

SHADOW - Main Result

Calculation: Real case E175 + Helzen

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) [ST-HUBERT]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,58	3,05	3,17	4,85	6,15	5,19	6,45	6,12	4,77	3,14	2,23	1,13

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW
315	397	595	550	415	406	433	424	559	874	1.217	937

W	WNW	NW	NNW	Sum
559	442	322	315	8.760

Monthly aggregation of real case reduction

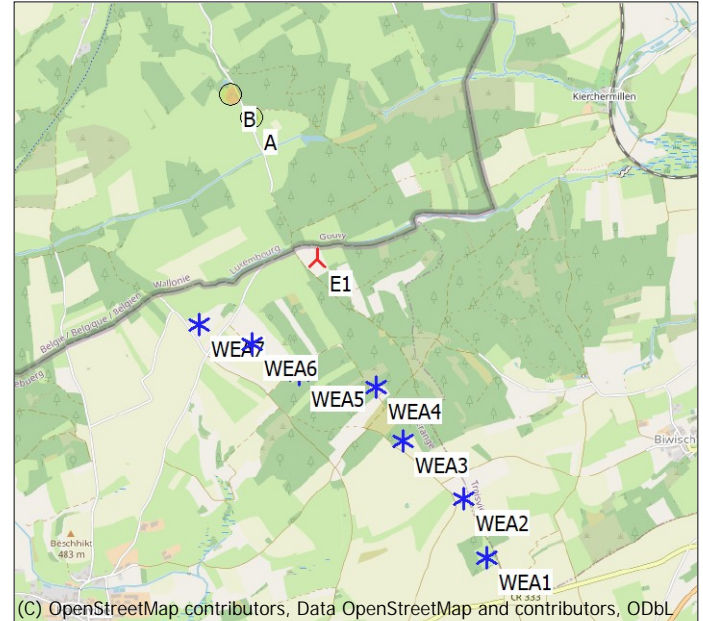
A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:

DHM: Maille-alti Assistant création projet (Luxembourgish Elevation Model - 5m)

Receptor grid resolution: 1,0 m

All coordinates are in

Luxemburgian TM-LUREF (LU)



▲ New WTG
● Shadow receptor

Scale 1:50.000

★ Existing WTG

WTGs

	X	Y	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]
E1	64.037	132.715	484,8	ENERCON E-175 EP5 6000 175.0 !O! hub: 162,...	Yes	ENERCON	E-175 EP5-6.000	6.000	175,0	162,0	1.737	-
WEA1	65.152	130.737	500,3	Siemens SWT-3.0-113 3000 113.0 !O! hub: 14...	Yes	Siemens	SWT-3.0-113-3.000	3.000	113,0	142,5	1.732	-
WEA2	64.999	131.121	505,0	Siemens SWT-3.0-113 3000 113.0 !O! hub: 14...	Yes	Siemens	SWT-3.0-113-3.000	3.000	113,0	142,5	1.732	-
WEA3	64.604	131.511	512,6	Siemens SWT-3.0-113 3000 113.0 !O! hub: 14...	Yes	Siemens	SWT-3.0-113-3.000	3.000	113,0	142,5	1.732	-
WEA4	64.420	131.874	515,1	Siemens SWT-3.0-113 3000 113.0 !O! hub: 14...	Yes	Siemens	SWT-3.0-113-3.000	3.000	113,0	142,5	1.732	-
WEA5	63.913	131.951	512,3	Siemens SWT-3.0-113 3000 113.0 !O! hub: 14...	Yes	Siemens	SWT-3.0-113-3.000	3.000	113,0	142,5	1.732	-
WEA6	63.599	132.155	508,2	Siemens SWT-3.0-113 3000 113.0 !O! hub: 14...	Yes	Siemens	SWT-3.0-113-3.000	3.000	113,0	142,5	1.732	-
WEA7	63.249	132.283	501,9	Siemens SWT-3.0-113 3000 113.0 !O! hub: 14...	Yes	Siemens	SWT-3.0-113-3.000	3.000	113,0	142,5	1.732	-

Shadow receptor-Input

No.	X	Y	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
A	63.606	133.646	472,5	5,0	2,0	0,2	90,0	"Green house mode"	2,2
B	63.467	133.800	476,8	5,0	2,0	0,2	90,0	"Green house mode"	2,2

