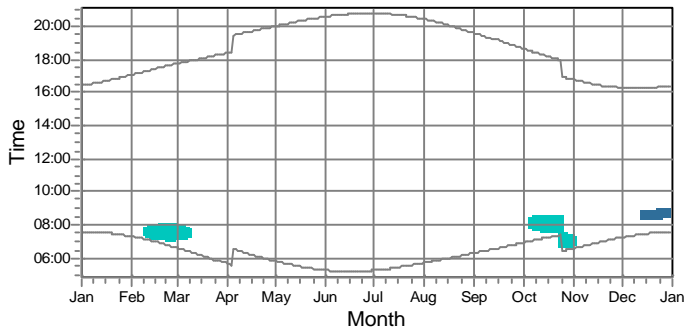
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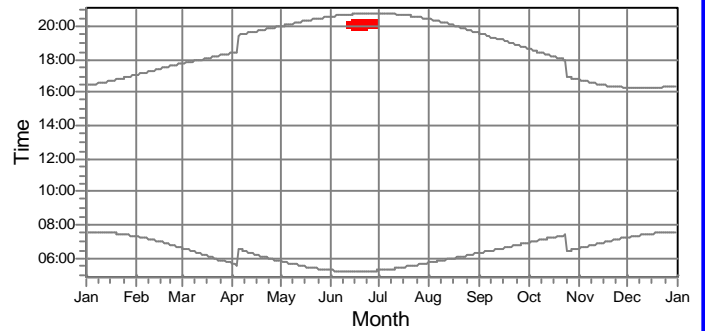
292: 292



293: 293



310: 310



WTGs

012

104-L

105-L

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
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Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

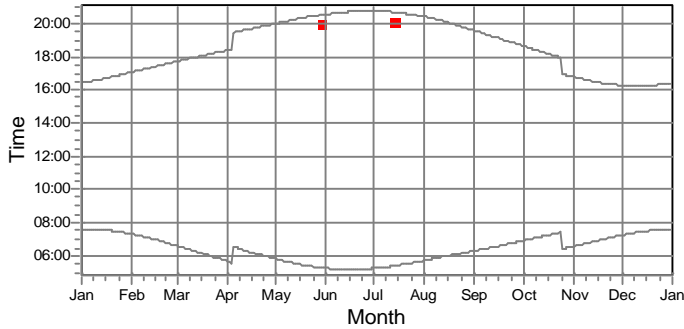
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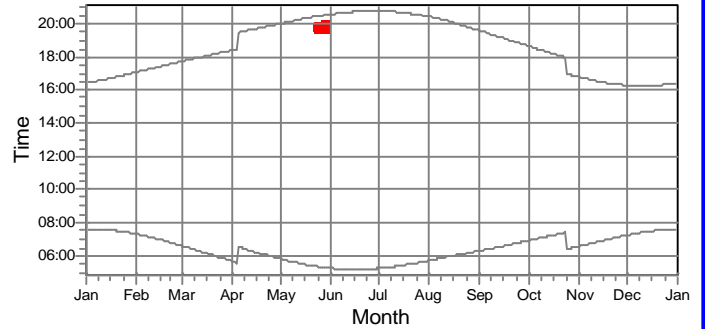
SHADOW - Calendar, graphical

