

Project:

Farma wiatrowa

# Brojce Gmina Brojce

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Licensed user:

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Calculated:

2012-03-13 22:15/2.7.490

**SHADOW - Main Result****Calculation:** Efekt migotania cienia - 21x3MW - V112 - Phase1

## PROGNOZA

### ODDZIAŁYWANIA NA ŚRODOWISKO

DO PROJEKTU ZMIANY STUDIUM UWARUNKOWAŃ  
I KIERUNKÓW ZAGOSPODAROWANIA PRZESTRZENNEGO  
DLA WYBRANYCH TERENÓW W GMINIE BROJCE

## Analiza cienia

Przedsięwzięcie:

Farma Wiatrowa

**Brojce**  
**Gmina Brojce**  
**21 x 3,0MW**  
**/119m/ - 106,5dB**

Inwestor:

**FINADVICE FAIR ENERGY**  
**WIND DEVELOPMENT 1 Sp. z o. o.**  
**ul. Śniadeckich 17**  
**00-654 Warszawa**

Marzec 2012r.

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## SHADOW - Main Result

**Calculation:** Efekt migotania cienia - 21x3MW - V112 - Phase 1

### Assumptions for shadow calculations

Maximum distance for influence

Calculate only when more than 20 % of sun is covered by the blade  
Please look in WTG table

Minimum sun height over horizon for influence

3 °

Day step for calculation

1 days

Time step for calculation

1 minutes

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,33	2,19	3,53	5,54	7,87	7,57	7,41	7,34	4,73	3,34	1,48	1,08

Operational hours are calculated from WTGs in calculation and wind distribution:

WA mixed 34m-synth 119m 30jan2010

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
338	404	489	730	507	694	738	1313	1207	872	893	319	8503

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

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:  
Height contours used: Height Contours: Brojce-oro final.wpo (5)

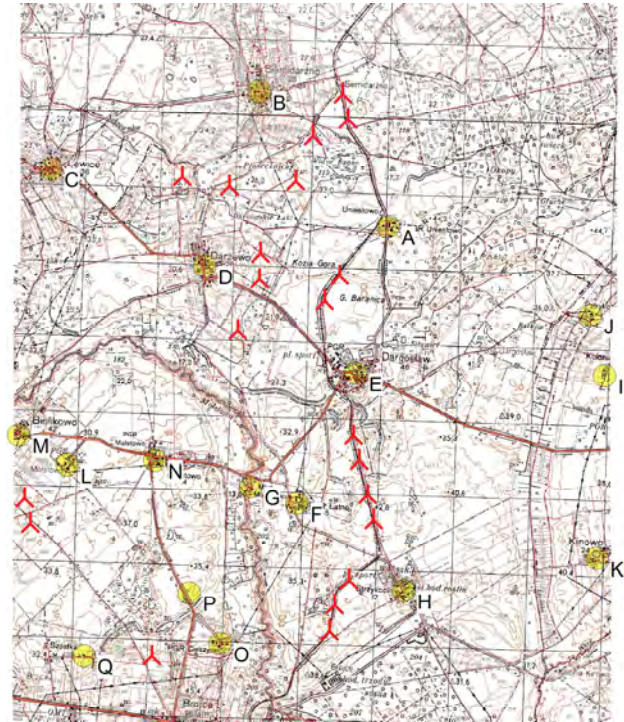
Area object(s) used in calculation:

Area object (ZVI): ZVI\_REGIONS\_Farma wiatrowa - Brojce\_0.w2r (1)

Obstacles used in calculation

Eye height: 1,5 m

Grid resolution: 10 m



▲ New WTG

☀ Shadow receptor

### WTGs

UTM WGS84 Zone: 33 East	North	Z	Row data/Description	WTG type			Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
				Valid	Manufact.	Type-generator				Calculation distance [m]	RPM [RPM]
UTM WGS84 Zone: 33		[m]									
1	522 736	5 986 050	24,5 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8
2	523 368	5 985 961	25,0 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8
3	524 806	5 987 264	30,0 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8
4	524 440	5 986 687	30,0 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8
5	524 893	5 986 935	30,0 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8
6	524 245	5 986 073	30,0 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8
7	523 831	5 985 098	29,5 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8
8	523 840	5 984 755	25,0 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8
9	524 900	5 984 860	30,3 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8
10	524 719	5 984 518	35,0 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8
11	520 891	5 981 679	26,3 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8
12	520 986	5 981 356	30,2 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8
13	525 204	5 982 754	32,5 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8
14	525 299	5 982 431	35,7 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8
15	525 434	5 981 980	37,5 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8
16	525 533	5 981 655	35,7 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8
17	525 254	5 980 842	37,5 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8
18	522 695	5 979 690	35,0 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8
19	525 079	5 980 498	36,9 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8
20	525 031	5 980 149	32,5 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8
21	523 591	5 984 057	25,8 VESTAS V112-3.0 IC ...Yes	Yes	VESTAS	V112-3.0 IC-3 000	3 000	112,0	119,0	1 709	12,8

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**SHADOW - Main Result****Calculation:** Efekt migotania cienia - 21x3MW - V112 - Phase 1**Shadow receptor-Input**

UTM WGS84 Zone: 33

No.	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
	[m]	[m]	[m]	[m]	[m]	[m]	[°]	[°]	
A	525 506	5 985 541	29,1	3,0	2,0	1,0	-180,0	90,0	"Green house mode"
B	523 693	5 987 236	20,0	3,0	2,0	1,0	-180,0	90,0	"Green house mode"
C	520 988	5 986 057	25,0	3,0	2,0	1,0	-180,0	90,0	"Green house mode"
D	523 103	5 984 885	30,0	3,0	2,0	1,0	-180,0	90,0	"Green house mode"
E	525 180	5 983 581	30,8	3,0	2,0	1,0	-180,0	90,0	"Green house mode"
F	524 507	5 981 815	30,0	3,0	2,0	1,0	-180,0	90,0	"Green house mode"
G	523 880	5 981 999	16,5	3,0	2,0	1,0	-180,0	90,0	"Green house mode"
H	525 987	5 980 738	34,0	3,0	2,0	1,0	-180,0	90,0	"Green house mode"
I	528 485	5 983 730	36,9	3,0	2,0	1,0	-180,0	90,0	"Green house mode"
J	528 255	5 984 522	27,5	3,0	2,0	1,0	-180,0	90,0	"Green house mode"
K	528 520	5 981 310	37,5	3,0	2,0	1,0	-180,0	90,0	"Green house mode"
L	521 429	5 982 155	30,7	3,0	2,0	1,0	-180,0	90,0	"Green house mode"
M	520 764	5 982 512	17,8	3,0	2,0	1,0	-180,0	90,0	"Green house mode"
N	522 585	5 982 278	30,0	3,0	2,0	1,0	-180,0	90,0	"Green house mode"
O	523 593	5 979 905	32,5	3,0	2,0	1,0	-180,0	90,0	"Green house mode"
P	523 145	5 980 551	33,5	3,0	2,0	1,0	-180,0	90,0	"Green house mode"
Q	521 796	5 979 645	35,0	3,0	2,0	1,0	-180,0	90,0	"Green house mode"

**Calculation Results**

Shadow receptor

**Shadow, expected values**

No. Shadow hours

per year

[h/year]

A	7:22
B	7:31
C	0:00
D	15:15
E	1:01
F	8:10
G	7:45
H	11:31
I	0:00
J	0:00
K	0:00
L	6:43
M	0:03
N	0:00
O	6:10
P	1:44
Q	3:51

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
1	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (347)	14:59	1:31
2	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (348)	0:00	0:00
3	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (349)	9:33	2:17
4	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (350)	16:20	2:14
5	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (351)	7:32	1:23
6	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (352)	9:11	2:36
7	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (353)	29:23	9:03
8	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (354)	20:12	4:04
9	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (355)	25:52	2:57
10	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (356)	23:27	2:43
11	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (357)	29:22	4:15
12	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (358)	24:56	2:31

To be continued on next page...

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**SHADOW - Main Result****Calculation:** Efekt migotania cienia - 21x3MW - V112 - Phase 1

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
13	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (359)	12:41	3:58
14	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (360)	6:49	2:01
15	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (361)	19:57	5:24
16	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (362)	13:16	2:38
17	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (363)	46:15	8:44
18	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (364)	45:57	8:25
19	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (365)	18:35	4:32
20	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (366)	16:07	3:21
21	VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (367)	25:41	2:56

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## SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: A - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(1)

### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:17 15:44	14:36 (10) 16:34	07:47 16:34	14:57 (9) 15:23 (9)	06:48 17:33	06:32 19:32
2	08:16 15:45	14:36 (10) 16:36	07:46 16:36	14:58 (9) 15:22 (9)	06:46 17:35	06:30 19:33
3	08:16 15:46	14:37 (10) 16:38	07:44 16:38	14:59 (9) 15:21 (9)	06:43 17:37	06:27 19:35
4	08:16 15:47	14:37 (10) 16:40	07:42 16:40	15:01 (9) 15:20 (9)	06:41 17:39	06:25 19:37
5	08:16 15:48	14:38 (10) 16:42	07:41 16:42	15:03 (9) 15:19 (9)	06:38 17:40	06:23 19:39
6	08:15 15:50	14:38 (10) 16:44	07:39 16:44	15:05 (9) 15:16 (9)	06:36 17:42	06:20 19:41
7	08:15 15:51	14:39 (10) 16:46	07:37 16:46	15:08 (9)	06:34 17:44	06:18 19:43
8	08:15 15:52	14:39 (10) 16:49	07:35 16:49	15:11 (9)	06:31 17:46	06:15 19:45
9	08:14 15:54	14:39 (10) 16:51	07:33 16:51	15:14 (9)	06:29 17:48	06:13 19:47
10	08:13 15:55	14:39 (10) 16:53	07:31 16:53	15:17 (9)	06:26 17:50	06:10 19:49
11	08:13 15:57	14:41 (10) 16:55	07:29 16:55	15:20 (9)	06:24 17:52	06:08 19:50
12	08:12 15:58	14:41 (10) 16:57	07:27 16:57	15:23 (9)	06:22 17:54	06:06 19:52
13	08:11 16:00	14:42 (10) 16:59	07:25 16:59	15:26 (9)	06:19 17:56	06:03 19:54
14	08:11 16:01	14:43 (10) 17:01	07:23 17:01	15:29 (9)	06:17 17:58	06:01 19:56
15	08:10 16:03	14:44 (10) 17:03	07:21 17:03	15:32 (9)	06:14 18:00	05:58 19:58
16	08:09 16:05	14:44 (10) 17:05	07:19 17:05	15:35 (9)	06:12 18:02	05:56 20:00
17	08:08 16:06	14:45 (10) 17:07	07:17 17:07	15:38 (9)	06:09 18:03	05:54 20:01
18	08:07 16:08	14:47 (10) 17:09	07:15 17:09	15:41 (9)	06:07 18:05	05:51 20:03
19	08:06 16:10	14:48 (10) 17:11	07:13 17:11	15:44 (9)	06:04 18:07	05:49 20:05
20	08:05 16:12	14:50 (10) 17:13	07:10 17:13	15:47 (9)	06:02 18:09	05:47 20:07
21	08:03 16:13	14:53 (9) 17:15	07:08 17:15	15:50 (9)	05:59 18:11	05:45 20:09
22	08:02 16:15	14:52 (9) 17:17	07:06 17:17	15:53 (9)	05:57 18:13	05:42 20:11
23	08:01 16:17	14:53 (9) 17:19	07:04 17:19	15:56 (9)	05:55 18:15	05:40 20:13
24	08:00 16:19	14:52 (9) 17:21	07:02 17:21	15:59 (9)	05:52 18:17	05:38 20:15
25	07:58 16:21	14:53 (9) 17:23	06:59 17:23	16:02 (9)	05:50 19:19	05:36 20:16
26	07:57 16:23	14:53 (9) 17:25	06:57 17:25	16:05 (9)	05:47 19:20	05:33 20:18
27	07:55 16:25	14:53 (9) 17:27	06:55 17:27	16:08 (9)	05:45 19:22	05:31 20:20
28	07:54 16:27	14:54 (9) 17:29	06:53 17:29	16:11 (9)	05:42 19:24	05:29 20:22
29	07:52 16:29	14:55 (9) 17:31	06:50 17:31	16:14 (9)	05:40 19:26	05:27 20:24
30	07:51 16:31	15:24 (9)	06:55 (9)	16:17 (9)	05:37 19:28	05:25 20:26
31	07:49 16:32	15:23 (9)	06:50 (9)	16:20 (9)	05:35 19:30	05:23 21:17
Potential sun hours	248	281	367	420	495	511
Total, worst case	925	118			279	
Sun reduction	0,17	0,22			0,49	
Oper. time red.	0,97	0,97			0,97	
Wind dir. red.	0,69	0,69			0,60	
Total reduction	0,11	0,15			0,30	
Total, real	105	18			83	

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)

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#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	04:29 21:33	05:09 20:57	19:59 (6) 20:19 (6)	06:04 19:50	06:57 18:36	06:56 16:25
2	04:29 21:32	05:11 20:55	19:59 (6) 20:19 (6)	06:06 19:48	06:59 18:33	06:58 16:23
3	04:30 21:32	05:12 20:53	20:00 (6) 20:20 (6)	06:07 19:45	07:01 18:31	07:00 16:21
4	04:31 21:31	05:14 20:52	19:59 (6) 20:19 (6)	06:09 19:43	07:03 18:28	07:02 16:19
5	04:32 21:31	05:16 20:50	20:00 (6) 20:19 (6)	06:11 19:40	07:05 18:26	07:04 16:17
6	04:33 21:30	05:18 20:48	19:59 (6) 20:18 (6)	06:13 19:38	07:07 18:24	07:06 16:15
7	04:34 21:30	05:19 20:46	20:00 (6) 20:16 (6)	06:14 19:35	07:08 18:21	07:08 16:13
8	04:35 21:29	05:21 20:44	20:01 (6) 20:15 (6)	06:16 19:33	07:10 18:19	07:10 16:11
9	04:36 21:28	05:23 20:42	20:01 (6) 20:12 (6)	06:18 19:30	07:12 18:16	07:12 16:10
10	04:37 21:27	05:25 20:40	20:03 (6) 20:11 (6)	06:20 19:28	07:14 18:14	07:14 16:08
11	04:38 21:26	05:26 20:38	20:04 (6) 20:08 (6)	06:22 19:26	07:16 18:12	07:16 16:06
12	04:39 21:25	05:28 20:36	06:23 19:23	07:18 18:09	07:18 16:04	08:06 15:35
13	04:41 21:24	05:30 20:33	06:25 19:21	07:20 18:07	07:20 16:03	08:07 15:35
14	04:42 21:23	05:32 20:31	06:27 19:18	07:22 18:04	07:21 16:01	08:08 15:35
15	04:43 21:22	05:33 20:29	06:29 19:16	07:23 18:02	07:23 15:59	08:09 15:35
16	04:44 21:21	05:35 20:27	06:30 19:13	07:25 18:00	07:25 15:58	08:10 15:35
17	04:46 21:20	05:37 20:25	06:32 19:11	07:27 17:57	07:27 15:56	08:11 15:35
18	04:47 21:19	05:39 20:23	06:34 19:08	07:29 17:55	07:29 15:55	08:12 15:35
19	04:49 21:17	05:41 20:20	06:36 19:06	07:31 17:53	07:31 15:53	08:13 15:35
20	04:50 21:16	05:42 20:18	06:38 19:03	07:33 17:51	07:33 15:52	08:13 15:36
21	04:51 21:15	05:44 20:16	06:39 19:01	07:35 17:48	07:35 15:51	08:14 15:36
22	04:53 21:13	05:46 20:14	06:41 18:58	07:37 17:46	07:36 15:49	08:14 15:37
23	04:54 21:12	05:48 20:11	06:43 18:56	07:39 17:44	07:38 15:48	08:15 15:37
24	04:56 21:10	05:49 20:09	06:45 18:53	07:41 17:42	07:40 15:47	08:15 15:38
25	04:58 21:09	20:06 (6) 20:14 (6)	05:51 20:07	06:47 18:51	07:42 17:39	08:16 15:46
26	04:59 21:07	20:04 (6) 20:15 (6)	05:53 20:04	06:48 18:48	07:44 17:37	08:16 15:45
27	05:01 21:06	20:03 (6) 20:17 (6)	05:55 20:02	06:50 18:46	07:46 17:35	08:16 15:44
28	05:02 21:04	20:02 (6) 20:17 (6)	05:57 20:00	06:52 18:43	06:48 16:33	07:47 15:43
29	05:04 21:02	20:01 (6) 20:18 (6)	05:58 19:57	06:54 18:41	07:48 16:31	07:48 15:42
30	05:06 21:01	20:00 (6) 20:18 (6)	06:00 19:55	06:56 18:38	07:50 16:29	07:50 15:41
31	05:07 20:59	20:00 (6) 20:19 (6)	06:02 19:52	06:54 16:27	06:54 16:27	08:17 15:43
Potential sun hours	513	460	382	328	258	232
Total, worst case	102	171			720	737
Sun reduction	0,45	0,49			0,17	0,14
Oper. time red.	0,97	0,97			0,97	0,97
Wind dir. red.	0,60	0,60			0,69	0,69
Total reduction	0,27	0,30			0,12	0,10
Total, real	27	51			85	73

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:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 6

Licensed user:

Leanergia Bartosz Dlugokecki

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: B - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(2)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	January	February	March	April	May	June
1	08:17 15:44	14:45 (1) 15:03 (1)	07:48 16:35		06:48 17:33	
2	08:17 15:45	14:44 (1) 15:03 (1)	07:46 16:36	8 08:28 (4) 08:36 (4)	06:46 17:35	
3	08:17 15:46	14:45 (1) 15:04 (1)	07:44 16:38	14 08:25 (4) 08:39 (4)	06:43 17:37	
4	08:16 15:47	14:46 (1) 15:05 (1)	07:42 16:41	18 08:23 (4) 08:41 (4)	06:41 17:39	
5	08:16 15:48	14:46 (1) 15:05 (1)	07:41 16:43	20 08:22 (4) 08:42 (4)	06:39 17:41	8 07:06 (5) 07:14 (5)
6	08:16 15:50	14:47 (1) 15:06 (1)	07:39 16:45	22 08:21 (4) 08:43 (4)	06:36 17:42	13 07:04 (5) 07:17 (5)
7	08:15 15:51	14:47 (1) 15:05 (1)	07:37 16:47	24 08:20 (4) 08:44 (4)	06:34 17:44	16 07:02 (5) 07:18 (5)
8	08:15 15:52	14:47 (1) 15:05 (1)	07:35 16:49	26 08:19 (4) 08:45 (4)	06:31 17:46	19 07:00 (5) 07:19 (5)
9	08:14 15:54	14:48 (1) 15:05 (1)	07:33 16:51	27 08:19 (4) 08:46 (4)	06:29 17:48	20 07:00 (5) 07:20 (5)
10	08:14 15:55	14:49 (1) 15:06 (1)	07:31 16:53	29 08:18 (4) 08:47 (4)	06:27 17:50	20 06:59 (5) 07:19 (5)
11	08:13 15:57	14:50 (1) 15:06 (1)	07:29 16:55	31 08:18 (4) 08:47 (4)	06:24 17:52	21 06:59 (5) 07:20 (5)
12	08:12 15:58	14:50 (1) 15:06 (1)	07:27 16:57	29 08:18 (4) 08:47 (4)	06:22 17:54	21 06:58 (5) 07:19 (5)
13	08:12 16:00	14:51 (1) 15:06 (1)	07:25 16:59	30 08:17 (4) 08:47 (4)	06:19 17:56	21 06:58 (5) 07:19 (5)
14	08:11 16:01	14:52 (1) 15:06 (1)	07:23 17:01	29 08:18 (4) 08:47 (4)	06:17 17:58	20 06:58 (5) 07:18 (5)
15	08:10 16:03	14:54 (1) 15:06 (1)	07:21 17:03	29 08:18 (4) 08:47 (4)	06:14 18:00	18 06:59 (5) 07:17 (5)
16	08:09 16:05	14:55 (1) 15:05 (1)	07:19 17:05	27 08:19 (4) 08:46 (4)	06:12 18:02	15 07:00 (5) 07:15 (5)
17	08:08 16:06	14:56 (1) 15:03 (1)	07:17 17:07	27 08:19 (4) 08:46 (4)	06:09 18:04	11 07:02 (5) 07:13 (5)
18	08:07 16:08	14:57 (1) 15:03 (1)	07:15 17:09	25 08:19 (4) 08:44 (4)	06:07 18:05	3 07:05 (5) 07:08 (5)
19	08:06 16:10	14:58 (1) 15:03 (1)	07:13 17:11	23 08:21 (4) 08:44 (4)	06:05 18:07	20 05:49 20:05
20	08:05 16:12	14:59 (1) 15:03 (1)	07:11 17:13	20 08:22 (4) 08:42 (4)	06:02 18:09	20 05:47 20:07
21	08:04 16:13	14:59 (1) 15:03 (1)	07:08 17:15	17 08:24 (4) 08:41 (4)	06:00 18:11	20 05:45 20:09
22	08:02 16:15	14:59 (1) 15:03 (1)	07:06 17:17	12 08:25 (4) 08:37 (4)	05:57 18:13	20 05:42 20:11
23	08:01 16:17	14:59 (1) 15:03 (1)	07:04 17:19	12 08:37 (4) 18:15	18:13	20 05:40 20:13
24	08:00 16:19	14:59 (1) 15:03 (1)	07:02 17:21	12 08:37 (4) 18:17	18:17	20 05:38 20:15
25	07:58 16:21	14:59 (1) 15:03 (1)	06:59 17:23	12 08:37 (4) 18:19	18:19	20 05:36 20:17
26	07:57 16:23	14:59 (1) 15:03 (1)	06:57 17:25	12 08:37 (4) 18:21	18:21	20 05:33 20:18
27	07:55 16:25	14:59 (1) 15:03 (1)	06:55 17:27	12 08:37 (4) 18:23	18:23	20 05:31 20:20
28	07:54 16:27	14:59 (1) 15:03 (1)	06:53 17:29	12 08:37 (4) 18:25	18:25	20 05:29 20:22
29	07:52 16:29	14:59 (1) 15:03 (1)	06:50 17:31	12 08:37 (4) 18:27	18:27	20 05:27 20:24
30	07:51 16:31	14:59 (1) 15:03 (1)	06:48 17:33	12 08:37 (4) 18:29	18:29	20 05:25 20:26
31	07:49 16:33	14:59 (1) 15:03 (1)	06:46 17:35	12 08:37 (4) 18:31	18:31	20 05:23 20:28
Potential sun hours	248	281	367	420	495	511
Total, worst case	273	485	272	239		
Sun reduction	0,17	0,22	0,30	0,40		
Oper. time red.	0,97	0,97	0,97	0,97		
Wind dir. red.	0,69	0,59	0,61	0,65		
Total reduction	0,11	0,13	0,18	0,25		
Total, real	31	63	48	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:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 7

Licensed user:

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: B - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(2)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December			
1	04:29 21:33	05:09 20:57	06:04 19:50	07:03 (3) 18:36	06:58 21	07:38 (5) 16:25	07:48 (4) 15:40	07:52 16	14:32 (1) 14:48 (1)
2	04:29 21:33	05:11 20:55	06:06 19:48	07:01 (3) 18:33	06:59 22	07:36 (5) 16:23	07:48 (4) 15:39	07:53 16	14:33 (1) 14:49 (1)
3	04:30 21:32	05:12 20:54	06:07 19:45	06:59 (3) 18:31	07:01 21	07:36 (5) 16:21	07:48 (4) 15:39	07:55 17	14:32 (1) 14:49 (1)
4	04:31 21:32	05:14 20:52	06:09 19:43	06:58 (3) 18:29	07:03 21	07:36 (5) 16:19	07:49 (4) 15:38	07:56 17	14:33 (1) 14:50 (1)
5	04:32 21:31	05:16 20:50	06:11 19:40	06:57 (3) 18:26	07:05 19	07:37 (5) 16:17	07:50 (4) 15:37	07:58 18	14:32 (1) 14:50 (1)
6	04:33 21:30	05:18 20:48	06:13 19:38	06:56 (3) 18:24	07:07 17	07:38 (5) 16:15	07:51 (4) 15:37	07:59 19	14:33 (1) 14:52 (1)
7	04:34 21:30	05:19 20:46	06:15 19:36	06:56 (3) 18:21	07:09 14	07:39 (5) 16:13	07:53 (4) 15:36	08:00 19	14:33 (1) 14:52 (1)
8	04:35 21:29	05:21 20:44	06:16 19:33	06:56 (3) 18:19	07:10 10	07:41 (5) 16:11	07:54 (4) 15:36	08:02 19	14:34 (1) 14:53 (1)
9	04:36 21:28	05:23 20:42	06:18 19:31	06:55 (3) 18:16	07:12 13	07:42 (5) 16:10	07:56 (4) 15:35	08:03 19	14:34 (1) 14:53 (1)
10	04:37 21:27	05:25 20:40	06:20 19:28	06:55 (3) 18:14	07:14 7	07:43 (5) 16:08	07:59 (4) 15:35	08:04 19	14:34 (1) 14:53 (1)
11	04:38 21:27	05:26 20:38	06:22 19:26	06:56 (3) 18:12	07:16 16	07:44 (5) 16:06	08:05 (4) 15:35	08:05 19	14:35 (1) 14:54 (1)
12	04:39 21:26	05:28 20:36	06:23 19:23	06:57 (3) 18:09	07:18 19	07:46 (5) 16:04	08:06 (4) 15:35	08:06 18	14:36 (1) 14:54 (1)
13	04:41 21:25	05:30 20:34	06:25 19:21	06:57 (3) 18:07	07:20 16	07:48 (5) 16:03	08:08 (4) 15:35	08:08 19	14:36 (1) 14:55 (1)
14	04:42 21:24	05:32 20:31	06:27 19:18	06:59 (3) 18:05	07:22 12	07:50 (5) 16:01	08:09 (4) 15:35	08:09 19	14:36 (1) 14:55 (1)
15	04:43 21:23	05:33 20:29	06:29 19:16	07:04 (3) 18:02	07:24 2	07:52 (5) 15:59	08:10 (4) 15:35	08:10 19	14:37 (1) 14:56 (1)
16	04:44 21:21	05:35 20:27	06:31 19:13	07:06 (3) 18:00	07:25 15	07:54 (5) 15:58	08:11 (4) 15:35	08:10 18	14:38 (1) 14:56 (1)
17	04:46 21:20	05:37 20:25	06:32 19:11	07:07 (3) 17:58	07:27 15	07:56 (5) 15:56	08:11 (4) 15:35	08:11 19	14:38 (1) 14:57 (1)
18	04:47 21:19	05:39 20:23	06:34 19:08	07:09 (3) 17:55	07:29 15	07:58 (5) 15:55	08:12 (4) 15:35	08:12 18	14:38 (1) 14:56 (1)
19	04:49 21:18	05:41 20:20	06:36 19:06	07:11 (3) 17:53	07:31 15	07:59 (5) 15:54	08:13 (4) 15:35	08:13 18	14:39 (1) 14:57 (1)
20	04:50 21:16	05:42 20:18	06:38 19:03	07:13 (3) 17:51	07:33 7	08:01 (4) 15:52	08:14 (4) 15:36	08:13 18	14:40 (1) 14:58 (1)
21	04:52 21:15	05:44 20:16	06:40 19:01	07:15 (3) 17:48	07:35 15	08:03 (4) 15:51	08:15 (4) 15:36	08:14 18	14:40 (1) 14:58 (1)
22	04:53 21:14	05:46 20:14	06:41 18:58	07:17 (3) 17:46	07:37 19	08:05 (4) 15:50	08:16 (4) 15:37	08:15 18	14:41 (1) 14:59 (1)
23	04:55 21:12	05:48 20:11	06:43 18:56	07:19 (3) 17:44	07:39 21	08:07 (4) 15:48	08:17 (4) 15:37	08:15 18	14:41 (1) 14:59 (1)
24	04:56 21:11	05:50 20:09	06:45 18:53	07:21 (3) 17:42	07:41 24	08:09 (4) 15:47	08:18 (4) 15:38	08:16 18	14:41 (1) 14:59 (1)
25	04:58 21:09	05:51 20:07	06:47 18:51	07:23 (3) 17:40	07:43 26	08:11 (4) 15:46	08:19 (4) 15:38	08:17 18	14:42 (1) 15:00 (1)
26	04:59 21:07	05:53 20:04	06:49 18:48	07:25 (3) 17:37	07:45 27	08:13 (4) 15:45	08:20 (4) 15:39	08:18 19	14:42 (1) 15:01 (1)
27	05:01 21:06	05:55 20:02	06:50 18:46	07:27 (3) 17:35	07:47 28	08:15 (4) 15:44	08:21 (4) 15:40	08:16 19	14:42 (1) 15:01 (1)
28	05:02 21:04	05:57 20:00	06:52 18:43	07:29 (3) 17:33	07:49 29	08:17 (4) 15:43	08:22 (4) 15:41	08:17 18	14:43 (1) 15:01 (1)
29	05:04 21:03	05:58 19:57	06:54 18:41	07:31 (3) 17:31	07:51 29	08:19 (4) 15:42	08:23 (4) 15:41	08:17 19	14:43 (1) 15:02 (1)
30	05:06 21:01	06:00 19:55	06:56 18:38	07:33 (3) 17:29	07:53 29	08:21 (4) 15:41	08:24 (4) 15:42	08:17 19	14:44 (1) 15:03 (1)
31	05:07 20:59	06:02 19:53	07:05 (3) 07:14 (3)	06:54 17:27	07:48 (4) 29	08:23 (4) 15:41	08:25 (4) 15:43	08:17 19	14:44 (1) 15:03 (1)
Potential sun hours	513	460	382	328	258	232			
Total, worst case		9	360	428	271	567			
Sun reduction		0,49	0,37	0,32	0,17	0,14			
Oper. time red.		0,97	0,97	0,97	0,97	0,97			
Wind dir. red.		0,65	0,64	0,59	0,61	0,69			
Total reduction		0,32	0,23	0,18	0,10	0,10			
Total, real		3	84	79	28	55			

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:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 8

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: C - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0° (3)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:17 15:44	07:48 16:35	06:48 17:33	06:33 19:32	05:23 20:28	04:33 21:18	04:29 21:33	05:09 20:57	06:04 19:50	06:58 18:36	06:56 16:25	07:52 15:40
2	08:17 15:45	07:46 16:37	06:46 17:35	06:30 19:34	05:21 20:30	04:32 21:19	04:30 21:33	05:11 20:56	06:06 19:48	07:00 18:34	06:58 16:23	07:53 15:40
3	08:17 15:46	07:44 16:39	06:43 17:37	06:28 19:36	05:19 20:31	04:31 21:21	04:30 21:32	05:13 20:54	06:08 19:45	07:01 18:31	07:00 16:21	07:55 15:39
4	08:16 15:47	07:43 16:41	06:41 17:39	06:25 19:37	05:17 20:33	04:30 21:22	04:31 21:32	05:14 20:52	06:09 19:43	07:03 18:29	07:02 16:19	07:56 15:38
5	08:16 15:49	07:41 16:43	06:39 17:41	06:23 19:39	05:15 20:35	04:30 21:23	04:32 21:31	05:16 20:50	06:11 19:41	07:05 18:26	07:04 16:17	07:58 15:38
6	08:16 15:50	07:39 16:45	06:36 17:43	06:20 19:41	05:13 20:37	04:29 21:24	04:33 21:31	05:18 20:48	06:13 19:38	07:07 18:24	07:06 16:15	07:59 15:37
7	08:15 15:51	07:37 16:47	06:34 17:45	06:18 19:43	05:11 20:39	04:28 21:25	04:34 21:30	05:20 20:46	06:15 19:36	07:09 18:21	07:08 16:13	08:01 15:36
8	08:15 15:52	07:35 16:49	06:32 17:47	06:15 19:45	05:09 20:40	04:27 21:26	04:35 21:29	05:21 20:44	06:16 19:33	07:11 18:19	07:10 16:12	08:02 15:36
9	08:14 15:54	07:33 16:51	06:29 17:48	06:13 19:47	05:07 20:42	04:27 21:27	04:36 21:28	05:23 20:42	06:18 19:31	07:12 18:17	07:12 16:10	08:03 15:36
10	08:14 15:55	07:31 16:53	06:27 17:50	06:11 19:49	05:05 20:44	04:26 21:28	04:37 21:28	05:25 20:40	06:20 19:28	07:14 18:14	07:14 16:08	08:04 15:35
11	08:13 15:57	07:29 16:55	06:24 17:52	06:08 19:51	05:03 20:46	04:26 21:28	04:38 21:27	05:27 20:38	06:22 19:26	07:16 18:12	07:16 16:06	08:05 15:35
12	08:12 15:58	07:27 16:57	06:22 17:54	06:06 19:52	05:01 20:48	04:26 21:29	04:40 21:26	05:28 20:36	06:24 19:23	07:18 18:09	07:18 16:05	08:07 15:35
13	08:12 16:00	07:25 16:59	06:19 17:56	06:03 19:54	05:00 20:49	04:25 21:30	04:41 21:25	05:30 20:34	06:25 19:21	07:20 18:07	07:20 16:03	08:08 15:35
14	08:11 16:02	07:23 17:01	06:17 17:58	06:01 19:56	04:58 20:51	04:25 21:31	04:42 21:24	05:32 20:32	06:27 19:18	07:22 18:05	07:22 16:01	08:09 15:35
15	08:10 16:03	07:21 17:03	06:15 18:00	05:59 19:58	04:56 20:53	04:25 21:31	04:43 21:23	05:34 20:29	06:29 19:16	07:24 18:02	07:24 16:00	08:10 15:35
16	08:09 16:05	07:19 17:05	06:12 18:02	05:56 20:00	04:54 20:54	04:25 21:32	04:45 21:21	05:35 20:27	06:31 19:13	07:26 18:00	07:26 15:58	08:11 15:35
17	08:08 16:07	07:17 17:07	06:10 18:04	05:54 20:02	04:53 20:56	04:24 21:32	04:46 21:20	05:37 20:25	06:33 19:11	07:27 17:58	07:27 15:57	08:11 15:35
18	08:07 16:08	07:15 17:09	06:07 18:06	05:52 20:04	04:51 20:58	04:24 21:33	04:47 21:19	05:39 20:23	06:34 19:08	07:29 17:55	07:29 15:55	08:12 15:35
19	08:06 16:10	07:13 17:11	06:05 18:07	05:49 20:05	04:50 20:59	04:24 21:33	04:49 21:18	05:41 20:21	06:36 19:06	07:31 17:53	07:31 15:54	08:13 15:36
20	08:05 16:12	07:11 17:13	06:02 18:09	05:47 20:07	04:48 21:01	04:24 21:33	04:50 21:16	05:43 20:18	06:38 19:03	07:33 17:51	07:33 15:52	08:14 15:36
21	08:04 16:14	07:09 17:15	06:00 18:11	05:45 20:09	04:47 21:03	04:25 21:34	04:52 21:15	05:44 20:16	06:40 19:01	07:35 17:49	07:35 15:51	08:14 15:36
22	08:02 16:15	07:06 17:17	05:57 18:13	05:43 20:11	04:45 21:04	04:25 21:34	04:53 21:14	05:46 20:14	06:41 18:58	07:37 17:46	07:37 15:50	08:15 15:37
23	08:01 16:17	07:04 17:19	05:55 18:15	05:40 20:13	04:44 21:06	04:25 21:34	04:55 21:12	05:48 20:12	06:43 18:56	07:39 17:44	07:38 15:48	08:15 15:37
24	08:00 16:19	07:02 17:21	05:52 18:17	05:38 20:15	04:42 21:07	04:25 21:34	04:56 21:11	05:50 20:09	06:45 18:53	07:41 17:42	07:40 15:47	08:16 15:38
25	07:58 16:21	07:00 17:23	06:50 19:19	05:36 20:17	04:41 21:09	04:26 21:34	04:58 21:09	05:52 20:07	06:47 18:51	07:43 17:40	07:42 15:46	08:16 15:39
26	07:57 16:23	06:57 17:25	06:47 19:21	05:34 20:19	04:40 21:10	04:26 21:34	04:59 21:08	05:53 20:05	06:49 18:48	07:45 17:38	07:44 15:45	08:16 15:39
27	07:56 16:25	06:55 17:27	06:45 19:23	05:31 20:20	04:38 21:12	04:27 21:34	05:01 21:06	05:55 20:02	06:50 18:46	07:47 17:35	07:45 15:44	08:17 15:40
28	07:54 16:27	06:53 17:29	06:42 19:24	05:29 20:22	04:37 21:13	04:27 21:34	05:03 21:04	05:57 20:00	06:52 18:44	06:49 16:33	07:47 15:43	08:17 15:41
29	07:53 16:29	06:50 17:31	06:40 19:26	05:27 20:24	04:36 21:14	04:28 21:34	05:04 21:03	05:59 19:57	06:54 18:41	06:51 16:31	07:49 15:42	08:17 15:42
30	07:51 16:31		06:38 19:28	05:25 20:26	04:35 21:16	04:28 21:33	05:06 21:01	06:00 19:55	06:56 18:39	06:53 16:29	07:50 15:41	08:17 15:43
31	07:49 16:33		06:35 19:30		04:34 21:17		05:08 20:59	06:02 19:53		06:55 16:27		08:17 15:44
Potential sun hours	248	281	367	420	495	511	513	460	382	328	258	232
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:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 9

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: D - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0° (4)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:17 15:44	09:34 (21) 10:02 (21)	07:48 16:35	06:48 17:33	06:32 19:32	07:46 (8) 05:23
2	08:17 15:45	09:34 (21) 10:02 (21)	07:46 16:37	06:46 17:35	06:30 19:34	08:04 (8) 20:28
3	08:16 15:46	09:35 (21) 10:03 (21)	07:44 16:39	06:43 17:37	06:28 19:35	05:19 20:29
4	08:16 15:47	09:35 (21) 10:03 (21)	07:42 16:41	06:41 17:39	06:25 19:37	05:17 20:33
5	08:16 15:48	09:36 (21) 10:03 (21)	07:41 16:43	06:39 17:41	07:04 (10) 19:39	05:15 20:35
6	08:16 15:50	09:37 (21) 10:03 (21)	07:39 16:45	06:36 17:43	07:02 (10) 19:41	05:13 20:37
7	08:15 15:51	09:38 (21) 10:04 (21)	07:37 16:47	06:34 17:44	07:00 (10) 19:43	05:11 20:38
8	08:15 15:52	09:38 (21) 10:03 (21)	07:35 16:49	06:31 17:46	06:57 (10) 19:45	05:09 20:40
9	08:14 15:54	09:39 (21) 10:03 (21)	07:33 16:51	06:29 17:48	06:55 (10) 19:47	05:07 20:42
10	08:14 15:55	09:41 (21) 10:04 (21)	07:31 16:53	06:27 17:50	06:53 (10) 19:49	05:05 20:44
11	08:13 15:57	09:41 (21) 10:04 (21)	07:29 16:55	06:24 17:52	06:53 (10) 19:50	05:03 20:46
12	08:12 15:58	09:42 (21) 10:03 (21)	07:27 16:57	06:22 17:54	06:53 (10) 19:52	05:01 20:47
13	08:11 16:00	09:43 (21) 10:03 (21)	07:25 16:59	06:19 17:56	06:54 (8) 19:54	05:00 20:49
14	08:11 16:01	09:45 (21) 10:02 (21)	07:23 17:01	06:17 17:58	06:50 (8) 19:56	04:58 20:51
15	08:10 16:03	09:46 (21) 10:01 (21)	07:21 17:03	06:14 18:00	06:49 (8) 19:58	04:56 20:53
16	08:09 16:05	09:47 (21) 09:59 (21)	07:19 17:05	06:12 18:02	06:46 (8) 18:04	05:56 20:54
17	08:08 16:06	09:50 (21) 09:57 (21)	07:17 17:07	06:09 18:04	06:45 (8) 18:06	05:54 20:56
18	08:07 16:08	07:15 17:09	06:07 18:05	06:44 (8) 18:07	05:52 20:03	04:51 20:58
19	08:06 16:10	07:13 17:11	06:05 18:07	06:43 (8) 18:09	05:49 20:05	04:50 20:59
20	08:05 16:12	07:11 17:13	06:02 18:09	06:42 (8) 18:11	05:47 20:07	04:48 21:01
21	08:03 16:14	07:08 17:15	06:00 18:11	06:42 (8) 18:13	05:45 20:09	04:47 21:02
22	08:02 16:15	07:06 17:17	05:57 18:13	06:41 (8) 18:15	05:42 20:11	04:45 21:04
23	08:01 16:17	07:04 17:19	05:55 18:15	06:41 (8) 18:17	05:40 20:13	04:44 21:05
24	08:00 16:19	07:02 17:21	05:52 18:17	06:40 (8) 18:19	05:38 20:15	04:42 21:07
25	07:58 16:21	06:59 17:23	06:50 19:19	07:41 (8) 18:15 (8)	05:36 20:16	04:41 21:08
26	07:57 16:23	06:57 17:25	06:47 19:21	07:40 (8) 18:13 (8)	05:34 20:18	04:40 21:10
27	07:55 16:25	06:55 17:27	06:45 19:22	07:41 (8) 18:13 (8)	05:31 20:20	04:38 21:11
28	07:54 16:27	06:53 17:29	06:42 19:24	07:41 (8) 18:11 (8)	05:29 20:22	04:37 21:13
29	07:52 16:29	06:50 17:31	06:40 19:26	07:42 (8) 18:10 (8)	05:27 20:24	04:36 21:14
30	07:51 16:31	06:48 17:33	06:37 19:28	07:42 (8) 18:08 (8)	05:25 20:26	04:35 21:15
31	07:49 16:33	06:46 17:35	06:35 19:30	07:44 (8) 18:06 (8)	05:23 20:28	04:34 21:17
Potential sun hours	248	281	367	420	495	511
Total, worst case	378		652	241	666	
Sun reduction	0,17		0,30	0,40	0,49	
Oper. time red.	0,97		0,97	0,97	0,97	
Wind dir. red.	0,60		0,62	0,66	0,67	
Total reduction	0,09		0,18	0,25	0,31	
Total, real	36		114	60	209	

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:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 10

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Calculated:

2012-03-13 22:15/2.7.490

## SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: D - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0° (4)

### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	04:29 21:33	05:09 20:57	06:17 (7) 19:50	06:58 18:36	07:33 (10) 16:25	07:52 15:40
2	04:30 21:33	05:11 20:55	06:16 (7) 19:48	06:59 18:34	07:31 (10) 16:23	07:53 15:39
3	04:30 21:32	05:13 20:54	06:16 (7) 19:45	07:01 18:31	07:31 (10) 16:21	07:55 15:39
4	04:31 21:32	05:14 20:52	06:15 (7) 19:43	07:03 18:29	07:31 (10) 16:19	07:56 15:38
5	04:32 21:31	05:16 20:50	06:15 (7) 19:40	07:05 18:26	07:33 (10) 16:17	07:58 15:37
6	04:33 21:30	05:18 20:48	06:15 (7) 19:38	07:07 18:24	07:35 (10) 16:15	07:59 15:37
7	04:34 21:30	05:19 20:46	06:14 (7) 19:36	07:09 18:21	07:37 (10) 16:13	08:00 15:36
8	04:35 21:29	05:21 20:44	06:15 (7) 19:33	07:10 18:19	07:39 (10) 16:11	08:02 15:36
9	04:36 21:28	05:23 20:42	06:14 (7) 19:31	07:12 18:16	07:42 (10) 16:10	08:03 15:36
10	04:37 21:27	05:25 20:40	06:15 (7) 19:28	07:14 18:14	07:14 16:08	08:04 15:35
11	04:38 21:26	05:26 20:38	06:15 (7) 19:26	07:16 18:12	07:16 16:06	08:05 15:35
12	04:40 21:26	05:28 20:36	06:15 (7) 19:23	07:18 18:09	07:18 16:04	08:06 15:35
13	04:41 21:25	05:30 20:34	06:15 (7) 19:21	07:20 18:07	07:20 16:03	08:07 15:35
14	04:42 21:24	05:32 20:31	06:16 (7) 19:18	07:22 18:05	07:22 16:01	08:08 15:35
15	04:43 21:22	05:34 20:29	06:16 (7) 19:16	07:24 18:02	07:24 16:00	08:09 15:35
16	04:45 21:21	05:35 20:27	06:17 (7) 19:13	07:25 18:00	07:25 15:58	08:10 15:35
17	04:46 21:20	05:37 20:25	06:19 (7) 19:11	07:27 17:58	07:27 15:57	08:11 15:35
18	04:47 21:19	05:39 20:23	06:20 (7) 19:08	07:28 (8) 17:55	07:29 15:55	08:12 15:35
19	04:49 21:18	05:41 20:20	06:22 (7) 19:06	07:28 (8) 17:53	07:31 15:54	08:13 15:35
20	04:50 21:16	05:42 (7) 20:18	06:25 (7) 19:03	07:28 (8) 17:51	07:33 15:52	08:13 15:36
21	04:52 21:15	05:44 (7) 20:16	06:25 (7) 19:01	07:26 (8) 17:48	07:35 15:51	08:14 15:36
22	04:53 21:13	05:46 (7) 20:14	06:25 (7) 18:58	07:26 (8) 17:46	07:36 15:50	08:15 15:37
23	04:55 21:12	05:48 (7) 20:11	06:23 (7) 18:56	07:26 (8) 17:44	07:38 15:48	08:15 15:37
24	04:56 21:11	05:50 (7) 20:09	06:22 (7) 18:53	07:27 (8) 17:42	07:40 15:47	08:15 15:38
25	04:58 21:09	05:51 (7) 20:07	06:21 (7) 18:51	07:27 (8) 17:40	07:42 15:46	08:16 15:38
26	04:59 21:07	05:53 (7) 20:04	06:20 (7) 18:48	07:27 (8) 17:37	07:44 15:45	08:16 15:39
27	05:01 21:06	05:55 (7) 20:02	06:19 (7) 18:46	07:28 (8) 17:35	07:45 15:44	08:16 15:40
28	05:03 21:04	05:57 (7) 20:00	06:18 (7) 18:43	07:29 (8) 17:33	07:47 15:43	08:16 15:41
29	05:04 21:02	05:59 (7) 19:57	06:18 (7) 18:41	07:30 (8) 17:31	07:48 15:42	08:17 15:42
30	05:06 21:01	06:00 (7) 19:55	06:18 (7) 18:38	07:32 (8) 17:29	07:50 15:41	08:17 15:43
31	05:07 20:59	06:02 (7) 19:53	06:17 (7) 18:36	07:34 (8) 17:27	07:52 15:40	08:17 15:44
Potential sun hours	513	460	382	328	258	232
Total, worst case	271	616	599	94	71	854
Sun reduction	0,45	0,49	0,37	0,32	0,17	0,14
Oper. time red.	0,97	0,97	0,97	0,97	0,97	0,97
Wind dir. red.	0,67	0,67	0,62	0,60	0,60	0,60
Total reduction	0,29	0,32	0,22	0,18	0,10	0,08
Total, real	77	194	131	17	7	70