Calculation Results

Shadow receptor

No.	Shadow, worst case			Shadow, expected values	
	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]	
A	19:39	43	0:34	1:41	
B	3:34	19	0:14	0:16	

Project:
Helzen

Licensed user:
Embridge
Route de Hannut, 55
BE-5000 Namur



Nicolas Jorion / nicolasj@embridge.be
Calculated:
10-03-25 16:13/4.1.254

SHADOW - Main Result

Calculation: Real case E175 + Helzen

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

No.	Name	Worst case [h/year]	Expected [h/year]
E1	ENERCON E-175 EP5 6000 175.0 !O! hub: 162,0 m (TOT: 249,5 m) (2)	20:52	1:46
WEA1	Siemens SWT-3.0-113 3000 113.0 !O! hub: 142,5 m (TOT: 199,0 m) (7)	0:00	0:00
WEA2	Siemens SWT-3.0-113 3000 113.0 !O! hub: 142,5 m (TOT: 199,0 m) (5)	0:00	0:00
WEA3	Siemens SWT-3.0-113 3000 113.0 !O! hub: 142,5 m (TOT: 199,0 m) (4)	0:00	0:00
WEA4	Siemens SWT-3.0-113 3000 113.0 !O! hub: 142,5 m (TOT: 199,0 m) (2)	0:00	0:00
WEA5	Siemens SWT-3.0-113 3000 113.0 !O! hub: 142,5 m (TOT: 199,0 m) (1)	0:00	0:00
WEA6	Siemens SWT-3.0-113 3000 113.0 !O! hub: 142,5 m (TOT: 199,0 m) (6)	0:00	0:00
WEA7	Siemens SWT-3.0-113 3000 113.0 !O! hub: 142,5 m (TOT: 199,0 m) (3)	0:00	0:00

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

SHADOW - Calendar

Calculation: Real case E175 + Helzen Shadow receptor: A - Shadow Receptor: 5,0 × 2,0 Azimuth: 0,0° Slope: 90,0° (1)
Assumptions for shadow calculations Sunshine probability S (Average daily sunshine hours) [ST-HUBERT]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1,58 3,05 3,17 4,85 6,15 5,19 6,45 6,12 4,77 3,14 2,23 1,13

Operational time

N NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum
315 397 595 550 415 406 433 424 559 874 1.217 937 559 442 322 315 8.760