Calculation: 060121 SouthWest area 2

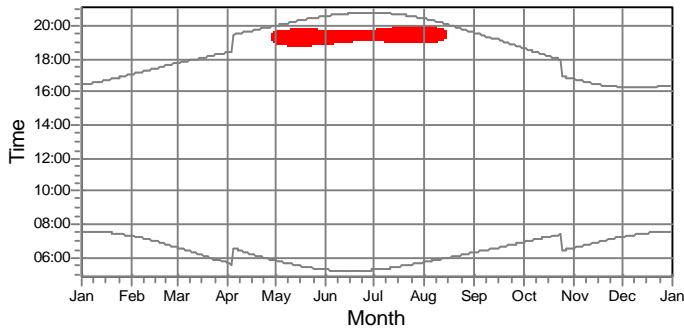
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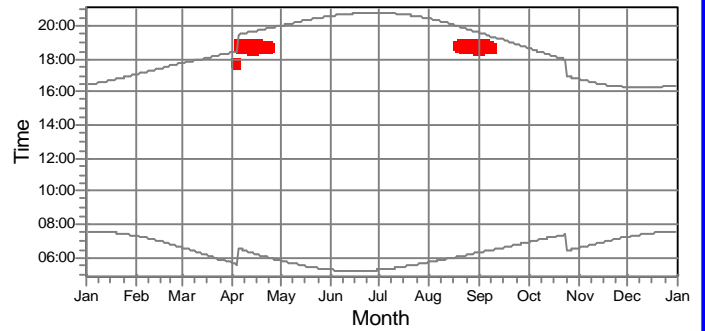
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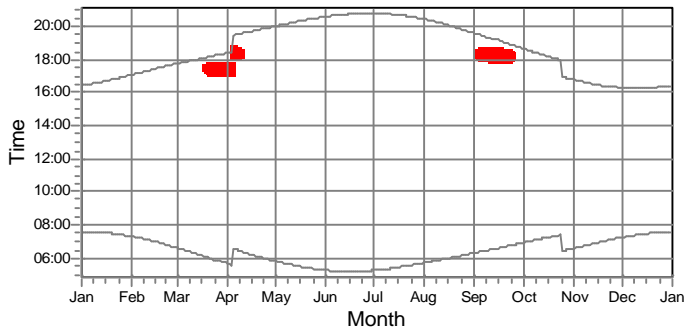
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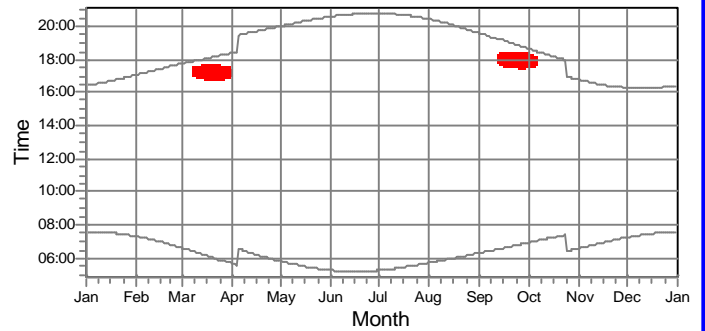
314: 314



315: 315



316: 316



WTGs

012 012

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
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Sunshine probabilities applied (pdf plots)
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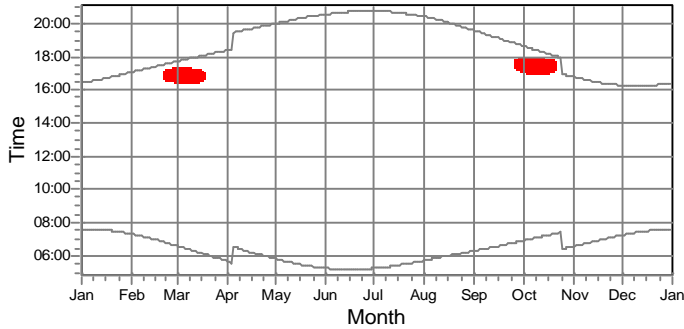
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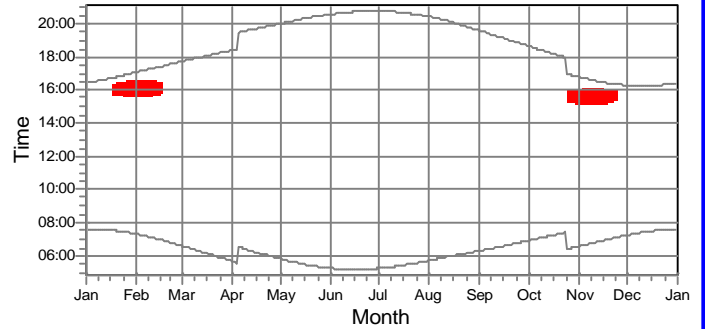
SHADOW - Calendar, graphical