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:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 11

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: E - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(5)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	January	February	March	April	May	June	July	August	September	October	November	December		
1	08:16	07:47	06:48	06:32	05:23	04:33	04:29	05:09	06:04	06:57	06:56	07:51		
	15:44	16:35	17:33	19:32	20:27	21:18	21:33	20:57	19:50	18:36	16:25	15:40		
2	08:16	07:46	06:46	06:30	05:21	04:32	04:30	05:11	06:06	06:59	06:58	07:53		
	15:45	16:37	17:35	19:33	20:29	21:19	21:32	20:55	19:48	18:33	16:23	15:39		
3	08:16	07:44	06:43	06:27	05:19	04:31	04:30	05:12	06:07	07:01	07:00	07:55		
	15:46	16:39	17:37	19:35	20:31	21:20	21:32	20:53	19:45	18:31	16:21	15:39		
4	08:16	07:42	06:41	06:25	05:17	04:30	04:31	05:14	06:09	07:03	07:02	07:56		
	15:47	16:41	17:39	19:37	20:33	21:21	21:31	20:51	19:43	18:28	16:19	15:38		
5	08:16	07:40	06:38	06:23	05:15	04:29	04:32	05:16	06:11	07:05	07:04	07:57		
	15:48	16:43	17:40	19:39	20:35	21:22	21:31	20:50	19:40	18:26	16:17	15:37		
6	08:15	07:39	06:36	06:20	05:13	04:29	04:33	05:18	06:13	07:07	07:06	07:59		
	15:50	16:45	17:42	19:41	20:37	21:24	21:30	20:48	19:38	18:24	16:15	15:37		
7	08:15	07:37	06:34	06:18	05:11	04:28	04:34	05:19	06:14	07:08	07:08	08:00		
	15:51	16:47	17:44	19:43	20:38	21:25	21:30	20:46	19:35	18:21	16:13	15:36		
8	08:15	07:35	06:31	06:15	05:09	04:27	04:35	05:21	06:16	07:10	07:10	08:01		
	15:52	16:49	17:46	19:45	20:40	21:25	21:29	20:44	19:33	18:19	16:11	15:36		
9	08:14	07:33	06:29	06:13	05:07	04:27	04:36	05:23	06:18	07:12	07:12	08:03		
	15:54	16:51	17:48	19:47	20:42	21:26	21:28	20:42	19:30	18:16	16:10	15:36		
10	08:13	07:31	06:26	06:10	05:05	04:26	04:37	05:25	06:20	07:14	07:14	08:04		
	15:55	16:53	17:50	19:48	20:44	21:27	21:27	20:40	19:28	18:14	16:08	15:35		
11	08:13	07:29	06:24	06:08	05:03	04:26	04:38	05:26	06:22	07:16	07:16	08:05		
	15:57	16:55	17:52	19:50	20:45	21:28	21:26	20:38	19:26	18:12	16:06	15:35		
12	08:12	07:27	06:22	06:06	05:01	04:25	04:39	05:28	19:47 (21)	06:23	07:18	08:06		
	15:58	16:57	17:54	19:52	20:47	21:29	21:25	20:35	5	19:52 (21)	18:09	16:04	15:35	
13	08:11	07:25	06:19	06:03	04:59	04:25	04:41	05:30	19:45 (21)	06:25	07:20	08:07		
	16:00	16:59	17:56	19:54	20:49	21:30	21:24	20:33	10	19:55 (21)	18:07	16:03	15:35	
14	08:10	07:23	06:17	06:01	04:58	04:25	04:42	05:32	19:44 (21)	06:27	07:21	08:08		
	16:01	17:01	17:58	19:56	20:51	21:30	21:23	20:31	12	19:56 (21)	18:04	16:01	15:35	
15	08:10	07:21	06:14	05:59	04:56	04:25	04:43	05:33	19:42 (21)	06:29	07:23	08:09		
	16:03	17:03	18:00	19:58	20:52	21:31	21:22	20:29	14	19:56 (21)	18:02	16:00	15:35	
16	08:09	07:19	06:12	05:56	04:54	04:24	04:45	05:35	19:41 (21)	06:31	07:25	08:10		
	16:05	17:05	18:02	20:00	20:54	21:31	21:21	20:27	16	19:57 (21)	18:00	15:58	15:35	
17	08:08	07:17	06:09	05:54	04:53	04:24	04:46	05:37	19:41 (21)	06:32	07:27	08:11		
	16:06	17:07	18:03	20:01	20:56	21:32	21:20	20:25	16	19:57 (21)	18:00	15:58	15:35	
18	08:07	07:15	06:07	05:52	04:51	04:24	04:47	05:39	19:40 (21)	06:34	07:29	08:12		
	16:08	17:09	18:05	20:03	20:57	21:32	21:19	20:23	14	19:54 (21)	18:08	15:55	15:35	
19	08:06	07:13	06:04	05:49	04:49	04:24	04:49	05:41	19:40 (21)	06:36	07:31	08:12		
	16:10	17:11	18:07	20:05	20:59	21:33	21:17	20:20	12	19:52 (21)	18:06	15:54	15:35	
20	08:04	07:10	06:02	05:47	19:38 (21)	04:48	04:24	05:42	19:41 (21)	06:38	07:33	08:13		
	16:12	17:13	18:09	20:07	2	19:40 (21)	21:01	21:33	10	19:51 (21)	18:03	15:52	15:36	
21	08:03	07:08	05:59	05:45	19:37 (21)	04:46	04:24	05:44	19:40 (21)	06:39	07:35	08:14		
	16:13	17:15	18:11	20:09	5	19:42 (21)	21:02	21:33	8	19:48 (21)	18:01	15:51	15:36	
22	08:02	07:06	05:57	05:42	19:36 (21)	04:45	04:25	05:43	19:42 (21)	06:41	07:37	08:14		
	16:15	17:17	18:13	20:11	8	19:44 (21)	21:04	21:33	4	19:46 (21)	18:58	17:46	15:50	15:37
23	08:01	07:04	05:55	05:40	19:35 (21)	04:44	04:25	05:45	19:43 (21)	06:43	07:39	08:15		
	16:17	17:19	18:15	20:13	11	19:46 (21)	21:05	21:34	2	19:44 (21)	18:56	17:44	15:48	15:37
24	07:59	07:02	05:52	05:38	19:34 (21)	04:42	04:25	05:46	19:43 (21)	06:45	07:41	08:15		
	16:19	17:21	18:17	20:14	13	19:47 (21)	21:07	21:34	20:09	18:53	17:42	15:47	15:38	
25	07:58	06:59	06:50	05:36	19:34 (21)	04:41	04:26	05:48	05:51	06:47	07:43	08:16		
	16:21	17:23	18:19	20:16	14	19:48 (21)	21:08	21:34	20:07	18:51	17:40	15:46	15:38	
26	07:57	06:57	06:47	05:33	19:34 (21)	04:40	04:26	05:49	05:53	06:48	07:44	08:16		
	16:23	17:25	18:20	20:18	16	19:50 (21)	21:10	21:34	21:07	18:48	17:37	15:45	15:39	
27	07:55	06:55	06:45	05:31	19:34 (21)	04:38	04:26	05:01	05:55	06:50	07:46	08:16		
	16:25	17:27	18:22	20:20	15	19:49 (21)	21:11	21:34	21:06	18:46	17:35	15:44	15:40	
28	07:54	06:52	06:42	05:29	19:35 (21)	04:37	04:27	05:02	05:57	06:52	07:48	08:16		
	16:27	17:29	18:24	20:22	13	19:48 (21)	21:13	21:33	21:04	18:43	17:33	15:43	15:41	
29	07:52	06:50	06:40	05:27	19:36 (21)	04:36	04:28	05:04	05:58	06:54	07:50	08:16		
	16:29	17:31	18:26	20:24	11	19:47 (21)	21:14	21:33	21:02	18:41	17:31	15:42	15:42	
30	07:51		06:37	05:25	19:38 (21)	04:35	04:28	05:06	06:00	06:56	07:50	08:16		
	16:31		18:28	20:26	8	19:46 (21)	21:15	21:33	21:01	19:55	18:38	17:29	15:43	
31	07:49		06:35			04:34		05:07		06:54		08:16		
	16:33		19:30			21:17		20:59		19:52		16:27	15:44	
Potential sun hours	248	282	367	420	495	511	513	460	382	328	258	232		
Total, worst case				116				123						
Sun reduction				0,40				0,49						
Oper. time red.				0,97				0,97						
Wind dir. red.				0,60				0,60						
Total reduction				0,23				0,29						
Total, real				27				35						

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:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 12

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Calculated:

2012-03-13 22:15/2.7.490

## SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: F - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(6)

### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:16 15:44	09:07 (17) 09:30 (17)	07:47 16:35	06:48 17:33	06:32 19:32	05:23 20:27
2	08:16 15:45	09:07 (17) 09:30 (17)	07:46 16:37	06:46 17:35	06:30 19:33	05:21 20:29
3	08:16 15:46	09:08 (17) 09:31 (17)	07:44 16:39	06:43 17:37	06:28 19:35	05:19 20:31
4	08:16 15:47	09:08 (17) 09:31 (17)	07:42 16:41	06:41 17:39	06:25 19:37	05:17 20:33
5	08:16 15:49	09:09 (17) 09:32 (17)	07:40 16:43	06:38 17:41	06:23 19:39	05:15 20:35
6	08:15 15:50	09:09 (17) 09:32 (17)	07:39 16:45	06:36 17:42	06:20 19:41	05:13 20:37
7	08:15 15:51	09:10 (17) 09:33 (17)	07:37 16:47	06:34 17:44	06:18 19:43	05:11 20:38
8	08:14 15:52	09:10 (17) 09:33 (17)	07:35 16:49	06:31 17:46	06:15 19:45	05:09 20:40
9	08:14 15:54	09:10 (17) 09:33 (17)	07:33 16:51	06:29 17:48	06:13 19:47	05:07 20:42
10	08:13 15:55	09:10 (17) 09:33 (17)	07:31 16:53	06:26 17:50	06:11 19:48	05:05 20:44
11	08:13 15:57	09:11 (17) 09:33 (17)	07:29 16:55	06:24 17:52	06:08 19:50	05:03 20:45
12	08:12 15:58	09:11 (17) 09:33 (17)	07:27 16:57	06:22 17:54	06:06 19:52	05:01 20:47
13	08:11 16:00	09:13 (17) 09:34 (17)	07:25 16:59	06:19 17:56	06:03 19:54	05:00 20:49
14	08:10 16:02	09:13 (17) 09:34 (17)	07:23 17:01	06:17 17:58	06:01 19:56	04:58 20:51
15	08:10 16:03	09:14 (17) 09:34 (17)	07:21 17:03	06:14 18:00	05:59 19:58	04:56 20:52
16	08:09 16:05	09:14 (17) 09:34 (17)	07:19 17:05	06:12 18:02	05:56 19:59	04:54 20:54
17	08:08 16:07	09:16 (17) 09:34 (17)	07:17 17:07	06:09 18:04	05:54 20:01	04:53 20:56
18	08:07 16:08	09:17 (17) 09:33 (17)	07:15 17:09	06:07 18:05	05:52 20:03	04:51 20:57
19	08:06 16:10	09:18 (17) 09:32 (17)	07:13 17:11	06:04 18:07	05:49 20:05	04:50 20:59
20	08:04 16:12	09:19 (17) 09:31 (17)	07:10 17:13	06:02 18:09	05:47 20:07	04:48 21:01
21	08:03 16:14	09:22 (17) 09:30 (17)	07:08 17:15	06:00 18:11	05:45 20:09	04:47 21:02
22	08:02 16:15	09:22 (17) 17:17	07:06 18:13	05:57 20:11	05:42 20:11	04:45 21:04
23	08:01 16:17	07:04 17:19	05:55 18:15	05:40 20:13	05:30 20:13	04:44 21:05
24	07:59 16:19	07:02 17:21	05:52 18:17	05:38 20:14	05:28 20:14	04:42 21:07
25	07:58 16:21	06:59 17:23	06:50 19:19	05:36 20:16	05:26 20:16	04:41 21:08
26	07:57 16:23	06:57 17:25	06:47 19:20	05:34 20:18	05:24 20:18	04:40 21:10
27	07:55 16:25	06:55 17:27	06:45 19:22	05:31 20:20	05:21 20:20	04:38 21:11
28	07:54 16:27	06:53 17:29	06:42 19:24	05:29 20:22	05:19 20:22	04:37 21:13
29	07:52 16:29	06:50 17:31	06:40 19:26	05:27 20:24	05:17 20:24	04:36 21:14
30	07:51 16:31	06:37 17:31	06:37 19:28	05:25 20:26	05:15 20:26	04:35 21:15
31	07:49 16:33	06:35 19:30	06:35 19:30	05:23 20:28	05:13 20:28	04:34 21:17
Potential sun hours	248	282	367	420	495	511
Total, worst case	424		317	442	9	
Sun reduction	0,17		0,30	0,40	0,49	
Oper. time red.	0,97		0,97	0,97	0,97	
Wind dir. red.	0,59		0,62	0,66	0,66	
Total reduction	0,09		0,18	0,25	0,31	
Total, real	39		56	110	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	(WTG causing flicker first time)
	Sun set (hh:mm)		Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 13

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Bartosz Długokęcki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: F - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0° (6)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	04:29 21:33	05:09 20:57	06:04 19:50	06:58 18:36	06:56 16:25	07:51 15:40 22 09:16 (17)
2	04:30 21:32	05:11 20:55	06:06 19:48	06:59 18:33	06:58 16:23	07:53 15:39 22 09:16 (17)
3	04:31 21:32	05:13 20:53	06:07 19:45	07:01 18:31	07:00 16:21	07:54 15:39 23 09:17 (17)
4	04:31 21:31	05:14 20:51	06:09 19:43	07:03 18:29	07:02 16:19	07:56 15:38 23 09:17 (17)
5	04:32 21:31	05:16 20:50	06:11 19:40	07:05 18:26	07:04 16:17	07:57 15:38 23 09:18 (17)
6	04:33 21:30	05:18 20:48	06:13 19:38	07:07 18:24	07:06 16:15	07:59 15:37 23 09:18 (17)
7	04:34 21:29	05:19 20:46	06:15 19:35	07:08 18:21	07:08 16:13	08:00 15:36 23 09:19 (17)
8	04:35 21:29	05:21 20:44	06:16 19:33	07:10 18:19	07:10 16:12	08:01 15:36 23 09:19 (17)
9	04:36 21:28	05:23 20:42	06:18 19:31	07:12 18:16	07:12 16:10	08:03 15:36 23 09:20 (17)
10	04:37 21:27	05:25 20:40	06:20 19:28	07:14 18:14	07:14 16:08	08:04 15:35 23 09:20 (17)
11	04:38 21:26	05:26 20:38	06:22 19:26	07:16 18:12	07:16 16:06	08:05 15:35 23 09:20 (17)
12	04:40 21:25	05:28 20:35	06:23 19:23	07:18 18:09	07:18 16:05	08:06 15:35 23 09:21 (17)
13	04:41 21:24	05:30 20:33	06:25 19:21	07:20 18:07	07:19 16:03	08:07 15:35 23 09:21 (17)
14	04:42 21:23	05:32 20:31	06:27 19:18	07:22 18:05	07:21 16:01	08:08 15:35 22 09:21 (17)
15	04:43 21:22	05:34 20:29	06:29 19:16	07:23 18:02	07:23 16:00	08:09 15:35 23 09:22 (17)
16	04:45 21:21	05:35 20:27	06:31 19:13	07:25 18:00	07:25 15:58	08:10 15:35 22 09:22 (17)
17	04:46 21:20	05:37 20:25	06:32 19:11	07:27 17:58	07:27 15:57	08:11 15:35 23 09:23 (17)
18	04:47 21:19	05:39 20:23	06:34 19:08	07:29 17:55	07:29 15:55	08:12 15:35 22 09:23 (17)
19	04:49 21:17	05:41 20:20	06:36 19:06	07:26 17:53	07:31 15:54	08:12 15:36 22 09:24 (17)
20	04:50 21:16	05:42 20:18	06:38 19:03	07:25 17:51	07:33 15:52	08:13 15:36 22 09:24 (17)
21	04:52 21:15	05:44 20:16	06:40 19:01	07:23 17:48	07:35 15:51	08:14 15:36 22 09:25 (17)
22	04:53 21:13	05:46 20:14	06:41 18:58	07:23 17:46	07:37 15:50	08:14 15:37 22 09:25 (17)
23	04:55 21:12	05:48 20:11	06:43 18:56	07:23 17:44	07:38 15:48	08:15 15:37 22 09:26 (17)
24	04:56 21:10	05:50 20:09	06:45 18:53	07:23 17:42	07:40 15:47	08:15 15:38 22 09:26 (17)
25	04:58 21:09	05:51 20:07	06:47 18:51	07:23 17:40	07:42 15:46	08:16 15:39 22 09:27 (17)
26	04:59 21:07	05:53 20:04	06:48 18:48	07:23 17:37	07:44 15:45	08:16 15:39 23 09:27 (17)
27	05:01 21:06	05:55 20:02	06:50 18:46	07:24 17:35	07:45 15:44	08:16 15:40 22 09:28 (17)
28	05:03 21:04	05:57 20:00	06:52 18:43	07:25 17:33	07:47 15:43	08:16 15:41 22 09:28 (17)
29	05:04 21:02	05:59 19:57	06:54 18:41	07:26 17:31	07:48 15:42	08:16 15:42 23 09:29 (17)
30	05:06 21:01	06:00 19:55	06:56 18:38	07:29 17:29	07:50 15:41	08:16 15:43 23 09:29 (17)
31	05:08 20:59	06:02 19:52	06:59 18:36	07:31 17:27	07:52 15:40	08:16 15:44 23 09:29 (17)
Potential sun hours	513	460	382	328	258	232
Total, worst case		457	320		152	699
Sun reduction		0,49	0,37		0,17	0,14
Oper. time red.		0,97	0,97		0,97	0,97
Wind dir. red.		0,66	0,62		0,59	0,59
Total reduction		0,31	0,22		0,10	0,08
Total, real		142	70		15	56

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:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 14

Licensed user:

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: G - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slo pe: 90,0° (7)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:16 15:44	07:47 16:35	06:48 17:33	06:32 19:32	07:10 (15) 07:25 (15)	05:23 20:27
2	08:16 15:45	07:46 16:37	06:46 17:35	06:30 19:34	07:11 (15) 07:23 (15)	05:21 20:29
3	08:16 15:46	07:44 16:39	06:43 17:37	06:28 19:35	07:13 (15) 07:21 (15)	05:19 20:31
4	08:16 15:47	07:42 16:41	06:41 17:39	06:25 19:37	05:17 20:33	05:17 20:35
5	08:16 15:49	07:41 16:43	06:39 17:41	06:23 19:39	05:15 20:35	04:30 21:22
6	08:15 15:50	07:39 16:45	06:36 17:43	06:20 19:41	05:13 20:37	04:29 21:24
7	08:15 15:51	07:37 16:47	06:34 17:44	06:18 19:43	05:11 20:38	04:28 21:25
8	08:15 15:53	07:35 16:49	06:31 17:46	06:15 19:45	05:09 20:40	04:28 21:25
9	08:14 15:54	07:33 16:51	06:29 17:48	06:13 19:47	05:07 20:42	04:27 21:26
10	08:13 15:55	07:31 16:53	06:27 17:50	06:11 19:48	05:05 20:44	04:26 21:27
11	08:13 15:57	07:29 16:55	06:24 17:52	06:08 19:50	05:03 20:45	04:26 21:28
12	08:12 15:58	07:27 16:57	06:22 17:54	06:06 19:52	05:01 20:47	04:26 21:29
13	08:11 16:00	07:25 16:59	06:19 17:56	06:03 19:54	05:00 20:49	04:25 21:30
14	08:10 16:02	07:23 17:01	06:17 17:58	06:01 19:56	04:58 20:51	04:25 21:30
15	08:10 16:03	07:21 17:03	06:14 18:00	06:51 (16) 07:04 (16)	05:59 19:58	04:56 20:52
16	08:09 16:05	07:19 17:05	06:12 18:02	06:52 (16) 07:01 (16)	05:56 20:00	04:54 20:54
17	08:08 16:07	07:17 17:07	06:09 18:04	06:54 20:01	05:54 20:56	04:53 20:56
18	08:07 16:08	07:15 17:09	06:07 18:05	06:52 20:03	05:52 20:57	04:51 20:57
19	08:06 16:10	07:13 17:11	06:05 18:07	06:50 20:05	05:50 20:59	04:50 20:59
20	08:04 16:12	07:10 17:13	06:02 18:09	06:48 20:07	05:48 21:01	04:48 21:01
21	08:03 16:14	07:08 17:15	06:00 18:11	06:45 20:09	05:45 21:02	04:47 21:02
22	08:02 16:15	07:06 17:17	05:57 18:13	06:42 20:11	05:42 21:04	04:45 21:04
23	08:01 16:17	07:04 17:19	05:55 18:15	06:40 20:13	05:40 21:05	04:44 21:05
24	07:59 16:19	07:02 17:21	05:52 18:17	06:38 (15) 06:21 (15)	05:38 20:15	04:42 21:07
25	07:58 16:21	06:59 17:23	05:50 19:19	07:15 (15) 07:25 (15)	05:36 20:16	04:41 21:08
26	07:57 16:23	06:57 17:25	05:47 19:20	07:12 (15) 07:26 (15)	05:34 20:18	04:40 21:10
27	07:55 16:25	06:55 17:27	05:45 19:22	07:11 (15) 07:27 (15)	05:31 20:20	04:39 21:11
28	07:54 16:27	06:53 17:29	05:42 19:24	07:10 (15) 07:26 (15)	05:29 20:22	04:37 21:13
29	07:52 16:29	06:50 17:31	05:40 19:26	07:10 (15) 07:27 (15)	05:27 20:24	04:36 21:14
30	07:51 16:31		05:37 19:28	07:09 (15) 07:26 (15)	05:25 20:26	04:35 21:15
31	07:49 16:33		05:35 19:30	07:10 (15) 07:26 (15)	05:24 21:17	04:34 21:17
Potential sun hours	248	282	367	420	495	511
Total, worst case			224	187	314	117
Sun reduction			0,30	0,40	0,49	0,44
Oper. time red.			0,97	0,97	0,97	0,97
Wind dir. red.			0,63	0,67	0,69	0,70
Total reduction			0,18	0,25	0,33	0,30
Total, real			41	48	104	35

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:

Farma wiatrowa - Brojce

Printed/Page

2012-03-13 22:17 / 15

Licensed user:

Leanergia Bartosz Dlugokecki

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Bartosz Długokęcki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

## SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: G - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(7)

### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	04:29 05:34 (13) 05:09	06:04	06:58	07:29 (16) 06:56	07:51	
	21:33 2 05:35 (13) 20:57	19:50	18:36 16 07:45 (16) 16:25	15:40		
2	04:30 05:33 (13) 05:11	06:06	06:59 07:29 (16) 06:58	07:53		
	21:32 5 05:38 (13) 20:55	19:48	18:33 15 07:44 (16) 16:23	15:40		
3	04:31 05:32 (13) 05:13	06:07	07:01 07:29 (16) 07:00	07:55		
	21:32 7 05:39 (13) 20:53	19:45	18:31 15 07:44 (16) 16:21	15:39		
4	04:31 05:32 (13) 05:14	06:09	07:03 07:31 (16) 07:02	07:56		
	21:31 8 05:40 (13) 20:52	19:43	18:29 12 07:43 (16) 16:19	15:38		
5	04:32 05:31 (13) 05:16	06:11	07:05 07:33 (16) 07:04	07:57		
	21:31 9 05:40 (13) 20:50	19:40	18:26 8 07:41 (16) 16:17	15:38		
6	04:33 05:30 (13) 05:18	06:13	07:07 07:35 (16) 07:06	07:59		
	21:30 11 05:41 (13) 20:48	19:38	18:24 4 07:39 (16) 16:15	15:37		
7	04:34 05:30 (13) 05:19	06:15	07:09 18:21	07:08 16:13	08:00	
	21:30 12 05:42 (13) 20:46	19:35	18:21	16:13	15:37	
8	04:35 05:30 (13) 05:21	06:20 (14) 06:16	07:10	07:10 16:10	08:01	
	21:29 13 05:43 (13) 20:44	4 06:24 (14) 19:33	18:19	16:12	15:36	
9	04:36 05:29 (13) 05:23	06:16 (14) 06:18	07:06 (15) 07:12	07:12 16:12	08:03	
	21:28 14 05:43 (13) 20:42	10 06:26 (14) 19:31	9 07:15 (15) 18:16	16:10	15:36	
10	04:37 05:29 (13) 05:25	06:15 (14) 06:20	07:04 (15) 07:14	07:14 16:10	08:04	
	21:27 15 05:44 (13) 20:40	13 06:28 (14) 19:28	12 07:16 (15) 18:14	16:08	15:35	
11	04:38 05:29 (13) 05:26	06:14 (14) 06:22	07:02 (15) 07:16	07:16 16:06	08:05	
	21:26 15 05:44 (13) 20:38	15 06:29 (14) 19:26	15 07:17 (15) 18:12	16:06	15:35	
12	04:40 05:29 (13) 05:28	06:13 (14) 06:23	07:02 (15) 07:18	07:18 16:06	08:06	
	21:25 16 05:45 (13) 20:36	16 06:29 (14) 19:23	16 07:18 (15) 18:09	16:05	15:35	
13	04:41 05:28 (13) 05:30	06:12 (14) 06:25	07:00 (15) 07:20	07:20 16:05	08:07	
	21:24 17 05:45 (13) 20:33	18 06:30 (14) 19:21	17 07:17 (15) 18:07	16:03	15:35	
14	04:42 05:29 (13) 05:32	06:12 (14) 06:27	07:00 (15) 07:22	07:22 16:01	08:08	
	21:23 17 05:46 (13) 20:31	18 06:30 (14) 19:18	17 07:17 (15) 18:05	16:01	15:35	
15	04:43 05:29 (13) 05:34	06:11 (14) 06:29	07:00 (15) 07:23	07:23 16:00	08:09	
	21:22 18 05:47 (13) 20:29	19 06:30 (14) 19:16	17 07:17 (15) 18:02	16:00	15:35	
16	04:45 05:28 (13) 05:35	06:12 (14) 06:31	07:01 (15) 07:25	07:25 16:00	08:10	
	21:21 19 05:47 (13) 20:27	18 06:30 (14) 19:13	15 07:16 (15) 18:00	15:58	15:35	
17	04:46 05:28 (13) 05:37	06:12 (14) 06:32	07:00 (15) 07:27	07:27 16:00	08:11	
	21:20 19 05:47 (13) 20:25	18 06:30 (14) 19:11	14 07:14 (15) 17:58	15:57	15:35	
18	04:47 05:29 (13) 05:39	06:12 (14) 06:34	07:02 (15) 07:29	07:29 16:00	08:12	
	21:19 18 05:47 (13) 20:23	16 06:28 (14) 19:08	10 07:12 (15) 17:55	15:55	15:35	
19	04:49 05:29 (13) 05:41	06:12 (14) 06:36	07:05 (15) 07:31	07:31 16:00	08:12	
	21:17 18 05:47 (13) 20:20	16 06:28 (14) 19:06	4 07:09 (15) 17:53	15:54	15:36	
20	04:50 05:29 (13) 05:42	06:14 (14) 06:38	07:33	07:33 16:00	08:13	
	21:16 18 05:47 (13) 20:18	13 06:27 (14) 19:03	17 07:15 (15) 17:51	15:52	15:36	
21	04:52 05:29 (13) 05:44	06:14 (14) 06:40	07:35	07:35 16:00	08:14	
	21:15 18 05:47 (13) 20:16	10 06:24 (14) 19:01	17 07:14 (15) 17:48	15:51	15:36	
22	04:53 05:29 (13) 05:46	06:18 (14) 06:41	07:37	07:37 16:00	08:14	
	21:13 18 05:47 (13) 20:14	3 06:21 (14) 18:58	17 07:14 (15) 17:46	15:50	15:37	
23	04:55 05:29 (13) 05:48	06:43	07:39	07:39 16:00	08:15	
	21:12 17 05:46 (13) 20:11	18 06:45	17 07:14 (15) 17:44	15:48	15:37	
24	04:56 05:30 (13) 05:50	06:45	07:41	07:41 16:00	08:15	
	21:10 16 05:46 (13) 20:09	18 06:45	17 07:14 (15) 17:42	15:47	15:38	
25	04:58 05:31 (13) 05:51	06:47	07:43	07:43 16:00	08:16	
	21:09 14 05:45 (13) 20:07	18 06:47	17 07:14 (15) 17:40	15:46	15:39	
26	04:59 05:33 (13) 05:53	06:49	07:44	07:44 16:00	08:16	
	21:07 12 05:45 (13) 20:04	18 06:48	17 07:14 (15) 17:37	15:45	15:39	
27	05:01 05:34 (13) 05:55	06:50	07:34 (16) 07:46	07:45 16:00	08:16	
	21:06 9 05:43 (13) 20:02	18 06:46	8 07:42 (16) 17:35	15:44	15:40	
28	05:03 05:36 (13) 05:57	06:52	07:32 (16) 06:48	07:47 16:00	08:16	
	21:04 6 05:42 (13) 20:00	18 06:43	12 07:44 (16) 16:33	15:43	15:41	
29	05:04 05:39 (13) 05:59	06:54	07:31 (16) 06:50	07:48 16:00	08:16	
	21:02 19 05:47 (13) 20:00	18 06:41	14 07:45 (16) 16:31	15:42	15:42	
30	05:06 05:40 (13) 06:00	06:56	07:30 (16) 06:52	07:50 16:00	08:16	
	21:01 19 05:47 (13) 20:00	18 06:41	15 07:45 (16) 16:29	15:41	15:43	
31	05:08 05:42 (13) 06:02	06:54	07:31 (16) 06:54	07:51 16:00	08:16	
	20:59 19 05:42 (13) 20:00	18 06:41	16 07:45 (16) 16:27	15:40	15:44	
Potential sun hours	513	460	382	328	258	232
Total, worst case	381	207	195	70		
Sun reduction	0,45	0,49	0,37	0,32		
Oper. time red.	0,97	0,97	0,97	0,97		
Wind dir. red.	0,70	0,67	0,64	0,61		
Total reduction	0,30	0,32	0,23	0,19		
Total, real	115	66	45	13		

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:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 16

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: H - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(8)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:16 15:44	07:47 16:35	06:48 17:33	06:32 19:32	05:23 20:27	18:46 (17) 21:18
2	08:16 15:45	07:46 16:37	06:45 17:35	06:30 19:33	05:21 20:29	18:47 (17) 21:19
3	08:16 15:46	07:44 16:39	06:43 17:37	06:27 19:35	05:19 20:31	18:48 (17) 21:20
4	08:16 15:47	07:42 16:41	06:41 17:39	06:25 19:37	05:17 20:33	18:50 (17) 21:21
5	08:16 15:49	07:40 16:43	06:38 17:40	06:23 19:39	05:15 20:35	18:52 (17) 21:22
6	08:15 15:50	07:39 16:45	06:36 17:42	17:00 (19) 19:41	05:13 20:36	18:55 (17) 21:23
7	08:15 15:51	07:37 16:47	16:11 (20) 17:44	16:57 (19) 19:43	05:11 20:38	19:06 (17) 21:24
8	08:14 15:52	07:35 16:49	16:09 (20) 17:46	16:55 (19) 19:45	05:09 20:40	19:13 (17) 21:25
9	08:14 15:54	07:33 16:51	16:07 (20) 17:48	16:53 (19) 19:46	05:07 20:42	19:14 (17) 21:26
10	08:13 15:55	07:31 16:53	16:06 (20) 17:50	16:52 (19) 19:48	05:05 20:44	19:15 (17) 21:27
11	08:13 15:57	07:29 16:55	16:04 (20) 17:52	16:51 (19) 19:50	18:57 (17) 20:45	19:16 (17) 21:28
12	08:12 15:58	07:27 16:57	16:03 (20) 17:54	16:50 (19) 19:52	18:54 (17) 20:47	19:17 (17) 21:29
13	08:11 16:00	07:25 16:59	16:03 (20) 17:56	16:50 (19) 19:54	18:52 (17) 20:49	19:18 (17) 21:30
14	08:10 16:01	07:23 17:01	16:03 (20) 17:58	16:50 (19) 19:56	18:51 (17) 20:50	19:19 (17) 21:31
15	08:09 16:03	07:21 17:03	16:03 (20) 18:00	16:50 (19) 19:58	18:49 (17) 20:52	19:20 (17) 21:32
16	08:08 16:05	07:19 17:05	16:03 (20) 18:02	16:49 (19) 19:59	18:48 (17) 20:54	19:21 (17) 21:33
17	08:08 16:06	07:17 17:07	16:02 (20) 18:03	16:50 (19) 20:01	18:47 (17) 20:56	19:22 (17) 21:34
18	08:06 16:08	07:15 17:09	16:03 (20) 18:05	16:50 (19) 20:03	18:45 (17) 20:57	19:23 (17) 21:35
19	08:05 16:10	07:12 17:11	16:04 (20) 18:07	16:51 (19) 20:05	18:45 (17) 20:59	19:24 (17) 21:36
20	08:04 16:12	07:10 17:13	16:05 (20) 18:09	16:52 (19) 20:07	18:44 (17) 21:00	19:25 (17) 21:37
21	08:03 16:14	07:08 17:15	16:05 (20) 18:11	16:54 (19) 20:09	18:44 (17) 21:02	19:26 (17) 21:38
22	08:02 16:15	07:06 17:17	16:07 (20) 18:13	16:56 (19) 20:11	18:44 (17) 21:04	19:27 (17) 21:39
23	08:01 16:17	07:04 17:19	16:10 (20) 18:15	17:07 (19) 20:12	18:44 (17) 21:05	19:28 (17) 21:40
24	07:59 16:19	07:01 17:21	16:20 (20) 18:17	17:12 (19) 20:14	18:43 (17) 21:07	19:29 (17) 21:41
25	07:58 16:21	06:59 17:23	16:21 (20) 18:18	17:13 (19) 20:16	18:43 (17) 21:08	19:30 (17) 21:42
26	07:57 16:23	06:57 17:25	16:22 (20) 18:20	17:14 (19) 20:18	18:43 (17) 21:10	19:31 (17) 21:43
27	07:55 16:25	06:55 17:27	16:23 (20) 18:22	17:15 (19) 20:20	18:44 (17) 21:11	19:32 (17) 21:44
28	07:54 16:27	06:52 17:29	16:24 (20) 18:24	17:16 (19) 20:22	18:44 (17) 21:12	19:33 (17) 21:45
29	07:52 16:29	06:50 17:31	16:25 (20) 18:26	17:17 (19) 20:24	18:45 (17) 21:14	19:34 (17) 21:46
30	07:51 16:31		16:26 (20) 18:28	17:18 (19) 20:25	18:45 (17) 21:15	19:35 (17) 21:47
31	07:49 16:33		16:27 (20) 19:30		18:45 (17) 21:16	19:36 (17) 21:48
Potential sun hours	248	282	367	420	495	511
Total, worst case		320	381	617	126	
Sun reduction		0,22	0,30	0,40	0,49	
Oper. time red.		0,97	0,97	0,97	0,97	
Wind dir. red.		0,70	0,66	0,63	0,63	
Total reduction		0,15	0,19	0,24	0,30	
Total, real		49	74	150	38	

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:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 17

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: H - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0° (8)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December	
1	04:29 21:32	05:09 20:57	06:04 19:50	18:57 (17) 19:09 (17)	06:57 18:36	17:29 (19) 16:25	15:34 (20) 15:40
2	04:30 21:32	05:11 20:55	06:06 19:47	18:58 (17) 18:33	06:59 17:56 (19)	16:23 15:53 (20)	15:39 15:39
3	04:31 21:32	05:13 20:53	06:07 19:45	18:57 (17) 18:31	07:01 17:55 (19)	16:21 16:21	15:37 (20) 15:39
4	04:31 21:31	05:14 20:51	06:09 19:43	18:56 (17) 18:28	07:03 17:54 (19)	16:20 16:19	15:39 (20) 15:38
5	04:32 21:31	05:16 20:49	06:11 19:40	18:56 (17) 18:26	07:05 17:53 (19)	16:19 16:17	15:42 (20) 15:37
6	04:33 21:30	05:18 20:47	19:06 (17) 19:12 (17)	06:13 19:38	07:07 18:24	17:33 (19) 17:51 (19)	07:06 16:15
7	04:34 21:29	05:19 20:46	19:03 (17) 19:17 (17)	06:14 19:35	07:08 18:21	17:35 (19) 17:49 (19)	07:08 16:13
8	04:35 21:29	05:21 20:44	19:01 (17) 19:19 (17)	06:16 19:33	07:10 18:19	17:38 (19) 17:45 (19)	07:10 16:11
9	04:36 21:28	05:23 20:42	18:58 (17) 19:20 (17)	06:18 19:30	07:12 18:16	17:45 (19) 16:10	16:11 15:36
10	04:37 21:27	05:25 20:39	18:57 (17) 19:22 (17)	06:20 19:28	07:14 18:14	16:10 16:08	15:36 15:35
11	04:38 21:26	05:26 20:37	18:56 (17) 19:23 (17)	06:22 19:25	07:16 18:12	16:08 16:06	15:35 15:35
12	04:40 21:25	05:28 20:35	18:54 (17) 19:23 (17)	06:23 19:23	07:18 18:09	16:07 16:04	15:35 15:35
13	04:41 21:24	05:30 20:33	18:53 (17) 19:24 (17)	06:25 19:21	07:20 18:07	16:03 16:03	15:35 15:35
14	04:42 21:23	05:32 20:31	18:53 (17) 19:25 (17)	06:27 19:18	07:21 18:04	16:01 16:01	15:35 15:35
15	04:43 21:22	05:33 20:29	18:51 (17) 19:25 (17)	06:29 19:16	07:23 18:02	16:00 16:00	15:35 15:35
16	04:45 21:21	05:35 20:27	18:51 (17) 19:25 (17)	06:30 19:13	07:25 18:00	16:00 15:58	15:35 15:35
17	04:46 21:20	05:37 20:25	18:51 (17) 19:26 (17)	06:32 19:11	07:27 17:57	15:57 15:57	15:35 15:35
18	04:47 21:18	05:39 20:22	18:49 (17) 19:25 (17)	06:34 19:08	07:29 17:55	15:55 15:55	15:35 15:35
19	04:49 21:17	05:41 20:20	18:49 (17) 19:25 (17)	06:36 19:06	07:31 17:53	16:42 (20) 16:48 (20)	07:31 15:54
20	04:50 21:16	05:42 20:18	18:49 (17) 19:25 (17)	06:38 19:03	07:33 17:51	16:39 (20) 16:51 (20)	07:33 15:52
21	04:52 21:15	05:44 20:16	18:48 (17) 19:24 (17)	06:39 19:01	17:42 (19) 17:52 (19)	16:36 (20) 16:53 (20)	07:34 15:51
22	04:53 21:13	05:46 20:13	18:49 (17) 19:24 (17)	06:41 18:58	17:39 (19) 17:55 (19)	16:35 (20) 16:54 (20)	07:36 15:50
23	04:55 21:12	05:48 20:11	18:49 (17) 19:24 (17)	06:43 18:56	17:37 (19) 17:56 (19)	16:34 (20) 16:55 (20)	07:38 15:48
24	04:56 21:10	05:50 20:09	18:48 (17) 19:23 (17)	06:45 18:53	17:35 (19) 17:57 (19)	16:34 (20) 16:56 (20)	07:40 15:47
25	04:58 21:09	05:51 20:06	18:49 (17) 19:22 (17)	06:47 18:51	17:33 (19) 17:57 (19)	16:33 (20) 16:56 (20)	07:41 15:46
26	04:59 21:07	05:53 20:04	18:50 (17) 19:21 (17)	06:48 18:48	17:32 (19) 17:58 (19)	16:33 (20) 16:56 (20)	07:43 15:45
27	05:01 21:05	05:55 20:02	18:49 (17) 19:20 (17)	06:50 18:46	17:31 (19) 17:58 (19)	16:32 (20) 16:56 (20)	07:45 15:44
28	05:03 21:04	05:57 19:59	18:50 (17) 19:19 (17)	06:52 18:43	17:31 (19) 17:58 (19)	15:32 (20) 15:56 (20)	07:46 15:43
29	05:04 21:02	05:58 19:57	18:52 (17) 19:17 (17)	06:54 18:41	17:30 (19) 17:58 (19)	15:32 (20) 15:56 (20)	07:48 15:42
30	05:06 21:00	06:00 19:55	18:52 (17) 19:14 (17)	06:56 18:38	17:30 (19) 17:58 (19)	15:33 (20) 15:55 (20)	07:50 15:41
31	05:07 20:59	06:02 19:52	18:54 (17) 19:12 (17)	06:54 18:38	17:30 (19) 17:58 (19)	15:33 (20) 15:54 (20)	15:41 15:44
Potential sun hours	513	460	382	328	258	232	
Total, worst case		745	239	422	65		
Sun reduction		0,49	0,37	0,32	0,17		
Oper. time red.		0,97	0,97	0,97	0,97		
Wind dir. red.		0,63	0,66	0,69	0,70		
Total reduction		0,30	0,24	0,21	0,12		
Total, real		226	58	89	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:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 18

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: I - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0° (9)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16 15:44	07:47 16:34	06:48 17:32	06:32 19:31	05:23 20:27	04:33 21:18	04:29 21:32	05:09 20:57	06:04 19:50	06:57 18:36	06:56 16:25	07:51 15:40
2	08:16 15:45	07:46 16:36	06:45 17:34	06:30 19:33	05:20 20:29	04:32 21:19	04:29 21:32	05:11 20:55	06:05 19:47	06:59 18:33	06:58 16:23	07:53 15:39
3	08:16 15:46	07:44 16:38	06:43 17:36	06:27 19:35	05:18 20:31	04:31 21:20	04:30 21:32	05:12 20:53	06:07 19:45	07:01 18:31	07:00 16:21	07:54 15:38
4	08:16 15:47	07:42 16:40	06:41 17:38	06:25 19:37	05:16 20:33	04:30 21:21	04:31 21:31	05:14 20:51	06:09 19:43	07:03 18:28	07:02 16:19	07:56 15:38
5	08:16 15:48	07:40 16:42	06:38 17:40	06:22 19:39	05:14 20:35	04:29 21:22	04:32 21:31	05:16 20:49	06:11 19:40	07:05 18:26	07:04 16:17	07:57 15:37
6	08:15 15:49	07:38 16:44	06:36 17:42	06:20 19:41	05:12 20:36	04:28 21:23	04:33 21:30	05:17 20:47	06:13 19:38	07:06 18:23	07:06 16:15	07:59 15:37
7	08:15 15:51	07:37 16:46	06:33 17:44	06:17 19:43	05:10 20:38	04:28 21:24	04:34 21:29	05:19 20:45	06:14 19:35	07:08 18:21	07:08 16:13	08:00 15:36
8	08:14 15:52	07:35 16:48	06:31 17:46	06:15 19:44	05:08 20:40	04:27 21:25	04:35 21:29	05:21 20:43	06:16 19:33	07:10 18:19	07:10 16:11	08:01 15:36
9	08:14 15:54	07:33 16:50	06:29 17:48	06:13 19:46	05:07 20:42	04:27 21:26	04:36 21:28	05:23 20:41	06:18 19:30	07:12 18:16	07:12 16:09	08:03 15:35
10	08:13 15:55	07:31 16:52	06:26 17:50	06:10 19:48	05:05 20:43	04:26 21:27	04:37 21:27	05:24 20:39	06:20 19:28	07:14 18:14	07:14 16:08	08:04 15:35
11	08:13 15:56	07:29 16:54	06:24 17:52	06:08 19:50	05:03 20:45	04:26 21:28	04:38 21:26	05:26 20:37	06:21 19:25	07:16 18:11	07:15 16:06	08:05 15:35
12	08:12 15:58	07:27 16:56	06:21 17:54	06:05 19:52	05:01 20:47	04:25 21:29	04:39 21:25	05:28 20:35	06:23 19:23	07:18 18:09	07:17 16:04	08:06 15:35
13	08:11 16:00	07:25 16:58	06:19 17:56	06:03 19:54	04:59 20:49	04:25 21:29	04:40 21:24	05:30 20:33	06:25 19:20	07:19 18:07	07:19 16:03	08:07 15:35
14	08:10 16:01	07:23 17:01	06:17 17:58	06:01 19:56	04:58 20:50	04:25 21:30	04:42 21:23	05:31 20:31	06:27 19:18	07:21 18:04	07:21 16:01	08:08 15:34
15	08:09 16:03	07:21 17:03	06:14 17:59	05:58 19:57	04:56 20:52	04:24 21:31	04:43 21:22	05:33 20:29	06:29 19:15	07:23 18:02	07:23 15:59	08:09 15:35
16	08:08 16:04	07:19 17:05	06:12 18:01	05:56 19:59	04:54 20:54	04:24 21:31	04:44 21:21	05:35 20:27	06:30 19:13	07:25 18:00	07:25 15:58	08:10 15:35
17	08:08 16:06	07:17 17:07	06:09 18:03	05:54 20:01	04:52 20:55	04:24 21:32	04:46 21:20	05:37 20:25	06:32 19:10	07:27 17:57	07:27 15:56	08:11 15:35
18	08:06 16:08	07:15 17:09	06:07 18:05	05:51 20:03	04:51 20:57	04:24 21:32	04:47 21:18	05:39 20:22	06:34 19:08	07:29 17:55	07:29 15:55	08:12 15:35
19	08:05 16:10	07:12 17:11	06:04 18:07	05:49 20:05	04:49 20:59	04:24 21:32	04:48 21:17	05:40 20:20	06:36 19:05	07:31 17:53	07:31 15:53	08:12 15:35
20	08:04 16:11	07:10 17:13	06:02 18:09	05:47 20:07	04:48 21:00	04:24 21:33	04:50 21:16	05:42 20:18	06:37 19:03	07:33 17:50	07:32 15:52	08:13 15:36
21	08:03 16:13	07:08 17:15	05:59 18:11	05:44 20:09	04:46 21:02	04:24 21:33	04:51 21:14	05:44 20:16	06:39 19:00	07:35 17:48	07:34 15:51	08:14 15:36
22	08:02 16:15	07:06 17:17	05:57 18:13	05:42 20:11	04:45 21:04	04:24 21:33	04:53 21:13	05:46 20:13	06:41 18:58	07:37 17:46	07:36 15:49	08:14 15:36
23	08:01 16:17	07:04 17:19	05:54 18:15	05:40 20:12	04:43 21:05	04:25 21:33	04:54 21:12	05:48 20:11	06:43 18:55	07:38 17:44	07:38 15:48	08:15 15:37
24	07:59 16:19	07:01 17:21	05:52 18:16	05:38 20:14	04:42 21:07	04:25 21:34	04:56 21:10	05:49 20:09	06:45 18:53	07:40 17:42	07:40 15:47	08:15 15:38
25	07:58 16:21	06:59 17:23	06:49 18:18	05:35 20:16	04:41 21:08	04:25 21:34	04:57 21:09	05:51 20:06	06:46 18:51	07:42 17:39	07:41 15:46	08:15 15:38
26	07:57 16:23	06:57 17:25	06:47 19:20	05:33 20:18	04:39 21:10	04:26 21:34	04:59 21:07	05:53 20:04	06:48 18:48	07:44 17:37	07:43 15:45	08:16 15:39
27	07:55 16:25	06:55 17:27	06:44 19:22	05:31 20:20	04:38 21:11	04:26 21:33	05:01 21:05	05:55 20:02	06:50 18:46	07:46 17:35	07:45 15:44	08:16 15:40
28	07:54 16:26	06:52 17:29	06:42 19:24	05:29 20:22	04:37 21:12	04:27 21:33	05:02 21:04	05:56 19:59	06:52 18:43	06:48 16:33	07:46 15:43	08:16 15:40
29	07:52 16:28	06:50 17:31	06:40 19:26	05:27 20:24	04:36 21:14	04:27 21:33	05:04 21:02	05:58 19:57	06:54 18:41	06:50 16:31	07:48 15:42	08:16 15:41
30	07:50 16:30		06:37 19:28	05:25 20:25	04:35 21:15	04:28 21:33	05:06 21:00	06:00 19:55	06:55 18:38	06:52 16:29	07:50 15:41	08:16 15:42
31	07:49 16:32		06:35 19:30		04:34 21:16		05:07 20:59	06:02 19:52		06:54 16:27		08:16 15:43
Potential sun hours	248	282	367	420	495	511	513	460	382	328	258	232
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:

Farma wiatrowa - Brojce

Printed/Page

2012-03-13 22:17 / 19

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Bartosz Długokęcki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: J - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slo pe: 90,0° (10)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:47	06:48	06:32	05:23	04:33	04:29	05:09	06:04	06:57	06:56	07:51
	15:44	16:34	17:32	19:31	20:27	21:18	21:33	20:57	19:50	18:36	16:25	15:40
2	08:16	07:46	06:45	06:30	05:20	04:32	04:29	05:11	06:05	06:59	06:58	07:53
	15:45	16:36	17:34	19:33	20:29	21:19	21:32	20:55	19:47	18:33	16:23	15:39
3	08:16	07:44	06:43	06:27	05:18	04:31	04:30	05:12	06:07	07:01	07:00	07:54
	15:46	16:38	17:36	19:35	20:31	21:20	21:32	20:53	19:45	18:31	16:21	15:38
4	08:16	07:42	06:41	06:25	05:16	04:30	04:31	05:14	06:09	07:03	07:02	07:56
	15:47	16:40	17:38	19:37	20:33	21:21	21:31	20:51	19:43	18:28	16:19	15:38
5	08:16	07:40	06:38	06:22	05:14	04:29	04:32	05:16	06:11	07:05	07:04	07:57
	15:48	16:42	17:40	19:39	20:35	21:22	21:31	20:49	19:40	18:26	16:17	15:37
6	08:15	07:39	06:36	06:20	05:12	04:28	04:33	05:17	06:13	07:06	07:06	07:59
	15:49	16:44	17:42	19:41	20:36	21:23	21:30	20:47	19:38	18:23	16:15	15:37
7	08:15	07:37	06:33	06:17	05:10	04:28	04:34	05:19	06:14	07:08	07:08	08:00
	15:51	16:46	17:44	19:43	20:38	21:24	21:29	20:46	19:35	18:21	16:13	15:36
8	08:14	07:35	06:31	06:15	05:08	04:27	04:35	05:21	06:16	07:10	07:10	08:01
	15:52	16:48	17:46	19:44	20:40	21:25	21:29	20:44	19:33	18:19	16:11	15:36
9	08:14	07:33	06:29	06:13	05:07	04:27	04:36	05:23	06:18	07:12	07:12	08:03
	15:54	16:50	17:48	19:46	20:42	21:26	21:28	20:42	19:30	18:16	16:09	15:35
10	08:13	07:31	06:26	06:10	05:05	04:26	04:37	05:24	06:20	07:14	07:14	08:04
	15:55	16:52	17:50	19:48	20:44	21:27	21:27	20:39	19:28	18:14	16:08	15:35
11	08:13	07:29	06:24	06:08	05:03	04:26	04:38	05:26	06:21	07:16	07:15	08:05
	15:56	16:54	17:52	19:50	20:45	21:28	21:26	20:37	19:25	18:11	16:06	15:35
12	08:12	07:27	06:21	06:05	05:01	04:25	04:39	05:28	06:23	07:18	07:17	08:06
	15:58	16:56	17:54	19:52	20:47	21:29	21:25	20:35	19:23	18:09	16:04	15:35
13	08:11	07:25	06:19	06:03	04:59	04:25	04:40	05:30	06:25	07:19	07:19	08:07
	16:00	16:58	17:56	19:54	20:49	21:29	21:24	20:33	19:20	18:07	16:03	15:35
14	08:10	07:23	06:17	06:01	04:57	04:25	04:42	05:31	06:27	07:21	07:21	08:08
	16:01	17:01	17:58	19:56	20:50	21:30	21:23	20:31	19:18	18:04	16:01	15:34
15	08:09	07:21	06:14	05:58	04:56	04:24	04:43	05:33	06:29	07:23	07:23	08:09
	16:03	17:03	17:59	19:58	20:52	21:31	21:22	20:29	19:15	18:02	15:59	15:34
16	08:09	07:19	06:12	05:56	04:54	04:24	04:44	05:35	06:30	07:25	07:25	08:10
	16:04	17:05	18:01	19:59	20:54	21:31	21:21	20:27	19:13	18:00	15:58	15:35
17	08:08	07:17	06:09	05:54	04:52	04:24	04:46	05:37	06:32	07:27	07:27	08:11
	16:06	17:07	18:03	20:01	20:56	21:32	21:20	20:25	19:10	17:57	15:56	15:35
18	08:07	07:15	06:07	05:51	04:51	04:24	04:47	05:39	06:34	07:29	07:29	08:12
	16:08	17:09	18:05	20:03	20:57	21:32	21:19	20:22	19:08	17:55	15:55	15:35
19	08:05	07:12	06:04	05:49	04:49	04:24	04:48	05:40	06:36	07:31	07:31	08:12
	16:10	17:11	18:07	20:05	20:59	21:33	21:17	20:20	19:05	17:53	15:53	15:35
20	08:04	07:10	06:02	05:47	04:48	04:24	04:50	05:42	06:37	07:33	07:33	08:13
	16:11	17:13	18:09	20:07	21:00	21:33	21:16	20:18	19:03	17:50	15:52	15:36
21	08:03	07:08	05:59	05:44	04:46	04:24	04:51	05:44	06:39	07:35	07:34	08:14
	16:13	17:15	18:11	20:09	21:02	21:33	21:15	20:16	19:00	17:48	15:51	15:36
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	16:15	17:17	18:13	20:11	21:04	21:33	21:13	20:13	18:58	17:46	15:49	15:36
23	08:01	07:04	05:54	05:40	04:43	04:25	04:54	05:48	06:43	07:38	07:38	08:15
	16:17	17:19	18:15	20:12	21:05	21:34	21:12	20:11	18:56	17:44	15:48	15:37
24	07:59	07:01	05:52	05:38	04:42	04:25	04:56	05:49	06:45	07:40	07:40	08:15
	16:19	17:21	18:16	20:14	21:07	21:34	21:10	20:09	18:53	17:42	15:47	15:38
25	07:58	06:59	06:49	05:35	04:41	04:25	04:57	05:51	06:46	07:42	07:41	08:15
	16:21	17:23	19:18	20:16	21:08	21:34	21:09	20:06	18:51	17:39	15:46	15:38
26	07:57	06:57	06:47	05:33	04:39	04:26	04:59	05:53	06:48	07:44	07:43	08:16
	16:23	17:25	19:20	20:18	21:10	21:34	21:07	20:04	18:48	17:37	15:45	15:39
27	07:55	06:55	06:44	05:31	04:38	04:26	05:01	05:55	06:50	07:46	07:45	08:16
	16:25	17:27	19:22	20:20	21:11	21:34	21:05	20:02	18:46	17:35	15:44	15:40
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	16:28	17:31	19:26	20:24	21:14	21:33	21:02	19:57	18:41	17:31	15:42	15:41
30	07:51		06:37	05:25	04:35	04:28	05:06	06:00	06:55	07:50	07:50	08:16
	16:30		19:28	20:25	21:15	21:33	21:00	19:55	18:38	17:29	15:41	15:42
31	07:49		06:35		04:34		05:07	06:02		06:54		08:16
	16:32		19:30		21:16		20:59	19:52		16:27		15:43
Potential sun hours	248	281	367	420	495	511	513	460	382	328	258	232
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:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 20

Licensed user:

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Bartosz Długokęcki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

## SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: K - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0° (11)

### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16 15:44	07:47 16:34	06:48 17:33	06:32 19:31	05:23 20:27	04:33 21:18	04:29 21:32	05:09 20:57	06:04 19:50	06:57 18:36	06:56 16:25	07:51 15:40
2	08:16 15:45	07:45 16:36	06:45 17:34	06:30 19:33	05:21 20:29	04:32 21:19	04:30 21:32	05:11 20:55	06:05 19:47	06:59 18:33	06:58 16:23	07:53 15:39
3	08:16 15:46	07:44 16:38	06:43 17:36	06:27 19:35	05:18 20:31	04:31 21:20	04:30 21:32	05:12 20:53	06:07 19:45	07:01 18:31	07:00 16:21	07:54 15:39
4	08:16 15:47	07:42 16:40	06:41 17:38	06:25 19:37	05:16 20:33	04:30 21:21	04:31 21:31	05:14 20:51	06:09 19:43	07:03 18:28	07:02 16:19	07:56 15:38
5	08:15 15:48	07:40 16:42	06:38 17:40	06:22 19:39	05:14 20:34	04:29 21:22	04:32 21:30	05:16 20:49	06:11 19:40	07:05 18:26	07:04 16:17	07:57 15:37
6	08:15 15:50	07:38 16:44	06:36 17:42	06:20 19:41	05:12 20:36	04:29 21:23	04:33 21:30	05:18 20:47	06:13 19:38	07:06 18:23	07:06 16:15	07:58 15:37
7	08:15 15:51	07:37 16:46	06:33 17:44	06:18 19:43	05:10 20:38	04:28 21:24	04:34 21:29	05:19 20:45	06:14 19:35	07:08 18:21	07:08 16:13	08:00 15:36
8	08:14 15:52	07:35 16:48	06:31 17:46	06:15 19:44	05:09 20:40	04:27 21:25	04:35 21:28	05:21 20:43	06:16 19:33	07:10 18:19	07:10 16:11	08:01 15:36
9	08:14 15:54	07:33 16:50	06:29 17:48	06:13 19:46	05:07 20:42	04:27 21:26	04:36 21:28	05:23 20:41	06:18 19:30	07:12 18:16	07:11 16:09	08:02 15:35
10	08:13 15:55	07:31 16:52	06:26 17:50	06:10 19:48	05:05 20:43	04:26 21:27	04:37 21:27	05:24 20:39	06:20 19:28	07:14 18:14	07:13 16:08	08:04 15:35
11	08:12 15:57	07:29 16:55	06:24 17:52	06:08 19:50	05:03 20:45	04:26 21:28	04:38 21:26	05:26 20:37	06:21 19:25	07:16 18:11	07:15 16:06	08:05 15:35
12	08:12 15:58	07:27 16:57	06:21 17:54	06:05 19:52	05:01 20:47	04:25 21:28	04:39 21:25	05:28 20:35	06:23 19:23	07:18 18:09	07:17 16:04	08:06 15:35
13	08:11 16:00	07:25 16:59	06:19 17:56	06:03 19:54	04:59 20:49	04:25 21:29	04:41 21:24	05:30 20:33	06:25 19:20	07:19 18:07	07:19 16:03	08:07 15:35
14	08:10 16:01	07:23 17:01	06:16 17:58	06:01 19:56	04:58 20:50	04:25 21:30	04:42 21:23	05:32 20:31	06:27 19:18	07:21 18:04	07:21 16:01	08:08 15:35
15	08:09 16:03	07:21 17:03	06:14 17:59	05:58 19:57	04:56 20:52	04:25 21:30	04:43 21:22	05:33 20:29	06:29 19:15	07:23 18:02	07:23 15:59	08:09 15:35
16	08:08 16:05	07:19 17:05	06:12 18:01	05:56 19:59	04:54 20:54	04:24 21:31	04:44 21:21	05:35 20:27	06:30 19:13	07:25 18:00	07:25 15:58	08:10 15:35
17	08:07 16:06	07:17 17:07	06:09 18:03	05:54 20:01	04:53 20:55	04:24 21:32	04:46 21:20	05:37 20:24	06:32 19:10	07:27 17:57	07:27 15:56	08:11 15:35
18	08:06 16:08	07:15 17:09	06:07 18:05	05:51 20:03	04:51 20:57	04:24 21:32	04:47 21:18	05:39 20:22	06:34 19:08	07:29 17:55	07:29 15:55	08:11 15:35
19	08:05 16:10	07:12 17:11	06:04 18:07	05:49 20:05	04:49 20:59	04:24 21:32	04:49 21:17	05:40 20:20	06:36 19:05	07:31 17:53	07:31 15:53	08:12 15:35
20	08:04 16:12	07:10 17:13	06:02 18:09	05:47 20:07	04:48 21:00	04:24 21:33	04:50 21:16	05:42 20:18	06:37 19:03	07:33 17:50	07:32 15:52	08:13 15:36
21	08:03 16:13	07:08 17:15	05:59 18:11	05:44 20:09	04:46 21:02	04:24 21:33	04:52 21:14	05:44 20:16	06:39 19:00	07:35 17:48	07:34 15:51	08:13 15:36
22	08:02 16:15	07:06 17:17	05:57 18:13	05:42 20:10	04:45 21:03	04:25 21:33	04:53 21:13	05:46 20:13	06:41 18:58	07:36 17:46	07:36 15:49	08:14 15:37
23	08:00 16:17	07:04 17:19	05:54 18:15	05:40 20:12	04:43 21:05	04:25 21:33	04:55 21:12	05:48 20:11	06:43 18:55	07:38 17:44	07:38 15:48	08:14 15:37
24	07:59 16:19	07:01 17:21	05:52 18:16	05:38 20:14	04:42 21:06	04:25 21:33	04:56 21:10	05:49 20:09	06:45 18:53	07:40 17:42	07:40 15:47	08:15 15:38
25	07:58 16:21	06:59 17:23	06:49 19:18	05:36 20:16	04:41 21:08	04:26 21:33	04:58 21:08	05:51 20:06	06:46 18:51	07:42 17:39	07:41 15:46	08:15 15:38
26	07:56 16:23	06:57 17:25	06:47 19:20	05:33 20:18	04:40 21:09	04:26 21:33	04:59 21:07	05:53 20:04	06:48 18:48	07:44 17:37	07:43 15:45	08:16 15:39
27	07:55 16:25	06:55 17:27	06:44 19:22	05:31 20:20	04:38 21:11	04:26 21:33	05:01 21:05	05:55 20:02	06:50 18:46	07:46 17:35	07:45 15:44	08:16 15:40
28	07:53 16:27	06:52 17:29	06:42 19:24	05:29 20:22	04:37 21:12	04:27 21:33	05:02 21:04	05:57 19:59	06:52 18:43	06:48 16:33	07:46 15:43	08:16 15:41
29	07:52 16:29	06:50 17:31	06:40 19:26	05:27 20:23	04:36 21:14	04:27 21:33	05:04 21:02	05:58 19:57	06:54 18:41	06:50 16:31	07:48 15:42	08:16 15:41
30	07:50 16:30		06:37 19:28	05:25 20:25	04:35 21:15	04:28 21:33	05:06 21:00	06:00 19:55	06:55 18:38	06:52 16:29	07:50 15:41	08:16 15:42
31	07:49 16:32		06:35 19:30		04:34 21:16		05:07 20:59	06:02 19:52		06:54 16:27		08:16 15:43
Potential sun hours	248	282	367	420	495	511	513	460	382	328	258	232
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:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 21

Licensed user:

Leanergia Bartosz Długokecki

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Bartosz Długokecki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

## SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: L - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0° (12)

### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOŁOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:17	13:54 (12) 07:48	15:17 (11) 06:48	06:33 05:23 04:33	04:29 05:09 06:04	06:58	06:56	06:56	06:56	06:56	06:56	06:56
2	08:17	13:55 (12) 07:46	15:16 (11) 06:46	06:30 05:21 04:32	04:30 05:11 06:06	07:00	06:58	06:58	06:58	06:58	06:58	06:58
3	08:16	13:56 (12) 07:44	15:15 (11) 06:43	06:28 05:19 04:31	04:31 05:13 06:08	07:01	06:59	06:59	06:59	06:59	06:59	06:59
4	08:16	13:56 (12) 07:42	15:15 (11) 06:41	06:25 05:17 04:31	04:32 05:14 06:09	07:03	06:58	06:58	06:58	06:58	06:58	06:58
5	08:16	13:57 (12) 07:41	15:15 (11) 06:39	06:23 05:15 04:30	04:32 05:16 06:11	07:05	06:57	06:57	06:57	06:57	06:57	06:57
6	08:16	13:57 (12) 07:39	15:15 (11) 06:36	06:20 05:13 04:29	04:33 05:18 06:13	07:07	06:56	06:56	06:56	06:56	06:56	06:56
7	08:15	13:58 (12) 07:37	15:15 (11) 06:34	06:18 05:11 04:28	04:34 05:20 06:15	07:09	06:55	06:55	06:55	06:55	06:55	06:55
8	08:15	13:59 (12) 07:35	15:15 (11) 06:31	06:16 05:09 04:28	04:35 05:21 06:17	07:11	06:54	06:54	06:54	06:54	06:54	06:54
9	08:14	13:59 (12) 07:33	15:15 (11) 06:29	06:13 05:07 04:27	04:36 05:23 06:18	07:12	06:53	06:53	06:53	06:53	06:53	06:53
10	08:14	14:00 (12) 07:31	15:15 (11) 06:27	06:11 05:05 04:27	04:37 05:25 06:20	07:14	06:52	06:52	06:52	06:52	06:52	06:52
11	08:13	14:01 (12) 07:29	15:15 (11) 06:24	06:08 05:03 04:26	04:39 05:27 06:22	07:16	06:51	06:51	06:51	06:51	06:51	06:51
12	08:12	14:02 (12) 07:27	15:16 (11) 06:22	06:06 05:02 04:26	04:40 05:28 06:24	07:18	06:50	06:50	06:50	06:50	06:50	06:50
13	08:11	14:03 (12) 07:25	15:16 (11) 06:19	06:04 05:00 04:25	04:41 05:30 06:25	07:20	06:49	06:49	06:49	06:49	06:49	06:49
14	08:11	14:04 (12) 07:23	15:16 (11) 06:17	06:01 04:58 04:25	04:42 05:32 06:27	07:22	06:48	06:48	06:48	06:48	06:48	06:48
15	08:10	14:06 (12) 07:21	15:17 (11) 06:14	05:59 04:56 04:25	04:44 05:34 06:29	07:24	06:47	06:47	06:47	06:47	06:47	06:47
16	08:09	14:06 (12) 07:19	15:18 (11) 06:12	05:56 04:55 04:25	04:45 05:35 06:31	07:25	06:46	06:46	06:46	06:46	06:46	06:46
17	08:08	14:08 (12) 07:17	15:19 (11) 06:10	05:54 04:53 04:25	04:46 05:37 06:33	07:27	06:45	06:45	06:45	06:45	06:45	06:45
18	08:07	14:11 (12) 07:15	15:19 (11) 06:07	05:52 04:51 04:25	04:48 05:39 06:34	07:29	06:44	06:44	06:44	06:44	06:44	06:44
19	08:06	14:12 (12) 07:13	15:21 (11) 06:05	05:49 04:50 04:25	04:49 05:41 06:36	07:31	06:43	06:43	06:43	06:43	06:43	06:43
20	08:05	14:12 (12) 07:11	15:24 (11) 06:02	05:47 04:48 04:25	04:50 05:43 06:38	07:33	06:42	06:42	06:42	06:42	06:42	06:42
21	08:03	14:13 (12) 07:09	15:26 (11) 06:00	05:45 04:47 04:25	04:52 05:44 06:40	07:35	06:41	06:41	06:41	06:41	06:41	06:41
22	08:02	14:14 (12) 07:07	15:30 (11) 05:57	05:43 04:45 04:25	04:53 05:46 06:41	07:37	06:40	06:40	06:40	06:40	06:40	06:40
23	08:01	14:15 (12) 07:05	15:37 (11) 05:53	05:41 04:44 04:25	04:55 05:48 06:43	07:39	06:39	06:39	06:39	06:39	06:39	06:39
24	08:00	14:16 (12) 07:03	15:41 (11) 05:50	05:39 04:43 04:25	04:56 05:50 06:45	07:41	06:38	06:38	06:38	06:38	06:38	06:38
25	07:58	14:17 (12) 07:01	15:45 (11) 05:47	05:37 04:42 04:25	04:57 05:52 06:47	07:43	06:37	06:37	06:37	06:37	06:37	06:37
26	07:57	14:18 (12) 06:59	15:49 (11) 05:44	05:35 04:41 04:25	04:58 05:55 06:49	07:45	06:36	06:36	06:36	06:36	06:36	06:36
27	07:55	14:19 (12) 06:57	15:53 (11) 05:41	05:33 04:39 04:25	04:59 05:57 06:51	07:47	06:35	06:35	06:35	06:35	06:35	06:35
28	07:54	14:20 (12) 06:55	15:57 (11) 05:38	05:31 04:37 04:25	05:00 05:59 06:53	07:49	06:34	06:34	06:34	06:34	06:34	06:34
29	07:52	14:21 (12) 06:53	16:01 (11) 05:35	05:29 04:35 04:25	05:01 06:00 06:56	07:51	06:33	06:33	06:33	06:33	06:33	06:33
30	07:51	14:22 (12) 06:51	16:05 (11) 05:32	05:27 04:33 04:25	05:02 06:01 06:58	07:53	06:32	06:32	06:32	06:32	06:32	06:32
31	07:49	14:23 (12) 06:49	16:09 (11) 05:29	05:25 04:31 04:25	05:03 06:02 06:59	07:55	06:31	06:31	06:31	06:31	06:31	06:31
Potential sun hours	248	282	367	420	495	511	513	460	382	328	258	232
Total, worst case	615	692								315	670	921
Sun reduction	0,17	0,22								0,32	0,17	0,14
Oper. time red.	0,97	0,97								0,97	0,97	0,97
Wind dir. red.	0,88	0,89								0,89	0,89	0,88
Total reduction	0,11	0,15								0,21	0,11	0,10
Total, real	68	104								67	77	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:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 22

Licensed user:

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: M - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0° (13)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:17 15:44	07:48 16:35	06:48 17:33	06:33 19:32	05:23 20:28	04:33 21:18	04:29 21:33	05:09 20:57	06:04 19:50	06:58 18:36	06:56 16:25	07:52 15:40
2	08:17 15:45	07:46 16:37	06:46 17:35	06:30 19:34	05:21 20:29	04:32 21:19	04:30 21:33	05:11 20:55	06:06 19:48	07:00 18:34	06:58 16:23	07:53 15:40
3	08:16 15:46	07:44 16:39	06:43 17:37	06:28 19:36	05:19 20:31	04:31 21:20	04:31 21:32	05:13 20:54	06:08 19:45	07:01 18:31	07:00 16:21	07:55 15:39
4	08:16 15:48	07:43 16:41	06:41 17:39	06:25 19:37	05:17 20:33	04:31 21:22	04:32 21:32	05:14 20:52	06:09 19:43	07:03 18:29	07:02 16:19	07:56 15:38
5	08:16 15:49	07:41 16:43	06:39 17:41	06:23 19:39	05:15 20:35	04:30 21:23	04:32 21:31	05:16 20:50	06:11 19:41	07:05 18:26	07:04 16:17	07:58 15:38
6	08:16 15:50	07:39 16:45	06:36 17:43	06:20 19:41	05:13 20:37	04:29 21:24	04:33 21:30	05:18 20:48	06:13 19:38	07:07 18:24	07:06 16:15	07:59 15:37
7	08:15 15:51	07:37 16:47	06:34 17:45	06:18 19:43	05:11 20:39	04:28 21:25	04:34 21:30	05:20 20:46	06:15 19:36	07:09 18:21	07:08 16:14	08:00 15:37
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11	08:13 15:57	07:29 16:55	06:24 17:52	06:08 19:50	05:03 20:46	04:26 21:28	04:39 21:27	05:27 20:38	06:22 19:26	07:16 18:12	07:16 16:06	08:05 15:35
12	08:12 15:59	07:27 16:57	06:22 17:54	06:06 19:52	05:02 20:47	04:26 21:29	04:40 21:26	05:28 20:36	06:24 19:23	07:18 18:09	07:18 16:05	08:06 15:35
13	08:12 16:00	07:25 16:59	06:19 17:56	06:04 19:54	05:00 20:49	04:25 21:30	04:41 21:25	05:30 20:34	06:25 19:21	07:20 18:07	07:20 16:03	08:07 15:35
14	08:11 16:02	07:23 17:01	06:17 17:58	06:01 19:56	04:58 20:51	04:25 21:30	04:42 21:24	05:32 20:31	06:27 19:18	07:22 18:05	07:22 16:01	08:08 15:35
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16	08:09 16:05	07:19 17:05	06:12 18:02	06:06 20:00	04:55 20:54	04:25 21:32	04:45 21:21	05:36 20:27	06:31 19:13	07:26 18:00	07:25 15:58	08:10 15:35
17	08:08 16:07	07:17 17:07	06:10 18:04	05:54 20:02	04:53 20:56	04:25 21:32	04:46 21:20	05:37 20:25	06:33 19:11	07:27 17:58	07:27 15:57	08:11 15:35
18	08:07 16:08	07:15 17:09	06:07 18:06	05:52 20:04	04:51 20:58	04:25 21:33	04:48 21:19	05:39 20:23	06:34 19:08	07:29 17:55	07:29 15:55	08:12 15:35
19	08:06 16:10	07:13 17:11	06:05 18:08	05:50 20:05	04:50 20:59	04:25 21:33	04:49 21:18	05:41 20:21	06:36 19:06	07:31 17:53	07:31 15:54	08:13 15:36
20	08:05 16:12	07:11 17:13	06:02 18:09	05:47 20:07	04:48 21:01	04:25 21:33	04:50 21:16	05:43 20:18	06:38 19:03	07:33 17:51	07:33 15:53	08:13 15:36
21	08:04 16:14	07:09 17:15	06:00 18:11	05:45 20:09	04:47 21:02	04:25 21:33	04:52 21:15	05:44 20:16	06:40 19:01	07:35 17:49	07:35 15:51	08:14 15:36
22	08:02 16:16	07:06 17:17	05:57 18:13	05:43 20:11	04:45 21:04	04:25 21:34	04:53 21:14	05:46 20:14	06:42 18:58	07:37 17:46	07:37 15:50	08:15 15:37
23	08:01 16:17	07:04 17:19	05:55 18:15	05:40 20:13	04:44 21:06	04:25 21:34	04:55 21:12	05:48 20:11	06:43 18:56	07:39 17:44	07:38 15:49	08:15 15:37
24	08:00 16:19	07:02 17:21	05:52 18:17	05:38 20:15	04:43 21:07	04:26 21:34	04:56 21:11	05:50 20:09	06:45 18:53	07:41 17:42	07:40 15:47	08:15 15:38
25	07:58 16:21	07:00 17:23	06:50 19:19	05:36 20:17	04:41 21:09	04:26 21:34	04:58 21:09	05:52 20:07	06:47 18:51	07:43 17:40	07:42 15:46	08:16 15:39
26	07:57 16:23	06:57 17:25	06:47 19:21	05:34 20:18	04:40 21:10	04:26 21:34	05:00 21:07	05:53 20:05	06:49 18:49	07:45 17:38	07:44 15:45	08:16 15:39
27	07:55 16:25	06:55 17:27	06:45 19:23	05:32 20:20	04:39 21:11	04:27 21:34	05:01 21:06	05:55 20:02	06:51 18:46	07:47 17:36	07:45 15:44	08:16 15:40
28	07:54 16:27	06:53 17:29	06:42 19:24	05:29 20:22	04:37 21:13	04:27 21:34	05:03 21:04	05:57 20:00	06:52 18:44	06:49 16:33	07:47 15:43	08:17 15:41
29	07:52 16:29	06:50 17:31	06:40 19:26	05:27 20:24	04:36 21:14	04:28 21:33	05:04 21:03	05:59 19:57	06:54 18:41	06:51 16:31	07:49 15:42	08:17 15:42
30	07:51 16:31		06:38 19:28	05:25 20:26	04:35 21:15	04:29 21:33	05:06 21:01	06:01 19:55	06:56 18:39	06:52 16:29	07:50 15:41	08:17 15:43
31	07:49 16:33		06:35 19:30		04:34 21:17		05:08 20:59	06:02 19:53		06:54 16:27		08:17 15:44
Potential sun hours	248	282	367	420	495	511	513	460	382	328	258	232
Total, worst case												45
Sun reduction												0,14
Oper. time red.												0,97
Wind dir. red.												0,61
Total reduction												0,09
Total, real												4

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:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 23

Licensed user:

Leanergia Bartosz Długokecki

Szczytnicka 18/4

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Bartosz Długokecki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: N - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slo pe: 90,0° (14)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:17 15:44	07:48 16:35	06:48 17:33	06:33 19:32	05:23 20:28	04:33 21:18	04:29 21:33	05:09 20:57	06:04 19:50	06:58 18:36	06:56 16:25	07:52 15:40
2	08:16 15:45	07:46 16:37	06:46 17:35	06:30 19:34	05:21 20:29	04:32 21:19	04:30 21:32	05:11 20:55	06:06 19:48	06:59 18:34	06:58 16:23	07:53 15:40
3	08:16 15:46	07:44 16:39	06:43 17:37	06:28 19:35	05:19 20:31	04:31 21:20	04:31 21:32	05:13 20:53	06:08 19:45	07:01 18:31	07:00 16:21	07:55 15:39
4	08:16 15:47	07:42 16:41	06:41 17:39	06:25 19:37	05:17 20:33	04:30 21:21	04:31 21:31	05:14 20:52	06:09 19:43	07:03 18:29	07:02 16:19	07:56 15:38
5	08:16 15:49	07:41 16:43	06:39 17:41	06:23 19:39	05:15 20:35	04:30 21:23	04:32 21:31	05:16 20:50	06:11 19:40	07:05 18:26	07:04 16:17	07:58 15:38
6	08:15 15:50	07:39 16:45	06:36 17:43	06:20 19:41	05:13 20:37	04:29 21:24	04:33 21:30	05:18 20:48	06:13 19:38	07:07 18:24	07:06 16:15	07:59 15:37
7	08:15 15:51	07:37 16:47	06:34 17:45	06:18 19:43	05:11 20:38	04:28 21:25	04:34 21:30	05:20 20:46	06:15 19:36	07:09 18:21	07:08 16:13	08:00 15:37
8	08:15 15:53	07:35 16:49	06:31 17:46	06:15 19:45	05:09 20:40	04:28 21:26	04:35 21:29	05:21 20:44	06:16 19:33	07:10 18:19	07:10 16:12	08:02 15:36
9	08:14 15:54	07:33 16:51	06:29 17:48	06:13 19:47	05:07 20:42	04:27 21:26	04:36 21:28	05:23 20:42	06:18 19:31	07:12 18:17	07:12 16:10	08:03 15:36
10	08:13 15:55	07:31 16:53	06:27 17:50	06:11 19:49	05:05 20:44	04:27 21:27	04:37 21:27	05:25 20:40	06:20 19:28	07:14 18:14	07:14 16:08	08:04 15:35
11	08:13 15:57	07:29 16:55	06:24 17:52	06:08 19:50	05:03 20:46	04:26 21:28	04:39 21:26	05:27 20:38	06:22 19:26	07:16 18:12	07:16 16:06	08:05 15:35
12	08:12 15:58	07:27 16:57	06:22 17:54	06:06 19:52	05:01 20:47	04:26 21:29	04:40 21:25	05:28 20:36	06:24 19:23	07:18 18:09	07:18 16:05	08:06 15:35
13	08:11 16:00	07:25 16:59	06:19 17:56	06:03 19:54	05:00 20:49	04:25 21:30	04:41 21:24	05:30 20:33	06:25 19:21	07:20 18:07	07:20 16:03	08:07 15:35
14	08:11 16:02	07:23 17:01	06:17 17:58	06:01 19:56	04:58 20:51	04:25 21:30	04:42 21:23	05:32 20:31	06:27 19:18	07:22 18:05	07:22 16:01	08:08 15:35
15	08:10 16:03	07:21 17:03	06:14 18:00	05:59 19:58	04:56 20:52	04:25 21:31	04:43 21:22	05:34 20:29	06:29 19:16	07:24 18:02	07:23 16:00	08:09 15:35
16	08:09 16:05	07:19 17:05	06:12 18:02	06:06 20:00	04:55 20:54	04:25 21:31	04:45 21:21	05:35 20:27	06:31 19:13	07:25 18:00	07:25 15:58	08:10 15:35
17	08:08 16:07	07:17 17:07	06:10 18:04	05:54 20:02	04:53 20:56	04:25 21:32	04:46 21:20	05:37 20:25	06:32 19:11	07:27 17:58	07:27 15:57	08:11 15:35
18	08:07 16:08	07:15 17:09	06:07 18:06	05:52 20:03	04:51 20:57	04:25 21:32	04:48 21:19	05:39 20:23	06:34 19:08	07:29 17:55	07:29 15:55	08:12 15:35
19	08:06 16:10	07:13 17:11	06:05 18:07	05:49 20:05	04:50 20:59	04:25 21:33	04:49 21:17	05:41 20:20	06:36 19:06	07:31 17:53	07:31 15:54	08:13 15:36
20	08:05 16:12	07:11 17:13	06:02 18:09	05:47 20:07	04:48 21:01	04:25 21:33	04:50 21:16	05:43 20:18	06:38 19:03	07:33 17:51	07:33 15:52	08:13 15:36
21	08:03 16:14	07:08 17:15	06:00 18:11	05:45 20:09	04:47 21:02	04:25 21:33	04:52 21:15	05:44 20:16	06:40 19:01	07:35 17:49	07:35 15:51	08:14 15:36
22	08:02 16:16	07:06 17:17	05:57 18:13	05:43 20:11	04:45 21:04	04:25 21:34	04:53 21:13	05:46 20:14	06:41 18:58	07:37 17:46	07:37 15:50	08:14 15:37
23	08:01 16:17	07:04 17:19	05:55 18:15	05:40 20:13	04:44 21:05	04:25 21:34	04:55 21:12	05:48 20:11	06:43 18:56	07:39 17:44	07:38 15:49	08:15 15:37
24	08:00 16:19	07:02 17:21	05:52 18:17	05:38 20:15	04:42 21:07	04:25 21:34	04:56 21:10	05:50 20:09	06:45 18:53	07:41 17:42	07:40 15:47	08:15 15:38
25	07:58 16:21	06:59 17:23	06:50 19:19	05:36 20:16	04:41 21:08	04:26 21:34	04:58 21:09	05:52 20:07	06:47 18:51	07:43 17:40	07:42 15:46	08:16 15:39
26	07:57 16:23	06:57 17:25	06:47 19:21	05:34 20:18	04:40 21:10	04:26 21:34	04:59 21:07	05:53 20:04	06:49 18:48	07:45 17:38	07:43 15:45	08:16 15:39
27	07:55 16:25	06:55 17:27	06:45 19:22	05:31 20:20	04:39 21:11	04:27 21:34	05:01 21:06	05:55 20:02	06:50 18:46	07:47 17:35	07:45 15:44	08:16 15:40
28	07:54 16:27	06:53 17:29	06:42 19:24	05:29 20:22	04:37 21:13	04:27 21:34	05:03 21:04	05:57 20:00	06:52 18:43	06:48 16:33	07:47 15:43	08:16 15:41
29	07:52 16:29	06:50 17:31	06:40 19:26	05:27 20:24	04:36 21:14	04:28 21:33	05:04 21:02	05:59 19:57	06:54 18:41	06:50 16:31	07:48 15:42	08:17 15:42
30	07:51 16:31		06:37 19:28	05:25 20:26	04:35 21:15	04:28 21:33	05:06 21:01	06:00 19:55	06:56 18:38	06:52 16:29	07:50 15:41	08:17 15:43
31	07:49 16:33		06:35 19:30		04:34 21:17		05:08 20:59	06:02 19:53		06:54 16:27		08:17 15:44
Potential sun hours	248	282	367	420	495	511	513	460	382	328	258	232
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:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 24

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Bartosz Długokęcki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: O - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slo pe: 90,0°(15)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:16 15:44	07:47 16:35	06:48 17:33	06:32 19:32	05:23 20:27	04:33 21:18
2	08:16 15:45	07:46 16:37	06:46 17:35	06:30 19:34	05:21 20:29	04:32 21:19
3	08:16 15:46	07:44 16:39	06:43 17:37	06:28 19:35	05:19 20:31	04:31 21:20
4	08:16 15:47	07:42 16:41	06:41 17:39	06:25 19:37	05:17 20:33	04:31 21:21
5	08:16 15:49	07:40 16:43	06:38 17:41	06:23 19:39	05:15 20:35	04:30 21:22
6	08:15 15:50	07:39 16:45	06:36 17:43	06:20 19:41	05:13 20:36	04:29 21:23
7	08:15 15:51	07:37 16:47	06:34 17:44	06:18 19:43	05:11 20:38	04:28 21:24
8	08:14 15:53	07:35 16:49	06:31 17:46	17:03 (18) 06:15 17:15 (18) 19:45	06:41 (20) 05:09 06:45 (20) 20:40	05:46 (19) 04:28 06:01 (19) 21:25
9	08:14 15:54	07:33 16:51	06:29 17:48	17:01 (18) 06:13 17:18 (18) 19:47	06:38 (20) 05:07 06:46 (20) 20:42	05:48 (19) 04:27 06:01 (19) 21:26
10	08:13 15:55	07:31 16:53	06:27 17:50	16:58 (18) 06:11 17:19 (18) 19:48	06:36 (20) 05:05 06:48 (20) 20:44	05:49 (19) 04:27 05:59 (19) 21:27
11	08:13 15:57	07:29 16:55	06:24 17:52	16:57 (18) 06:08 17:21 (18) 19:50	06:34 (20) 05:03 06:48 (20) 20:45	05:50 (19) 04:26 05:57 (19) 21:28
12	08:12 15:58	07:27 16:57	06:22 17:54	16:56 (18) 06:06 17:21 (18) 19:52	06:31 (20) 05:01 06:48 (20) 20:47	04:26 21:29
13	08:11 16:00	07:25 16:59	06:19 17:56	16:55 (18) 06:03 17:22 (18) 19:54	06:30 (20) 05:00 06:48 (20) 20:49	04:25 21:29
14	08:10 16:02	07:23 17:01	06:17 17:58	16:54 (18) 06:01 17:21 (18) 19:56	06:30 (20) 04:58 06:48 (20) 20:51	04:25 21:30
15	08:10 16:03	07:21 17:03	06:14 18:00	16:54 (18) 05:59 17:22 (18) 19:58	06:29 (20) 04:56 06:47 (20) 20:52	04:25 21:31
16	08:09 16:05	07:19 17:05	06:12 18:02	16:53 (18) 05:56 17:21 (18) 20:00	06:30 (20) 04:55 06:47 (20) 20:54	04:25 21:31
17	08:08 16:07	07:17 17:07	06:09 18:04	16:53 (18) 05:54 17:21 (18) 20:01	06:31 (20) 04:53 06:46 (20) 20:56	04:25 21:32
18	08:07 16:08	07:15 17:09	06:07 18:05	16:53 (18) 05:52 17:20 (18) 20:03	06:32 (20) 04:51 06:44 (20) 20:57	04:25 21:32
19	08:06 16:10	07:13 17:11	06:05 18:07	16:53 (18) 05:49 17:20 (18) 20:05	06:33 (20) 04:50 06:41 (20) 20:59	04:25 21:33
20	08:04 16:12	07:10 17:13	06:02 18:09	16:53 (18) 05:47 17:19 (18) 20:07	04:48 21:01	04:25 21:33
21	08:03 16:14	07:08 17:15	06:00 18:11	16:54 (18) 05:45 17:18 (18) 20:09	04:47 21:02	04:25 21:33
22	08:02 16:16	07:06 17:17	05:57 18:13	16:55 (18) 05:43 17:16 (18) 20:11	04:45 21:04	04:25 21:33
23	08:01 16:17	07:04 17:19	05:55 18:15	16:57 (18) 05:40 17:15 (18) 20:13	04:44 21:05	04:25 21:34
24	07:59 16:19	07:02 17:21	05:52 18:17	16:58 (18) 05:38 17:11 (18) 20:14	04:42 21:07	04:26 21:34
25	07:58 16:21	06:59 17:23	05:50 19:19	18:03 (18) 05:36 18:07 (18) 20:16	04:41 21:08	04:26 21:34
26	07:57 16:23	06:57 17:25	05:47 19:20	05:34 20:18	04:40 21:10	04:26 21:34
27	07:55 16:25	06:55 17:27	05:45 19:22	05:31 20:20	04:39 21:11	04:27 21:34
28	07:54 16:27	06:53 17:29	05:42 19:24	05:29 20:22	05:56 (19) 04:37 05:58 (19) 21:12	04:27 21:33
29	07:52 16:29	06:50 17:31	05:40 19:26	05:27 20:24	05:54 (19) 04:36 06:00 (19) 21:14	04:28 21:33
30	07:51 16:31		05:37 19:28	05:25 20:26	05:52 (19) 04:35 06:01 (19) 21:15	04:29 21:33
31	07:49 16:33		06:35 19:30		04:34 21:16	
Potential sun hours	248	282	367	420	495	511
Total, worst case			397	178	153	
Sun reduction			0,30	0,40	0,49	
Oper. time red.			0,97	0,97	0,97	
Wind dir. red.			0,66	0,67	0,68	
Total reduction			0,19	0,26	0,33	
Total, real			76	45	50	

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:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 25

Licensed user:

Leanergia Bartosz Dlugokecki

Szczytnicka 18/4

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Bartosz Długokęcki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: O - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slo pe: 90,0°(15)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	04:29 21:33	05:09 20:57	06:02 (19) 06:06 (19)	06:04 19:50	06:33 (20) 18:36	17:34 (18) 16:25
2	04:30 21:32	05:11 20:55	05:59 (19) 06:08 (19)	06:06 19:48	06:35 (20) 18:34	17:35 (18) 16:23
3	04:31 21:32	05:13 20:53	05:58 (19) 06:10 (19)	06:08 19:45	06:36 (20) 18:31	17:36 (18) 16:21
4	04:32 21:31	05:14 20:51	05:57 (19) 06:10 (19)	06:09 19:43	06:38 (20) 18:29	17:37 (18) 16:19
5	04:32 21:31	05:16 20:50	05:56 (19) 06:11 (19)	06:11 19:40	07:05 18:26	17:39 (18) 16:17
6	04:33 21:30	05:18 20:48	05:56 (19) 06:12 (19)	06:13 19:38	07:07 18:24	17:43 (18) 16:15
7	04:34 21:29	05:20 20:46	05:55 (19) 06:12 (19)	06:15 19:35	07:09 18:21	17:49 (18) 16:13
8	04:35 21:29	05:21 20:44	05:55 (19) 06:12 (19)	06:16 19:33	07:10 18:19	17:49 (18) 16:12
9	04:36 21:28	05:23 20:42	05:54 (19) 06:11 (19)	06:18 19:31	07:12 18:16	17:49 (18) 16:10
10	04:37 21:27	05:25 20:40	05:56 (19) 06:11 (19)	06:20 19:28	07:14 18:14	17:49 (18) 16:08
11	04:39 21:26	05:27 20:38	05:58 (19) 06:11 (19)	06:22 19:26	07:16 18:12	17:49 (18) 16:06
12	04:40 21:25	05:28 20:35	05:59 (19) 06:10 (19)	06:24 19:23	07:18 18:09	17:49 (18) 16:05
13	04:41 21:24	05:30 20:33	06:01 (19) 06:09 (19)	06:25 19:21	07:20 18:07	17:49 (18) 16:03
14	04:42 21:23	05:32 20:31	06:03 (19) 06:08 (19)	06:27 19:18	07:22 18:05	17:49 (18) 16:01
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17	04:46 21:20	05:37 20:25	06:32 19:11	06:32 17:58	07:27 17:58	17:49 (18) 15:57
18	04:48 21:19	05:39 20:23	06:34 19:08	06:34 17:55	07:29 17:55	17:49 (18) 15:55
19	04:49 21:17	05:41 20:20	06:36 19:06	17:46 (18) 17:58 (18)	07:31 17:53	17:49 (18) 15:54
20	04:50 21:16	05:43 20:18	06:38 19:03	17:43 (18) 18:01 (18)	07:33 17:51	17:49 (18) 15:52
21	04:52 21:15	05:44 20:16	06:40 19:01	17:40 (18) 18:01 (18)	07:35 17:49	17:49 (18) 15:51
22	04:53 21:13	05:46 20:14	06:41 18:58	17:39 (18) 18:02 (18)	07:37 17:46	17:49 (18) 15:50
23	04:55 21:12	05:48 20:11	06:41 (20) 06:42 (20)	06:43 18:56	17:38 (18) 18:03 (18)	17:49 (18) 15:49
24	04:56 21:10	05:50 20:09	06:36 (20) 06:45 (20)	06:45 18:53	17:37 (18) 18:03 (18)	17:49 (18) 15:47
25	04:58 21:09	05:51 20:07	06:34 (20) 06:47 (20)	06:47 18:51	17:36 (18) 18:04 (18)	17:49 (18) 15:46
26	05:00 21:07	05:53 20:04	06:33 (20) 06:48 (20)	06:49 18:48	17:35 (18) 18:03 (18)	17:49 (18) 15:45
27	05:01 21:06	05:55 20:02	06:31 (20) 06:48 (20)	06:50 18:46	17:34 (18) 18:03 (18)	17:49 (18) 15:44
28	05:03 21:04	05:57 20:00	06:31 (20) 06:49 (20)	06:52 18:43	17:34 (18) 18:03 (18)	17:49 (18) 15:43
29	05:04 21:02	05:59 19:57	06:31 (20) 06:49 (20)	06:54 18:41	17:34 (18) 18:02 (18)	17:49 (18) 15:42
30	05:06 21:01	06:00 19:55	06:31 (20) 06:49 (20)	06:56 18:38	17:35 (18) 18:02 (18)	17:49 (18) 15:41
31	05:08 20:59	06:02 19:52	06:31 (20) 06:48 (20)	06:54 16:27	06:54 16:27	17:49 (18) 15:44
Potential sun hours	513	460	382	328	258	232
Total, worst case		301	331	109		
Sun reduction		0,49	0,37	0,32		
Oper. time red.		0,97	0,97	0,97		
Wind dir. red.		0,68	0,66	0,66		
Total reduction		0,32	0,24	0,20		
Total, real		98	79	22		