Calculation: 060121 SouthWest area 2

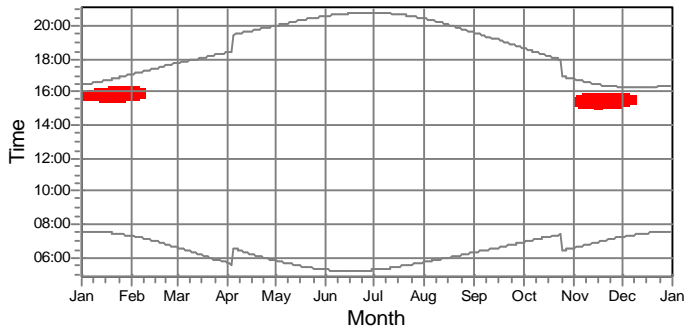
317: 317



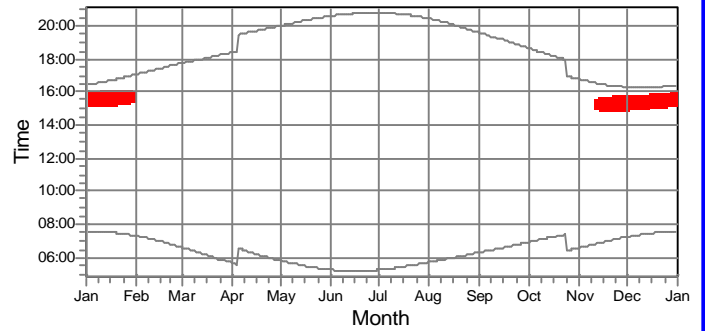
318: 318



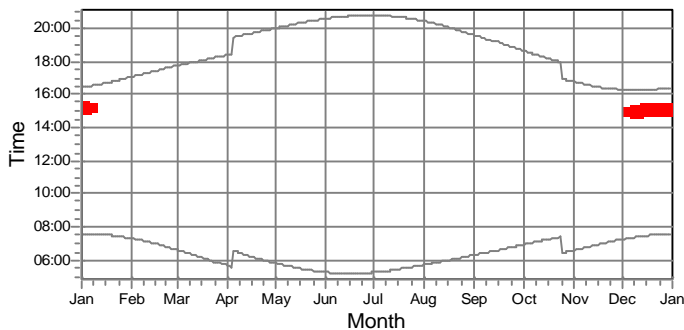
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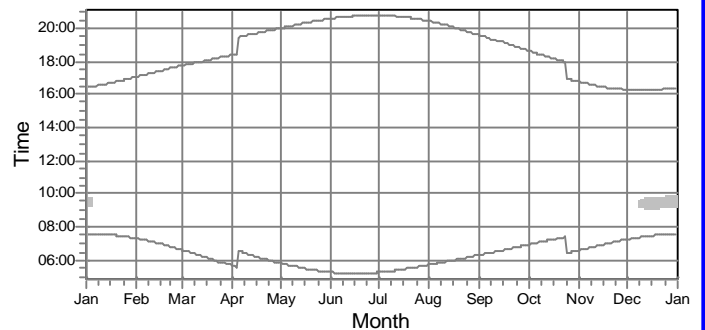
320: 320



321: 321



333: 333



WTGs



012



067

Project:
060119 Marble River

Description:
Marble River Wind Project
Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

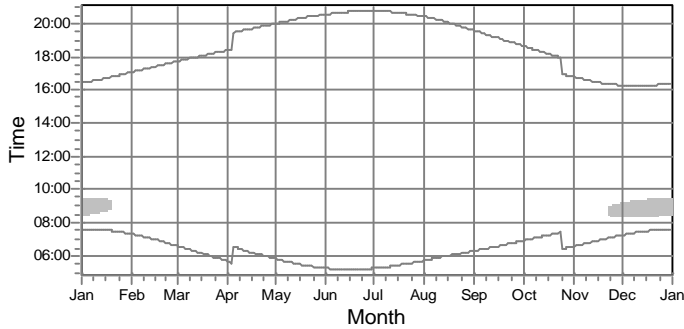
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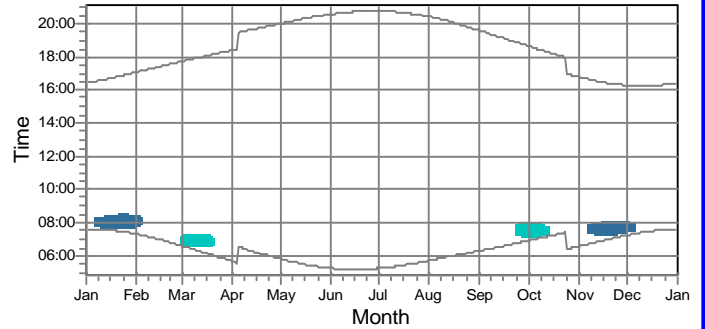
SHADOW - Calendar, graphical