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:

Farma wiatrowa - Brojce

Printed/Page

2012-03-13 22:17 / 26

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: P - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0° (16)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December			
1	08:16	13:51 (18)	07:47	06:48	06:33	05:23	04:33	04:29	05:09	06:04	06:58	06:56	07:51	13:44 (18)	
15:44	26	14:17 (18)	16:35	17:33	19:32	20:27	21:18	21:33	20:57	19:50	18:36	16:25	15:40	14	13:58 (18)
2	08:16	13:52 (18)	07:46	06:46	06:30	05:21	04:32	04:30	05:11	06:06	06:59	06:58	07:53	13:43 (18)	
15:45	25	14:17 (18)	16:37	17:35	19:34	20:29	21:19	21:32	20:55	19:48	18:34	16:23	15:40	16	13:59 (18)
3	08:16	13:53 (18)	07:44	06:43	06:28	05:19	04:31	04:31	05:13	06:08	07:01	07:00	07:55	13:43 (18)	
15:46	25	14:18 (18)	16:39	17:37	19:35	20:31	21:20	21:32	20:53	19:45	18:31	16:21	15:39	18	14:01 (18)
4	08:16	13:53 (18)	07:42	06:41	06:25	05:17	04:30	04:32	05:14	06:09	07:03	07:02	07:56	13:42 (18)	
15:47	24	14:17 (18)	16:41	17:39	19:37	20:33	21:21	21:31	20:51	19:43	18:29	16:19	15:38	19	14:01 (18)
5	08:16	13:54 (18)	07:41	06:39	06:23	05:15	04:30	04:32	05:16	06:11	07:05	07:04	07:57	13:42 (18)	
15:49	24	14:18 (18)	16:43	17:41	19:39	20:35	21:22	21:31	20:50	19:40	18:26	16:17	15:38	21	14:03 (18)
6	08:15	13:55 (18)	07:39	06:36	06:20	05:13	04:29	04:33	05:18	06:13	07:07	07:06	07:59	13:41 (18)	
15:50	23	14:18 (18)	16:45	17:43	19:41	20:37	21:23	21:30	20:48	19:38	18:24	16:15	15:37	22	14:03 (18)
7	08:15	13:56 (18)	07:37	06:34	06:18	05:11	04:28	04:34	05:20	06:15	07:09	07:08	08:00	13:42 (18)	
15:51	22	14:18 (18)	16:47	17:45	19:43	20:38	21:24	21:29	20:46	19:35	18:21	16:13	15:37	23	14:05 (18)
8	08:14	13:57 (18)	07:35	06:31	06:15	05:09	04:28	04:35	05:21	06:16	07:10	07:10	08:01	13:41 (18)	
15:53	21	14:18 (18)	16:49	17:46	19:45	20:40	21:25	21:29	20:44	19:33	18:19	16:12	15:36	24	14:05 (18)
9	08:14	13:58 (18)	07:33	06:29	06:13	05:07	04:27	04:36	05:23	06:18	07:12	07:12	08:03	13:42 (18)	
15:54	19	14:17 (18)	16:51	17:48	19:47	20:42	21:26	21:28	20:42	19:31	18:17	16:10	15:36	24	14:06 (18)
10	08:13	13:59 (18)	07:31	06:27	06:11	05:05	04:27	04:37	05:25	06:20	07:14	07:14	08:04	13:42 (18)	
15:55	18	14:17 (18)	16:53	17:50	19:48	20:44	21:27	21:27	20:40	19:28	18:14	16:08	15:36	25	14:07 (18)
11	08:13	14:00 (18)	07:29	06:24	06:08	05:03	04:26	04:39	05:27	06:22	07:16	07:16	08:05	13:42 (18)	
15:57	16	14:16 (18)	16:55	17:52	19:50	20:45	21:28	21:26	20:38	19:26	18:12	16:06	15:35	25	14:07 (18)
12	08:12	14:01 (18)	07:27	06:22	06:06	05:01	04:26	04:40	05:28	06:24	07:18	07:18	08:06	13:42 (18)	
15:58	14	14:15 (18)	16:57	17:54	19:52	20:47	21:29	21:25	20:36	19:23	18:09	16:05	15:35	26	14:08 (18)
13	08:11	14:04 (18)	07:25	06:19	06:03	05:00	04:25	04:41	05:30	06:25	07:20	07:20	08:07	13:42 (18)	
16:00	11	14:15 (18)	16:59	17:56	19:54	20:49	21:29	21:24	20:33	19:21	18:07	16:03	15:35	26	14:08 (18)
14	08:10	14:06 (18)	07:23	06:17	06:01	04:58	04:25	04:42	05:32	06:27	07:22	07:21	08:08	13:42 (18)	
16:02	6	14:12 (18)	17:01	17:58	19:56	20:51	21:30	21:23	20:31	19:18	18:05	16:01	15:35	27	14:09 (18)
15	08:10		07:21	06:14	05:59	04:56	04:25	04:44	05:34	06:29	07:23	07:23	08:09	13:43 (18)	
16:03			17:03	18:00	19:58	20:52	21:31	21:22	20:29	19:16	18:02	16:00	15:35	26	14:09 (18)
16	08:09		07:19	06:12	05:56	04:55	04:25	04:45	05:35	06:31	07:25	07:25	08:10	13:43 (18)	
16:05			17:05	18:02	20:00	20:54	21:31	21:21	20:27	19:13	18:00	15:58	15:35	27	14:10 (18)
17	08:08		07:17	06:09	05:54	04:53	04:25	04:46	05:37	06:32	07:27	07:27	08:11	13:44 (18)	
16:07			17:07	18:04	20:01	20:56	21:32	21:20	20:25	19:11	17:58	15:57	15:35	27	14:11 (18)
18	08:07		07:15	06:07	05:52	04:51	04:25	04:48	05:39	06:34	07:29	07:29	08:12	13:44 (18)	
16:08			17:09	18:05	20:03	20:57	21:32	21:19	20:23	19:08	17:55	15:55	15:35	28	14:12 (18)
19	08:06		07:13	06:05	05:49	04:50	04:25	04:49	05:41	06:36	07:31	07:31	08:12	13:45 (18)	
16:10			17:11	18:07	20:05	20:59	21:33	21:17	20:20	19:06	17:53	15:54	15:36	27	14:12 (18)
20	08:04		07:11	06:02	05:47	04:48	04:25	04:50	05:43	06:38	07:33	07:33	08:13	13:45 (18)	
16:12			17:13	18:09	20:07	21:01	21:33	21:16	20:18	19:03	17:51	15:52	15:36	27	14:12 (18)
21	08:03		07:08	06:00	05:45	04:47	04:25	04:52	05:44	06:40	07:35	07:35	08:14	13:46 (18)	
16:14			17:15	18:11	20:09	21:02	21:33	21:15	20:16	19:01	17:49	15:51	15:36	27	14:13 (18)
22	08:02		07:06	05:57	05:43	04:45	04:25	04:53	05:46	06:41	07:37	07:36	08:14	13:46 (18)	
16:16			17:17	18:13	20:11	21:04	21:33	21:13	20:14	18:58	17:46	15:50	15:37	27	14:13 (18)
23	08:01		07:04	05:55	05:40	04:44	04:25	04:55	05:48	06:43	07:39	07:38	08:15	13:47 (18)	
16:17			17:19	18:15	20:13	21:05	21:34	21:12	20:11	18:56	17:44	15:49	15:37	27	14:14 (18)
24	07:59		07:02	05:52	05:38	04:42	04:26	04:56	05:50	06:45	07:41	07:40	08:15	13:47 (18)	
16:19			17:21	18:17	20:15	21:07	21:34	21:10	20:09	18:53	17:42	15:47	15:38	27	14:14 (18)
25	07:58		06:59	06:50	05:36	04:41	04:26	04:58	05:52	06:47	07:43	07:42	08:16	13:47 (18)	
16:21			17:23	19:19	20:16	21:08	21:34	21:09	20:07	18:51	17:40	15:46	15:39	27	14:14 (18)
26	07:57		06:57	06:47	05:34	04:40	04:26	05:00	05:53	06:49	07:45	07:43	08:16	13:48 (18)	
16:23			17:25	19:21	20:18	21:10	21:34	21:07	20:04	18:48	17:38	15:45	15:39	27	14:15 (18)
27	07:55		06:55	06:45	05:31	04:39	04:27	05:01	05:55	06:50	07:46	07:45	08:16	13:49 (18)	
16:25			17:27	19:22	20:20	21:11	21:34	21:06	20:02	18:46	17:35	15:44	15:40	27	14:16 (18)
28	07:54		06:53	06:42	05:29	04:37	04:27	05:03	05:57	06:52	07:48	07:47	08:16	13:50 (18)	
16:27			17:29	19:24	20:22	21:13	21:33	21:04	20:00	18:43	17:33	15:43	15:41	26	14:16 (18)
29	07:52		06:50	06:40	05:27	04:36	04:28	05:04	05:59	06:54	07:50	07:48	08:16	13:50 (18)	
16:29			17:31	19:26	20:24	21:14	21:33	21:02	19:57	18:41	17:31	15:42	15:42	27	14:17 (18)
30	07:51			06:37	05:25	04:35	04:28	05:06	06:00	06:56	06:52	07:50	08:16	13:50 (18)	
16:31				19:28	20:26	21:15	21:33	21:01	19:55	18:38	17:29	15:41	15:43	26	14:16 (18)
31	07:49			06:35		04:34		05:08	06:02		06:54		08:16	13:51 (18)	
16:33				19:30		21:17		20:59	19:52		16:27		15:44	26	14:17 (18)
Potential sun hours	248	282	367	420	495	511	513	460	382	328	258	232			
Total, worst case	274										17		766		
Sun reduction	0,17										0,17		0,14		
Oper. time red.	0,97										0,97		0,97		
Wind dir. red.	0,68										0,68		0,68		
Total reduction	0,11										0,11		0,10		
Total, real	30										2		73		

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:

Farma wiatrowa - Brojce

Printed/Page

2012-03-13 22:17 / 27

Licensed user:

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Calculated:

2012-03-13 22:15/2.7.490

## SHADOW - Calendar

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1 Shadow receptor: Q - Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slo pe: 90,0°(17)

### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December				
1	08:16	07:47	06:48	06:33	07:04 (18)	05:23	04:33	04:29	05:09	06:04	06:53 (18)	06:58	06:56	07:52		
	15:44	16:35	17:33	19:32	16	07:20 (18)	20:28	21:18	21:33	20:57	19:50	29	07:22 (18)	18:36	16:25	15:41
2	08:16	07:46	06:46	06:30	07:01 (18)	05:21	04:32	04:30	05:11	06:06	06:53 (18)	06:59	06:58	07:53		
	15:45	16:37	17:35	19:34	20	07:21 (18)	20:29	21:19	21:32	20:55	19:48	29	07:22 (18)	18:34	16:23	15:40
3	08:16	07:44	06:43	06:28	06:59 (18)	05:19	04:31	04:31	05:13	06:08	06:52 (18)	07:01	07:00	07:55		
	15:46	16:39	17:37	19:35	23	07:22 (18)	20:31	21:20	21:32	20:53	19:45	29	07:21 (18)	18:31	16:21	15:39
4	08:16	07:42	06:41	06:25	06:57 (18)	05:17	04:31	04:32	05:15	06:09	06:52 (18)	07:03	07:02	07:56		
	15:48	16:41	17:39	19:37	26	07:23 (18)	20:33	21:21	21:31	20:52	19:43	29	07:21 (18)	18:29	16:19	15:38
5	08:16	07:41	06:39	06:23	06:57 (18)	05:15	04:30	04:33	05:16	06:11	06:52 (18)	07:05	07:04	07:57		
	15:49	16:43	17:41	19:39	27	07:24 (18)	20:35	21:22	21:31	20:50	19:38	29	07:21 (18)	18:26	16:17	15:38
6	08:15	07:39	06:36	06:20	06:56 (18)	05:13	04:29	04:33	05:18	06:13	06:52 (18)	07:07	07:06	07:59		
	15:50	16:45	17:43	19:41	28	07:24 (18)	20:37	21:24	21:30	20:48	19:38	28	07:20 (18)	18:24	16:15	15:37
7	08:15	07:37	06:34	06:18	06:55 (18)	05:11	04:28	04:34	05:20	06:15	06:52 (18)	07:09	07:08	08:00		
	15:51	16:47	17:45	19:43	29	07:24 (18)	20:38	21:25	21:30	20:46	19:36	26	07:18 (18)	18:21	16:14	15:37
8	08:15	07:35	06:31	06:16	06:55 (18)	05:09	04:28	04:35	05:21	06:17	06:52 (18)	07:10	07:10	08:01		
	15:53	16:49	17:47	19:45	29	07:24 (18)	20:40	21:25	21:29	20:44	19:33	26	07:18 (18)	18:19	16:12	15:36
9	08:14	07:33	06:29	06:13	06:54 (18)	05:07	04:27	04:36	05:23	06:18	06:53 (18)	07:12	07:12	08:03		
	15:54	16:51	17:48	19:47	29	07:23 (18)	20:42	21:26	21:28	20:42	19:31	23	07:16 (18)	18:17	16:10	15:36
10	08:13	07:31	06:27	06:11	06:54 (18)	05:05	04:27	04:38	05:25	06:20	06:54 (18)	07:14	07:14	08:04		
	15:56	16:53	17:50	19:49	29	07:23 (18)	20:44	21:27	21:27	20:40	19:28	20	07:14 (18)	18:14	16:08	15:36
11	08:13	07:29	06:24	06:08	06:54 (18)	05:03	04:26	04:39	05:27	06:22	06:56 (18)	07:16	07:16	08:05		
	15:57	16:55	17:52	19:50	29	07:23 (18)	20:45	21:28	21:26	20:38	19:26	16	07:12 (18)	18:12	16:06	15:35
12	08:12	07:27	06:22	06:06	06:54 (18)	05:02	04:26	04:40	05:28	06:24	06:58 (18)	07:18	07:18	08:06		
	15:59	16:57	17:54	19:52	27	07:21 (18)	20:47	21:29	21:25	20:36	19:23	11	07:09 (18)	18:09	16:05	15:35
13	08:11	07:25	06:19	06:04	06:54 (18)	05:00	04:26	04:41	05:30	06:25	06:57 (18)	07:20	07:20	08:07		
	16:00	16:59	17:56	19:54	27	07:21 (18)	20:49	21:30	21:24	20:33	19:21		07:20	18:07	16:03	15:35
14	08:10	07:23	06:17	06:01	06:55 (18)	04:58	04:25	04:42	05:32	06:27	06:57 (18)	07:22	07:21	08:08		
	16:02	17:01	17:58	19:56	25	07:20 (18)	20:51	21:30	21:23	20:31	19:18		07:22	18:05	16:01	15:35
15	08:10	07:21	06:14	05:59	06:55 (18)	04:56	04:25	04:44	05:34	06:29	06:57 (18)	07:24	07:23	08:09		
	16:03	17:03	18:00	19:58	23	07:18 (18)	20:52	21:31	21:22	20:29	19:16		07:24	18:02	16:00	15:35
16	08:09	07:19	06:12	05:56	06:56 (18)	04:55	04:25	04:45	05:36	06:31	06:57 (18)	07:25	07:25	08:10		
	16:05	17:05	18:02	20:00	21	07:17 (18)	20:54	21:31	21:21	20:27	19:13		07:25	18:00	15:58	15:35
17	08:08	07:17	06:10	05:54	06:58 (18)	04:53	04:25	04:46	05:37	06:33	06:57 (18)	07:27	07:27	08:11		
	16:07	17:07	18:04	20:02	17	07:15 (18)	20:56	21:32	21:20	20:25	19:11		07:27	17:58	15:57	15:35
18	08:07	07:15	06:07	05:52	07:01 (18)	04:51	04:25	04:48	05:39	06:34	06:57 (18)	07:29	07:29	08:12		
	16:09	17:09	18:06	20:03	11	07:12 (18)	20:57	21:32	21:19	20:23	19:08		07:29	17:55	15:55	15:36
19	08:06	07:13	06:05	05:50		04:50	04:25	04:49	05:41	06:36	06:57 (18)	07:31	07:31	08:12		
	16:10	17:11	18:07	20:05		20:59	21:33	21:17	20:20	19:06	18:53		07:31	17:53	15:54	15:36
20	08:05	07:11	06:02	05:47		04:48	04:25	04:51	05:43	06:38	06:57 (18)	07:33	07:33	08:13		
	16:12	17:13	18:09	20:07		21:01	21:33	21:16	20:18	19:03	18:50		07:33	17:51	15:53	15:36
21	08:03	07:08	06:00	05:45		04:47	04:25	04:52	05:44	06:40	06:57 (18)	07:35	07:35	08:14		
	16:14	17:15	18:11	20:09		21:02	21:33	21:15	20:16	19:01	18:48		07:35	17:49	15:51	15:37
22	08:02	07:06	05:57	05:43		04:45	04:25	04:53	05:46	06:41	06:57 (18)	07:37	07:36	08:14		
	16:16	17:17	18:13	20:11		21:04	21:33	21:13	20:14	18:58	18:45		07:37	17:46	15:50	15:37
23	08:01	07:04	05:55	05:40		04:44	04:25	04:55	05:48	06:43	06:57 (18)	07:39	07:38	08:15		
	16:18	17:19	18:15	20:13		21:05	21:34	21:12	20:11	18:56	18:43		07:39	17:44	15:49	15:38
24	08:00	07:02	05:52	05:38		04:43	04:26	04:57	05:50	06:45	06:57 (18)	07:41	07:40	08:15		
	16:19	17:21	18:17	20:15		21:07	21:34	21:10	20:09	4	07:12 (18)	18:53	17:42	15:48	15:38	
25	07:58	06:59	06:50	05:36		04:41	04:26	04:58	05:52	06:47	06:57 (18)	07:43	07:42	08:16		
	16:21	17:23	19:19	20:16		21:08	21:34	21:09	20:07	13	07:15 (18)	18:51	17:40	15:46	15:39	
26	07:57	06:57	06:47	05:34		04:40	04:26	05:00	05:53	06:49	06:57 (18)	07:45	07:43	08:16		
	16:23	17:25	19:21	20:18		21:10	21:34	21:07	20:04	18	07:18 (18)	18:48	17:38	15:45	15:40	
27	07:55	06:55	06:45	05:32		04:39	04:27	05:01	05:55	06:50	06:59 (18)	06:50	07:47	07:45	08:16	
	16:25	17:27	19:22	20:20		21:11	21:34	21:06	20:02	20	07:19 (18)	18:46	17:36	15:44	15:40	
28	07:54	06:53	06:42	05:29		04:38	04:27	05:03	05:57	06:52	06:57 (18)	06:52	06:48	07:47	08:16	
	16:27	17:29	19:24	20:22		21:13	21:33	21:04	20:00	23	07:20 (18)	18:43	16:33	15:43	15:41	
29	07:52	06:50	06:40	05:27		04:36	04:28	05:04	05:59	06:54	06:56 (18)	06:54	06:50	07:48	08:16	
	16:29	17:31	19:26	20:24		21:14	21:33	21:02	19:57	25	07:21 (18)	18:41	16:31	15:42	15:42	
30	07:51		06:38	05:25		04:35	04:29	05:06	06:01	06:56	06:55 (18)	06:56	06:52	07:50	08:16	
	16:31		19:28	20:26		21:15	21:33	21:01	19:55	27	07:22 (18)	18:39	16:29	15:41	15:43	
31	07:49		06:35	05:23	07:06 (18)		04:34		05:08	06:02	06:53 (18)		06:54		08:16	
	16:33		19:30	20:28	07:17 (18)		21:17		20:59	19:53	06:53 (18)		16:27		15:44	
Potential sun hours	248	282	367	420		495	511	513	460	382	328	258	232			
Total, worst case			11	436					158	295						
Sun reduction			0,30	0,40					0,49	0,37						
Oper. time red.			0,97	0,97					0,97	0,97						
Wind dir. red.			0,66	0,66					0,66	0,66						
Total reduction			0,19	0,25					0,32	0,24						
Total, real			2	110					50	70						

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		

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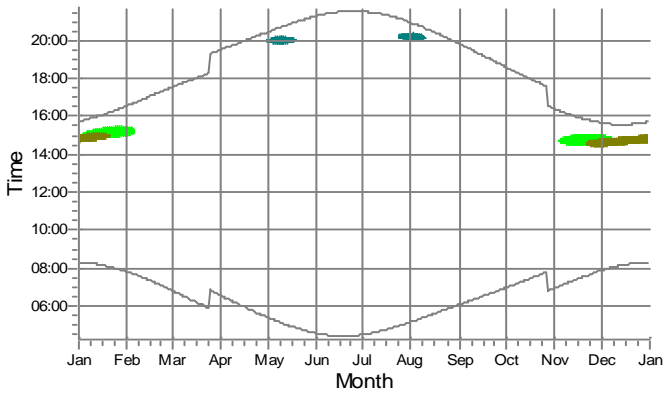
Calculated:

2012-03-13 22:15/2.7.490

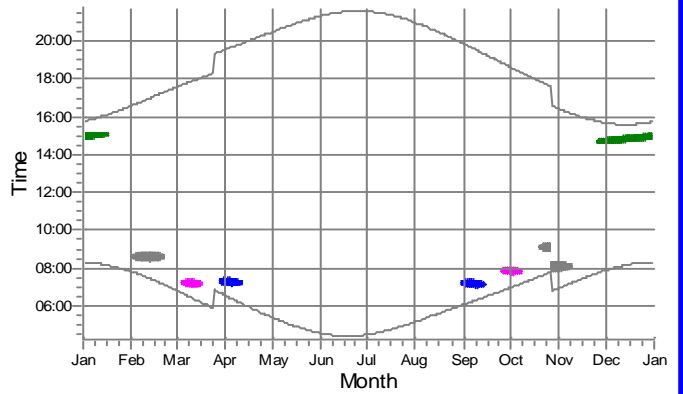
### SHADOW - Calendar, graphical

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1

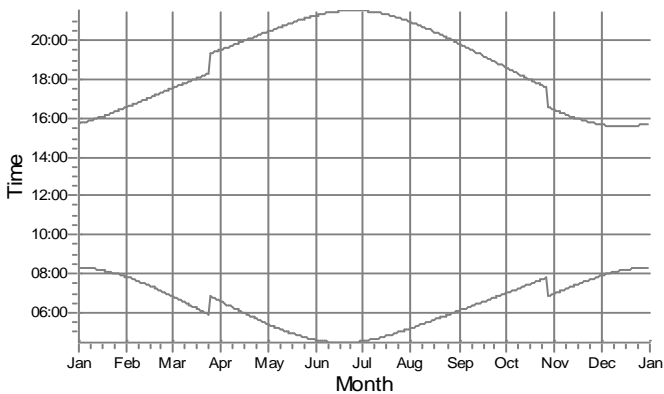
A: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(1)



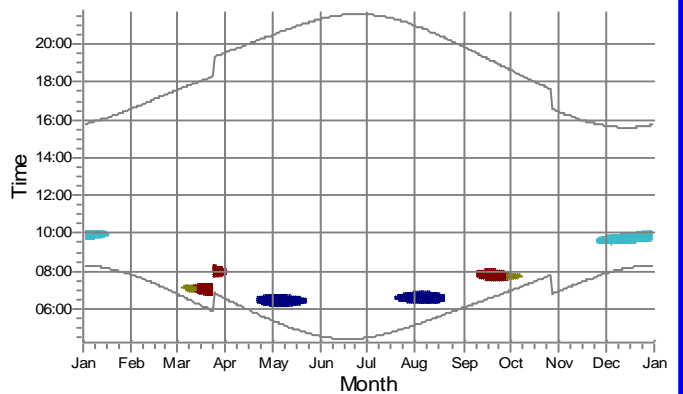
B: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(2)



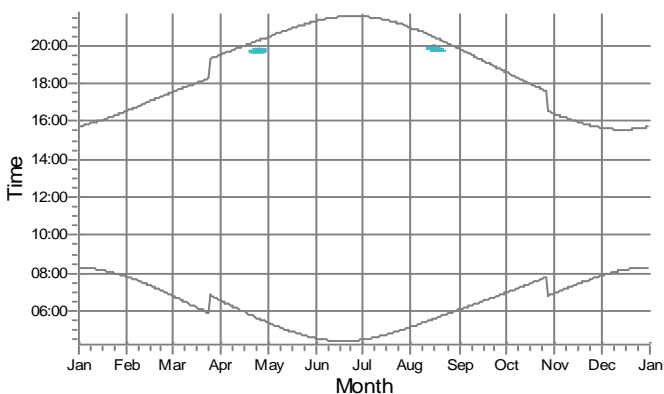
C: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(3)



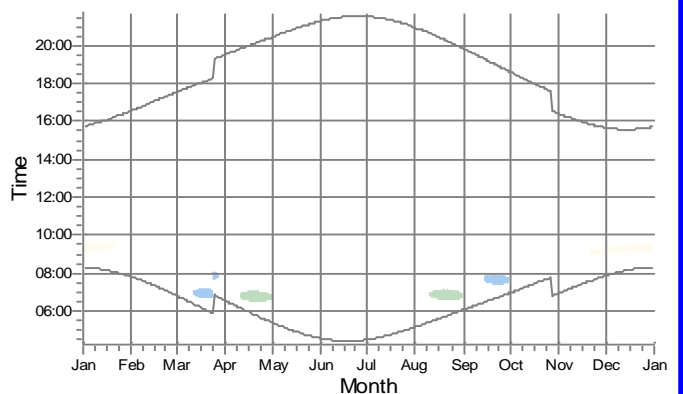
D: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(4)
















E: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(5)



F: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(6)



WTGs

	1: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (347)		7: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (353)		16: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (362)
	3: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (349)		8: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (354)		17: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (363)
	4: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (350)		9: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (355)		21: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (367)
	5: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (351)		10: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (356)		
	6: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (352)		15: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (361)		

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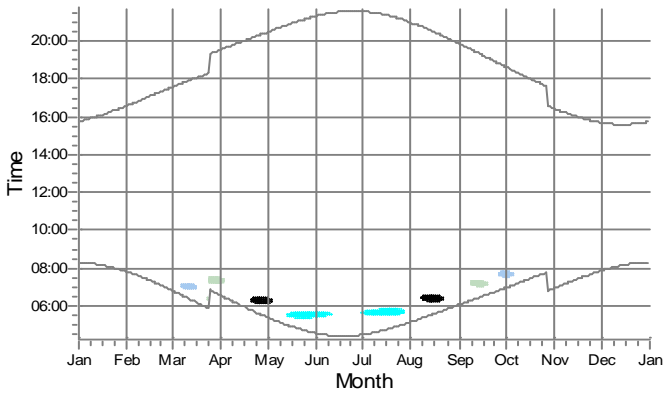
Calculated:

2012-03-13 22:15/2.7.490

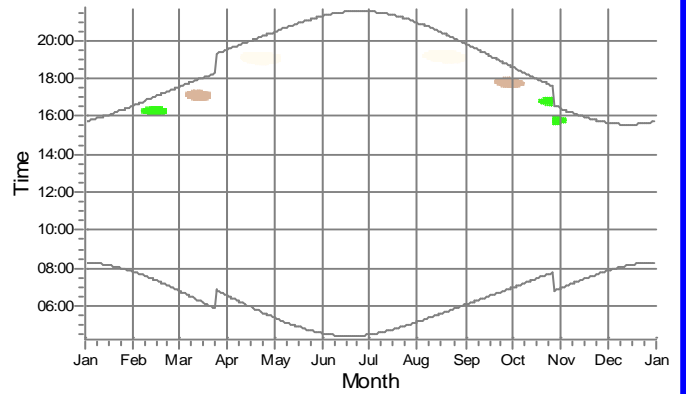
**SHADOW - Calendar, graphical**

**Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1**

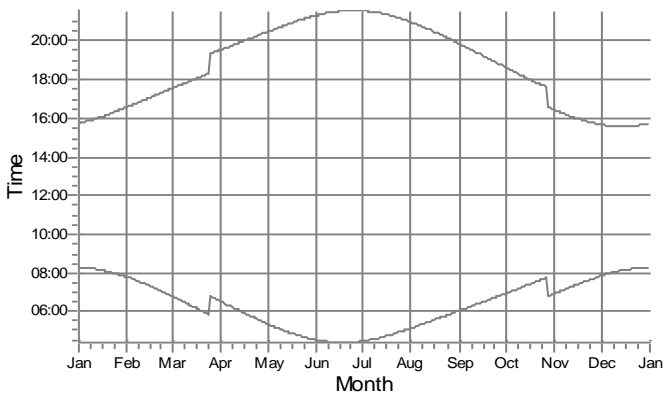
G: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(7)



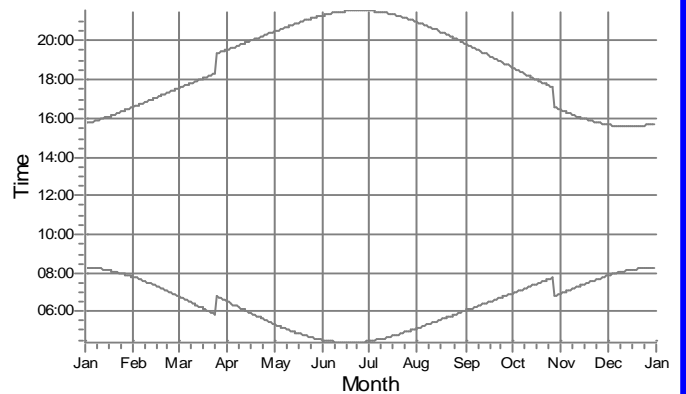
H: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(8)



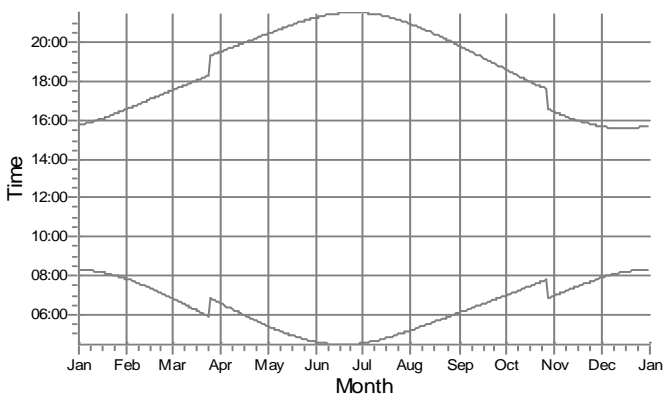
I: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(9)



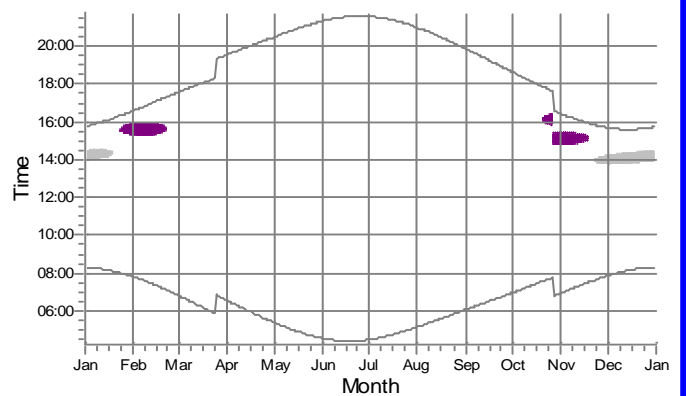
J: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(10)












K: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(11)



L: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(12)



WTGs

	11: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (357)		14: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (360)		17: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (363)
	12: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (358)		15: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (361)		19: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (365)
	13: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (359)		16: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (362)		20: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (366)

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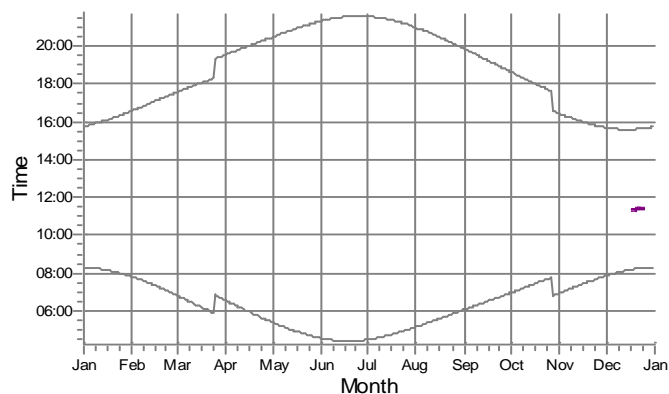
Calculated:

2012-03-13 22:15/2.7.490

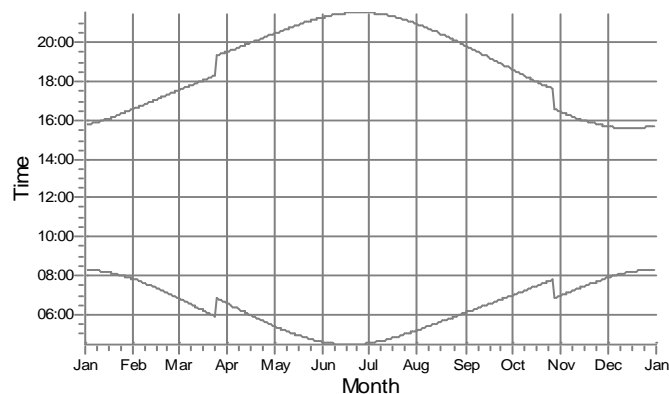
### SHADOW - Calendar, graphical

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1

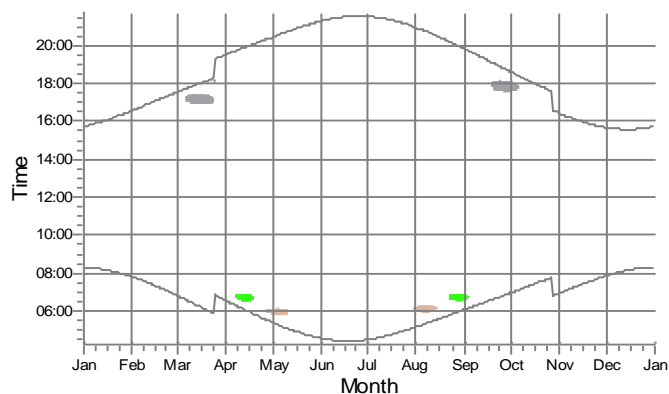
M: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(13)



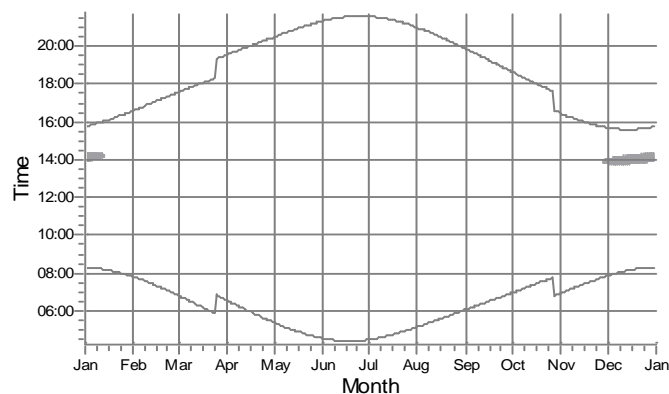
N: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(14)



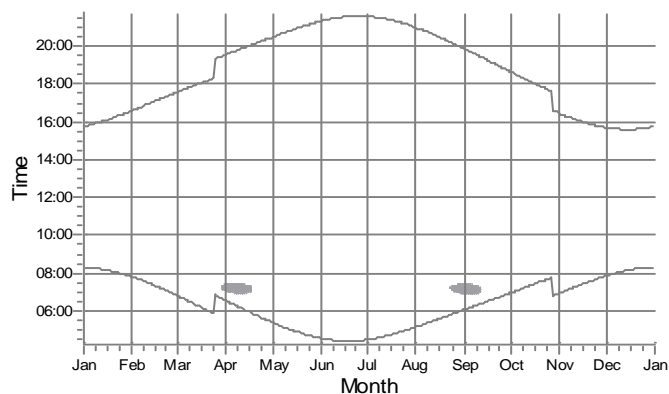
O: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(15)







P: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(16)



Q: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(17)



WTGs

- |   |  |   |  |
|---|--|---|--|
|  | 11: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (357) |  | 19: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (365) |
|  | 18: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (364) |  | 20: VESTAS V112-3.0 IC 3000 112.0 IOI hub: 119,0 m (366) |

Project:

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Calculated:

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### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 1 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (347)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:17 14:45-15:03/18	07:48 06:48	06:32 05:23	04:33 04:29	05:09 06:04	06:58 06:56	07:52 14:32-14:48/16					
1	15:44	16:35 17:33	19:32 20:28	21:18 21:33	20:57 19:50	18:36 16:25	15:40					
2	08:17 14:44-15:03/19	07:46 06:46	06:30 05:21	04:32 04:30	05:11 06:06	06:59 06:58	07:53 14:33-14:49/16					
2	15:45	16:37 17:35	19:34 20:29	21:19 21:33	20:55 19:48	18:34 16:23	15:39					
3	08:17 14:45-15:04/19	07:44 06:43	06:28 05:19	04:31 04:30	05:13 06:07	07:01 07:00	07:55 14:32-14:49/17					
3	15:46	16:39 17:37	19:36 20:31	21:21 21:32	20:54 19:45	18:31 16:21	15:39					
4	08:16 14:46-15:05/19	07:43 06:41	06:25 05:17	04:30 04:31	05:14 06:09	07:03 07:02	07:56 14:33-14:50/17					
4	15:47	16:41 17:39	19:37 20:33	21:22 21:32	20:52 19:43	18:29 16:19	15:38					
5	08:16 14:46-15:05/19	07:41 06:39	06:23 05:15	04:29 04:32	05:16 06:11	07:05 07:04	07:58 14:32-14:50/18					
5	15:48	16:43 17:41	19:39 20:35	21:23 21:31	20:50 19:40	18:26 16:17	15:37					
6	08:16 14:47-15:06/19	07:39 06:36	06:20 05:13	04:29 04:33	05:18 06:13	07:07 07:06	07:59 14:33-14:52/19					
6	15:50	16:45 17:43	19:41 20:37	21:24 21:30	20:48 19:38	18:24 16:15	15:37					
7	08:15 14:47-15:05/18	07:37 06:34	06:18 05:11	04:28 04:34	05:19 06:15	07:09 07:08	08:00 14:33-14:52/19					
7	15:51	16:47 17:44	19:43 20:39	21:25 21:30	20:46 19:36	18:21 16:13	15:36					
8	08:15 14:47-15:05/18	07:35 06:31	06:15 05:09	04:27 04:35	05:21 06:16	07:10 07:10	08:02 14:34-14:53/19					
8	15:52	16:49 17:46	19:45 20:40	21:26 21:29	20:44 19:33	18:19 16:11	15:36					
9	08:14 14:48-15:05/17	07:33 06:29	06:13 05:07	04:27 04:36	05:23 06:18	07:12 07:12	08:03 14:34-14:53/19					
9	15:54	16:51 17:48	19:47 20:42	21:27 21:28	20:42 19:31	18:16 16:10	15:36					
10	08:14 14:49-15:06/17	07:31 06:27	06:11 05:05	04:26 04:37	05:25 06:20	07:14 07:14	08:04 14:34-14:53/19					
10	15:55	16:53 17:50	19:49 20:44	21:28 21:27	20:40 19:28	18:14 16:08	15:35					
11	08:13 14:50-15:06/16	07:29 06:24	06:08 05:03	04:26 04:38	05:26 06:22	07:16 07:16	08:05 14:35-14:54/19					
11	15:57	16:55 17:52	19:50 20:46	21:28 21:27	20:38 19:26	18:12 16:06	15:35					
12	08:12 14:50-15:06/16	07:27 06:22	06:06 05:01	04:25 04:39	05:28 06:24	07:18 07:18	08:06 14:36-14:54/18					
12	15:58	16:57 17:54	19:52 20:47	21:29 21:26	20:36 19:23	18:09 16:04	15:35					
13	08:12 14:51-15:06/15	07:25 06:19	06:03 05:00	04:25 04:41	05:30 06:25	07:20 07:20	08:08 14:36-14:55/19					
13	16:00	16:59 17:56	19:54 20:49	21:30 21:25	20:34 19:21	18:07 16:03	15:35					
14	08:11 14:52-15:06/14	07:23 06:17	06:01 04:58	04:25 04:42	05:32 06:27	07:22 07:22	08:09 14:36-14:55/19					
14	16:01	17:01 17:58	19:56 20:51	21:31 21:24	20:31 19:18	18:05 16:01	15:35					
15	08:10 14:54-15:06/12	07:21 06:14	05:59 04:56	04:25 04:43	05:34 06:29	07:24 07:24	08:10 14:37-14:56/19					
15	16:03	17:03 18:00	19:58 20:53	21:31 21:23	20:29 19:16	18:02 16:00	15:35					
16	08:09 14:55-15:05/10	07:19 06:12	05:56 04:54	04:24 04:45	05:35 06:31	07:25 07:25	08:10 14:38-14:56/18					
16	16:05	17:05 18:02	20:00 20:54	21:32 21:21	20:27 19:13	18:00 15:58	15:35					
17	08:08 14:56-15:03/7	07:17 06:10	05:54 04:53	04:24 04:46	05:37 06:32	07:27 07:27	08:11 14:38-14:57/19					
17	16:06	17:07 18:04	20:02 20:56	21:32 21:20	20:25 19:11	17:58 15:57	15:35					
18	08:07 16:08	07:15 17:09	06:07 18:05	05:52 20:03	04:51 20:58	04:24 21:33	08:12 14:38-14:56/18					
18	16:08	17:09 18:05	20:03 20:58	21:33 21:19	20:23 19:08	17:55 15:55	15:35					
19	08:06 16:10	07:13 17:11	06:05 18:07	05:49 20:05	04:50 20:59	04:24 21:33	08:13 14:39-14:57/18					
19	16:10	17:11 18:07	20:05 20:59	21:33 21:18	20:21 19:06	17:53 15:54	15:35					
20	08:05 16:12	07:11 17:09	06:02 18:07	05:47 20:07	04:48 21:01	04:24 21:33	08:13 14:40-14:58/18					
20	16:12	17:13 18:09	20:07 21:01	21:33 21:16	20:18 19:03	17:51 15:52	15:36					
21	08:04 16:14	07:08 17:15	06:00 18:11	05:45 20:09	04:46 21:02	04:24 21:34	08:14 14:40-14:58/18					
21	16:14	17:15 18:11	20:09 21:02	21:34 21:15	20:16 19:01	17:48 15:51	15:36					
22	08:02 16:15	07:06 17:17	05:57 18:13	05:42 20:11	04:45 21:04	04:25 21:34	08:15 14:41-14:59/18					
22	16:15	17:17 18:13	20:11 21:04	21:34 21:14	20:14 18:58	17:46 15:50	15:37					
23	08:01 16:17	07:04 17:19	05:55 18:15	05:40 20:13	04:44 21:06	04:25 21:34	08:15 14:41-14:59/18					
23	16:17	17:19 18:15	20:13 21:06	21:34 21:12	20:11 18:56	17:44 15:48	15:37					
24	08:00 16:19	07:02 17:21	05:52 18:17	05:38 20:15	04:42 21:07	04:25 21:34	08:16 14:41-14:59/18					
24	16:19	17:21 18:17	20:15 21:07	21:34 21:11	20:09 18:53	17:42 15:47	15:38					
25	07:58 16:21	07:00 17:23	06:50 19:19	05:36 20:17	04:41 21:09	04:26 21:34	08:16 14:42-15:00/18					
25	16:21	17:23 19:19	20:17 21:09	21:34 21:09	20:07 18:51	17:40 15:46	15:38					
26	07:57 16:23	06:57 17:25	06:47 19:21	05:34 20:18	04:40 21:10	04:26 21:34	08:16 14:42-15:01/19					
26	16:23	17:25 19:21	20:18 21:10	21:34 21:07	20:04 18:48	17:37 15:45	15:39					
27	07:55 16:25	06:55 17:27	06:45 19:22	05:31 20:20	04:38 21:11	04:26 21:34	08:16 14:42-15:01/19					
27	16:25	17:27 19:22	20:20 21:11	21:34 21:06	20:02 18:46	17:35 15:44	15:40					
28	07:54 16:27	06:53 17:29	06:42 19:24	05:29 20:22	04:37 21:13	04:27 21:34	08:17 14:43-15:01/18					
28	16:27	17:29 19:24	20:22 21:13	21:34 21:04	20:00 18:43	17:33 15:43	15:41					
29	07:52 16:29	06:50 17:31	06:40 19:26	05:27 20:24	04:36 21:14	04:28 21:34	08:17 14:43-15:02/19					
29	16:29	17:31 19:26	20:24 21:14	21:34 21:03	19:57 18:41	17:31 15:42	15:42					
30	07:51 16:31	07:51 19:28	06:37 19:28	05:25 20:26	04:35 21:16	04:28 21:33	08:17 14:44-15:03/19					
30	16:31	19:28 20:26	21:16 21:16	21:33 21:01	19:55 18:38	16:29 15:41	15:43					
31	07:49 16:33	07:49 19:30	06:35 19:30	05:27 21:17	04:34 21:17	05:07 19:53	08:17 14:44-15:03/19					
31	16:33	19:30 20:28	21:17 21:17	21:33 20:59	19:53 18:38	16:27 15:41	15:44					
Potential sun hours	248	281	367	420	495	511	513	460	382	328	258	232
Sum of minutes with flicker	273	0	0	0	0	0	0	0	0	0	59	567

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/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker



Project:

Farma wiatrowa - Brojce

Printed/Page

2012-03-13 22:17 / 32

Licensed user:

Leanergia Bartosz Długokecki

Szczytnicka 18/4

PL-50 382 Wrocław

+48 600 914 594

Bartosz Długokecki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 2 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (348)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOŁOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:17 15:44	07:48 16:35	06:48 17:33	06:32 19:32	05:23 20:28	04:33 21:18	04:29 21:33	05:09 20:57	06:04 19:50	06:58 18:36	06:56 16:25	07:52 15:40
2	08:17 15:45	07:46 16:37	06:46 17:35	06:30 19:34	05:21 20:29	04:32 21:19	04:30 21:33	05:11 20:55	06:06 19:48	06:59 18:33	06:58 16:23	07:53 15:39
3	08:16 15:46	07:44 16:39	06:43 17:37	06:28 19:35	05:19 20:31	04:31 21:20	04:30 21:32	05:12 20:54	06:07 19:45	07:01 18:31	07:00 16:21	07:55 15:39
4	08:16 15:47	07:42 16:41	06:41 17:39	06:25 19:37	05:17 20:33	04:30 21:22	04:31 21:32	05:14 20:52	06:09 19:43	07:03 18:29	07:02 16:19	07:56 15:38
5	08:16 15:48	07:41 16:43	06:39 17:41	06:23 19:39	05:15 20:35	04:29 21:23	04:32 21:31	05:16 20:50	06:11 19:40	07:05 18:26	07:04 16:17	07:58 15:37
6	08:16 15:50	07:39 16:45	06:36 17:43	06:20 19:41	05:13 20:37	04:29 21:24	04:33 21:30	05:18 20:48	06:13 19:38	07:07 18:24	07:06 16:15	07:59 15:37
7	08:15 15:51	07:37 16:47	06:34 17:44	06:18 19:43	05:11 20:39	04:28 21:25	04:34 21:30	05:19 20:46	06:15 19:36	07:09 18:21	07:08 16:13	08:00 15:36
8	08:15 15:52	07:35 16:49	06:31 17:46	06:15 19:45	05:09 20:40	04:27 21:26	04:35 21:29	05:21 20:44	06:16 19:33	07:10 18:19	07:10 16:11	08:02 15:36
9	08:14 15:54	07:33 16:51	06:29 17:48	06:13 19:47	05:07 20:42	04:27 21:27	04:36 21:28	05:23 20:42	06:18 19:31	07:12 18:16	07:12 16:10	08:03 15:36
10	08:14 15:55	07:31 16:53	06:27 17:50	06:11 19:49	05:05 20:44	04:26 21:28	04:37 21:27	05:25 20:40	06:20 19:28	07:14 18:14	07:14 16:08	08:04 15:35
11	08:13 15:57	07:29 16:55	06:24 17:52	06:08 19:50	05:03 20:46	04:26 21:28	04:38 21:27	05:26 20:38	06:22 19:26	07:16 18:12	07:16 16:06	08:05 15:35
12	08:12 15:58	07:27 16:57	06:22 17:54	06:06 19:52	05:01 20:47	04:25 21:29	04:39 21:26	05:28 20:36	06:23 19:23	07:18 18:09	07:18 16:04	08:06 15:35
13	08:12 16:00	07:25 16:59	06:19 17:56	06:03 19:54	04:59 20:49	04:25 21:30	04:41 21:25	05:30 20:34	06:25 19:21	07:20 18:07	07:20 16:03	08:07 15:35
14	08:11 16:01	07:23 17:01	06:17 17:58	06:01 19:56	04:58 20:51	04:25 21:30	04:42 21:24	05:32 20:31	06:27 19:18	07:22 18:05	07:22 16:01	08:08 15:35
15	08:10 16:03	07:21 17:03	06:14 18:00	05:59 19:58	04:56 20:53	04:25 21:31	04:43 21:22	05:33 20:29	06:29 19:16	07:24 18:02	07:24 16:00	08:09 15:35
16	08:09 16:05	07:19 17:05	06:12 18:02	05:56 20:00	04:54 20:54	04:24 21:32	04:45 21:21	05:35 20:27	06:31 19:13	07:25 18:00	07:25 15:58	08:10 15:35
17	08:08 16:06	07:17 17:07	06:09 18:04	05:54 20:02	04:53 20:56	04:24 21:32	04:46 21:20	05:37 20:25	06:32 19:11	07:27 17:58	07:27 15:56	08:11 15:35
18	08:07 16:08	07:15 17:09	06:07 18:05	05:52 20:03	04:51 20:58	04:24 21:33	04:47 21:19	05:39 20:23	06:34 19:08	07:29 17:55	07:29 15:55	08:12 15:35
19	08:06 16:10	07:13 17:11	06:05 18:07	05:49 20:05	04:49 20:59	04:24 21:33	04:49 21:18	05:41 20:20	06:36 19:06	07:31 17:53	07:31 15:54	08:13 15:35
20	08:05 16:12	07:11 17:13	06:02 18:09	05:47 20:07	04:48 21:01	04:24 21:33	04:50 21:16	05:42 20:18	06:38 19:03	07:33 17:51	07:33 15:52	08:13 15:36
21	08:03 16:13	07:08 17:15	06:00 18:11	05:45 20:09	04:46 21:02	04:24 21:34	04:52 21:15	05:44 20:16	06:40 19:01	07:35 17:48	07:35 15:51	08:14 15:36
22	08:02 16:15	07:06 17:17	05:57 18:13	05:42 20:11	04:45 21:04	04:25 21:34	04:53 21:14	05:46 20:14	06:41 18:58	07:37 17:46	07:37 15:50	08:15 15:37
23	08:01 16:17	07:04 17:19	05:55 18:15	05:40 20:13	04:44 21:06	04:25 21:34	04:55 21:12	05:48 20:11	06:43 18:56	07:39 17:44	07:38 15:48	08:15 15:37
24	08:00 16:19	07:02 17:21	05:52 18:17	05:38 20:15	04:42 21:07	04:25 21:34	04:56 21:11	05:50 20:09	06:45 18:53	07:41 17:42	07:40 15:47	08:15 15:38
25	07:58 16:21	06:59 17:23	06:50 19:19	05:36 20:17	04:41 21:09	04:26 21:34	04:58 21:09	05:51 20:07	06:47 18:51	07:43 17:40	07:42 15:46	08:16 15:38
26	07:57 16:23	06:57 17:25	06:47 19:21	05:34 20:18	04:40 21:10	04:26 21:34	04:59 21:07	05:53 20:04	06:49 18:48	07:45 17:37	07:44 15:45	08:16 15:39
27	07:55 16:25	06:55 17:27	06:45 19:22	05:31 20:20	04:38 21:11	04:26 21:34	05:01 21:06	05:55 20:02	06:50 18:46	07:47 17:35	07:45 15:44	08:16 15:40
28	07:54 16:27	06:53 17:29	06:42 19:24	05:29 20:22	04:37 21:13	04:27 21:34	05:02 21:04	05:57 20:00	06:52 18:43	06:49 16:33	07:47 15:43	08:17 15:41
29	07:52 16:29	06:50 17:31	06:40 19:26	05:27 20:24	04:36 21:14	04:28 21:34	05:04 21:02	05:59 19:57	06:54 18:41	06:50 16:31	07:49 15:42	08:17 15:42
30	07:51 16:31		06:37 19:28	05:25 20:26	04:35 21:16	04:28 21:33	05:06 21:01	06:00 19:55	06:56 18:38	06:52 16:29	07:50 15:41	08:17 15:43
31	07:49 16:33		06:35 19:30		04:34 21:17		05:07 20:59	06:02 19:53		06:54 16:27		08:17 15:44
Potential sun hours	248	281	367	420	495	511	513	460	382	328	258	232
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Farma wiatrowa - Brojce

Printed/Page

2012-03-13 22:17 / 33

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Leanergia Bartosz Dlugokecki

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+48 600 914 594

Bartosz Długokęcki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 3 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (349)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum

338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	January	February	March	April	May	June	July	August	September	October	November	December		
1	08:17	07:48	06:48	06:32	07:04-07:25/21	05:23	04:33	04:29	05:09	06:04	07:03-07:17/14	06:58	06:56	07:52
	15:44	16:34	17:33	19:32		20:28	21:18	21:33	20:57	19:50		18:36	16:25	15:40
2	08:17	07:46	06:46	06:30	07:02-07:24/22	05:21	04:32	04:29	05:11	06:06	07:01-07:18/17	06:59	06:58	07:53
	15:45	16:36	17:35	19:34		20:29	21:19	21:33	20:55	19:48		18:33	16:23	15:39
3	08:16	07:44	06:43	06:27	07:02-07:25/23	05:19	04:31	04:30	05:12	06:07	06:59-07:19/20	07:01	07:00	07:55
	15:46	16:38	17:37	19:35		20:31	21:20	21:32	20:54	19:45		18:31	16:21	15:38
4	08:16	07:42	06:41	06:25	07:01-07:24/23	05:16	04:30	04:31	05:14	06:09	06:58-07:19/21	07:03	07:02	07:56
	15:47	16:40	17:39	19:37		20:33	21:22	21:32	20:52	19:43		18:28	16:19	15:38
5	08:16	07:41	06:38	06:23	07:01-07:25/24	05:14	04:29	04:32	05:16	06:11	06:57-07:20/23	07:05	07:04	07:58
	15:48	16:42	17:40	19:39		20:35	21:23	21:31	20:50	19:40		18:26	16:17	15:37
6	08:16	07:39	06:36	06:20	07:00-07:23/23	05:12	04:28	04:33	05:18	06:13	06:56-07:19/23	07:07	07:06	07:59
	15:50	16:44	17:42	19:41		20:37	21:24	21:30	20:48	19:38		18:24	16:15	15:37
7	08:15	07:37	06:34	06:18	07:01-07:23/22	05:11	04:28	04:34	05:19	06:14	06:56-07:19/23	07:09	07:08	08:00
	15:51	16:46	17:44	19:43		20:38	21:25	21:30	20:46	19:35		18:21	16:13	15:36
8	08:15	07:35	06:31	06:15	07:01-07:23/22	05:09	04:27	04:35	05:21	06:16	06:56-07:19/23	07:10	07:10	08:02
	15:52	16:48	17:46	19:45		20:40	21:26	21:29	20:44	19:33		18:19	16:11	15:36
9	08:14	07:33	06:29	06:13	07:01-07:21/20	05:07	04:27	04:36	05:23	06:18	06:55-07:18/23	07:12	07:12	08:03
	15:54	16:51	17:48	19:47		20:42	21:27	21:28	20:42	19:31		18:16	16:10	15:35
10	08:14	07:31	06:26	06:10	07:02-07:19/17	05:05	04:26	04:37	05:24	06:20	06:55-07:17/22	07:14	07:14	08:04
	15:55	16:53	17:50	19:48		20:44	21:27	21:27	20:40	19:28		18:14	16:08	15:35
11	08:13	07:29	06:24	06:08	07:04-07:18/14	05:03	04:26	04:38	05:26	06:22	06:56-07:17/21	07:16	07:16	08:05
	15:57	16:55	17:52	19:50		20:46	21:28	21:27	20:38	19:26		18:12	16:06	15:35
12	08:12	07:27	06:22	06:06	07:06-07:14/8	05:01	04:25	04:39	05:28	06:23	06:57-07:16/19	07:18	07:18	08:06
	15:58	16:57	17:54	19:52		20:47	21:29	21:26	20:36	19:23		18:09	16:04	15:35
13	08:11	07:25	06:19	06:03		04:59	04:25	04:41	05:30	06:25	06:57-07:13/16	07:20	07:20	08:07
	16:00	16:59	17:56	19:54		20:49	21:30	21:25	20:34	19:21		18:07	16:03	15:35
14	08:11	07:23	06:17	06:01		04:58	04:25	04:42	05:32	06:27	06:59-07:11/12	07:22	07:22	08:08
	16:01	17:01	17:58	19:56		20:51	21:30	21:24	20:31	19:18		18:04	16:01	15:35
15	08:10	07:21	06:14	05:58		04:56	04:24	04:43	05:33	06:29	07:04-07:06/2	07:23	07:23	08:09
	16:03	17:03	18:00	19:58		20:53	21:31	21:22	20:29	19:16		18:02	15:59	15:35
16	08:09	07:19	06:12	05:56		04:54	04:24	04:44	05:35	06:31		07:25	07:25	08:10
	16:05	17:05	18:02	20:00		20:54	21:32	21:21	20:27	19:13		18:00	15:58	15:35
17	08:08	07:17	06:09	05:54		04:53	04:24	04:46	05:37	06:32		07:27	07:27	08:11
	16:06	17:07	18:03	20:02		20:56	21:32	21:20	20:25	19:11		17:57	15:56	15:35
18	08:07	07:15	06:07	05:51		04:51	04:24	04:47	05:39	06:34		07:29	07:29	08:12
	16:08	17:09	18:05	20:03		20:58	21:33	21:19	20:23	19:08		17:55	15:55	15:35
19	08:06	07:13	06:04	05:49		04:49	04:24	04:49	05:41	06:36		07:31	07:31	08:13
	16:10	17:11	18:07	20:05		20:59	21:33	21:18	20:20	19:06		17:53	15:53	15:35
20	08:05	07:11	06:02	05:47		04:48	04:24	04:50	05:42	06:38		07:33	07:33	08:13
	16:12	17:13	18:09	20:07		21:01	21:33	21:16	20:18	19:03		17:51	15:52	15:36
21	08:03	07:08	06:00	05:45		04:46	04:24	04:51	05:44	06:39		07:35	07:35	08:14
	16:13	17:15	18:11	20:09		21:02	21:34	21:15	20:16	19:01		17:48	15:51	15:36
22	08:02	07:06	05:57	05:42		04:45	04:24	04:53	05:46	06:41		07:37	07:36	08:15
	16:15	17:17	18:13	20:11		21:04	21:34	21:13	20:14	18:58		17:46	15:49	15:36
23	08:01	07:04	05:55	05:40		04:43	04:25	04:54	05:48	06:43		07:39	07:38	08:15
	16:17	17:19	18:15	20:13		21:05	21:34	21:12	20:11	18:56		17:44	15:48	15:37
24	08:00	07:02	05:52	05:38		04:42	04:25	04:56	05:49	06:45		07:41	07:40	08:15
	16:19	17:21	18:17	20:15		21:07	21:34	21:11	20:09	18:53		17:42	15:47	15:38
25	07:58	06:59	06:50	05:36		04:41	04:25	04:58	05:51	06:47		07:43	07:42	08:16
	16:21	17:23	18:19	20:16		21:09	21:34	21:09	20:07	18:51		17:39	15:46	15:38
26	07:57	06:57	06:47	05:33		04:39	04:26	04:59	05:53	06:48		07:45	07:44	08:16
	16:23	17:25	18:20	20:18		21:10	21:34	21:07	20:04	18:48		17:37	15:45	15:39
27	07:55	06:55	06:45	05:31		04:38	04:26	05:01	05:55	06:50		07:46	07:45	08:16
	16:25	17:27	18:22	20:20		21:11	21:34	21:06	20:02	18:46		17:35	15:44	15:40
28	07:54	06:53	06:42	05:29		04:37	04:27	05:02	05:57	06:52		07:48	07:47	08:17
	16:27	17:29	18:24	20:22		21:13	21:34	21:04	20:00	18:43		17:33	15:43	15:41
29	07:52	06:50	06:40	07:09-07:21/12	05:27	04:36	04:27	05:04	05:58	06:54		07:50	07:49	08:17
	16:29	17:31	18:26	20:24		21:14	21:34	21:02	19:57	18:41		17:31	15:42	15:41
30	07:51		06:37	07:06-07:22/16	05:25	04:35	04:28	05:06	06:00	06:56		07:52	07:50	08:17
	16:30		19:28	20:26		21:15	21:33	21:01	19:55	18:38		17:29	15:41	15:42
31	07:49		06:35	07:05-07:23/18		04:34		05:07	06:02	07:05-07:14/9		06:54	06:54	08:17
	16:32		19:30			21:17		20:59	19:52			16:27		15:43
Potential sun hours	248	281	367	420	495	511	513	460	382	279	328	258	232	0
Sum of minutes with flicker	0	0	46	239	0	0	0	9	0	279	0	0	0	0

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/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Farma wiatrowa - Brojce

Printed/Page

2012-03-13 22:17 / 34

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+48 600 914 594

Bartosz Długokęcki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 4 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (350)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum

338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:17 15:44	07:48 16:34	06:48 17:33	06:32 19:32	05:23 20:28	04:33 21:18	04:29 21:33	05:09 20:57	06:04 19:50	06:58 18:36	06:56 16:25	07:48-08:16/28 15:40
2	08:17 15:45	07:46 16:36	06:46 17:35	06:30 19:34	05:21 20:29	04:32 21:19	04:29 21:33	05:11 20:55	06:06 19:48	06:59 18:33	06:58 16:23	07:48-08:16/28 15:39
3	08:16 15:46	07:44 16:38	06:43 17:37	06:27 19:35	05:19 20:31	04:31 21:20	04:30 21:32	05:12 20:54	06:07 19:45	07:01 18:31	07:00 16:21	07:48-08:15/27 15:39
4	08:16 15:47	07:42 16:40	06:41 17:39	06:25 19:37	05:17 20:33	04:30 21:22	04:31 21:32	05:14 20:52	06:09 19:43	07:03 18:29	07:02 16:19	07:49-08:15/26 15:38
5	08:16 15:48	07:41 16:42	06:39 17:41	06:23 19:39	05:15 20:35	04:29 21:23	04:32 21:31	05:16 20:50	06:11 19:40	07:05 18:26	07:04 16:17	07:50-08:14/24 15:37
6	08:16 15:50	07:39 16:44	06:36 17:42	06:20 19:41	05:13 20:37	04:29 21:24	04:33 21:30	05:18 20:48	06:13 19:38	07:07 18:24	07:06 16:15	07:51-08:14/23 15:37
7	08:15 15:51	07:37 16:47	06:34 17:44	06:18 19:43	05:11 20:38	04:28 21:25	04:34 21:30	05:19 20:46	06:14 19:35	07:09 18:21	07:08 16:13	07:53-08:12/19 15:36
8	08:15 15:52	07:35 16:49	06:31 17:46	06:15 19:45	05:09 20:40	04:27 21:26	04:35 21:29	05:21 20:44	06:16 19:33	07:10 18:19	07:10 16:11	07:54-08:11/17 15:36
9	08:14 15:54	07:33 16:51	06:29 17:48	06:13 19:47	05:07 20:42	04:27 21:27	04:36 21:28	05:23 20:42	06:18 19:31	07:12 18:16	07:12 16:10	07:56-08:09/13 15:35
10	08:14 15:55	07:31 16:53	06:27 17:50	06:10 19:48	05:05 20:44	04:26 21:27	04:37 21:27	05:25 20:40	06:20 19:28	07:14 18:14	07:14 16:08	07:59-08:06/7 15:35
11	08:13 15:57	07:29 16:55	06:24 17:52	06:08 19:50	05:03 20:46	04:26 21:28	04:38 21:27	05:26 20:38	06:22 19:26	07:16 18:12	07:16 16:06	08:05 15:35
12	08:12 15:58	07:27 16:57	06:22 17:54	06:06 19:52	05:01 20:47	04:25 21:29	04:39 21:26	05:28 20:36	06:23 19:23	07:18 18:09	07:18 16:04	08:06 15:35
13	08:11 16:00	07:25 16:59	06:19 17:56	06:03 19:54	04:59 20:49	04:25 21:30	04:41 21:25	05:30 20:34	06:25 19:21	07:20 18:07	07:20 16:03	08:07 15:35
14	08:11 16:01	07:23 17:01	06:17 17:58	06:01 19:56	04:58 20:51	04:25 21:30	04:42 21:24	05:32 20:31	06:27 19:18	07:22 18:04	07:22 16:01	08:08 15:35
15	08:10 16:03	07:21 17:03	06:14 18:00	05:59 19:58	04:56 20:53	04:24 21:31	04:43 21:22	05:33 20:29	06:29 19:16	07:23 18:02	07:23 16:00	08:09 15:35
16	08:09 16:05	07:19 17:05	06:12 18:02	05:56 20:00	04:54 20:54	04:24 21:32	04:44 21:21	05:35 20:27	06:31 19:13	07:25 18:00	07:25 16:00	08:10 15:35
17	08:08 16:06	07:17 17:07	06:09 18:03	05:54 20:02	04:53 20:56	04:24 21:32	04:46 21:20	05:37 20:25	06:32 19:11	07:27 17:57	07:27 16:00	08:11 15:35
18	08:07 16:08	07:15 17:09	06:07 18:05	05:52 20:03	04:51 20:58	04:24 21:33	04:47 21:19	05:39 20:23	06:34 19:08	07:29 17:55	07:29 16:00	08:12 15:35
19	08:06 16:10	07:13 17:11	06:04 18:07	05:49 20:05	04:49 20:59	04:24 21:33	04:49 21:18	05:41 20:20	06:36 19:06	07:31 17:53	07:31 16:00	08:13 15:35
20	08:05 16:12	07:11 17:13	06:02 18:09	05:47 20:07	04:48 21:01	04:24 21:33	04:50 21:16	05:42 20:18	06:38 19:03	07:33 17:51	07:33 16:00	08:13 15:36
21	08:03 16:13	07:08 17:15	06:00 18:11	05:45 20:09	04:46 21:02	04:24 21:34	04:51 21:15	05:44 20:16	06:39 19:01	07:35 17:48	07:35 16:00	08:14 15:36
22	08:02 16:15	07:06 17:17	05:57 18:13	05:42 20:11	04:45 21:04	04:25 21:34	04:53 21:13	05:46 20:14	06:41 18:58	07:37 17:46	07:37 16:00	08:15 15:37
23	08:01 16:17	07:04 17:19	05:55 18:15	05:40 20:13	04:43 21:05	04:25 21:34	04:55 21:12	05:48 20:11	06:43 18:56	07:39 17:44	07:39 16:00	08:15 15:37
24	08:00 16:19	07:02 17:21	05:52 18:17	05:38 20:15	04:42 21:07	04:25 21:34	04:56 21:11	05:49 20:09	06:45 18:53	07:41 17:42	07:41 16:00	08:15 15:38
25	07:58 16:21	06:59 17:23	06:50 19:19	05:36 20:16	04:41 21:08	04:25 21:34	04:58 21:09	05:51 20:07	06:47 18:51	07:43 17:40	07:43 16:00	08:16 15:38
26	07:57 16:23	06:57 17:25	06:47 19:20	05:33 20:18	04:39 21:10	04:26 21:34	04:59 21:07	05:53 20:04	06:48 18:48	07:45 17:37	07:45 16:00	08:16 15:39
27	07:55 16:25	06:55 17:27	06:45 19:22	05:31 20:20	04:38 21:11	04:26 21:34	05:01 21:06	05:55 20:02	06:50 18:46	07:47 17:35	07:47 16:00	08:16 15:40
28	07:54 16:27	06:53 17:29	06:42 19:24	05:29 20:22	04:37 21:13	04:27 21:34	05:02 21:04	05:57 20:00	06:52 18:43	07:48 17:33	07:48 16:00	08:17 15:41
29	07:52 16:29	06:50 17:31	06:40 19:26	05:27 20:24	04:36 21:14	04:27 21:34	05:04 21:02	05:58 19:57	06:54 18:41	07:50 17:31	07:50 16:00	08:17 15:41
30	07:51 16:31		06:37 19:28	05:25 20:26	04:35 21:15	04:28 21:33	05:06 21:01	06:00 19:55	06:56 18:38	07:47 17:29	07:47 16:00	08:17 15:42
31	07:49 16:32		06:35 19:30		04:34 21:17		05:07 20:59	06:02 19:53		06:54 17:29		08:17 15:43
Potential sun hours	248	281	367	420	495	511	513	460	382	328	258	232
Sum of minutes with flicker	0	485	0	0	0	0	0	0	0	283	212	0

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/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Farma wiatrowa - Brojce

Printed/Page

2012-03-13 22:17 / 35

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Bartosz Dlugokecki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 5 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (351)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:17	07:48	06:48	06:32	05:23	04:33	04:29	05:09	06:04	06:58 07:38-07:59/21	06:56	07:52
	15:44	16:34	17:33	19:32	20:28	21:18	21:33	20:57	19:50	18:36	16:25	15:40
2	08:17	07:46	06:46	06:30	05:21	04:32	04:29	05:11	06:06	06:59 07:36-07:58/22	06:58	07:53
	15:45	16:36	17:35	19:34	20:29	21:19	21:33	20:55	19:48	18:33	16:23	15:39
3	08:16	07:44	06:43	06:27	05:19	04:31	04:30	05:12	06:07	07:01 07:36-07:57/21	07:00	07:55
	15:46	16:38	17:37	19:35	20:31	21:20	21:32	20:54	19:45	18:31	16:21	15:39
4	08:16	07:42	06:41	06:25	05:16	04:30	04:31	05:14	06:09	07:03 07:36-07:57/21	07:02	07:56
	15:47	16:40	17:39	19:37	20:33	21:22	21:32	20:52	19:43	18:28	16:19	15:38
5	08:16	07:41	06:38 07:06-07:14/8	06:23	05:14	04:29	04:32	05:16	06:11	07:05 07:37-07:56/19	07:04	07:58
	15:48	16:42	17:40	19:39	20:35	21:23	21:31	20:50	19:40	18:26	16:17	15:37
6	08:16	07:39	06:36 07:04-07:17/13	06:20	05:12	04:29	04:33	05:18	06:13	07:07 07:38-07:55/17	07:06	07:59
	15:50	16:44	17:42	19:41	20:37	21:24	21:30	20:48	19:38	18:24	16:15	15:37
7	08:15	07:37	06:34 07:02-07:18/16	06:18	05:11	04:28	04:34	05:19	06:14	07:08 07:39-07:53/14	07:08	08:00
	15:51	16:46	17:44	19:43	20:38	21:25	21:30	20:46	19:35	18:21	16:13	15:36
8	08:15	07:35	06:31 07:00-07:19/19	06:15	05:09	04:27	04:35	05:21	06:16	07:10 07:41-07:51/10	07:10	08:02
	15:52	16:49	17:46	19:45	20:40	21:26	21:29	20:44	19:33	18:19	16:11	15:36
9	08:14	07:33	06:29 07:00-07:20/20	06:13	05:07	04:27	04:36	05:23	06:18	07:12	07:12	08:03
	15:54	16:51	17:48	19:47	20:42	21:27	21:28	20:42	19:31	18:16	16:10	15:35
10	08:14	07:31	06:26 06:59-07:19/20	06:10	05:05	04:26	04:37	05:25	06:20	07:14	07:14	08:04
	15:55	16:53	17:50	19:48	20:44	21:27	21:27	20:40	19:28	18:14	16:08	15:35
11	08:13	07:29	06:24 06:59-07:20/21	06:08	05:03	04:26	04:38	05:26	06:22	07:16	07:16	08:05
	15:57	16:55	17:52	19:50	20:46	21:28	21:26	20:38	19:26	18:12	16:06	15:35
12	08:12	07:27	06:22 06:58-07:19/21	06:06	05:01	04:25	04:39	05:28	06:23	07:18	07:18	08:06
	15:58	16:57	17:54	19:52	20:47	21:29	21:26	20:36	19:23	18:09	16:04	15:35
13	08:11	07:25	06:19 06:58-07:19/21	06:03	04:59	04:25	04:41	05:30	06:25	07:20	07:20	08:07
	16:00	16:59	17:56	19:54	20:49	21:30	21:25	20:33	19:21	18:07	16:03	15:35
14	08:11	07:23	06:17 06:58-07:18/20	06:01	04:58	04:25	04:42	05:32	06:27	07:22	07:22	08:08
	16:01	17:01	17:58	19:56	20:51	21:30	21:24	20:31	19:18	18:04	16:01	15:35
15	08:10	07:21	06:14 06:59-07:17/18	05:58	04:56	04:24	04:43	05:33	06:29	07:23	07:23	08:09
	16:03	17:03	18:00	19:58	20:52	21:31	21:22	20:29	19:16	18:02	15:59	15:35
16	08:09	07:19	06:12 07:00-07:15/15	05:56	04:54	04:24	04:44	05:35	06:31	07:25	07:25	08:10
	16:05	17:05	18:02	20:00	20:54	21:32	21:21	20:27	19:13	18:00	15:58	15:35
17	08:08	07:17	06:09 07:02-07:13/11	05:54	04:53	04:24	04:46	05:37	06:32	07:27	07:27	08:11
	16:06	17:07	18:03	20:02	20:56	21:32	21:20	20:25	19:11	17:57	15:56	15:35
18	08:07	07:15	06:07 07:05-07:08/3	05:51	04:51	04:24	04:47	05:39	06:34	07:29	07:29	08:12
	16:08	17:09	18:05	20:03	20:58	21:33	21:19	20:23	19:08	17:55	15:55	15:35
19	08:06	07:13	06:04	05:49	04:49	04:24	04:49	05:41	06:36	07:31	07:31	08:13
	16:10	17:11	18:07	20:05	20:59	21:33	21:18	20:20	19:06	17:53	15:53	15:35
20	08:05	07:11	06:02	05:47	04:48	04:24	04:50	05:42	06:38	07:33	07:33	08:13
	16:12	17:13	18:09	20:07	21:01	21:33	21:16	20:18	19:03	17:51	15:52	15:36
21	08:03	07:08	06:00	05:45	04:46	04:24	04:51	05:44	06:39	07:35	07:35	08:14
	16:13	17:15	18:11	20:09	21:02	21:33	21:15	20:16	19:01	17:48	15:51	15:36
22	08:02	07:06	05:57	05:42	04:45	04:24	04:53	05:46	06:41	07:37	07:36	08:15
	16:15	17:17	18:13	20:11	21:04	21:34	21:13	20:14	18:58	17:46	15:49	15:36
23	08:01	07:04	05:55	05:40	04:43	04:25	04:54	05:48	06:43	07:39	07:38	08:15
	16:17	17:19	18:15	20:13	21:05	21:34	21:12	20:11	18:56	17:44	15:48	15:37
24	08:00	07:02	05:52	05:38	04:42	04:25	04:56	05:49	06:45	07:41	07:40	08:15
	16:19	17:21	18:17	20:15	21:07	21:34	21:11	20:09	18:53	17:42	15:47	15:38
25	07:58	06:59	06:50	05:36	04:41	04:25	04:58	05:51	06:47	07:43	07:42	08:16
	16:21	17:23	19:19	20:16	21:08	21:34	21:09	20:07	18:51	17:39	15:46	15:38
26	07:57	06:57	06:47	05:33	04:39	04:26	04:59	05:53	06:48 07:44-07:54/10	07:45	07:43	08:16
	16:23	17:25	19:20	20:18	21:10	21:34	21:07	20:04	18:48	17:37	15:45	15:39
27	07:55	06:55	06:45	05:31	04:38	04:26	05:01	05:55	06:50 07:41-07:56/15	07:46	07:45	08:16
	16:25	17:27	19:22	20:20	21:11	21:34	21:06	20:02	18:46	17:35	15:44	15:40
28	07:54	06:53	06:42	05:29	04:37	04:27	05:02	05:57	06:52 07:40-07:57/17	06:48	07:47	08:16
	16:27	17:29	19:24	20:22	21:13	21:34	21:04	20:00	18:43	17:33	15:43	15:41
29	07:52	06:50	06:40	05:27	04:36	04:27	05:04	05:58	06:54 07:39-07:58/19	06:50	07:48	08:17
	16:29	17:31	19:26	20:24	21:14	21:33	21:02	19:57	18:41	17:31	15:42	15:41
30	07:51		06:37	05:25	04:35	04:28	05:06	06:00	06:56 07:38-07:58/20	06:52	07:50	08:17
	16:30		19:28	20:26	21:15	21:33	21:01	19:55	18:38	16:29	15:41	15:42
31	07:49		06:35		04:34		05:07	06:02		06:54		08:17
	16:32		19:30		21:17		20:59	19:52		16:27		15:43
Potential sun hours	248	281	367	420	495	511	513	460	382	328	258	232
Sum of minutes with flicker	0	0	226	0	0	0	0	0	81	145	0	0

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/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Farma wiatrowa - Brojce

Printed/Page

2012-03-13 22:17 / 36

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 6 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (352)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	January	February	March	April	May	June	July	August	September	October	November	December		
1	08:17 15:44	07:48 16:35	06:48 17:33	06:32 19:32	05:23 20:28	19:58-19:59/1	04:33 21:18	04:29 21:33	05:09 20:57	19:59-20:19/20	06:04 19:50	06:58 18:36	06:56 16:25	07:52 15:40
2	08:17 15:45	07:46 16:37	06:46 17:35	06:30 19:34	05:21 20:29	19:55-20:01/6	04:32 21:19	04:30 21:33	05:11 20:55	19:59-20:19/20	06:06 19:48	06:59 18:33	06:58 16:23	07:53 15:39
3	08:16 15:46	07:44 16:39	06:43 17:37	06:27 19:35	05:19 20:31	19:53-20:02/9	04:31 21:20	04:30 21:32	05:12 20:54	20:00-20:20/20	06:07 19:45	07:01 18:31	07:00 16:21	07:55 15:39
4	08:16 15:47	07:42 16:41	06:41 17:39	06:25 19:37	05:17 20:33	19:51-20:04/13	04:30 21:22	04:31 21:32	05:14 20:52	19:59-20:19/20	06:09 19:43	07:03 18:29	07:02 16:19	07:56 15:38
5	08:16 15:48	07:41 16:43	06:39 17:41	06:23 19:39	05:15 20:35	19:50-20:05/15	04:29 21:23	04:32 21:31	05:16 20:50	20:00-20:19/19	06:11 19:40	07:05 18:26	07:04 16:17	07:58 15:37
6	08:16 15:50	07:39 16:45	06:36 17:42	06:20 19:41	05:13 20:37	19:50-20:08/18	04:29 21:24	04:33 21:30	05:18 20:48	19:59-20:18/19	06:13 19:38	07:07 18:24	07:06 16:15	07:59 15:37
7	08:15 15:51	07:37 16:47	06:34 17:44	06:18 19:43	05:11 20:38	19:50-20:09/19	04:28 21:25	04:34 21:30	05:19 20:46	20:00-20:16/16	06:15 19:35	07:09 18:21	07:08 16:13	08:00 15:36
8	08:15 15:52	07:35 16:49	06:31 17:46	06:15 19:45	05:09 20:40	19:49-20:09/20	04:27 21:26	04:35 21:30	05:21 20:44	20:01-20:15/14	06:16 19:33	07:10 18:19	07:10 16:11	08:02 15:36
9	08:14 15:54	07:33 16:51	06:29 17:48	06:13 19:47	05:07 20:42	19:49-20:09/20	04:27 21:27	04:36 21:28	05:23 20:42	20:01-20:12/11	06:18 19:31	07:12 18:16	07:12 16:10	08:03 15:35
10	08:14 15:55	07:31 16:53	06:27 17:50	06:10 19:48	05:05 20:44	19:49-20:10/21	04:26 21:27	04:37 21:27	05:25 20:40	20:03-20:11/8	06:20 19:28	07:14 18:14	07:14 16:08	08:04 15:35
11	08:13 15:57	07:29 16:55	06:24 17:52	06:08 19:50	05:03 20:46	19:49-20:09/20	04:26 21:28	04:38 21:26	05:26 20:38	20:04-20:08/4	06:22 19:26	07:16 18:12	07:16 16:06	08:05 15:35
12	08:12 15:58	07:27 16:57	06:22 17:54	06:06 19:52	05:01 20:47	19:49-20:09/20	04:25 21:29	04:39 21:26	05:28 20:36	06:23 19:23	07:18 18:09	07:18 16:04	07:18 15:35	08:06 15:35
13	08:11 16:00	07:25 16:59	06:19 17:56	06:03 19:54	04:59 20:49	19:50-20:09/19	04:25 21:30	04:41 21:25	05:30 20:34	06:25 19:21	07:20 18:07	07:20 16:03	08:07 15:35	08:07 15:35
14	08:11 16:01	07:23 17:01	06:17 17:58	06:01 19:56	04:58 20:51	19:50-20:08/18	04:25 21:30	04:42 21:24	05:32 20:31	06:27 19:18	07:22 18:04	07:22 16:01	08:08 15:35	08:08 15:35
15	08:10 16:03	07:21 17:03	06:14 18:00	05:59 19:58	04:56 20:52	19:51-20:08/17	04:24 21:31	04:43 21:22	05:33 20:29	06:29 19:16	07:23 18:02	07:23 16:00	08:09 15:35	08:09 15:35
16	08:09 16:05	07:19 17:05	06:12 18:02	05:56 20:00	04:54 20:54	19:52-20:06/14	04:24 21:32	04:44 21:21	05:35 20:27	06:31 19:13	07:25 18:00	07:25 15:58	08:10 15:35	08:10 15:35
17	08:08 16:06	07:17 17:07	06:09 18:04	05:54 20:02	04:53 20:56	19:53-20:06/13	04:24 21:32	04:46 21:20	05:37 20:25	06:32 19:11	07:27 17:58	07:27 15:56	08:11 15:35	08:11 15:35
18	08:07 16:08	07:15 17:09	06:07 18:05	05:52 20:03	04:51 20:58	19:54-20:04/10	04:24 21:33	04:47 21:19	05:39 20:23	06:34 19:08	07:29 17:55	07:29 15:55	08:12 15:35	08:12 15:35
19	08:06 16:10	07:13 17:11	06:04 18:07	05:49 20:05	04:49 20:59	19:57-20:02/5	04:24 21:33	04:49 21:18	05:41 20:20	06:36 19:06	07:31 17:53	07:31 15:54	08:13 15:35	08:13 15:35
20	08:05 16:12	07:11 17:13	06:02 18:09	05:47 20:07	04:48 21:01		04:24 21:33	04:50 21:16	05:42 20:18	06:38 19:03	07:33 17:51	07:33 15:52	08:13 15:36	08:13 15:36
21	08:03 16:13	07:08 17:15	06:00 18:11	05:45 20:09	04:46 21:02		04:24 21:33	04:52 21:15	05:44 20:16	06:40 19:01	07:35 17:48	07:35 15:51	08:14 15:36	08:14 15:36
22	08:02 16:15	07:06 17:17	05:57 18:13	05:42 20:11	04:45 21:04		04:25 21:34	04:53 21:13	05:46 20:14	06:41 18:58	07:37 17:46	07:36 15:50	08:15 15:37	08:15 15:37
23	08:01 16:17	07:04 17:19	05:55 18:15	05:40 20:13	04:44 21:05		04:25 21:34	04:55 21:12	05:48 20:11	06:43 18:56	07:39 17:44	07:38 15:48	08:15 15:37	08:15 15:37
24	08:00 16:19	07:02 17:21	05:52 18:17	05:38 20:15	04:42 21:07		04:25 21:34	04:56 21:11	05:50 20:09	06:45 18:53	07:41 17:42	07:40 15:47	08:15 15:38	08:15 15:38
25	07:58 16:21	06:59 17:23	06:50 19:19	05:36 20:16	04:41 21:08		04:25 21:34	04:58 21:09	20:06-20:14/8	05:51 20:07	07:43 18:51	07:42 17:40	08:16 15:46	08:16 15:38
26	07:57 16:23	06:57 17:25	06:47 19:20	05:33 20:18	04:40 21:10		04:26 21:34	04:59 21:07	20:04-20:15/11	05:53 20:04	07:45 18:48	07:43 17:37	08:16 15:45	08:16 15:39
27	07:55 16:25	06:55 17:27	06:45 19:22	05:31 20:20	04:38 21:11		04:26 21:34	05:01 21:06	20:03-20:17/14	05:55 20:02	07:47 18:46	07:45 17:35	08:16 15:44	08:16 15:40
28	07:54 16:27	06:53 17:29	06:42 19:24	05:29 20:22	04:37 21:13		04:27 21:34	05:02 21:04	20:02-20:17/15	05:57 20:00	06:52 18:43	06:48 16:33	07:47 15:43	08:16 15:41
29	07:52 16:29	06:50 17:31	06:40 19:26	05:27 20:24	04:36 21:14		04:27 21:33	05:04 21:02	20:01-20:18/17	05:58 19:57	06:54 18:41	06:50 16:31	07:48 15:42	08:17 15:42
30	07:51 16:31	06:51 17:31	06:37 19:28	05:25 20:26	04:35 21:15		04:28 21:33	05:06 21:01	20:00-20:18/18	06:00 19:55	06:56 18:38	06:52 16:29	07:50 15:41	08:17 15:42
31	07:49 16:33	06:51 17:31	06:35 19:30	05:25 20:26	04:34 21:17		05:07 20:59	20:00-20:19/19	06:02 19:53	06:02 19:53	06:54 16:27	06:54 15:43	08:17 15:43	08:17 15:43
Potential sun hours	248	281	367	420	495	511	513	460	382	328	258	232		
Sum of minutes with flicker	0	0	0	0	278	0	102	171	0	0	0	0		

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	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

Project:

Farma wiatrowa - Brojce

Printed/Page

2012-03-13 22:17 / 37

Licensed user:

Leanergia Bartosz Dlugokecki

Szczytnicka 18/4

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+48 600 914 594

Bartosz Dlugokecki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 7 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (353)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:17 15:44	07:48 16:35	06:48 17:33	06:32 19:32	05:23 06:06-06:40/34 20:28	04:33 21:18	04:29 21:33	05:09 06:17-06:50/33 20:57	06:04 19:50	06:58 18:36	06:56 16:25	07:52 15:40
2	08:17 15:45	07:46 16:37	06:46 17:35	06:30 19:34	05:21 06:06-06:40/34 20:29	04:32 21:19	04:30 21:32	05:11 06:16-06:50/34 20:55	06:06 19:48	06:59 18:33	06:58 16:23	07:53 15:39
3	08:16 15:46	07:44 16:39	06:43 17:37	06:28 19:35	05:19 06:05-06:40/35 20:31	04:31 21:20	04:30 21:32	05:12 06:16-06:50/34 20:54	06:07 19:45	07:01 18:31	07:00 16:21	07:55 15:39
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6	08:16 15:50	07:39 16:45	06:36 17:42	06:20 19:41	05:13 06:05-06:41/36 20:37	04:29 21:24	04:33 21:30	05:18 06:15-06:51/36 20:48	06:13 19:38	07:07 18:24	07:06 16:15	07:59 15:37
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8	08:15 15:52	07:35 16:49	06:31 17:46	06:15 19:45	05:09 06:05-06:40/35 20:40	04:27 21:26	04:35 21:29	05:21 06:15-06:50/35 20:44	06:16 19:33	07:10 18:19	07:10 16:11	08:02 15:36
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10	08:14 15:55	07:31 16:53	06:27 17:50	06:11 19:48	05:05 06:06-06:40/34 20:44	04:26 21:27	04:37 21:27	05:25 06:15-06:50/35 20:40	06:20 19:28	07:14 18:14	07:14 16:08	08:04 15:35
11	08:13 15:57	07:29 16:55	06:24 17:52	06:08 19:50	05:03 06:06-06:39/33 20:46	04:26 21:28	04:38 21:26	05:26 06:15-06:50/35 20:38	06:22 19:26	07:16 18:12	07:16 16:06	08:05 15:35
12	08:12 15:58	07:27 16:57	06:22 17:54	06:06 19:52	05:01 06:06-06:38/32 20:47	04:25 21:29	04:39 21:26	05:28 06:15-06:48/33 20:36	06:23 19:23	07:18 18:09	07:18 16:04	08:06 15:35
13	08:11 16:00	07:25 16:59	06:19 17:56	06:03 19:54	04:59 06:07-06:39/32 20:49	04:25 21:30	04:41 21:25	05:30 06:15-06:48/33 20:34	06:25 19:21	07:20 18:07	07:20 16:03	08:07 15:35
14	08:11 16:01	07:23 17:01	06:17 17:58	06:01 19:56	04:58 06:07-06:37/30 20:51	04:25 21:30	04:42 21:23	05:32 06:16-06:47/31 20:31	06:27 19:18	07:22 18:05	07:22 16:01	08:08 15:35
15	08:10 16:03	07:21 17:03	06:14 18:00	05:59 19:58	04:56 06:08-06:37/29 20:52	04:25 21:31	04:43 21:22	05:33 06:16-06:46/30 20:29	06:29 19:16	07:23 18:02	07:23 16:00	08:09 15:35
16	08:09 16:05	07:19 17:05	06:12 18:02	05:56 20:00	04:54 06:08-06:36/28 20:54	04:24 21:32	04:45 21:21	05:35 06:17-06:45/28 20:27	06:31 19:13	07:25 18:00	07:25 16:00	08:10 15:35
17	08:08 16:06	07:17 17:07	06:09 18:04	05:54 20:02	04:53 06:09-06:36/27 20:56	04:24 21:32	04:46 21:20	05:37 06:19-06:44/25 20:25	06:32 19:11	07:27 17:57	07:27 16:00	08:11 15:35
18	08:07 16:08	07:15 17:09	06:07 18:05	05:52 20:03	04:51 06:10-06:34/24 20:57	04:24 21:32	04:47 21:19	05:39 06:20-06:41/21 20:23	06:34 19:08	07:29 17:55	07:29 16:00	08:12 15:35
19	08:06 16:10	07:13 17:11	06:05 18:07	05:49 20:05	04:49 06:11-06:33/22 20:59	04:24 21:33	04:49 21:18	05:41 06:22-06:40/18 20:20	06:36 19:06	07:31 17:53	07:31 16:00	08:13 15:35
20	08:05 16:12	07:11 17:13	06:02 18:09	05:47 20:07	04:48 06:13-06:33/20 21:01	04:24 21:33	04:50 21:16	05:42 06:25-06:37/12 20:18	06:38 19:03	07:33 17:51	07:33 16:00	08:13 15:36
21	08:03 16:13	07:08 17:15	06:00 18:11	05:45 20:09	04:46 06:14-06:31/17 21:02	04:24 21:33	04:52 21:15	05:44 06:26-06:38/12 20:16	06:40 19:01	07:35 17:48	07:35 16:00	08:14 15:36
22	08:02 16:15	07:06 17:17	05:57 18:13	05:42 20:11	06:23-06:28/5 21:04	04:45 21:34	06:25-06:40/15 21:13	05:46 06:25-06:40/15 20:14	06:41 18:58	07:37 17:46	07:36 16:00	08:14 15:37
23	08:01 16:17	07:04 17:19	05:55 18:15	05:40 20:13	06:18-06:33/15 21:05	04:44 21:34	06:23-06:42/19 21:12	05:48 06:23-06:42/19 20:11	06:43 18:56	07:39 17:44	07:38 16:00	08:15 15:37
24	08:00 16:19	07:02 17:21	05:52 18:17	05:38 20:15	06:15-06:34/19 21:07	04:42 21:34	06:22-06:43/21 21:10	05:50 06:22-06:43/21 20:09	06:45 18:53	07:41 17:42	07:40 16:00	08:15 15:38
25	07:58 16:21	06:59 17:23	06:50 18:19	05:36 20:16	06:13-06:36/23 21:08	04:41 21:34	06:21-06:44/23 21:09	05:51 06:21-06:44/23 20:07	06:47 18:51	07:43 17:40	07:42 16:00	08:16 15:38
26	07:57 16:23	06:57 17:25	06:47 19:20	05:34 20:18	06:11-06:37/26 21:10	04:40 21:34	06:20-06:46/26 21:07	05:53 06:20-06:46/26 20:04	06:49 18:48	07:45 17:37	07:43 16:00	08:16 15:39
27	07:55 16:25	06:55 17:27	06:45 19:22	05:31 20:20	06:10-06:38/28 21:11	04:38 21:34	06:19-06:46/27 21:06	05:55 06:19-06:46/27 20:02	06:50 18:46	07:47 17:35	07:45 16:00	08:16 15:40
28	07:54 16:27	06:53 17:29	06:42 19:24	05:29 20:22	06:09-06:39/30 21:13	04:37 21:34	06:19-06:48/29 21:04	05:57 06:19-06:48/29 20:00	06:52 18:43	06:48 16:33	07:47 16:00	08:16 15:41
29	07:52 16:29	06:50 17:31	06:40 19:26	05:27 20:24	06:08-06:39/31 21:14	04:36 21:33	06:18-06:48/30 21:02	05:59 06:18-06:48/30 19:57	06:54 18:41	06:50 16:31	07:48 16:00	08:17 15:42
30	07:51 16:31	06:47 17:33	06:37 19:28	05:25 20:26	06:07-06:40/33 21:15	04:35 21:33	06:18-06:49/31 21:01	06:00 06:18-06:49/31 19:55	06:56 18:38	06:52 16:29	07:50 16:00	08:17 15:43
31	07:49 16:33	06:45 17:35	06:35 19:30	05:23 20:28	06:06-06:39/32 21:16	04:34 21:33	06:17-06:49/32 21:00	06:02 06:17-06:49/32 19:53	06:54 18:38	06:54 16:27	08:17 16:00	08:17 15:44
Potential sun hours	248	281	367	420	495	511	513	460	382	328	258	232
Sum of minutes with flicker	0	0	0	210	666	0	271	616	0	0	0	0