Calculation: 060121 SouthWest area 2

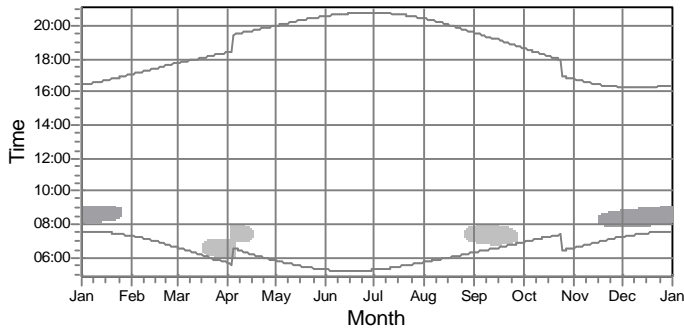
334: 334



366: 366



371: 371



WTGs



Project:
060119 Marble River

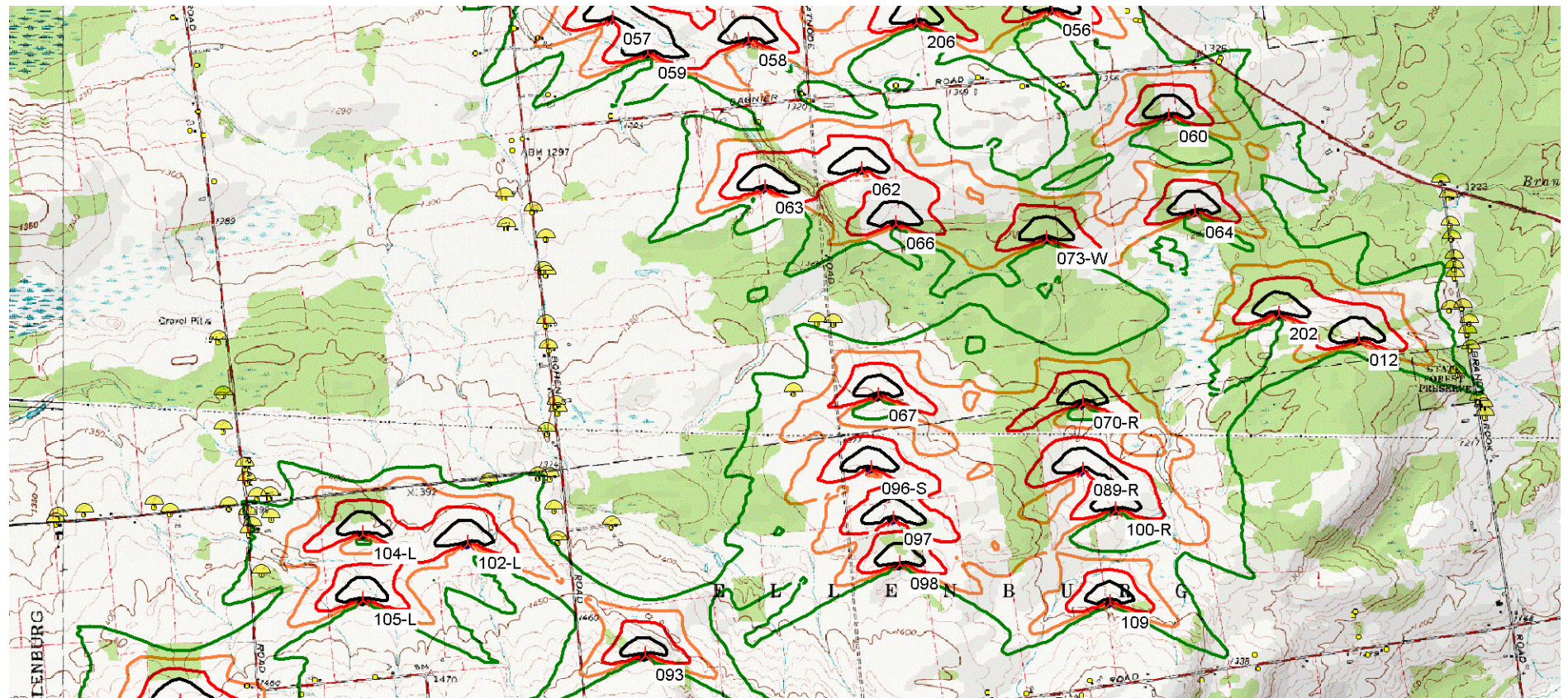
Description:
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Shadow-Flicker, SW part 2
32 of 109 Gamesa G-90 (90m rotor) on 78 meter towers
Shadow / no-shadow (worst case intensity wise)
Window properties: 1m2 horizontal, 1m above ground
1000 meter max shadow distance applied along with default 3° inclination
Sunshine probabilities applied (pdf plots)
Directional run-hours applied (91% of time)

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SHADOW - Bitmap map: 060106 Marble River USGS 50kz13.bmi

Calculation: 060121 SouthWest area 2 File: 060106 Marble River USGS 50kz13.bmi



Map: 060106 Marble River USGS 50kz13, Print scale 1:35,000, Map center UTM NAD27 Zone: 18 East: 582,979 North: 4,971,518

- ▲ New WTG
 - ▲ Shadow receptor
 - 10
 - 25
 - 50
 - 100
- Isolines showing shadow in Shadow hours/per year. Real value calculation.