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	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

Project:

Farma wiatrowa - Brojce

Printed/Page

2012-03-13 22:17 / 38

Licensed user:

Leanergia Bartosz Dlugokecki

Szczytnicka 18/4

PL-50 382 Wroclaw

+48 600 914 594

Bartosz Długokęcki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 8 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (354)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,33	2,19	3,53	5,54	7,87	7,57	7,41	7,34	4,73	3,34	1,48	1,08

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
338	404	489	730	507	694	738	1313	1207	872	893	319	8503

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

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:17 15:44	07:48 16:35	06:48 17:33	06:32 19:32	07:46-08:04/18 20:28	05:23 20:28	04:33 21:18	04:29 21:33	05:09 20:57	06:04 19:50	06:58 18:36	07:47/12 16:25	07:52 15:40
2	08:17 15:45	07:46 16:37	06:46 17:35	06:30 19:34	07:48-08:01/13 20:29	05:21 20:29	04:32 21:19	04:30 21:32	05:11 20:55	06:06 19:48	06:59 18:33	07:53 16:23	07:53 15:39
3	08:16 15:46	07:44 16:39	06:43 17:37	06:28 19:35	06:20 20:31	05:19 20:31	04:31 21:20	04:30 21:32	05:13 20:53	06:07 19:45	07:01 18:31	07:00 16:21	07:55 15:39
4	08:16 15:47	07:42 16:41	06:41 17:39	06:25 19:37	05:17 20:33	05:17 20:33	04:30 21:22	04:31 21:32	05:14 20:52	06:09 19:43	07:03 18:29	07:02 16:19	07:56 15:38
5	08:16 15:48	07:41 16:43	06:39 17:41	06:23 19:39	06:23 20:35	05:15 20:35	04:29 21:23	04:32 21:31	05:16 20:50	06:11 19:40	07:05 18:26	07:04 16:17	07:58 15:37
6	08:16 15:50	07:39 16:45	06:36 17:42	06:20 19:41	06:20 20:37	05:13 20:37	04:29 21:24	04:33 21:30	05:18 20:48	06:13 19:38	07:07 18:24	07:06 16:15	07:59 15:37
7	08:15 15:51	07:37 16:47	06:34 17:44	06:18 19:43	06:18 20:38	05:11 20:38	04:28 21:25	04:34 21:30	05:19 20:46	06:15 19:36	07:09 18:21	07:08 16:13	08:00 15:36
8	08:15 15:52	07:35 16:49	06:31 17:46	06:15 19:45	06:15 20:40	05:09 20:40	04:27 21:26	04:35 21:29	05:21 20:44	06:16 19:33	07:10 18:19	07:10 16:11	08:02 15:36
9	08:14 15:54	07:33 16:51	06:29 17:48	06:13 19:47	06:13 20:42	05:07 20:42	04:27 21:27	04:36 21:28	05:23 20:42	06:18 19:31	07:12 18:16	07:12 16:10	08:03 15:36
10	08:14 15:55	07:31 16:53	06:27 17:50	06:11 19:48	06:11 20:44	05:05 20:44	04:26 21:27	04:37 21:27	05:25 20:40	06:20 19:28	07:41-07:54/13 18:14	07:14 16:08	08:04 15:35
11	08:13 15:57	07:29 16:55	06:24 17:52	06:08 19:50	06:08 20:46	05:03 20:46	04:26 21:28	04:38 21:26	05:26 20:38	06:22 19:26	07:38-07:56/18 18:12	07:16 16:06	08:05 15:35
12	08:12 15:58	07:27 16:57	06:22 17:54	06:06 19:52	06:06 20:47	05:01 20:47	04:25 21:29	04:39 21:25	05:28 20:36	06:23 19:23	07:36-07:58/22 18:09	07:18 16:04	08:06 15:35
13	08:11 16:00	07:25 16:59	06:19 17:56	06:04-07:10/16 19:54	06:03 20:49	05:00 20:49	04:25 21:30	04:41 21:25	05:30 20:33	06:25 19:21	07:33-07:59/26 18:07	07:20 16:03	08:07 15:35
14	08:11 16:01	07:23 17:01	06:17 17:58	06:50-07:11/21 19:56	06:01 20:51	04:58 20:51	04:25 21:30	04:42 21:23	05:32 20:31	06:27 19:18	07:32-08:00/28 18:05	07:22 16:01	08:08 15:35
15	08:10 16:03	07:21 17:03	06:14 18:00	06:49-07:13/24 19:58	05:59 20:52	04:56 20:52	04:25 21:31	04:43 21:22	05:33 20:29	06:29 19:16	07:31-08:01/30 18:02	07:23 16:00	08:09 15:35
16	08:09 16:05	07:19 17:05	06:12 18:02	06:46-07:14/28 20:00	05:56 20:54	04:54 20:54	04:24 21:32	04:45 21:21	05:35 20:27	06:31 19:13	07:30-08:02/32 18:00	07:25 16:58	08:10 15:35
17	08:08 16:06	07:17 17:07	06:09 18:04	06:45-07:15/30 20:02	05:54 20:56	04:53 20:56	04:24 21:32	04:46 21:20	05:37 20:25	06:32 19:11	07:28-08:02/34 17:58	07:27 16:57	08:11 15:35
18	08:07 16:08	07:15 17:09	06:07 18:05	06:44-07:15/31 20:03	05:52 20:57	04:51 20:57	04:24 21:32	04:47 21:19	05:39 20:23	06:34 19:08	07:28-08:02/34 17:55	07:29 16:55	08:12 15:35
19	08:06 16:10	07:13 17:11	06:05 18:07	06:43-07:16/33 20:05	05:49 20:59	04:50 20:59	04:24 21:33	04:49 21:18	05:41 20:20	06:36 19:06	07:28-08:02/34 17:53	07:31 16:54	08:13 15:35
20	08:05 16:12	07:11 17:13	06:02 18:09	06:42-07:16/34 20:07	05:47 20:07	04:48 21:01	04:24 21:33	04:50 21:16	05:42 20:18	06:38 19:03	07:27-08:02/35 17:51	07:33 16:52	08:13 15:36
21	08:03 16:13	07:08 17:15	06:00 18:11	06:42-07:16/34 20:09	05:45 21:02	04:46 21:02	04:25 21:33	04:52 21:15	05:44 20:16	06:40 19:01	07:26-08:01/35 17:48	07:35 16:51	08:14 15:36
22	08:02 16:15	07:06 17:17	05:57 18:13	06:41-07:16/35 20:11	05:42 20:11	04:45 21:04	04:25 21:34	04:53 21:13	05:46 20:14	06:41 18:58	07:26-08:01/35 17:46	07:37 16:50	08:14 15:37
23	08:01 16:17	07:04 17:19	05:55 18:15	06:41-07:16/35 20:13	05:40 20:13	04:44 21:05	04:25 21:34	04:55 21:12	05:48 20:11	06:43 18:56	07:26-08:00/34 17:44	07:39 16:48	08:15 15:37
24	08:00 16:19	07:02 17:21	05:52 18:17	06:40-07:15/35 20:15	05:38 20:15	04:42 21:07	04:25 21:34	04:56 21:10	05:50 20:09	06:45 18:53	07:27-08:00/33 17:42	07:41 16:47	08:15 15:38
25	07:58 16:21	06:59 17:23	06:50 19:19	07:41-08:15/34 20:16	05:36 20:16	04:41 21:08	04:26 21:34	04:58 21:09	05:51 20:07	06:47 18:51	07:27-07:59/32 17:40	07:43 16:46	08:16 15:38
26	07:57 16:23	06:57 17:25	06:47 19:20	07:40-08:13/33 20:18	05:34 20:18	04:40 21:10	04:26 21:34	04:59 21:07	05:53 20:04	06:49 18:48	07:27-07:57/30 17:37	07:45 16:45	08:16 15:39
27	07:55 16:25	06:55 17:27	06:45 19:22	07:41-08:13/32 20:20	05:31 20:20	04:38 21:11	04:26 21:34	05:01 21:06	05:55 20:02	06:50 18:46	07:28-07:56/28 17:35	07:47 16:44	08:16 15:40
28	07:54 16:27	06:53 17:29	06:42 19:24	07:41-08:11/30 20:22	05:29 20:22	04:37 21:13	04:27 21:34	05:03 21:04	05:57 20:00	06:52 18:43	07:29-07:54/25 17:33	06:48 16:43	08:16 15:41
29	07:52 16:29	06:50 17:31	06:40 19:26	07:42-08:10/28 20:24	05:27 20:24	04:36 21:14	04:28 21:33	05:04 21:02	05:59 19:57	06:54 18:41	07:30-07:53/23 17:31	06:50 16:42	08:17 15:42
30	07:51 16:31	06:49 17:33	06:37 19:28	07:42-08:08/26 20:26	05:25 20:26	04:35 21:15	04:28 21:33	05:06 21:01	06:00 19:55	06:56 18:38	07:32-07:50/18 17:29	06:52 16:41	08:17 15:43
31	07:49 16:33	06:48 17:35	06:35 19:30	07:44-08:06/22 20:28	05:23 20:28	04:34 21:17	04:27 21:34	05:07 20:59	06:02 19:53	06:54 18:36	07:31-07:49/17 17:27	06:51 16:40	08:17 15:44
Potential sun hours	248	281	367	420	495	511	513	460	382	328	258	232	
Sum of minutes with flicker	0	0	570	31	0	0	0	0	599	12	0	0	

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	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

Project:

Farma wiatrowa - Brojce

Printed/Page

2012-03-13 22:17 / 39

Licensed user:

Leanergia Bartosz Dlugokecki

Szczytnicka 18/4

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Bartosz Dlugokecki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 9 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (355)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum

338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:17	07:47 14:57-15:23/26	06:48	06:32	05:23	04:33	04:29	05:09	06:04	06:57	06:56	07:52 14:36-14:57/21
	15:44	16:35	17:33	19:32	20:27	21:18	21:33	20:57	19:50	18:36	16:25	15:40
2	08:16	07:46 14:58-15:22/24	06:46	06:30	05:21	04:32	04:30	05:11	06:06	06:59	06:58	07:53 14:36-14:56/20
	15:45	16:37	17:35	19:34	20:29	21:19	21:32	20:55	19:48	18:33	16:23	15:39
3	08:16	07:44 14:59-15:21/22	06:43	06:27	05:19	04:31	04:30	05:12	06:07	07:01	07:00	07:55 14:38-14:56/18
	15:46	16:39	17:37	19:35	20:31	21:20	21:32	20:53	19:45	18:31	16:21	15:39
4	08:16	07:42 15:01-15:20/19	06:41	06:25	05:17	04:30	04:31	05:14	06:09	07:03	07:02	07:56 14:39-14:56/17
	15:47	16:41	17:39	19:37	20:33	21:21	21:31	20:52	19:43	18:28	16:19	15:38
5	08:16	14:58-15:04/6	07:41 15:03-15:19/16	06:38	06:23	05:15	04:29	04:32	05:16	06:11	07:05	07:04 14:39-14:42/3
	15:48	16:43	17:40	19:39	20:35	21:23	21:31	20:50	19:40	18:26	16:17	15:37
6	08:15	14:56-15:06/10	07:39 15:05-15:16/11	06:36	06:20	05:13	04:29	04:33	05:18	06:13	07:07	07:06 14:34-14:47/13
	15:50	16:45	17:42	19:41	20:37	21:24	21:30	20:48	19:38	18:24	16:15	15:37
7	08:15	14:56-15:08/12	07:37	06:34	06:18	05:11	04:28	04:34	05:19	06:14	07:08	07:08 14:32-14:49/17
	15:51	16:47	17:44	19:43	20:38	21:25	21:30	20:46	19:35	18:21	16:13	15:36
8	08:15	14:55-15:09/14	07:35	06:31	06:15	05:09	04:27	04:35	05:21	06:16	07:10	07:10 14:31-14:51/20
	15:52	16:49	17:46	19:45	20:40	21:26	21:29	20:44	19:33	18:19	16:11	15:36
9	08:14	14:54-15:11/17	07:33	06:29	06:13	05:07	04:27	04:36	05:23	06:18	07:12	07:12 14:30-14:52/22
	15:54	16:51	17:48	19:47	20:42	21:26	21:28	20:42	19:31	18:16	16:10	15:36
10	08:13	14:54-15:12/18	07:31	06:26	06:10	05:05	04:26	04:37	05:25	06:20	07:14	07:14 14:29-14:53/24
	15:55	16:53	17:50	19:48	20:44	21:27	21:27	20:40	19:28	18:14	16:08	15:35
11	08:13	14:54-15:14/20	07:29	06:24	06:08	05:03	04:26	04:38	05:26	06:22	07:16	07:16 14:28-14:54/26
	15:57	16:55	17:52	19:50	20:45	21:28	21:26	20:38	19:26	18:12	16:06	15:35
12	08:12	14:54-15:15/21	07:27	06:22	06:06	05:01	04:25	04:39	05:28	06:23	07:18	07:18 14:27-14:55/28
	15:58	16:57	17:54	19:52	20:47	21:29	21:25	20:36	19:23	18:09	16:04	15:35
13	08:11	14:53-15:16/23	07:25	06:19	06:03	04:59	04:25	04:41	05:30	06:25	07:20	07:20 14:27-14:55/28
	16:00	16:59	17:56	19:54	20:49	21:30	21:24	20:33	19:21	18:07	16:03	15:35
14	08:11	14:53-15:17/24	07:23	06:17	06:01	04:58	04:25	04:42	05:32	06:27	07:22	07:21 14:26-14:55/29
	16:01	17:01	17:58	19:56	20:51	21:30	21:23	20:31	19:18	18:04	16:01	15:35
15	08:10	14:53-15:18/25	07:21	06:14	05:59	04:56	04:25	04:43	05:33	06:29	07:23	07:23 14:27-14:57/30
	16:03	17:03	18:00	19:58	20:52	21:31	21:22	20:29	19:16	18:02	16:00	15:35
16	08:09	14:52-15:18/26	07:19	06:12	05:56	04:54	04:24	04:44	05:35	06:31	07:25	07:25 14:27-14:57/30
	16:05	17:05	18:02	20:00	20:54	21:31	21:21	20:27	19:13	18:00	15:58	15:35
17	08:08	14:52-15:19/27	07:17	06:09	05:54	04:53	04:24	04:46	05:37	06:32	07:27	07:27 14:27-14:57/30
	16:06	17:07	18:03	20:01	20:56	21:32	21:20	20:25	19:11	17:57	15:56	15:35
18	08:07	14:52-15:20/28	07:15	06:07	05:52	04:51	04:24	04:47	05:39	06:34	07:29	07:29 14:27-14:58/31
	16:08	17:09	18:05	20:03	20:57	21:32	21:19	20:23	19:08	17:55	15:55	15:35
19	08:06	14:53-15:21/28	07:13	06:04	05:49	04:49	04:24	04:49	05:41	06:36	07:31	07:31 14:27-14:58/31
	16:10	17:11	18:07	20:05	20:59	21:33	21:17	20:20	19:06	17:53	15:54	15:35
20	08:05	14:52-15:21/29	07:10	06:02	05:47	04:48	04:24	04:50	05:42	06:38	07:33	07:33 14:28-14:58/30
	16:12	17:13	18:09	20:07	21:01	21:33	21:16	20:18	19:03	17:51	15:52	15:36
21	08:03	14:53-15:22/29	07:08	06:00	05:45	04:46	04:24	04:52	05:44	06:39	07:35	07:35 14:28-14:58/30
	16:13	17:15	18:11	20:09	21:02	21:33	21:15	20:16	19:01	17:48	15:51	15:36
22	08:02	14:52-15:22/30	07:06	05:57	05:42	04:45	04:25	04:53	05:46	06:41	07:37	07:36 14:28-14:58/30
	16:15	17:17	18:13	20:11	21:04	21:34	21:13	20:14	18:58	17:46	15:50	15:37
23	08:01	14:53-15:23/30	07:04	05:55	05:40	04:44	04:25	04:55	05:48	06:43	07:39	07:38 14:29-14:58/29
	16:17	17:19	18:15	20:13	21:05	21:34	21:12	20:11	18:56	17:44	15:48	15:37
24	08:00	14:52-15:23/31	07:02	05:52	05:38	04:42	04:25	04:56	05:50	06:45	07:41	07:40 14:30-14:58/28
	16:19	17:21	18:17	20:15	21:07	21:34	21:10	20:09	18:53	17:42	15:47	15:38
25	07:58	14:53-15:24/31	06:59	06:50	05:36	04:41	04:26	04:58	05:51	06:47	07:43	07:42 14:30-14:58/28
	16:21	17:23	19:19	20:16	21:08	21:34	21:09	20:07	18:51	17:40	15:46	15:38
26	07:57	14:53-15:24/31	06:57	06:47	05:33	04:40	04:26	04:59	05:53	06:48	07:44	07:43 14:31-14:58/27
	16:23	17:25	19:20	20:18	21:10	21:34	21:07	20:04	18:48	17:37	15:45	15:39
27	07:55	14:53-15:23/30	06:55	06:45	05:31	04:38	04:26	05:01	05:55	06:50	07:46	07:45 14:32-14:58/26
	16:25	17:27	19:22	20:20	21:11	21:34	21:06	20:02	18:46	17:35	15:44	15:40
28	07:54	14:54-15:24/30	06:53	06:42	05:29	04:37	04:27	05:02	05:57	06:52	07:48	07:47 14:32-14:57/25
	16:27	17:29	19:24	20:22	21:13	21:34	21:04	20:00	18:43	17:33	15:43	15:41
29	07:52	14:55-15:24/29	06:50	06:40	05:27	04:36	04:28	05:04	05:58	06:54	07:48	07:48 14:33-14:57/24
	16:29	17:31	19:26	20:24	21:14	21:33	21:02	19:57	18:41	17:31	15:42	15:42
30	07:51	14:55-15:23/28		06:37	05:25	04:35	04:28	05:06	06:00	06:56	07:50	14:34-14:57/23
	16:31		19:28	20:26	21:15	21:33	21:01	19:55	18:38	17:29	15:41	15:42
31	07:49	14:56-15:23/27		06:35		04:34		05:07	06:02		06:54	
	16:33		19:30		21:17			20:59	19:52		16:27	15:43
Potential sun hours	248					511	513	460	382	328	258	232
Sum of minutes with flicker	654	281	118	0	0	0	0	0	0	0	662	118

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/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker



Project:

**Farma wiatrowa - Brojce**

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2012-03-13 22:17 / 40

Licensed user:

**Leanergia Bartosz Dlugokecki**

Szczytnicka 18/4

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+48 600 914 594

Bartosz Długokęcki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

## SHADOW - Calendar per WTG

**Calculation:** Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 10 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (356)

### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	January	February	March	April	May	June
1	08:17 14:36-14:57/21 15:44	07:47 16:35	06:48 17:33	06:32 19:32	05:23 20:27	04:33 21:18
2	08:16 14:36-14:58/22 15:45	07:46 16:37	06:46 17:35	06:30 19:34	05:21 20:29	04:32 21:19
3	08:16 14:37-14:59/22 15:46	07:44 16:39	06:43 17:37	06:27 19:35	05:19 20:31	04:31 21:20
4	08:16 14:37-14:59/22 15:47	07:42 16:41	06:41 17:39	06:25 19:37	05:17 20:33	04:30 21:21
5	08:16 14:38-15:00/22 15:48	07:41 16:43	06:38 07:04-07:05/1 17:41	06:23 19:39	05:15 20:35	04:29 21:23
6	08:15 14:38-15:00/22 15:50	07:39 16:45	06:36 07:02-07:08/6 17:42	06:20 19:41	05:13 20:37	04:29 21:24
7	08:15 14:39-15:01/22 15:51	07:37 16:47	06:34 07:00-07:09/9 17:44	06:18 19:43	05:11 20:38	04:28 21:25
8	08:15 14:39-15:01/22 15:52	07:35 16:49	06:31 06:57-07:09/12 17:46	06:15 19:45	05:09 20:40	04:27 21:26
9	08:14 14:39-15:01/22 15:54	07:33 16:51	06:29 06:55-07:10/15 17:48	06:13 19:47	05:07 20:42	04:27 21:26
10	08:13 14:39-15:01/22 15:55	07:31 16:53	06:26 06:53-07:09/16 17:50	06:10 19:48	05:05 20:44	04:26 21:27
11	08:13 14:41-15:02/21 15:57	07:29 16:55	06:24 06:53-07:09/16 17:52	06:08 19:50	05:03 20:45	04:26 21:28
12	08:12 14:41-15:02/21 15:58	07:27 16:57	06:22 06:53-07:08/15 17:54	06:06 19:52	05:01 20:47	04:25 21:29
13	08:11 14:42-15:02/20 16:00	07:25 16:59	06:19 06:55-07:07/12 17:56	06:03 19:54	04:59 20:49	04:25 21:30
14	08:11 14:43-15:02/19 16:01	07:23 17:01	06:17 06:56-07:04/8 17:58	06:01 19:56	04:58 20:51	04:25 21:30
15	08:10 14:44-15:02/18 16:03	07:21 17:03	06:14 18:00	05:59 19:58	04:56 20:52	04:25 21:31
16	08:09 14:44-15:01/17 16:05	07:19 17:05	06:12 18:02	05:56 20:00	04:54 20:54	04:24 21:31
17	08:08 14:45-15:01/16 16:06	07:17 17:07	06:09 18:03	05:54 20:01	04:53 20:56	04:24 21:32
18	08:07 14:47-15:01/14 16:08	07:15 17:09	06:07 18:05	05:52 20:03	04:51 20:57	04:24 21:32
19	08:06 14:48-15:01/13 16:10	07:13 17:11	06:04 18:07	05:49 20:05	04:49 20:59	04:24 21:33
20	08:05 14:50-14:59/9 16:12	07:10 17:13	06:02 18:09	05:47 20:07	04:48 21:01	04:24 21:33
21	08:03 14:54-14:56/2 16:13	07:08 17:15	06:00 18:11	05:45 20:09	04:46 21:02	04:24 21:33
22	08:02 16:15	07:06 17:17	05:57 18:13	05:42 20:11	04:45 21:04	04:25 21:34
23	08:01 16:17	07:04 17:19	05:55 18:15	05:40 20:13	04:44 21:05	04:25 21:34
24	08:00 16:19	07:02 17:21	05:52 18:17	05:38 20:15	04:42 21:07	04:25 21:34
25	07:58 16:21	06:59 17:23	06:50 19:19	05:36 20:16	04:41 21:08	04:26 21:34
26	07:57 16:23	06:57 17:25	06:47 19:20	05:33 20:18	04:40 21:10	04:26 21:34
27	07:55 16:25	06:55 17:27	06:45 19:22	05:31 20:20	04:38 21:11	04:26 21:34
28	07:54 16:27	06:53 17:29	06:42 19:24	05:29 20:22	04:37 21:13	04:27 21:34
29	07:52 16:29	06:50 17:31	06:40 19:26	05:27 20:24	04:36 21:14	04:28 21:33
30	07:51 16:31		06:37 19:28	05:25 20:26	04:35 21:15	04:28 21:33
31	07:49 16:33		06:35 19:30		04:34 21:17	
Potential sun hours	248	281	367	420	495	511
Sum of minutes with flicker	389	0	110	0	0	0

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/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 41

Licensed user:

Leanergia Bartosz Dlugokecki

Szczytnicka 18/4

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+48 600 914 594

Bartosz Długokęcki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 10 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (356)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	July	August	September	October	November	December
1	04:29 21:33	05:09 20:57	06:04 19:50	06:58 18:36	07:33-07:47/14 16:25	06:56 15:40
2	04:30 21:32	05:11 20:55	06:06 19:48	06:59 18:33	07:31-07:46/15 16:23	06:58 15:39
3	04:30 21:32	05:12 20:53	06:07 19:45	07:01 18:31	07:31-07:47/16 16:21	07:00 15:39
4	04:31 21:31	05:14 20:52	06:09 19:43	07:03 18:29	07:31-07:47/16 16:19	07:02 15:38
5	04:32 21:31	05:16 20:50	06:11 19:40	07:05 18:26	07:33-07:46/13 16:17	07:04 15:37
6	04:33 21:30	05:18 20:48	06:13 19:38	07:07 18:24	07:35-07:45/10 16:15	07:06 15:37
7	04:34 21:30	05:19 20:46	06:15 19:35	07:08 18:21	07:37-07:44/7 16:13	07:08 15:36
8	04:35 21:29	05:21 20:44	06:16 19:33	07:10 18:19	07:39-07:42/3 16:11	07:10 15:36
9	04:36 21:28	05:23 20:42	06:18 19:31	07:12 18:16	07:12 16:10	08:03 15:36
10	04:37 21:27	05:25 20:40	06:20 19:28	07:14 18:14	07:14 16:08	08:04 15:35
11	04:38 21:26	05:26 20:38	06:22 19:26	07:16 18:12	07:16 16:06	08:05 15:35
12	04:39 21:25	05:28 20:36	06:23 19:23	07:18 18:09	07:18 16:04	08:06 15:35
13	04:41 21:24	05:30 20:33	06:25 19:21	07:20 18:07	07:20 16:03	08:07 15:35
14	04:42 21:23	05:32 20:31	06:27 19:18	07:22 18:04	07:21 16:01	08:08 15:35
15	04:43 21:22	05:33 20:29	06:29 19:16	07:23 18:02	07:23 16:00	08:09 15:35
16	04:45 21:21	05:35 20:27	06:31 19:13	07:25 18:00	07:25 15:58	08:10 15:35
17	04:46 21:20	05:37 20:25	06:32 19:11	07:27 17:58	07:27 15:56	08:11 15:35
18	04:47 21:19	05:39 20:23	06:34 19:08	07:29 17:55	07:29 15:55	08:12 15:35
19	04:49 21:17	05:41 20:20	06:36 19:06	07:31 17:53	07:31 15:54	08:13 15:35
20	04:50 21:16	05:42 20:18	06:38 19:03	07:33 17:51	07:33 15:52	08:13 15:36
21	04:52 21:15	05:44 20:16	06:39 19:01	07:35 17:48	07:35 15:51	08:14 15:36
22	04:53 21:13	05:46 20:14	06:41 18:58	07:37 17:46	07:36 15:50	14:29-14:32/3 15:37
23	04:55 21:12	05:48 20:11	06:43 18:56	07:39 17:44	07:38 15:48	14:27-14:36/9 15:37
24	04:56 21:10	05:50 20:09	06:45 18:53	07:41 17:42	07:40 15:47	14:25-14:38/13 15:38
25	04:58 21:09	05:51 20:07	06:47 18:51	07:43 17:40	07:42 15:46	14:24-14:39/15 15:38
26	04:59 21:07	05:53 20:04	06:48 18:48	07:45 17:37	07:43 15:45	14:24-14:40/16 15:39
27	05:01 21:06	05:55 20:02	06:50 18:46	07:46 17:35	07:45 15:44	14:24-14:41/17 15:40
28	05:02 21:04	05:57 20:00	06:52 18:43	06:48 16:33	07:47 15:43	14:23-14:41/18 15:41
29	05:04 21:02	05:58 19:57	06:54 18:41	06:50 16:31	07:48 15:42	14:23-14:42/19 15:42
30	05:06 21:01	06:00 19:55	06:56 18:38	06:52 16:29	07:50 15:41	14:23-14:43/20 15:43
31	05:07 20:59	06:02 19:52		06:54 16:27		14:35-14:57/22 15:43
Potential sun hours	513	460	382	328	258	232
Sum of minutes with flicker	0	0	18	94	130	666

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/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 42

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 11 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (357)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:17 15:44	07:48 15:17-15:49/32 16:35	06:48 17:33	06:33 19:32	05:23 20:28	04:33 21:18	04:29 21:33	05:09 20:57	06:04 19:50	06:58 18:36	06:56 14:45-15:22/37 16:25	07:52 15:41
2	08:17 15:45	07:46 15:16-15:49/33 16:37	06:46 17:35	06:30 19:34	05:21 20:29	04:32 21:19	04:30 21:32	05:11 20:55	06:06 19:48	07:00 18:34	06:58 14:44-15:22/38 16:23	07:53 15:40
3	08:16 15:46	07:44 15:16-15:50/34 16:39	06:43 17:37	06:28 19:36	05:19 20:31	04:31 21:20	04:31 21:32	05:13 20:54	06:08 19:45	07:01 18:31	07:00 14:44-15:22/38 16:21	07:55 15:39
4	08:16 15:48	07:42 15:15-15:51/36 16:41	06:41 17:39	06:25 19:37	05:17 20:33	04:31 21:22	04:32 21:32	05:15 20:52	06:09 19:43	07:03 18:29	07:02 14:44-15:22/38 16:19	07:56 15:38
5	08:16 15:49	07:41 15:15-15:51/36 16:43	06:39 17:41	06:23 19:39	05:15 20:35	04:30 21:23	04:32 21:31	05:16 20:50	06:11 19:41	07:05 18:26	07:04 14:44-15:21/37 16:17	07:58 15:38
6	08:16 15:50	07:39 15:15-15:52/37 16:45	06:36 17:43	06:20 19:41	05:13 20:37	04:29 21:24	04:33 21:30	05:18 20:48	06:13 19:38	07:07 18:24	07:06 14:44-15:21/37 16:15	07:59 15:37
7	08:15 15:51	07:37 15:15-15:52/37 16:47	06:34 17:45	06:18 19:43	05:11 20:39	04:28 21:25	04:34 21:30	05:20 20:46	06:15 19:36	07:09 18:21	07:08 14:46-15:22/36 16:14	08:00 15:37
8	08:15 15:53	07:35 15:15-15:52/37 16:49	06:32 17:47	06:16 19:45	05:09 20:40	04:28 21:26	04:35 21:29	05:21 20:44	06:17 19:33	07:11 18:19	07:10 14:46-15:21/35 16:12	08:02 15:36
9	08:14 15:54	07:33 15:15-15:52/37 16:51	06:29 17:48	06:13 19:47	05:07 20:42	04:27 21:27	04:36 21:28	05:23 20:42	06:18 19:31	07:12 18:17	07:12 14:46-15:21/35 16:10	08:03 15:36
10	08:14 15:56	07:31 15:15-15:52/37 16:53	06:27 17:50	06:11 19:49	05:05 20:44	04:27 21:27	04:38 21:27	05:25 20:40	06:20 19:28	07:14 18:14	07:14 14:47-15:20/33 16:08	08:04 15:36
11	08:13 15:57	07:29 15:15-15:52/37 16:55	06:24 17:52	06:08 19:50	05:03 20:46	04:26 21:28	04:39 21:26	05:27 20:38	06:22 19:26	07:16 18:12	07:16 14:48-15:19/31 16:06	08:05 15:35
12	08:12 15:59	07:27 15:16-15:52/36 16:57	06:22 17:54	06:06 19:52	05:02 20:47	04:26 21:29	04:40 21:26	05:28 20:36	06:24 19:23	07:18 18:09	07:18 14:48-15:18/30 16:05	08:06 15:35
13	08:11 16:00	07:25 15:15-15:51/36 16:59	06:19 17:56	06:04 19:54	05:00 20:49	04:25 21:30	04:41 21:25	05:30 20:34	06:25 19:21	07:20 18:07	07:20 14:49-15:17/28 16:03	08:07 15:35
14	08:11 16:02	07:23 15:16-15:51/35 17:01	06:17 17:58	06:01 19:56	04:58 20:51	04:25 21:30	04:42 21:23	05:32 20:31	06:27 19:18	07:22 18:05	07:22 14:52-15:17/25 16:01	08:08 15:35
15	08:10 16:03	07:21 15:17-15:50/33 17:03	06:15 18:00	05:59 19:58	04:56 20:53	04:25 21:31	04:44 21:22	05:34 20:29	06:29 19:16	07:24 18:02	07:24 14:53-15:16/23 16:00	08:09 15:35
16	08:09 16:05	07:19 15:18-15:50/32 17:05	06:12 18:02	05:56 20:00	04:55 20:54	04:25 21:32	04:45 21:21	05:36 20:27	06:31 19:13	07:26 18:00	07:25 14:54-15:15/21 15:58	08:10 15:35
17	08:08 16:07	07:17 15:19-15:49/30 17:07	06:10 18:04	05:54 20:02	04:53 20:56	04:25 21:32	04:46 21:20	05:37 20:25	06:33 19:11	07:27 17:58	07:27 14:56-15:13/17 15:57	08:11 15:35
18	08:07 16:08	07:15 15:19-15:47/28 17:09	06:07 18:06	05:52 20:04	04:51 20:58	04:25 21:32	04:48 21:19	05:39 20:23	06:34 19:08	07:29 17:55	07:29 14:59-15:10/11 15:55	08:12 11:15-11:18/3 15:36
19	08:06 16:10	07:13 15:21-15:46/25 17:11	06:05 18:07	05:50 20:05	04:50 20:59	04:25 21:33	04:49 21:18	05:41 20:21	06:36 19:06	07:31 17:53	07:31 14:55-15:11/12 15:53	08:13 11:15-11:20/5 15:36
20	08:05 16:12	07:11 15:24-15:45/21 17:13	06:02 18:09	05:47 20:07	04:48 21:01	04:25 21:33	04:50 21:16	05:43 20:18	06:38 19:03	07:33 17:51	07:33 14:56-16:11/12 15:53	08:13 11:14-11:21/7 15:36
21	08:03 16:14	07:08 15:26-15:42/16 17:15	06:00 18:11	05:45 20:09	04:47 21:02	04:25 21:33	04:52 21:15	05:44 20:16	06:40 19:01	07:35 15:59-16:11/12 17:49	07:35 14:55-16:14/19 15:51	08:14 11:15-11:22/7 15:37
22	08:02 16:16	07:06 15:30-15:37/7 17:17	05:57 18:13	05:43 20:11	04:45 21:04	04:25 21:34	04:53 21:13	05:46 20:14	06:42 18:58	07:37 15:55-16:14/19 17:46	07:36 14:55-16:16/23 15:50	08:14 11:16-11:23/7 15:37
23	08:01 16:17	07:04 15:32-15:37/7 17:19	05:55 18:15	05:40 20:13	04:44 21:05	04:25 21:34	04:53 21:12	05:48 20:11	06:43 18:56	07:39 15:53-16:16/23 17:44	07:38 14:55-16:16/23 15:49	08:15 11:16-11:23/7 15:38
24	08:00 16:19	07:02 15:29-15:31/2 17:21	05:52 18:17	05:38 20:15	04:43 21:07	04:26 21:34	04:56 21:11	05:50 20:09	06:45 18:53	07:41 15:51-16:17/26 17:42	07:40 14:54-16:18/29 15:47	08:15 11:17-11:22/5 15:38
25	07:58 16:21	07:00 15:25-15:37/12 17:23	06:50 19:19	05:36 20:17	04:41 21:08	04:26 21:34	04:58 21:09	05:52 20:07	06:47 18:51	07:43 15:49-16:18/29 17:40	07:42 14:54-16:18/29 15:46	08:16 11:18-11:22/4 15:39
26	07:57 16:23	06:57 15:22-15:39/17 17:25	06:47 19:21	05:34 20:18	04:40 21:10	04:26 21:34	05:00 21:07	05:53 20:04	06:49 18:48	07:45 15:48-16:19/31 17:38	07:44 14:54-16:19/31 15:45	08:16 15:39
27	07:55 16:25	06:55 15:21-15:42/21 17:27	06:45 19:23	05:32 20:20	04:39 21:11	04:27 21:34	05:01 21:06	05:55 20:02	06:50 18:46	07:47 15:47-16:19/32 17:36	07:45 14:54-16:19/32 15:44	08:16 15:40
28	07:54 16:27	06:53 15:20-15:44/24 17:29	06:42 19:24	05:29 20:22	04:38 21:13	04:27 21:34	05:03 21:04	05:57 20:00	06:52 18:44	07:46 14:46-15:20/34 17:33	07:47 14:46-15:20/34 15:43	08:16 15:41
29	07:52 16:29	06:50 15:19-15:45/26 17:31	06:40 19:26	05:27 20:24	04:36 21:14	04:28 21:33	05:04 21:02	05:59 19:57	06:54 18:41	07:45 14:45-15:20/35 17:31	07:48 14:45-15:20/35 15:42	08:17 15:42
30	07:51 16:31	06:48 15:18-15:46/28 17:33	06:38 19:28	05:25 20:26	04:35 21:15	04:29 21:33	05:06 21:01	05:56 19:55	06:01 18:39	07:44 14:44-15:21/37 17:29	07:50 14:44-15:21/37 15:41	08:17 15:43
31	07:49 16:33	06:46 15:18-15:48/30 17:35	06:35 19:30	05:23 20:28	04:34 21:17	04:28 21:33	05:08 20:59	06:02 19:53	06:02 18:39	07:43 14:45-15:22/37 17:27	07:49 14:45-15:22/37 15:40	08:17 15:44
Potential sun hours	248	282	367	420	495	511	513	460	382	328	258	232
Sum of minutes with flicker	160	692	0	0	0	0	0	0	0	315	550	45

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	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

Project:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 43

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Bartosz Dlugokecki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 12 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (358)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:17 13:54-14:24/30 15:44	07:48 16:35 17:33	06:48 17:33 19:32	06:33 19:32 20:28	05:23 20:28 21:18	04:33 21:18 21:33	04:29 21:33 20:57	05:09 20:57 19:50	06:04 19:50 18:36	06:58 18:36 16:25	06:56 16:25 15:41	07:52 13:44-14:09/25 15:41
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Potential sun hours	248	282	367	420	495	511	513	460	382	328	258	232
Sum of minutes with flicker	455	0	0	0	0	0	0	0	0	0	120	921

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/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Farma wiatrowa - Brojce

Printed/Page

2012-03-13 22:17 / 44

Licensed user:

Leanergia Bartosz Dlugokecki

Szczytnicka 18/4

PL-50 382 Wroclaw

+48 600 914 594

Bartosz Długokęcki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 13 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (359)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:16 15:44	07:47 16:35	06:48 17:33	06:32 19:32	05:23 20:27	04:33 21:18	05:21-05:37/16 21:33	04:29 21:33	05:34-05:35/1 20:57	06:04 19:50	06:57 18:36	06:56 16:25	07:51 15:40
2	08:16 15:45	07:46 16:37	06:46 17:35	06:30 19:33	05:21 20:29	04:32 21:19	05:22-05:37/15 21:32	04:30 20:55	05:33-05:38/5 19:48	06:06 18:33	06:59 18:33	06:58 16:23	07:53 15:39
3	08:16 15:46	07:44 16:39	06:43 17:37	06:27 19:35	05:19 20:31	04:31 21:20	05:22-05:36/14 21:32	04:30 20:53	05:32-05:39/7 19:45	06:07 18:31	07:01 18:31	07:00 16:21	07:54 15:39
4	08:16 15:47	07:42 16:41	06:41 17:39	06:25 19:37	05:17 20:33	04:30 21:21	05:23-05:37/14 21:31	04:31 20:51	05:32-05:40/8 19:43	06:09 18:28	07:03 18:28	07:02 16:19	07:56 15:38
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Potential sun hours	248	282	367	420	495	511	513	460	382	328	258	232	0
Sum of minutes with flicker	0	0	0	0	264	117	380	0	0	0	0	0	0

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/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Farma wiatrowa - Brojce

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Licensed user:

Leanergia Bartosz Dlugokecki

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Bartosz Dlugokecki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 14 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (360)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:16 15:44	07:47 16:35	06:48 17:33	06:32 19:32	05:23 20:27	06:05-06:21/16 21:18	04:33 21:33	04:29 20:57	05:09 20:07	06:04 19:50	06:57 18:36	06:56 16:25	07:51 15:40
2	08:16 15:45	07:46 16:37	06:45 17:35	06:30 19:33	05:21 20:29	06:05-06:19/14 21:19	04:32 21:32	04:30 20:55	05:11 19:48	06:06 18:33	06:59 16:23	06:58 16:23	07:53 15:39
3	08:16 15:46	07:44 16:39	06:43 17:37	06:27 19:35	05:19 20:31	06:06-06:18/12 21:20	04:31 21:32	04:30 20:53	05:13 19:45	06:07 18:31	07:01 16:21	07:00 16:21	07:54 15:39
4	08:16 15:47	07:42 16:41	06:41 17:39	06:25 19:37	05:17 20:33	06:08-06:16/8 21:21	04:30 21:31	04:31 20:51	05:14 19:43	06:09 18:28	07:03 16:19	07:02 16:19	07:56 15:38
5	08:16 15:48	07:40 16:43	06:38 17:40	06:23 19:39	05:15 20:35	05:15 21:22	04:29 21:31	05:16 20:50	06:11 19:40	07:05 18:26	07:04 16:17	07:04 16:17	07:57 15:37
6	08:15 15:50	07:39 16:45	06:36 17:42	06:20 19:41	05:13 20:36	05:13 21:23	04:29 21:30	05:18 20:48	06:13 19:38	07:07 18:24	07:06 16:15	07:06 16:15	07:59 15:37
7	08:15 15:51	07:37 16:47	06:34 17:44	06:18 19:43	05:11 20:38	05:11 21:24	04:28 21:29	05:19 20:46	06:14 19:35	07:08 18:21	07:08 16:13	08:00 16:13	08:00 15:36
8	08:14 15:52	07:35 16:49	06:31 17:46	06:15 19:45	05:09 20:40	05:09 21:25	04:27 21:29	05:21 20:44	06:20-06:24/4 19:33	07:10 18:19	07:10 16:11	08:01 16:11	08:01 15:36
9	08:14 15:54	07:33 16:51	06:29 17:48	06:13 19:46	05:07 20:42	05:07 21:26	04:27 21:28	05:23 20:42	06:16-06:26/10 19:30	07:12 18:16	07:12 16:10	08:03 16:10	08:03 15:36
10	08:13 15:55	07:31 16:53	06:26 17:50	06:10 19:48	05:05 20:44	05:05 21:27	04:26 21:27	05:25 20:40	06:15-06:28/13 19:28	07:14 18:14	07:14 16:08	08:04 16:08	08:04 15:35
11	08:13 15:57	07:29 16:55	06:24 17:52	06:08 19:50	05:03 20:45	05:03 21:28	04:26 21:26	05:26 20:38	06:14-06:29/15 19:26	07:16 18:12	07:16 16:06	08:05 16:06	08:05 15:35
12	08:12 15:58	07:27 16:57	06:22 17:54	06:06 19:52	05:01 20:47	05:01 21:29	04:25 21:25	05:28 20:35	06:13-06:29/16 19:23	07:18 18:09	07:18 16:04	08:06 16:04	08:06 15:35
13	08:11 16:00	07:25 16:59	06:19 17:56	06:03 19:54	05:00 20:49	05:00 21:29	04:25 21:24	05:30 20:33	06:12-06:30/18 19:21	07:20 18:07	07:19 16:03	08:07 16:03	08:07 15:35
14	08:10 16:01	07:23 17:01	06:17 17:58	06:01 19:56	04:58 20:51	04:58 21:30	04:25 21:23	05:32 20:31	06:12-06:30/18 19:18	07:21 18:04	07:21 16:01	08:08 16:01	08:08 15:35
15	08:10 16:03	07:21 17:03	06:14 18:00	05:59 19:58	04:56 20:52	04:56 21:31	04:25 21:22	05:33 20:29	06:11-06:30/19 19:16	07:23 18:02	07:23 16:00	08:09 16:00	08:09 15:35
16	08:09 16:05	07:19 17:05	06:12 18:02	05:56 20:00	04:54 20:54	04:54 21:31	04:24 21:21	05:35 20:27	06:12-06:30/18 19:13	07:25 18:00	07:25 15:58	08:10 15:58	08:10 15:35
17	08:08 16:06	07:17 17:07	06:09 18:03	05:54 20:01	04:53 20:56	04:53 21:32	04:24 21:20	05:37 20:25	06:12-06:28/16 19:11	07:33 17:58	07:33 15:57	08:11 15:57	08:11 15:35
18	08:07 16:08	07:15 17:09	06:07 18:05	05:52 20:03	04:51 20:57	04:51 21:32	04:24 21:19	05:39 20:22	06:12-06:28/16 19:08	07:29 17:55	07:29 15:55	08:12 15:55	08:12 15:35
19	08:06 16:10	07:13 17:11	06:04 18:07	05:49 20:05	04:50 20:59	04:50 21:33	04:24 21:17	05:41 20:20	06:12-06:28/16 19:06	07:31 17:53	07:31 15:54	08:12 15:54	08:12 15:35
20	08:04 16:12	07:10 17:13	06:02 18:09	05:47 20:07	04:48 21:01	04:48 21:33	04:24 21:16	05:42 20:18	06:14-06:27/13 19:03	07:33 17:51	07:33 15:52	08:13 15:52	08:13 15:36
21	08:03 16:14	07:08 17:15	05:59 18:11	05:45 20:09	06:12-06:18/6 21:02	05:45 21:33	04:25 21:15	05:44 20:16	06:14-06:24/10 19:01	07:35 17:48	07:35 15:51	08:14 15:51	08:14 15:36
22	08:02 16:15	07:06 17:17	05:57 18:13	05:42 20:11	06:09-06:20/11 21:04	05:42 21:33	04:25 21:13	05:46 20:13	06:18-06:21/3 18:58	07:37 17:46	07:37 15:50	08:14 15:50	08:14 15:37
23	08:01 16:17	07:04 17:19	05:55 18:15	05:40 20:13	06:08-06:22/14 21:05	05:40 21:34	04:25 21:12	05:48 20:11	06:43 18:56	07:39 17:44	07:39 15:48	08:15 15:48	08:15 15:37
24	07:59 16:19	07:02 17:21	05:52 18:17	05:38 20:14	06:06-06:21/15 21:07	05:38 21:34	04:25 21:10	05:50 20:09	06:45 18:53	07:41 17:42	07:41 15:47	08:15 15:47	08:15 15:38
25	07:58 16:21	06:59 17:23	06:50 19:19	05:36 20:16	06:05-06:22/17 21:08	05:36 21:34	04:26 21:09	05:51 20:07	06:47 18:51	07:42 17:40	07:42 15:46	08:16 15:46	08:16 15:38
26	07:57 16:23	06:57 17:25	06:47 19:20	05:33 20:18	06:04-06:22/18 21:10	05:33 21:34	04:26 21:07	05:53 20:04	06:48 18:48	07:44 17:37	07:44 15:45	08:16 15:45	08:16 15:39
27	07:55 16:25	06:55 17:27	06:45 19:22	05:31 20:20	06:04-06:22/18 21:11	05:31 21:34	04:27 21:06	05:55 20:02	06:50 18:46	07:46 17:35	07:46 15:44	08:16 15:44	08:16 15:40
28	07:54 16:27	06:52 17:29	06:42 19:24	05:29 20:22	06:04-06:22/18 21:13	05:29 21:33	04:27 21:04	05:57 20:00	06:52 18:43	07:48 17:33	07:48 15:43	08:16 15:43	08:16 15:41
29	07:52 16:29	06:50 17:31	06:40 19:26	05:27 20:24	06:04-06:22/18 21:14	05:27 21:33	04:28 21:02	05:58 19:57	06:54 18:41	07:50 17:31	07:50 15:42	08:16 15:42	08:16 15:42
30	07:51 16:31		06:37 19:28	05:25 20:26	06:04-06:21/17 21:15	05:25 21:33	04:28 21:01	06:00 19:55	06:56 18:38	07:52 17:29	07:52 15:41	08:16 15:41	08:16 15:43
31	07:49 16:33		06:35 19:30		04:34 21:17	04:34 21:33		06:02 19:52		06:54 17:27		08:16 15:44	08:16 15:44
Potential sun hours	248	282	367	420	495	511	513	460	382	328	258	232	0
Sum of minutes with flicker	0	0	0	152	50	0	0	207	0	0	0	0	0

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/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Farma wiatrowa - Brojce

Printed/Page

2012-03-13 22:17 / 46

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 15 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (361)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:16 15:44	07:47 16:35	06:48 17:33	06:32 19:32	07:10-07:25/15 20:27	05:23 20:27	06:36-06:45/9 04:33	04:29 20:57	05:09 20:57	06:04 19:50	06:57 18:36	06:56 16:25	07:51 15:40
2	08:16 15:45	07:46 16:37	06:45 17:35	06:30 19:33	07:11-07:23/12 20:29	05:21 20:29	04:32 21:19	04:30 21:32	05:11 20:55	06:06 19:48	06:59 18:33	06:58 16:23	07:53 15:39
3	08:16 15:46	07:44 16:39	06:43 17:37	06:27 19:35	07:13-07:21/8 20:31	05:19 20:31	04:31 21:20	04:30 21:32	05:13 20:53	06:07 19:45	07:01 18:31	07:00 16:21	07:54 15:39
4	08:16 15:47	07:42 16:41	06:41 17:39	06:25 19:37	05:17 20:33	05:17 20:33	04:30 21:21	04:31 21:31	05:14 20:51	06:09 19:43	07:03 18:28	07:02 16:19	07:56 15:38
5	08:16 15:48	07:40 16:43	06:38 17:40	06:23 19:39	05:15 20:35	05:15 20:35	04:29 21:22	04:32 21:31	05:16 20:50	06:11 19:40	07:05 18:26	07:04 16:17	07:57 15:37
6	08:15 15:50	07:39 16:45	06:36 17:42	06:20 19:41	05:13 20:36	05:13 20:36	04:29 21:23	04:33 21:30	05:18 20:48	06:13 19:38	07:07 18:24	07:06 16:15	07:59 15:37
7	08:15 15:51	07:37 16:47	06:34 17:44	06:18 19:43	05:11 20:38	05:11 20:38	04:28 21:24	04:34 21:29	05:19 20:46	06:14 19:35	07:08 18:21	07:08 16:13	08:00 15:36
8	08:14 15:52	07:35 16:49	06:31 17:46	06:15 19:45	05:09 20:40	05:09 20:40	04:27 21:25	04:35 21:29	05:21 20:44	06:16 19:33	07:10 18:19	07:10 16:11	08:01 15:36
9	08:14 15:54	07:33 16:51	06:29 17:48	06:13 19:46	05:07 20:42	05:07 20:42	04:27 21:26	04:36 21:28	05:23 20:42	06:18 19:30	07:06-07:15/9 17:12	07:12 16:10	08:03 15:36
10	08:13 15:55	07:31 16:53	06:26 17:50	06:10 19:48	05:05 20:44	05:05 20:44	04:26 21:27	04:37 21:27	05:25 20:40	06:20 19:28	07:04-07:16/12 17:14	07:14 16:08	08:04 15:35
11	08:13 15:57	07:29 16:55	06:24 17:52	06:08 19:50	05:03 20:45	05:03 20:45	04:26 21:28	04:38 21:26	05:26 20:38	06:22 19:26	07:02-07:17/15 17:16	07:16 16:06	08:05 15:35
12	08:12 15:58	07:27 16:57	06:22 17:54	06:06 19:52	06:39-06:51/12 20:47	05:01 20:47	04:26 21:29	04:40 21:25	05:28 20:35	06:23 19:23	07:02-07:18/16 17:18	07:18 16:04	08:06 15:35
13	08:11 16:00	07:25 16:59	06:19 17:56	06:03 19:54	06:37-06:53/16 20:49	05:00 20:49	04:25 21:29	04:41 21:24	05:30 20:33	06:25 19:21	07:00-07:17/17 17:17	07:20 16:03	08:07 15:35
14	08:10 16:01	07:23 17:01	06:17 17:58	06:01 19:56	06:35-06:55/20 20:51	04:58 20:51	04:25 21:30	04:42 21:23	05:32 20:31	06:27 19:18	07:00-07:17/17 17:17	07:21 16:01	08:08 15:35
15	08:10 16:03	07:21 17:03	06:14 18:00	05:59 19:58	06:33-06:55/22 20:52	04:56 20:52	04:25 21:31	04:43 21:22	05:33 20:29	06:29 19:16	07:00-07:17/17 17:17	07:23 16:00	08:09 15:35
16	08:09 16:05	07:19 17:05	06:12 18:02	05:56 20:00	06:32-06:56/24 20:54	04:54 20:54	04:25 21:31	04:45 21:21	05:35 20:27	06:31 19:13	07:01-07:16/15 17:16	07:25 16:00	08:10 15:35
17	08:08 16:06	07:17 17:07	06:09 18:03	05:54 20:01	06:31-06:57/26 20:56	04:53 20:56	04:24 21:32	04:46 21:20	05:37 20:25	06:32 19:11	07:00-07:14/14 17:14	07:27 16:00	08:11 15:35
18	08:07 16:08	07:15 17:09	06:07 18:05	05:52 20:03	06:30-06:58/28 20:57	04:51 20:57	04:24 21:32	04:47 21:19	05:39 20:22	06:34 19:08	07:02-07:12/10 17:12	07:29 16:00	08:12 15:35
19	08:06 16:10	07:13 17:11	06:04 18:07	05:49 20:05	06:29-06:57/28 20:59	04:50 20:59	04:24 21:33	04:49 21:17	05:41 20:20	06:34 19:06	07:05-07:09/4 17:09	07:31 16:00	08:12 15:35
20	08:04 16:12	07:10 17:13	06:02 18:09	05:47 20:07	06:29-06:57/28 21:01	04:48 21:01	04:24 21:33	04:50 21:16	05:42 20:18	06:34 19:03	07:02-07:12/10 17:12	07:33 16:00	08:13 15:36
21	08:03 16:14	07:08 17:15	05:59 18:11	05:45 20:09	06:29-06:57/28 21:02	04:47 21:02	04:25 21:33	04:52 21:15	05:44 20:16	06:33 19:01	07:01/28 17:28	07:35 16:00	08:14 15:36
22	08:02 16:15	07:06 17:17	05:57 18:13	05:42 20:11	06:29-06:57/28 21:04	04:45 21:04	04:25 21:33	04:53 21:13	05:46 20:13	06:33 18:58	07:02/29 17:29	07:37 16:00	08:14 15:37
23	08:01 16:17	07:04 17:19	05:55 18:15	05:40 20:13	06:29-06:57/28 21:05	04:44 21:05	04:25 21:34	04:55 21:12	05:48 20:11	06:33 18:56	07:01/28 17:28	07:39 16:00	08:15 15:37
24	07:59 16:19	07:02 17:21	05:52 18:17	05:38 20:14	06:28-06:55/27 21:07	04:42 21:07	04:25 21:34	04:56 21:10	05:50 20:09	06:33 18:53	07:00/27 17:27	07:41 16:00	08:15 15:38
25	07:58 16:21	06:59 17:23	06:50 19:19	05:36 20:16	07:15-07:25/10 21:08	04:41 21:08	04:26 21:34	04:58 21:09	05:51 20:07	06:33 18:51	07:00/27 17:27	07:42 16:00	08:15 15:38
26	07:57 16:23	06:57 17:25	06:47 19:20	05:33 20:18	07:12-07:26/14 21:10	04:40 21:10	04:26 21:34	04:59 21:07	05:53 20:04	06:34 18:48	06:59/25 17:25	07:44 16:00	08:16 15:39
27	07:55 16:25	06:55 17:27	06:45 19:22	05:31 20:20	07:11-07:27/16 21:11	04:38 21:11	04:27 21:34	05:01 21:06	05:55 20:02	06:33 18:46	06:58/25 17:25	07:46 16:00	08:16 15:40
28	07:54 16:27	06:52 17:29	06:42 19:24	05:29 20:22	07:10-07:26/16 21:12	04:37 21:12	04:27 21:33	05:03 21:04	05:57 20:00	06:34 18:43	06:57/23 17:23	07:48 16:00	08:16 15:41
29	07:52 16:29	06:50 17:31	06:40 19:26	05:27 20:24	07:10-07:27/17 21:14	04:36 21:14	04:28 21:33	05:04 21:02	05:58 19:57	06:36 18:41	06:56/19 17:26	07:50 16:00	08:16 15:42
30	07:51 16:31	06:57 17:33	06:47 19:28	05:25 20:26	07:09-07:26/17 21:15	04:35 21:15	04:28 21:33	05:06 21:00	06:00 19:55	06:37 18:38	06:53/16 17:26	07:50 16:00	08:16 15:43
31	07:49 16:33	06:55 17:35	06:45 19:30	05:23 20:28	07:10-07:26/16 21:16	04:34 21:16	04:27 21:34	05:07 20:59	06:02 19:52	06:39 18:32	06:50/11 17:26	07:51 16:00	08:16 15:44
Potential sun hours	248	282	367	420	495	511	513	460	382	328	258	232	0
Sum of minutes with flicker	0	0	109	477	9	0	0	456	146	0	0	0	0

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	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

Project:

Farma wiatrowa - Brojce

Printed/Page

2012-03-13 22:17 / 47

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PL-50 382 Wroclaw

+48 600 914 594

Bartosz Długokęcki / dlugokecki@gmail.com

Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 16 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (362)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:16 15:44	07:47 16:35	06:48 17:33	06:32 19:32	05:23 20:27	04:33 21:18	04:29 21:33	05:09 20:57	06:04 19:50	06:57 18:36	07:29-07:45/16	06:56 16:25	07:51 15:40
2	08:16 15:45	07:46 16:37	06:45 17:35	06:30 19:33	05:21 20:29	04:32 21:19	04:30 21:32	05:11 20:55	06:06 19:48	06:59 18:33	07:29-07:44/15	06:58 16:23	07:53 15:39
3	08:16 15:46	07:44 16:39	06:43 17:37	06:27 19:35	05:19 20:31	04:31 21:20	04:30 21:32	05:13 20:53	06:07 19:45	07:01 18:31	07:29-07:44/15	07:00 16:21	07:54 15:39
4	08:16 15:47	07:42 16:41	06:41 17:39	06:25 19:37	05:17 20:33	04:30 21:21	04:31 21:31	05:14 20:51	06:09 19:43	07:03 18:28	07:31-07:43/12	07:02 16:19	07:56 15:38
5	08:16 15:48	07:40 16:43	06:38 17:40	06:23 19:39	05:15 20:35	04:29 21:22	04:32 21:31	05:16 20:49	06:11 19:40	07:05 18:26	07:33-07:41/8	07:04 16:17	07:57 15:37
6	08:15 15:50	07:39 16:45	06:36 17:42	06:20 19:41	05:13 20:36	04:29 21:23	04:33 21:30	05:18 20:48	06:13 19:38	07:07 18:24	07:35-07:39/4	07:06 16:15	07:59 15:37
7	08:15 15:51	07:37 16:47	06:34 17:44	06:18 19:43	05:11 20:38	04:28 21:24	04:34 21:29	05:19 20:46	06:14 19:35	07:08 18:21		07:08 16:13	08:00 15:36
8	08:14 15:52	07:35 16:49	06:31 17:46	06:15 19:45	05:09 20:40	04:27 21:25	04:35 21:29	05:21 20:44	06:16 19:33	07:10 18:19		07:10 16:11	08:01 15:36
9	08:14 15:54	07:33 16:51	06:29 17:48	06:13 19:46	05:07 20:42	04:27 21:26	04:36 21:28	05:23 20:42	06:18 19:30	07:12 18:16		07:12 16:10	08:03 15:36
10	08:13 15:55	07:31 16:53	06:26 17:50	06:10 19:48	05:05 20:44	04:26 21:27	04:37 21:27	05:25 20:40	06:20 19:28	07:14 18:14		07:14 16:08	08:04 15:35
11	08:13 15:57	07:29 16:55	06:24 17:52	06:08 19:50	05:03 20:45	04:26 21:28	04:38 21:26	05:26 20:37	06:22 19:26	07:16 18:12		07:16 16:06	08:05 15:35
12	08:12 15:58	07:27 16:57	06:22 17:54	06:06 19:52	05:01 20:47	04:26 21:29	04:40 21:25	05:28 20:35	06:23 19:23	07:18 18:09		07:18 16:04	08:06 15:35
13	08:11 16:00	07:25 16:59	06:19 17:56	06:50-07:06/16	06:03 19:54	05:00 20:49	04:25 21:29	05:30 20:33	06:25 19:21	07:20 18:07		07:19 16:03	08:07 15:35
14	08:10 16:01	07:23 17:01	06:17 17:58	06:46-07:05/19	06:01 19:56	04:58 20:51	04:25 21:30	05:32 20:31	06:27 19:18	07:21 18:04		07:21 16:01	08:08 15:35
15	08:09 16:03	07:21 17:03	06:14 18:00	06:44-07:04/20	05:59 19:58	04:56 20:52	04:25 21:31	05:33 20:29	06:29 19:16	07:34-07:43/9		07:23 16:00	08:09 15:35
16	08:09 16:05	07:19 17:05	06:12 18:02	06:42-07:02/20	05:56 19:59	04:54 20:54	04:25 21:31	05:35 20:27	06:31 19:13	07:31-07:46/15		07:25 16:00	08:10 15:35
17	08:08 16:06	07:17 17:07	06:09 18:03	06:41-07:04/23	05:54 20:01	04:53 20:56	04:24 21:32	05:37 20:25	06:32 19:11	07:28-07:46/18		07:27 16:00	08:11 15:35
18	08:07 16:08	07:15 17:09	06:07 18:05	06:40-07:04/24	05:52 20:03	04:51 20:57	04:24 21:32	05:39 20:22	06:34 19:08	07:27-07:48/21		07:29 16:00	08:12 15:35
19	08:05 16:10	07:13 17:11	06:04 18:07	06:40-07:04/24	05:49 20:05	04:50 20:59	04:24 21:33	05:41 20:20	06:36 19:06	07:26-07:48/22		07:31 16:00	08:12 15:36
20	08:04 16:12	07:10 17:13	06:02 18:09	06:39-07:04/25	05:47 20:07	04:48 21:00	04:24 21:33	05:42 20:18	06:38 19:03	07:25-07:49/24		07:33 16:00	08:13 15:36
21	08:03 16:14	07:08 17:15	05:59 18:11	06:39-07:04/25	05:45 20:09	04:47 21:02	04:25 21:33	05:44 20:16	06:39 19:01	07:23-07:48/25		07:35 16:00	08:14 15:36
22	08:02 16:15	07:06 17:17	05:57 18:13	06:38-07:03/25	05:42 20:11	04:45 21:04	04:25 21:33	05:46 20:13	06:41 18:58	07:23-07:48/25		07:37 16:00	08:14 15:37
23	08:01 16:17	07:04 17:19	05:55 18:15	06:39-07:03/24	05:40 20:13	04:44 21:05	04:25 21:33	05:48 20:11	06:43 18:56	07:23-07:48/25		07:39 16:00	08:15 15:37
24	07:59 16:19	07:02 17:21	05:52 18:17	06:38-07:01/23	05:38 20:14	04:42 21:07	04:25 21:34	05:50 20:09	06:45 18:53	07:23-07:48/25		07:41 16:00	08:15 15:38
25	07:58 16:21	06:59 17:23	06:50 19:18	07:40-08:00/20	05:36 20:16	04:41 21:08	04:26 21:34	05:51 20:07	06:47 18:51	07:23-07:47/24		07:42 16:00	08:15 15:38
26	07:57 16:23	06:57 17:25	06:47 19:20	07:40-07:58/18	05:34 20:18	04:40 21:10	04:26 21:34	05:53 20:04	06:48 18:48	07:23-07:46/23		07:44 16:00	08:16 15:39
27	07:55 16:25	06:55 17:27	06:45 19:22	07:42-07:57/15	05:31 20:20	04:38 21:11	04:27 21:34	05:01 20:02	06:50 18:46	07:24-07:43/19		07:46 16:00	08:16 15:40
28	07:54 16:27	06:52 17:29	06:42 19:24	07:43-07:53/10	05:29 20:22	04:37 21:12	04:27 21:33	05:03 20:04	06:52 18:43	07:25-07:44/19		06:48 16:00	08:16 15:41
29	07:52 16:29	06:50 17:31	06:40 19:26		05:27 20:24	04:36 21:14	04:28 21:33	05:58 20:07	06:54 18:41	07:26-07:45/19		06:50 16:00	08:16 15:42
30	07:51 16:31		06:37 19:28		05:25 20:26	04:35 21:15	04:28 21:33	06:00 20:00	06:56 18:38	07:29-07:45/16		06:52 16:00	08:16 15:43
31	07:49 16:33		06:35 19:30			04:34 21:16		06:02 20:59				06:54 16:00	08:16 15:44
Potential sun hours	248	282	367	420	495	511	513	460	382	328	258	232	
Sum of minutes with flicker	0	0	395	0	0	0	0	0	331	70	0	0	

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/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker



Project:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 48

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 17 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (363)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:16 09:07-09:30/23 15:44	07:47 16:35	06:48 17:33	06:32 19:32	05:23 18:46-19:14/28 20:27	04:33 21:18
2	08:16 09:07-09:30/23 15:45	07:46 16:37	06:45 17:35	06:30 19:33	05:21 18:47-19:13/26 20:29	04:32 21:19
3	08:16 09:08-09:31/23 15:46	07:44 16:39	06:43 17:37	06:27 19:35	05:19 18:48-19:12/24 20:31	04:31 21:20
4	08:16 09:08-09:31/23 15:47	07:42 16:41	06:41 17:39	06:25 19:37	05:17 18:50-19:10/20 20:33	04:30 21:21
5	08:16 09:09-09:32/23 15:49	07:40 16:43	06:38 17:41	06:23 19:39	05:15 18:52-19:09/17 20:35	04:30 21:22
6	08:15 09:09-09:32/23 15:50	07:39 16:45	06:36 17:42	06:20 19:41	05:13 18:55-19:06/11 20:36	04:29 21:23
7	08:15 09:10-09:33/23 15:51	07:37 16:47	06:34 17:44	06:18 19:43	05:11 20:38	04:28 21:24
8	08:14 09:10-09:33/23 15:52	07:35 16:49	06:31 17:46	06:15 19:45	05:09 20:40	04:28 21:25
9	08:14 09:10-09:33/23 15:54	07:33 16:51	06:29 17:48	06:13 19:46	05:07 20:42	04:27 21:26
10	08:13 09:10-09:33/23 15:55	07:31 16:53	06:26 17:50	06:10 19:48	05:05 20:44	04:26 21:27
11	08:13 09:11-09:33/22 15:57	07:29 16:55	06:24 17:52	06:08 18:57-19:10/13 19:50	05:03 20:45	04:26 21:28
12	08:12 09:11-09:33/22 15:58	07:27 16:57	06:22 17:54	06:06 18:54-19:13/19 19:52	05:01 20:47	04:26 21:29
13	08:11 09:13-09:34/21 16:00	07:25 16:59	06:19 17:56	06:03 18:52-19:15/23 19:54	05:00 20:49	04:25 21:29
14	08:10 09:13-09:34/21 16:02	07:23 17:01	06:17 17:58	06:01 18:51-19:17/26 19:56	04:58 20:51	04:25 21:30
15	08:09 09:14-09:34/20 16:03	07:21 17:03	06:14 18:00	05:59 18:49-19:17/28 19:58	04:56 20:52	04:25 21:31
16	08:09 09:14-09:34/20 16:05	07:19 17:05	06:12 18:02	05:56 18:48-19:18/30 19:59	04:54 20:54	04:25 21:31
17	08:08 09:16-09:34/18 16:07	07:17 17:07	06:09 18:03	05:54 18:47-19:19/32 20:01	04:53 20:56	04:24 21:32
18	08:07 09:17-09:33/16 16:08	07:15 17:09	06:07 18:05	05:52 18:45-19:19/34 20:03	04:51 20:57	04:24 21:32
19	08:05 09:18-09:32/14 16:10	07:13 17:11	06:04 18:07	05:49 18:45-19:19/34 20:05	04:50 20:59	04:24 21:33
20	08:04 09:19-09:31/12 16:12	07:10 17:13	06:02 18:09	05:47 18:44-19:20/36 20:07	04:48 21:00	04:25 21:33
21	08:03 09:22-09:30/8 16:14	07:08 17:15	05:59 18:11	05:45 18:44-19:20/36 20:09	04:47 21:02	04:25 21:33
22	08:02 16:15	07:06 17:17	05:57 18:13	05:42 18:44-19:20/36 20:11	04:45 21:04	04:25 21:33
23	08:01 16:17	07:04 17:19	05:55 18:15	05:40 18:44-19:20/36 20:13	04:44 21:05	04:25 21:33
24	07:59 16:19	07:02 17:21	05:52 18:17	05:38 18:43-19:19/36 20:14	04:42 21:07	04:25 21:34
25	07:58 16:21	06:59 17:23	06:50 19:19	05:36 18:43-19:18/35 20:16	04:41 21:08	04:26 21:34
26	07:57 16:23	06:57 17:25	06:47 19:20	05:34 18:43-19:18/35 20:18	04:40 21:10	04:26 21:34
27	07:55 16:25	06:55 17:27	06:45 19:22	05:31 18:44-19:18/34 20:20	04:39 21:11	04:27 21:33
28	07:54 16:27	06:52 17:29	06:42 19:24	05:29 18:44-19:17/33 20:22	04:37 21:12	04:27 21:33
29	07:52 16:29	06:50 17:31	06:40 19:26	05:27 18:45-19:16/31 20:24	04:36 21:14	04:28 21:33
30	07:51 16:31		06:37 19:28	05:25 18:45-19:15/30 20:25	04:35 21:15	04:28 21:33
31	07:49 16:33		06:35 19:30		04:34 21:16	
Potential sun hours	248	282	367	420	495	511
Sum of minutes with flicker	424	0	0	617	126	0

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/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 49

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 17 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (363)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	04:29 21:33	05:09 20:57	06:04 19:50	06:57 18:36	06:56 16:25	07:51 15:40
2	04:30 21:32	05:11 20:55	06:06 19:48	06:59 18:33	06:58 16:23	07:53 15:40
3	04:31 21:32	05:13 20:53	06:07 19:45	07:01 18:31	07:00 16:21	07:54 15:39
4	04:31 21:31	05:14 20:51	06:09 19:43	07:03 18:29	07:02 16:19	07:56 15:38
5	04:32 21:31	05:16 20:49	06:11 19:40	07:05 18:26	07:04 16:17	07:57 15:38
6	04:33 21:30	05:18 20:48	19:06-19:12/6 06:13 19:38	07:07 18:24	07:06 16:15	07:59 15:37
7	04:34 21:29	05:19 20:46	19:03-19:17/14 06:15 19:35	07:08 18:21	07:08 16:13	08:00 15:36
8	04:35 21:29	05:21 20:44	19:01-19:19/18 06:16 19:33	07:10 18:19	07:10 16:11	08:01 15:36
9	04:36 21:28	05:23 20:42	18:58-19:20/22 06:18 19:30	07:12 18:16	07:12 16:10	08:03 15:36
10	04:37 21:27	05:25 20:40	18:57-19:22/25 06:20 19:28	07:14 18:14	07:14 16:08	08:04 15:35
11	04:38 21:26	05:26 20:37	18:56-19:23/27 06:22 19:26	07:16 18:12	07:16 16:06	08:05 15:35
12	04:40 21:25	05:28 20:35	18:54-19:23/29 06:23 19:23	07:18 18:09	07:17 16:05	08:06 15:35
13	04:41 21:24	05:30 20:33	18:53-19:24/31 06:25 19:21	07:20 18:07	07:19 16:03	08:07 15:35
14	04:42 21:23	05:32 20:31	18:53-19:25/32 06:27 19:18	07:21 18:05	07:21 16:01	08:08 15:35
15	04:43 21:22	05:34 20:29	18:51-19:25/34 06:29 19:16	07:23 18:02	07:23 16:00	08:09 15:35
16	04:45 21:21	05:35 20:27	18:51-19:25/34 06:31 19:13	07:25 18:00	07:25 15:58	08:10 15:35
17	04:46 21:20	05:37 20:25	18:51-19:26/35 06:32 19:11	07:27 17:58	07:27 15:57	08:11 15:35
18	04:47 21:19	05:39 20:22	18:49-19:25/36 06:34 19:08	07:29 17:55	07:29 15:55	08:12 15:35
19	04:49 21:17	05:41 20:20	18:49-19:25/36 06:36 19:06	07:31 17:53	07:31 15:54	08:12 15:36
20	04:50 21:16	05:42 20:18	18:49-19:25/36 06:38 19:03	07:33 17:51	07:33 15:52	08:13 15:36
21	04:52 21:15	05:44 20:16	18:48-19:24/36 06:39 19:01	07:35 17:48	07:34 15:51	08:14 15:36
22	04:53 21:13	05:46 20:13	18:49-19:24/35 06:41 18:58	07:37 17:46	07:36 15:50	08:14 15:37
23	04:55 21:12	05:48 20:11	18:49-19:24/35 06:43 18:56	07:39 17:44	07:38 15:48	08:15 15:37
24	04:56 21:10	05:50 20:09	18:48-19:23/35 06:45 18:53	07:41 17:42	07:40 15:47	08:15 15:38
25	04:58 21:09	05:51 20:07	18:49-19:22/33 06:47 18:51	07:42 17:40	07:41 15:46	08:15 15:39
26	04:59 21:07	05:53 20:04	18:50-19:21/31 06:48 18:48	07:44 17:37	07:43 15:45	08:16 15:39
27	05:01 21:05	05:55 20:02	18:49-19:20/31 06:50 18:46	07:46 17:35	07:45 15:44	08:16 15:40
28	05:03 21:04	05:57 19:59	18:50-19:19/29 06:52 18:43	06:48 16:33	07:47 15:43	08:16 15:41
29	05:04 21:02	05:59 19:57	18:52-19:17/25 06:54 18:41	06:50 16:31	07:48 15:42	08:16 15:42
30	05:06 21:00	06:00 19:55	18:52-19:14/22 06:56 18:38	06:52 16:29	07:50 15:41	08:16 15:43
31	05:08 20:59	06:02 19:52	18:54-19:12/18   	06:54 16:27	 	08:16 15:44
Potential sun hours	513	460	382	328	258	232
Sum of minutes with flicker	0	745	12	0	152	699

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/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 50

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 18 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (364)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	January	February	March	April	May	June
1	08:16 13:51-14:17/26 15:44	07:47 16:35	06:48 17:33	06:33 07:04-07:20/16 19:32	05:23 20:27	04:33 21:18
2	08:16 13:52-14:17/25 15:45	07:46 16:37	06:46 17:35	06:30 07:01-07:21/20 19:34	05:21 20:29	04:32 21:19
3	08:16 13:53-14:18/25 15:46	07:44 16:39	06:43 17:37	06:28 06:59-07:22/23 19:35	05:19 20:31	04:31 21:20
4	08:16 13:53-14:17/24 15:48	07:42 16:41	06:41 17:39	06:25 06:57-07:23/26 19:37	05:17 20:33	04:31 21:21
5	08:16 13:54-14:18/24 15:49	07:41 16:43	06:39 17:41	06:23 06:57-07:24/27 19:39	05:15 20:35	04:30 21:22
6	08:15 13:55-14:18/23 15:50	07:39 16:45	06:36 17:43	06:20 06:56-07:24/28 19:41	05:13 20:37	04:29 21:23
7	08:15 13:56-14:18/22 15:51	07:37 16:47	06:34 17:45	06:18 06:55-07:24/29 19:43	05:11 20:38	04:28 21:24
8	08:14 13:57-14:18/21 15:53	07:35 16:49	06:31 17:03-17:15/12 17:46	06:15 06:55-07:24/29 19:45	05:09 20:40	04:28 21:25
9	08:14 13:58-14:17/19 15:54	07:33 16:51	06:29 17:01-17:18/17 17:48	06:13 06:54-07:23/29 19:47	05:07 20:42	04:27 21:26
10	08:13 13:59-14:17/18 15:56	07:31 16:53	06:27 16:58-17:19/21 17:50	06:11 06:54-07:23/29 19:48	05:05 20:44	04:27 21:27
11	08:13 14:00-14:16/16 15:57	07:29 16:55	06:24 16:57-17:21/24 17:52	06:08 06:54-07:23/29 19:50	05:03 20:45	04:26 21:28
12	08:12 14:01-14:15/14 15:59	07:27 16:57	06:22 16:56-17:21/25 17:54	06:06 06:54-07:21/27 19:52	05:02 20:47	04:26 21:29
13	08:11 14:04-14:15/11 16:00	07:25 16:59	06:19 16:55-17:22/27 17:56	06:04 06:54-07:21/27 19:54	05:00 20:49	04:25 21:29
14	08:10 14:06-14:12/6 16:02	07:23 17:01	06:17 16:54-17:21/27 17:58	06:01 06:55-07:20/25 19:56	04:58 20:51	04:25 21:30
15	08:10 16:03 16:03	07:21 17:03	06:14 16:54-17:22/28 18:00	05:59 06:55-07:18/23 19:58	04:56 20:52	04:25 21:31
16	08:09 16:05 16:05	07:19 17:05	06:12 16:53-17:21/28 18:02	05:56 06:56-07:17/21 20:00	04:55 20:54	04:25 21:31
17	08:08 16:07 16:07	07:17 17:07	06:09 16:53-17:21/28 18:04	05:54 06:58-07:15/17 20:01	04:53 20:56	04:25 21:32
18	08:07 16:08 16:08	07:15 17:09	06:07 16:53-17:20/27 18:06	05:52 07:01-07:12/11 20:03	04:51 20:57	04:25 21:32
19	08:06 16:10 16:10	07:13 17:11	06:05 16:53-17:20/27 18:07	05:49 20:05	04:50 20:59	04:25 21:33
20	08:04 16:12 16:12	07:11 17:13	06:02 16:53-17:19/26 18:09	05:47 20:07	04:48 21:01	04:25 21:33
21	08:03 16:14 16:14	07:08 17:15	06:00 16:54-17:18/24 18:11	05:45 20:09	04:47 21:02	04:25 21:33
22	08:02 16:16 16:16	07:06 17:17	05:57 16:55-17:16/21 18:13	05:43 20:11	04:45 21:04	04:25 21:33
23	08:01 16:17 16:17	07:04 17:19	05:55 16:57-17:15/18 18:15	05:40 20:13	04:44 21:05	04:25 21:34
24	07:59 16:19 16:19	07:02 17:21	05:52 16:58-17:11/13 18:17	05:38 20:15	04:43 21:07	04:26 21:34
25	07:58 16:21 16:21	06:59 17:23	06:50 18:03-18:07/4 19:19	05:36 20:16	04:41 21:08	04:26 21:34
26	07:57 16:23 16:23	06:57 17:25	06:47 19:21	05:34 20:18	04:40 21:10	04:26 21:34
27	07:55 16:25 16:25	06:55 17:27	06:45 19:22	05:32 20:20	04:39 21:11	04:27 21:34
28	07:54 16:27 16:27	06:53 17:29	06:42 19:24	05:29 20:22	04:38 21:13	04:27 21:33
29	07:52 16:29 16:29	06:50 17:31	06:40 19:26	05:27 20:24	04:36 21:14	04:28 21:33
30	07:51 16:31 16:31		06:37 19:28	05:25 20:26	04:35 21:15	04:29 21:33
31	07:49 16:33 16:33		06:35 07:06-07:17/11 19:30		04:34 21:17	
Potential sun hours	248	282	367	420	495	511
Sum of minutes with flicker	274	0	408	436	0	0

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/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 51

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 18 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (364)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	July	August	September	October	November	December
1	04:29 21:33	05:09 20:57	06:04 19:50	06:53-07:22/29 18:36	06:58 16:25	07:51 15:40
2	04:30 21:32	05:11 20:55	06:06 19:48	06:53-07:22/29 18:34	06:59 16:23	07:53 15:40
3	04:31 21:32	05:13 20:53	06:08 19:45	06:52-07:21/29 18:31	07:01 16:21	07:54 15:39
4	04:32 21:31	05:14 20:51	06:09 19:43	06:52-07:21/29 18:29	07:07 16:19	07:56 15:38
5	04:32 21:31	05:16 20:50	06:11 19:40	06:52-07:21/29 18:26	07:05 16:17	07:57 15:38
6	04:33 21:30	05:18 20:48	06:13 19:38	06:52-07:20/28 18:24	07:07 16:15	07:59 15:37
7	04:34 21:29	05:20 20:46	06:15 19:36	06:52-07:18/26 18:21	07:09 16:14	08:00 15:37
8	04:35 21:29	05:21 20:44	06:16 19:33	06:52-07:18/26 18:19	07:10 16:12	08:01 15:36
9	04:36 21:28	05:23 20:42	06:18 19:31	06:53-07:16/23 18:17	07:12 16:10	08:03 15:36
10	04:38 21:27	05:25 20:40	06:20 19:28	06:54-07:14/20 18:14	07:14 16:08	08:04 15:36
11	04:39 21:26	05:27 20:38	06:22 19:26	06:56-07:12/16 18:12	07:16 16:06	08:05 15:35
12	04:40 21:25	05:28 20:36	06:24 19:23	06:58-07:09/11 18:09	07:18 16:05	08:06 15:35
13	04:41 21:24	05:30 20:33	06:25 19:21	07:20 18:07	07:20 16:03	08:07 15:35
14	04:42 21:23	05:32 20:31	06:27 19:18	07:22 18:05	07:21 16:01	08:08 15:35
15	04:44 21:22	05:34 20:29	06:29 19:16	07:23 18:02	07:23 16:00	08:09 15:35
16	04:45 21:21	05:35 20:27	06:31 19:13	07:25 18:00	07:25 15:58	08:10 15:35
17	04:46 21:20	05:37 20:25	06:32 19:11	07:27 17:58	07:27 15:57	08:11 15:35
18	04:48 21:19	05:39 20:23	06:34 19:08	07:29 17:55	07:29 15:55	08:12 15:36
19	04:49 21:17	05:41 20:20	06:36 19:06	17:46-17:58/12 17:53	07:31 15:54	08:12 15:36
20	04:50 21:16	05:43 20:18	06:38 19:03	17:43-18:01/18 17:51	07:33 15:53	08:13 15:36
21	04:52 21:15	05:44 20:16	06:40 19:01	17:40-18:01/21 17:49	07:35 15:51	08:14 15:37
22	04:53 21:13	05:46 20:14	06:41 18:58	17:39-18:02/23 17:46	07:36 15:50	08:14 15:37
23	04:55 21:12	05:48 20:11	06:43 18:56	17:38-18:03/25 17:44	07:38 15:49	08:15 15:38
24	04:56 21:10	05:50 20:09	06:45 18:53	17:37-18:03/26 17:42	07:40 15:47	08:15 15:38
25	04:58 21:09	05:52 20:07	06:47 18:51	17:36-18:04/28 17:40	07:42 15:46	08:16 15:39
26	05:00 21:07	05:53 20:04	06:49 18:48	17:35-18:03/28 17:38	07:43 15:45	08:16 15:39
27	05:01 21:06	05:55 20:02	06:50 18:46	17:34-18:03/29 17:35	07:46 15:44	08:16 15:40
28	05:03 21:04	05:57 20:00	06:52 18:43	17:34-18:03/29 16:33	07:47 15:43	08:16 15:41
29	05:04 21:02	05:59 19:57	06:54 18:41	17:34-18:02/28 16:31	07:48 15:42	08:16 15:42
30	05:06 21:01	06:00 19:55	06:56 18:38	17:35-18:02/27 16:29	07:50 15:41	08:16 15:43
31	05:08 20:59	06:02 19:52	06:53-07:21/28 19:52	16:27	15:44	08:16 15:44
Potential sun hours	513	460	382	328	258	232
Sum of minutes with flicker	0	158	589	109	17	766

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/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 52

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 19 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (365)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOŁOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:16 15:44	07:47 16:35	06:48 17:33	06:32 19:32	05:23 20:27	05:50-06:02/12 21:18
2	08:16 15:45	07:46 16:37	06:45 17:35	06:30 19:33	05:21 20:29	05:48-06:02/14 21:19
3	08:16 15:46	07:44 16:39	06:43 17:37	06:27 19:35	05:19 20:31	05:46-06:02/16 21:20
4	08:16 15:47	07:42 16:41	06:41 17:39	06:25 19:37	05:17 20:33	05:46-06:03/17 21:21
5	08:16 15:49	07:40 16:43	06:38 17:41	06:23 19:39	05:15 20:35	05:46-06:03/17 21:22
6	08:15 15:50	07:39 16:45	06:36 17:42	17:00-17:11/11 19:41	06:20 19:41	05:46-06:02/16 21:23
7	08:15 15:51	07:37 16:47	06:34 17:44	16:57-17:13/16 19:43	06:18 19:43	05:46-06:02/16 21:24
8	08:14 15:53	07:35 16:49	06:31 17:46	16:55-17:15/20 19:45	06:15 19:45	05:46-06:01/15 21:25
9	08:14 15:54	07:33 16:51	06:29 17:48	16:53-17:16/23 19:46	06:13 19:46	05:48-06:01/13 21:26
10	08:13 15:55	07:31 16:53	06:26 17:50	16:52-17:17/25 19:48	06:11 19:48	05:49-05:59/10 21:27
11	08:13 15:57	07:29 16:55	06:24 17:52	16:51-17:17/26 19:50	06:08 19:50	05:50-05:57/7 21:28
12	08:12 15:58	07:27 16:57	06:22 17:54	16:51-17:18/27 19:52	06:06 19:52	05:01 20:47
13	08:11 16:00	07:25 16:59	06:19 17:56	16:50-17:17/27 19:54	06:03 19:54	05:00 20:49
14	08:10 16:02	07:23 17:01	06:17 17:58	16:50-17:18/28 19:56	06:01 19:56	04:58 20:51
15	08:09 16:03	07:21 17:03	06:14 18:00	16:50-17:18/28 19:58	05:59 19:58	04:56 20:52
16	08:09 16:05	07:19 17:05	06:12 18:02	16:49-17:17/28 19:59	05:56 19:59	04:54 20:54
17	08:08 16:07	07:17 17:07	06:09 18:03	16:50-17:16/26 20:01	05:54 20:01	04:53 20:56
18	08:07 16:08	07:15 17:09	06:07 18:05	16:50-17:15/25 20:03	05:52 20:03	04:51 20:57
19	08:05 16:10	07:13 17:11	06:04 18:07	16:51-17:14/23 20:05	05:49 20:05	04:50 20:59
20	08:04 16:12	07:10 17:13	06:02 18:09	16:52-17:12/20 20:07	05:47 20:07	04:48 21:00
21	08:03 16:14	07:08 17:15	06:00 18:11	16:54-17:11/17 20:09	05:45 20:09	04:47 21:02
22	08:02 16:15	07:06 17:17	05:57 18:13	16:56-17:07/11 20:11	05:42 20:11	04:45 21:04
23	08:01 16:17	07:04 17:19	05:55 18:15	05:40 20:13	05:40 20:13	04:44 21:05
24	07:59 16:19	07:02 17:21	05:52 18:17	05:38 20:14	05:38 20:14	04:42 21:07
25	07:58 16:21	06:59 17:23	06:50 19:19	05:36 20:16	05:36 20:16	04:41 21:08
26	07:57 16:23	06:57 17:25	06:47 19:20	05:34 20:18	05:34 20:18	04:40 21:10
27	07:55 16:25	06:55 17:27	06:45 19:22	05:31 20:20	05:31 20:20	04:39 21:11
28	07:54 16:27	06:52 17:29	06:42 19:24	05:29 20:22	05:56-05:58/2 20:22	04:37 21:12
29	07:52 16:29	06:50 17:31	06:40 19:26	05:27 20:24	05:54-06:00/6 20:24	04:36 21:14
30	07:51 16:31	06:47 17:33	06:37 19:28	05:25 20:25	05:52-06:01/9 20:25	04:35 21:15
31	07:49 16:33	06:45 17:35	06:35 19:30	05:23 20:27	05:50-06:00/8 20:27	04:34 21:16
Potential sun hours	248	282	367	420	495	511
Sum of minutes with flicker	0	0	381	17	153	0

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/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 53

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 19 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (365)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	04:29 21:33	05:09 20:57	06:02-06:06/4 19:50	06:04 18:36	17:29-17:57/28 16:25	06:56 15:40
2	04:30 21:32	05:11 20:55	05:59-06:08/9 19:48	06:06 18:33	17:29-17:56/27 16:23	06:58 15:40
3	04:31 21:32	05:13 20:53	05:58-06:10/12 19:45	06:07 18:31	17:30-17:55/25 16:21	07:00 15:39
4	04:31 21:31	05:14 20:51	05:57-06:10/13 19:43	06:09 18:29	17:31-17:54/23 16:19	07:02 15:38
5	04:32 21:31	05:16 20:49	05:56-06:11/15 19:40	06:11 18:26	17:31-17:53/22 16:17	07:04 15:38
6	04:33 21:30	05:18 20:48	05:56-06:12/16 19:38	06:13 18:24	17:33-17:51/18 16:15	07:06 15:37
7	04:34 21:29	05:19 20:46	05:55-06:12/17 19:35	06:15 18:21	17:35-17:49/14 16:13	07:08 15:37
8	04:35 21:29	05:21 20:44	05:55-06:12/17 19:33	06:16 18:19	17:38-17:45/7 16:12	08:01 15:36
9	04:36 21:28	05:23 20:42	05:54-06:11/17 19:30	06:18 18:16	17:38-17:45/7 16:10	08:03 15:36
10	04:37 21:27	05:25 20:40	05:56-06:11/15 19:28	06:20 18:14	17:38-17:45/7 16:08	08:04 15:35
11	04:38 21:26	05:26 20:37	05:58-06:11/13 19:26	06:22 18:12	17:38-17:45/7 16:06	08:05 15:35
12	04:40 21:25	05:28 20:35	05:59-06:10/11 19:23	06:23 18:09	17:38-17:45/7 16:05	08:06 15:35
13	04:41 21:24	05:30 20:33	06:01-06:09/8 19:21	06:25 18:07	17:38-17:45/7 16:03	08:07 15:35
14	04:42 21:23	05:32 20:31	06:03-06:08/5 19:18	06:27 18:05	17:38-17:45/7 16:01	08:08 15:35
15	04:43 21:22	05:34 20:29	06:04-06:05/1 19:16	06:29 18:02	17:38-17:45/7 16:00	08:09 15:35
16	04:45 21:21	05:35 20:27	06:31 19:13	06:31 18:00	17:38-17:45/7 15:58	08:10 15:35
17	04:46 21:20	05:37 20:25	06:32 19:11	06:32 17:58	17:38-17:45/7 15:57	08:11 15:35
18	04:47 21:19	05:39 20:22	06:34 19:08	06:34 17:55	17:38-17:45/7 15:55	08:12 15:35
19	04:49 21:17	05:41 20:20	06:36 19:06	06:36 17:53	17:38-17:45/7 15:54	08:12 15:36
20	04:50 21:16	05:42 20:18	06:38 19:03	06:38 17:51	17:38-17:45/7 15:52	08:13 15:36
21	04:52 21:15	05:44 20:16	06:39 17:42-17:52/10 19:01	06:39 17:42-17:52/10 17:48	17:38-17:45/7 15:51	08:14 15:36
22	04:53 21:13	05:46 20:13	06:41 17:39-17:55/16 18:58	06:41 17:39-17:55/16 17:46	17:38-17:45/7 15:50	08:14 15:37
23	04:55 21:12	05:48 20:11	06:43 17:37-17:56/19 18:56	06:43 17:37-17:56/19 17:44	17:38-17:45/7 15:48	08:15 15:37
24	04:56 21:10	05:50 20:09	06:45 17:35-17:57/22 18:53	06:45 17:35-17:57/22 17:42	17:38-17:45/7 15:47	08:15 15:38
25	04:58 21:09	05:51 20:07	06:47 17:33-17:57/24 18:51	06:47 17:33-17:57/24 17:40	17:38-17:45/7 15:46	08:15 15:39
26	04:59 21:07	05:53 20:04	06:48 17:32-17:58/26 18:48	06:48 17:32-17:58/26 17:37	17:38-17:45/7 15:45	08:16 15:39
27	05:01 21:05	05:55 20:02	06:50 17:31-17:58/27 18:46	06:50 17:31-17:58/27 17:35	17:38-17:45/7 15:44	08:16 15:40
28	05:03 21:04	05:57 19:59	06:52 17:31-17:58/27 18:43	06:52 17:31-17:58/27 16:33	17:38-17:45/7 15:43	08:16 15:41
29	05:04 21:02	05:59 19:57	06:54 17:30-17:58/28 18:41	06:54 17:30-17:58/28 16:31	17:38-17:45/7 15:42	08:16 15:42
30	05:06 21:00	06:00 19:55	06:56 17:30-17:58/28 18:38	06:56 17:30-17:58/28 16:29	17:38-17:45/7 15:41	08:16 15:43
31	05:08 20:59	06:02 19:52		06:54 16:27		08:16 15:44
Potential sun hours	513	460	382	328	258	232
Sum of minutes with flicker	0	173	227	164	0	0

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/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Farma wiatrowa - Brojce

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2012-03-13 22:17 / 54

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Calculated:

2012-03-13 22:15/2.7.490

## SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 20 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (366)

### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:16 15:44	07:47 16:35	06:48 17:33	06:32 19:32	05:23 20:27	04:33 21:18
2	08:16 15:45	07:46 16:37	06:45 17:35	06:30 19:33	05:21 20:29	04:32 21:19
3	08:16 15:46	07:44 16:39	06:43 17:37	06:27 19:35	05:19 20:31	04:31 21:20
4	08:16 15:47	07:42 16:41	06:41 17:39	06:25 19:37	05:17 20:33	04:30 21:21
5	08:16 15:49	07:40 16:43	06:38 17:41	06:23 19:39	05:15 20:35	04:30 21:22
6	08:15 15:50	07:39 16:45	06:36 17:42	06:20 19:41	05:13 20:36	04:29 21:23
7	08:15 15:51	07:37 16:11-16:18/7 16:47	06:34 17:44	06:18 19:43	05:11 20:38	04:28 21:24
8	08:14 15:53	07:35 16:09-16:20/11 16:49	06:31 17:46	06:15 06:41-06:45/4 19:45	05:09 20:40	04:28 21:25
9	08:14 15:54	07:33 16:07-16:22/15 16:51	06:29 17:48	06:13 06:38-06:46/8 19:46	05:07 20:42	04:27 21:26
10	08:13 15:55	07:31 16:06-16:24/18 16:53	06:26 17:50	06:11 06:36-06:48/12 19:48	05:05 20:44	04:26 21:27
11	08:13 15:57	07:29 16:04-16:24/20 16:55	06:24 17:52	06:08 06:34-06:48/14 19:50	05:03 20:45	04:26 21:28
12	08:12 15:58	07:27 16:03-16:25/22 16:57	06:22 17:54	06:06 06:31-06:48/17 19:52	05:01 20:47	04:26 21:29
13	08:11 16:00	07:25 16:03-16:26/23 16:59	06:19 17:56	06:03 06:30-06:48/18 19:54	05:00 20:49	04:25 21:29
14	08:10 16:02	07:23 16:03-16:27/24 17:01	06:17 17:58	06:01 06:30-06:48/18 19:56	04:58 20:50	04:25 21:30
15	08:09 16:03	07:21 16:03-16:27/24 17:03	06:14 18:00	05:59 06:29-06:47/18 19:58	04:56 20:52	04:25 21:31
16	08:09 16:05	07:19 16:03-16:27/24 17:05	06:12 18:02	05:56 06:30-06:47/17 19:59	04:54 20:54	04:25 21:31
17	08:08 16:07	07:17 16:02-16:26/24 17:07	06:09 18:03	05:54 06:31-06:46/15 20:01	04:53 20:56	04:25 21:32
18	08:07 16:08	07:15 16:03-16:26/23 17:09	06:07 18:05	05:52 06:32-06:44/12 20:03	04:51 20:57	04:24 21:32
19	08:05 16:10	07:13 16:04-16:26/22 17:11	06:04 18:07	05:49 06:33-06:41/8 20:05	04:50 20:59	04:25 21:32
20	08:04 16:12	07:10 16:05-16:25/20 17:13	06:02 18:09	05:47 20:07	04:48 21:00	04:25 21:33
21	08:03 16:14	07:08 16:05-16:23/18 17:15	06:00 18:11	05:45 20:09	04:47 21:02	04:25 21:33
22	08:02 16:15	07:06 16:07-16:22/15 17:17	05:57 18:13	05:42 20:11	04:45 21:04	04:25 21:33
23	08:01 16:17	07:04 16:10-16:20/10 17:19	05:55 18:15	05:40 20:13	04:44 21:05	04:25 21:33
24	07:59 16:19	07:02 17:21	05:52 18:17	05:38 20:14	04:42 21:07	04:25 21:34
25	07:58 16:21	06:59 17:23	05:50 19:19	05:36 20:16	04:41 21:08	04:26 21:34
26	07:57 16:23	06:57 17:25	06:47 19:20	05:34 20:18	04:40 21:10	04:26 21:34
27	07:55 16:25	06:55 17:27	06:45 19:22	05:31 20:20	04:39 21:11	04:27 21:33
28	07:54 16:27	06:52 17:29	06:42 19:24	05:29 20:22	04:37 21:12	04:27 21:33
29	07:52 16:29	06:50 17:31	06:40 19:26	05:27 20:24	04:36 21:14	04:28 21:33
30	07:51 16:31		06:37 19:28	05:25 20:25	04:35 21:15	04:28 21:33
31	07:49 16:33		06:35 19:30		04:34 21:16	
Potential sun hours	248	282	367	420	495	511
Sum of minutes with flicker	0	320	0	161	0	0

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/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Farma wiatrowa - Brojce

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 20 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (366)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Reference year for calendar 2012

Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum

338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503

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

	July	August	September	October	November	December
1	04:29 21:33	05:09 20:57	06:04 19:50	06:57 18:36	06:56 16:25	15:34-15:54/20 15:40
2	04:30 21:32	05:11 20:55	06:06 19:48	06:59 18:33	06:58 16:23	15:36-15:53/17 15:40
3	04:31 21:32	05:13 20:53	06:07 19:45	07:01 18:31	07:00 16:21	15:37-15:51/14 15:39
4	04:31 21:31	05:14 20:51	06:09 19:43	07:03 18:29	07:02 16:19	15:39-15:49/10 15:38
5	04:32 21:31	05:16 20:49	06:11 19:40	07:05 18:26	07:04 16:17	15:42-15:46/4 15:38
6	04:33 21:30	05:18 20:48	06:13 19:38	07:07 18:24	07:06 16:15	07:06 15:37
7	04:34 21:29	05:19 20:46	06:15 19:35	07:08 18:21	07:08 16:13	07:08 15:37
8	04:35 21:29	05:21 20:44	06:16 19:33	07:10 18:19	07:10 16:12	07:10 15:36
9	04:36 21:28	05:23 20:42	06:18 19:30	07:12 18:16	07:12 16:10	07:12 15:36
10	04:37 21:27	05:25 20:40	06:20 19:28	07:14 18:14	07:14 16:08	07:14 15:35
11	04:38 21:26	05:26 20:37	06:22 19:26	07:16 18:12	07:16 16:06	07:16 15:35
12	04:40 21:25	05:28 20:35	06:23 19:23	07:18 18:09	07:17 16:05	07:17 15:35
13	04:41 21:24	05:30 20:33	06:25 19:21	07:20 18:07	07:19 16:03	07:19 15:35
14	04:42 21:23	05:32 20:31	06:27 19:18	07:21 18:05	07:21 16:01	07:21 15:35
15	04:43 21:22	05:34 20:29	06:29 19:16	07:23 18:02	07:23 16:00	07:23 15:35
16	04:45 21:21	05:35 20:27	06:31 19:13	07:25 18:00	07:25 15:58	07:25 15:35
17	04:46 21:20	05:37 20:25	06:32 19:11	07:27 17:58	07:27 15:57	07:27 15:35
18	04:47 21:19	05:39 20:22	06:34 19:08	07:29 17:55	07:29 15:55	07:29 15:35
19	04:49 21:17	05:41 20:20	06:36 19:06	07:31 17:53	07:31 15:54	07:31 15:36
20	04:50 21:16	05:42 20:18	06:38 19:03	07:33 17:51	07:33 15:52	07:33 15:36
21	04:52 21:15	05:44 20:16	06:39 19:01	07:35 17:48	07:34 15:51	07:34 15:36
22	04:53 21:13	05:46 20:13	06:41 18:58	07:37 17:46	07:36 15:50	07:36 15:37
23	04:55 21:12	05:48 20:11	06:43 18:56	07:39 17:44	07:38 15:48	07:38 15:37
24	04:56 21:10	05:50 20:09	06:45 18:53	07:41 17:42	07:40 15:47	07:40 15:38
25	04:58 21:09	05:51 20:07	06:47 18:51	07:42 17:40	07:41 15:46	07:41 15:39
26	04:59 21:07	05:53 20:04	06:48 18:48	07:44 17:37	07:43 15:45	07:43 15:39
27	05:01 21:05	05:55 20:02	06:50 18:46	07:46 17:35	07:45 15:44	07:45 15:40
28	05:03 21:04	05:57 19:59	06:52 18:43	07:48 16:33	07:47 15:43	07:47 15:41
29	05:04 21:02	05:59 19:57	06:54 18:41	07:50 16:31	07:48 15:42	07:48 15:42
30	05:06 21:00	06:00 19:55	06:56 18:38	07:52 16:29	07:50 15:41	07:50 15:43
31	05:08 20:59	06:02 19:52	06:58 18:36	07:54 16:27	07:52 15:40	07:52 15:44
Potential sun hours	513	460	382	328	258	232
Sum of minutes with flicker	0	126	37	258	65	0

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/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker



Project:

Farma wiatrowa - Brojce

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Calculated:

2012-03-13 22:15/2.7.490

### SHADOW - Calendar per WTG

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1WTG: 21 - VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (367)

#### Assumptions for shadow calculations

Maximum distance for influence 2. WTG distance circle radius  
 Minimum sun height over horizon for influence 3 °  
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Sunshine probability S (Average daily sunshine hours) [KOLOBRZEG]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,33 2,19 3,53 5,54 7,87 7,57 7,41 7,34 4,73 3,34 1,48 1,08

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 338 404 489 730 507 694 738 1 313 1 207 872 893 319 8 503  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:17 09:34-10:02/28 15:44 15:45	07:48 16:35 16:37	06:48 17:33 17:35	06:32 06:30 19:34	05:23 20:28 20:29	04:33 21:18 21:19	04:29 21:33 21:32	05:09 20:57 05:11	06:04 06:06 19:48	06:58 06:59 18:33	06:56 06:58 16:23	07:52 07:53 15:39
2	08:17 09:34-10:02/28 15:45 15:46	07:46 16:37 16:41	06:46 17:35 17:37	06:30 06:28 19:35	05:21 20:29 20:31	04:32 21:19 21:20	04:30 21:32 21:32	05:11 20:55 05:13	06:06 06:07 19:45	06:59 07:01 18:31	06:58 07:00 16:21	07:53 07:55 15:39
3	08:16 09:35-10:03/28 15:46 15:47	07:44 16:39 16:41	06:43 17:37 17:39	06:28 06:25 19:37	05:19 20:31 20:33	04:31 21:20 21:21	04:30 21:32 21:31	05:13 20:53 05:14	06:07 06:09 19:43	07:01 07:03 18:29	07:00 07:02 16:19	07:55 07:56 15:38
4	08:16 09:35-10:03/28 15:47 15:48	07:42 16:41 16:43	06:41 17:39 17:41	06:25 06:23 19:39	05:17 20:35 20:35	04:30 21:21 21:23	04:31 21:31 21:31	05:14 20:52 05:16	06:09 06:11 19:40	07:03 07:05 18:26	07:02 07:04 16:17	07:56 07:58 15:37
5	08:16 09:36-10:03/27 15:48 15:50	07:41 16:43 16:45	06:39 17:41 17:43	06:23 06:20 19:41	05:15 20:35 20:37	04:29 21:24 21:24	04:32 21:30 21:30	05:16 20:50 05:18	06:11 06:13 19:38	07:05 07:07 18:24	07:04 07:06 16:15	07:58 07:59 15:37
6	08:15 09:37-10:03/26 15:51 15:52	07:39 16:45 16:47	06:36 17:43 17:44	06:20 06:18 19:43	05:13 20:38 20:38	04:29 21:25 21:25	04:33 21:30 21:30	05:18 20:46 05:21	06:13 06:16 19:36	07:07 07:10 18:21	07:06 07:10 16:13	07:59 08:00 15:36
7	08:15 09:38-10:04/26 15:51 15:52	07:37 16:47 16:49	06:34 17:44 17:46	06:18 06:15 19:45	05:11 20:40 20:40	04:28 21:26 21:26	04:34 21:30 21:29	05:19 20:46 05:25	06:15 06:16 19:33	07:09 07:10 18:19	07:08 07:10 16:11	08:00 08:02 15:36
8	08:15 09:38-10:03/25 15:54 15:55	07:35 16:49 16:51	06:31 17:46 17:48	06:15 06:13 19:47	05:09 20:42 20:42	04:27 21:27 21:27	04:35 21:30 21:28	05:21 20:44 05:25	06:16 06:18 19:31	07:10 07:12 18:16	07:10 07:12 16:10	08:02 08:03 15:36
9	08:14 09:41-10:04/23 15:55 15:57	07:33 16:53 16:55	06:29 17:50 17:52	06:13 06:11 19:50	05:07 20:46 20:46	04:27 21:27 21:28	04:36 21:30 21:26	05:23 20:44 05:26	06:18 06:22 19:26	07:12 07:14 18:12	07:12 07:16 16:06	08:04 08:05 15:35
10	08:14 09:41-10:04/23 15:57 15:58	07:31 16:53 16:55	06:27 17:50 17:52	06:11 06:08 19:50	05:05 20:46 20:46	04:26 21:27 21:27	04:37 21:30 21:26	05:25 20:44 05:26	06:20 06:22 19:26	07:14 07:14 18:14	07:14 07:16 16:06	08:04 08:05 15:35
11	08:13 09:41-10:04/23 15:57 15:58	07:29 16:55 16:57	06:24 17:52 17:54	06:08 06:06 19:52	05:03 20:47 20:47	04:26 21:28 21:28	04:38 21:30 21:26	05:26 20:44 05:26	06:22 06:23 19:26	07:16 07:16 18:12	07:16 07:18 16:06	08:05 08:06 15:35
12	08:12 09:42-10:03/21 15:58 16:00	07:27 16:57 16:59	06:22 17:54 17:56	06:06 06:03 19:54	05:01 20:49 20:49	04:26 21:29 21:30	04:40 21:30 21:24	05:28 20:44 05:33	19:47-19:52/5 06:23	07:18 07:18 18:09	07:18 07:20 16:04	08:06 08:07 15:35
13	08:11 09:43-10:03/20 16:00 16:01	07:25 16:59 17:01	06:19 17:56 17:58	06:03 06:01 19:54	05:00 20:49 20:51	04:25 21:30 21:30	04:41 21:30 21:24	05:30 20:44 05:32	19:45-19:55/10 06:25	07:20 07:20 18:07	07:20 07:22 16:03	08:07 08:08 15:35
14	08:11 09:45-10:02/17 16:01 16:03	07:23 16:59 17:01	06:17 17:56 17:58	06:01 05:59 19:56	04:58 20:51 20:52	04:25 21:30 21:30	04:42 21:30 21:23	05:32 20:44 05:34	19:44-19:56/12 06:27	07:22 07:22 18:05	07:22 07:23 16:01	08:08 08:09 15:35
15	08:10 09:46-10:01/15 16:03 16:05	07:21 17:03 17:05	06:14 18:00 18:02	05:59 05:56 20:00	04:56 20:52 20:54	04:25 21:31 21:31	04:43 21:22 21:27	05:34 20:29 05:35	19:42-19:56/14 06:29	07:23 07:25 18:02	07:23 07:25 16:00	08:09 08:10 15:35
16	08:09 09:47-09:59/12 16:05 16:06	07:19 17:05 17:07	06:12 18:02 18:04	05:56 20:00 20:02	04:54 20:54 20:56	04:24 21:31 21:32	04:45 21:27 21:20	05:35 20:25 05:39	19:41-19:57/16 06:31	07:25 07:27 18:00	07:25 07:27 15:58	08:10 08:11 15:35
17	08:08 09:50-09:57/7 16:06 16:08	07:17 17:07 17:09	06:09 18:05 18:07	05:54 20:03 20:05	04:53 20:57 20:59	04:24 21:32 21:33	04:46 21:19 21:19	05:37 20:23 05:41	19:41-19:57/16 06:32	07:27 07:27 17:58	07:27 07:31 15:57	08:11 08:12 15:35
18	08:07 16:08 16:10	07:15 17:09 17:11	06:07 18:05 18:07	05:52 20:03 20:05	04:51 20:57 20:59	04:24 21:32 21:33	04:47 21:19 21:19	05:39 20:23 05:41	19:40-19:54/14 06:34	07:29 07:29 17:55	07:29 07:31 15:55	08:12 08:13 15:35
19	08:06 16:10 16:12	07:13 17:11 17:13	06:05 18:05 18:07	05:49 20:03 20:05	04:50 20:57 20:59	04:24 21:33 21:33	04:49 21:18 21:18	05:41 20:20 05:44	19:40-19:52/12 06:36	07:31 07:31 17:53	07:31 07:33 15:54	08:13 08:14 15:35
20	08:05 16:12 16:14	07:11 17:13 17:15	06:02 18:09 18:11	05:47 19:38-19:40/2 20:07	04:48 21:01 21:03	04:24 21:33 21:33	04:50 21:16 21:16	05:42 20:18 05:46	19:41-19:51/10 06:38	07:33 07:33 17:51	07:33 07:35 15:52	08:13 08:14 15:36
21	08:03 16:14 16:16	07:08 17:15 17:17	06:00 18:11 18:13	05:45 19:37-19:42/5 20:09	04:47 21:02 21:04	04:25 21:33 21:33	04:52 21:15 21:15	05:44 20:16 05:48	19:40-19:48/8 06:40	07:35 07:35 17:48	07:35 07:36 15:51	08:14 08:15 15:36
22	08:02 16:15 16:17	07:06 17:17 17:19	05:57 18:13 18:15	05:42 19:36-19:44/8 20:11	04:45 21:04 21:04	04:25 21:34 21:34	04:53 21:14 21:14	05:46 20:14 05:48	19:42-19:46/4 06:41	07:37 07:37 17:46	07:36 07:38 15:50	08:14 08:15 15:37
23	08:01 16:17 16:19	07:04 17:19 17:21	05:55 18:15 18:17	05:40 19:35-19:46/11 20:13	04:44 21:05 21:07	04:25 21:34 21:34	04:55 21:11 21:11	05:48 20:11 05:50	19:43-19:44/1 06:43	07:39 07:39 17:44	07:38 07:40 15:48	08:15 08:16 15:38
24	08:00 16:21 16:23	07:02 17:23 17:25	05:52 18:15 18:17	05:38 19:34-19:47/13 20:13	04:42 21:07 21:09	04:25 21:34 21:34	04:56 21:11 21:11	05:50 20:09 05:53	06:45 06:45 18:58	07:41 07:41 17:42	07:40 07:42 15:47	08:15 08:16 15:38
25	07:58 16:21 16:23	06:59 17:23 17:25	06:50 18:19 18:21	05:36 19:34-19:48/14 20:16	04:41 21:08 21:10	04:26 21:34 21:34	04:58 21:09 21:09	05:51 20:07 05:53	06:47 06:49 18:51	07:43 07:43 17:40	07:42 07:44 15:46	08:16 08:17 15:38
26	07:57 16:23 16:25	06:57 17:25 17:27	06:47 18:20 18:22	05:34 19:34-19:50/16 20:18	04:40 21:10 21:12	04:26 21:34 21:34	04:59 21:07 21:07	05:53 20:04 05:55	06:49 06:50 18:48	07:45 07:45 17:37	07:43 07:45 15:45	08:16 08:17 15:39
27	07:55 16:25 16:27	06:55 17:27 17:29	06:45 18:22 18:24	05:31 19:34-19:49/15 20:20	04:38 21:11 21:13	04:27 21:34 21:34	05:01 21:06 21:06	05:55 20:02 05:57	06:50 06:52 18:46	07:47 07:47 17:35	07:45 07:47 15:44	08:16 08:17 15:40
28	07:52 16:29 16:31	06:50 17:29 17:31	06:40 18:24 18:26	05:27 19:36-19:47/11 20:22	04:36 21:13 21:15	04:28 21:34 21:34	05:04 21:09 21:09	05:59 20:07 06:00	06:54 06:56 18:41	07:48 07:48 16:31	09:25-09:42/17 15:42	08:17 08:18 15:42
29	07:51 16:31 16:33	06:49 17:31 17:33	06:37 18:26 18:28	05:25 19:38-19:46/8 20:26	04:35 21:15 21:17	04:28 21:33 21:33	05:06 21:01 21:01	06:00 19:55 19:55	06:56 06:58 18:38	07:50 07:50 16:29	09:24-09:44/20 15:41	08:17 08:18 15:43
30	07:49 16:33 16:35	06:47 17:33 17:35	06:35 18:30 18:32	06:35 19:30-19:46/8 20:26	04:34 21:17 21:19	04:34 21:33 21:33	05:07 21:01 21:01	06:02 19:53 19:53	06:54 06:56 18:38	07:44 07:44 16:27	15:44 15:44	08:17 08:18 15:44
Potential sun hours	248	281	367	420	495	511	513	460	382	328	258	232
Sum of minutes with flicker	378	0	0	116	0	0	0	122	0	0	71	854

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/Minutes with flicker  
 Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

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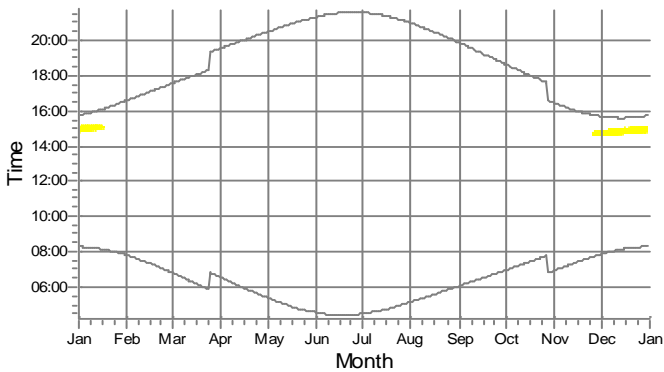
Calculated:

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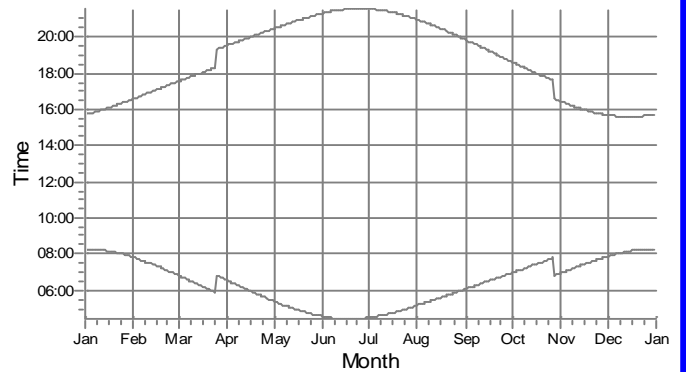
### SHADOW - Calendar per WTG, graphical

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1

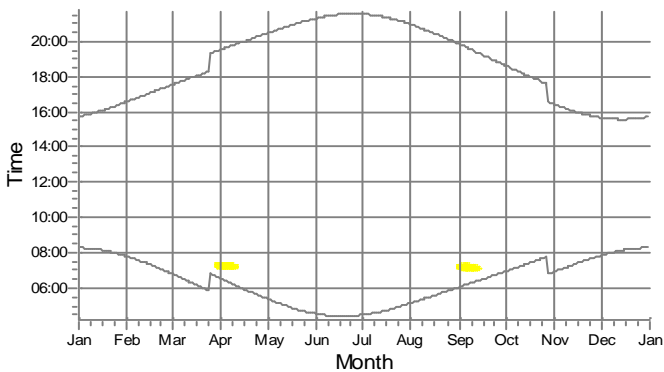
1: VESTAS V112-3.0 IC 3000 112.0 IO! hub: 119,0 m (347)



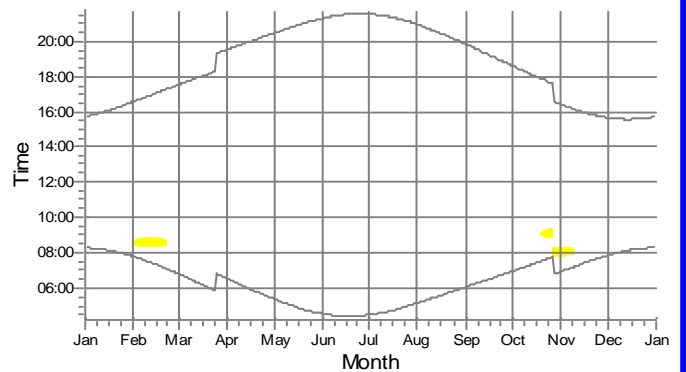
2: VESTAS V112-3.0 IC 3000 112.0 IO! hub: 119,0 m (348)



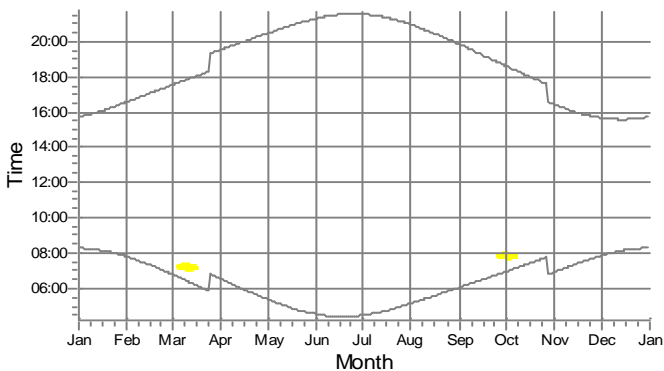
3: VESTAS V112-3.0 IC 3000 112.0 IO! hub: 119,0 m (349)



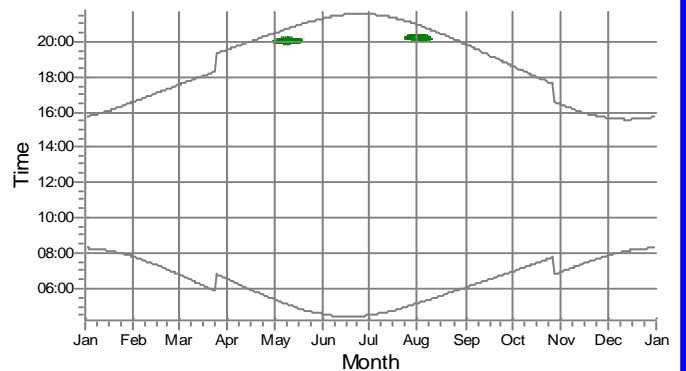
4: VESTAS V112-3.0 IC 3000 112.0 IO! hub: 119,0 m (350)



5: VESTAS V112-3.0 IC 3000 112.0 IO! hub: 119,0 m (351)



6: VESTAS V112-3.0 IC 3000 112.0 IO! hub: 119,0 m (352)



Shadow receptor

A: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(1)

B: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(2)

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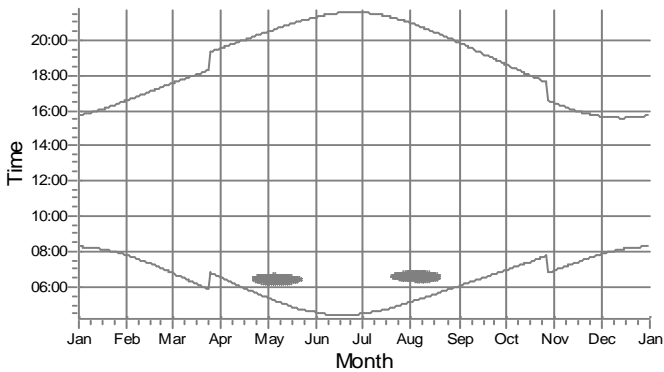
Calculated:

2012-03-13 22:15/2.7.490

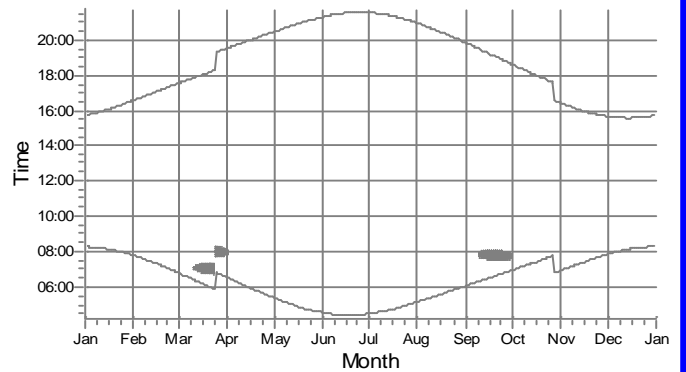
### SHADOW - Calendar per WTG, graphical

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1

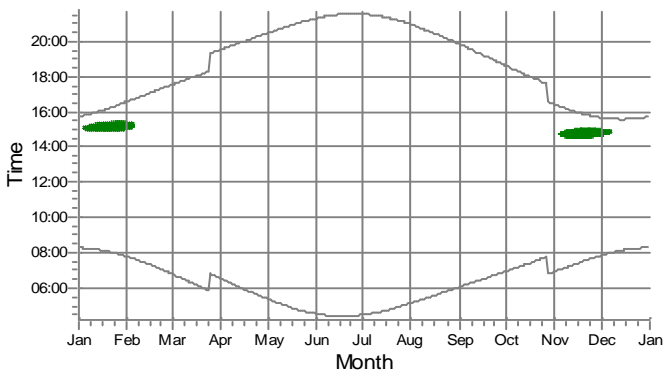
7: VESTAS V112-3.0 IC 3000 112.0 IO! hub: 119,0 m (353)



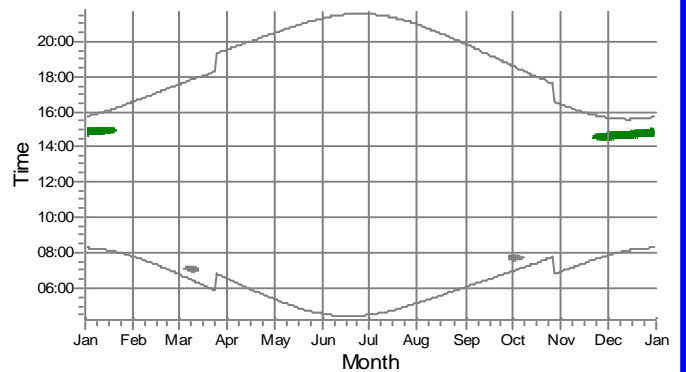
8: VESTAS V112-3.0 IC 3000 112.0 IO! hub: 119,0 m (354)



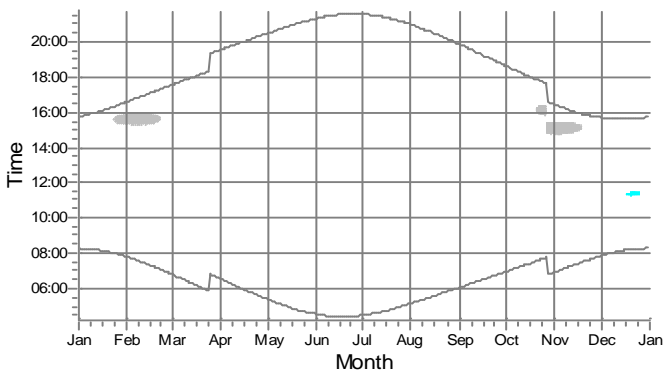
9: VESTAS V112-3.0 IC 3000 112.0 IO! hub: 119,0 m (355)



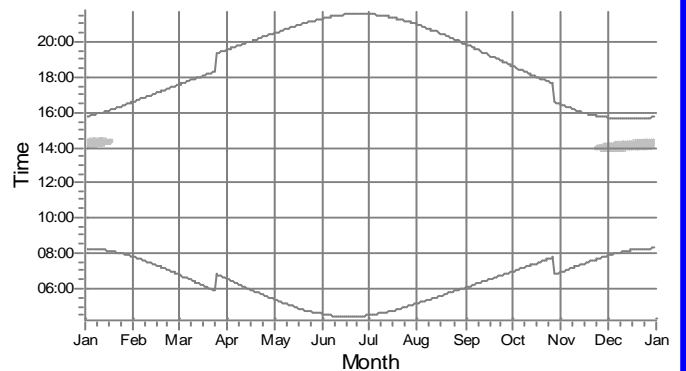
10: VESTAS V112-3.0 IC 3000 112.0 IO! hub: 119,0 m (356)



11: VESTAS V112-3.0 IC 3000 112.0 IO! hub: 119,0 m (357)



12: VESTAS V112-3.0 IC 3000 112.0 IO! hub: 119,0 m (358)



Shadow receptor

- A: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(1)
- D: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(4)

- L: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(12)
- M: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope: 90,0°(13)

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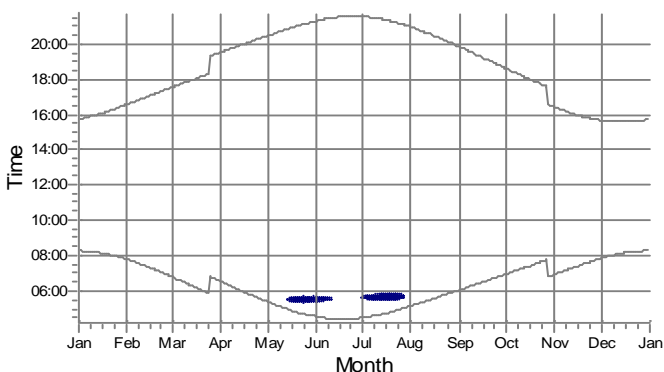
Calculated:

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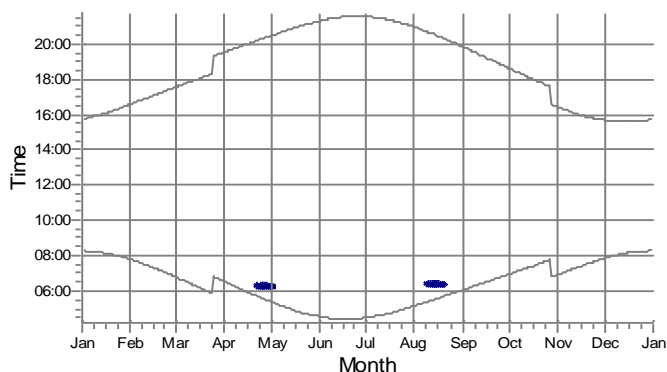
### SHADOW - Calendar per WTG, graphical

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1

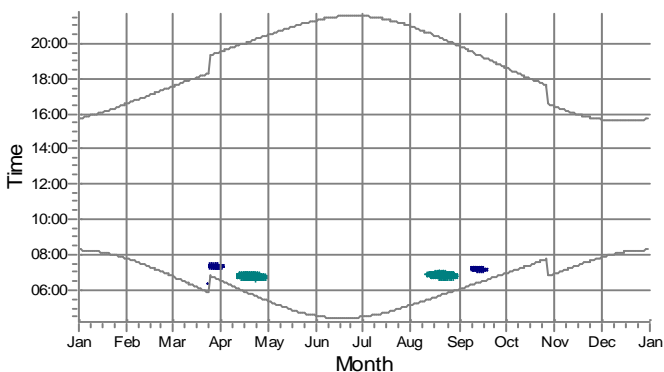
13: VESTAS V112-3.0 IC 3000 112.0 IO! hub: 119,0 m (359)



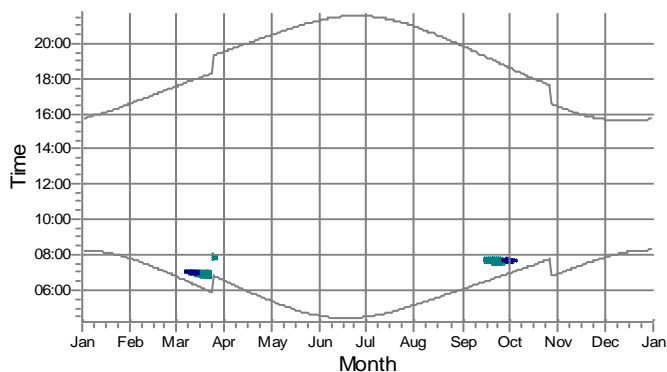
14: VESTAS V112-3.0 IC 3000 112.0 IO! hub: 119,0 m (360)



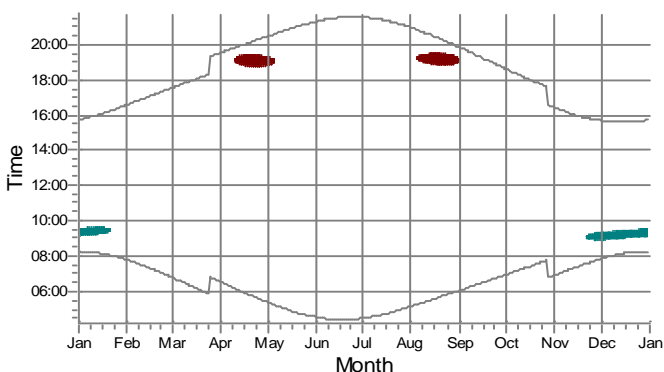
15: VESTAS V112-3.0 IC 3000 112.0 IO! hub: 119,0 m (361)



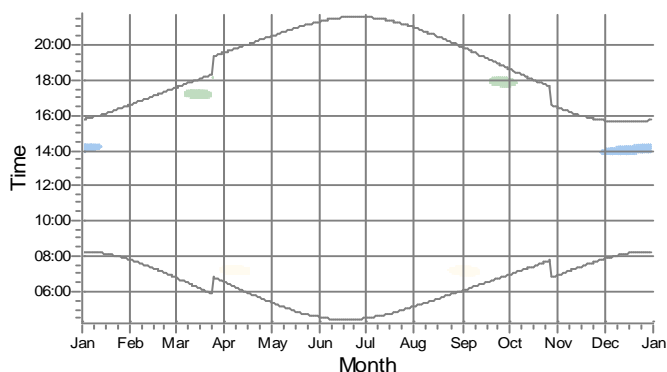
16: VESTAS V112-3.0 IC 3000 112.0 IO! hub: 119,0 m (362)



17: VESTAS V112-3.0 IC 3000 112.0 IO! hub: 119,0 m (363)



18: VESTAS V112-3.0 IC 3000 112.0 IO! hub: 119,0 m (364)



Shadow receptor

- F: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope : 90,0°(6)
- G: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope : 90,0°(7)
- H: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope : 90,0°(8)

- O: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope : 90,0°(15)
- P: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope : 90,0°(16)
- Q: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope : 90,0°(17)

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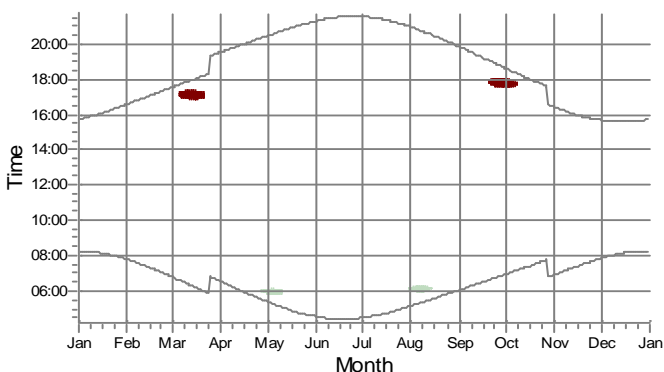
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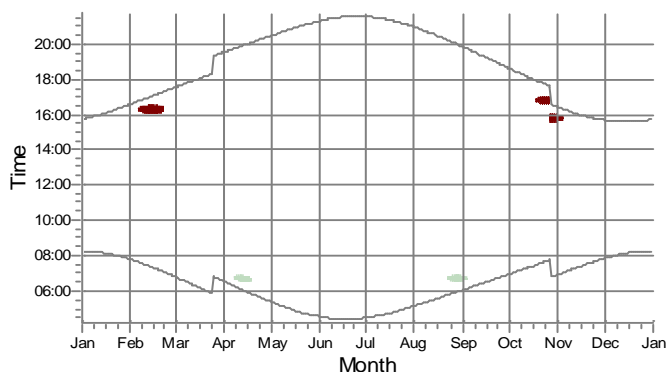
**SHADOW - Calendar per WTG, graphical**

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1

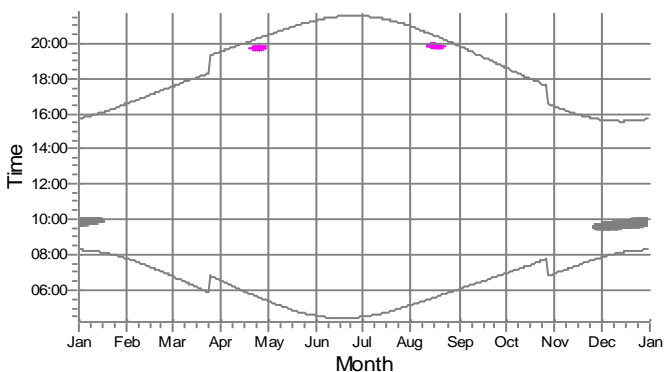
19: VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (365)



20: VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (366)



21: VESTAS V112-3.0 IC 3000 112.0 !O! hub: 119,0 m (367)



Shadow receptor

- D: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope : 90,0°(4)
- E: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope : 90,0°(5)

- H: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope : 90,0°(8)
- O: Shadow Receptor: 3,0 x 2,0 Azimuth: -180,0° Slope : 90,0°(15)

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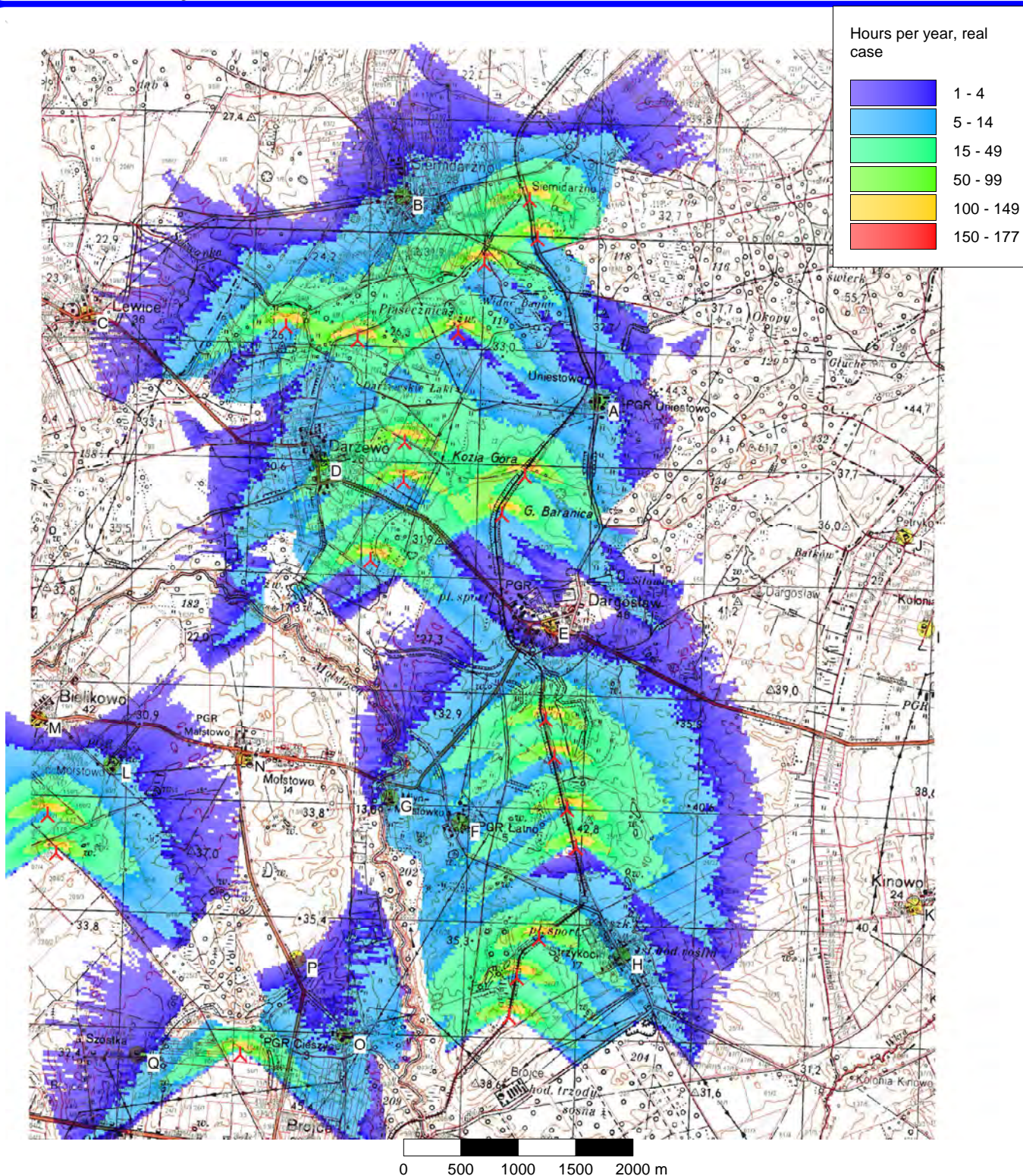
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## SHADOW - Map

Calculation: Efekt migotania cienia - 21x3MW - V112 - Phase 1



Map: Brojce20000-dzialki, Print scale 1:50 000, Map center UTM WGS 84 Zone: 33 East: 524 600 North: 5 983 700

New WTG

Shadow receptor