		January	February	March	April	May	June	July	August	September	October	November	December			
1	08:36	10:32 (E1)	08:12	07:22	07:15	06:14	05:33	05:30	06:04	06:50	07:35	07:25	08:13	10:28 (E1)		
2	16:44	30	11:02 (E1)	17:29	18:17	20:07	20:55	21:37	21:50	21:21	20:23	19:17	17:15	16:38	10	10:38 (E1)
	08:36		10:33 (E1)	08:11	07:20	07:13	06:13	05:32	05:31	06:06	06:52	07:37	07:27	08:14		10:25 (E1)
3	16:45	29	11:02 (E1)	17:31	18:19	20:09	20:56	21:38	21:50	21:20	20:21	19:15	17:13	16:37	15	10:40 (E1)
	08:36		10:34 (E1)	08:09	07:18	07:11	06:11	05:31	05:32	06:07	06:53	07:38	07:29	08:16		10:25 (E1)
4	16:46	29	11:03 (E1)	17:33	18:21	20:11	20:58	21:39	21:50	21:18	20:19	19:13	17:11	16:37	18	10:43 (E1)
	08:36		10:35 (E1)	08:08	07:16	07:09	06:09	05:31	05:32	06:08	06:55	07:40	07:30	08:17		10:24 (E1)
5	16:47	28	11:03 (E1)	17:34	18:22	20:12	20:59	21:40	21:49	21:16	20:17	19:11	17:10	16:36	21	10:45 (E1)
	08:36		10:35 (E1)	08:06	07:14	07:07	06:07	05:30	05:33	06:10	06:56	07:42	07:32	08:18		10:24 (E1)
6	16:49	27	11:02 (E1)	17:36	18:24	20:14	21:01	21:41	21:49	21:15	20:14	19:08	17:08	16:36	23	10:47 (E1)
	08:35		10:37 (E1)	08:05	07:12	07:05	06:06	05:29	05:34	06:11	06:58	07:43	07:34	08:19		10:23 (E1)
7	16:50	25	11:02 (E1)	17:38	18:26	20:15	21:02	21:42	21:48	21:13	20:12	19:06	17:07	16:35	25	10:48 (E1)
	08:35		10:38 (E1)	08:03	07:10	07:02	06:04	05:29	05:35	06:13	06:59	07:45	07:35	08:21		10:23 (E1)
8	16:51	23	11:01 (E1)	17:40	18:27	20:17	21:04	21:43	21:48	21:11	20:10	19:04	17:05	16:35	26	10:49 (E1)
	08:35		10:40 (E1)	08:01	07:08	07:00	06:02	05:28	05:36	06:14	07:01	07:46	07:37	08:22		10:22 (E1)
9	16:52	21	11:01 (E1)	17:41	18:29	20:18	21:05	21:43	21:47	21:10	20:08	19:02	17:03	16:35	28	10:50 (E1)
	08:34		10:41 (E1)	08:00	07:05	06:58	06:01	05:28	05:37	06:16	07:02	07:48	07:39	08:23		10:22 (E1)
10	16:53	18	10:59 (E1)	17:43	18:31	20:20	21:07	21:44	21:47	21:08	20:06	19:00	17:02	16:35	29	10:51 (E1)
	08:34		10:43 (E1)	07:58	07:03	06:56	05:59	05:28	05:37	06:17	07:04	07:49	07:40	08:24		10:22 (E1)
11	16:55	16	10:59 (E1)	17:45	18:32	20:22	21:08	21:45	21:46	21:06	20:03	18:58	17:00	16:34	30	10:52 (E1)
	08:33		10:45 (E1)	07:56	07:01	06:54	05:58	05:27	05:38	06:19	07:05	07:51	07:42	08:25		10:23 (E1)
12	16:56	11	10:56 (E1)	17:47	18:34	20:23	21:10	21:46	21:45	21:04	20:01	18:56	16:59	16:34	30	10:53 (E1)
	08:33		10:50 (E1)	07:55	06:59	06:52	05:56	05:27	05:39	06:20	07:07	07:53	07:44	08:26		10:23 (E1)
13	16:57	2	10:52 (E1)	17:48	18:35	20:25	21:11	21:46	21:45	21:03	19:59	18:54	16:57	16:34	31	10:54 (E1)
	08:32			07:53	06:57	06:50	05:55	05:27	05:40	06:22	07:08	07:54	07:45	08:27		10:23 (E1)
14	16:59			17:50	18:37	20:26	21:13	21:47	21:44	21:01	19:57	18:51	16:56	16:34	32	10:55 (E1)
	08:31			07:51	06:55	06:48	05:53	05:26	05:41	06:23	07:10	07:56	07:47	08:28		10:22 (E1)
15	17:00			17:52	18:39	20:28	21:14	21:47	21:43	20:59	19:55	18:49	16:55	16:34	33	10:55 (E1)
	08:31			07:49	06:53	06:46	05:52	05:26	05:43	06:25	07:11	07:57	07:49	08:29		10:23 (E1)
16	17:02			17:53	18:40	20:29	21:15	21:48	21:42	20:57	19:52	18:47	16:53	16:34	33	10:56 (E1)
	08:30			07:48	06:50	06:44	05:50	05:26	05:44	06:26	07:13	07:59	07:50	08:29		10:23 (E1)
17	17:03			17:55	18:42	20:31	21:17	21:48	21:41	20:55	19:50	18:45	16:52	16:34	33	10:56 (E1)
	08:29			07:46	06:48	06:42	05:49	05:26	05:45	06:28	07:14	08:01	07:52	08:30		10:24 (E1)
18	17:05			17:57	18:44	20:33	21:18	21:49	21:40	20:53	19:48	18:43	16:51	16:35	33	10:57 (E1)
	08:28			07:44	06:46	06:39	05:48	05:26	05:46	06:29	07:16	08:02	07:53	08:31		10:24 (E1)
19	17:06			17:59	18:45	20:34	21:20	21:49	21:39	20:51	19:46	18:41	16:50	16:35	34	10:58 (E1)
	08:27			07:42	06:44	06:37	05:46	05:26	05:47	06:31	07:17	08:04	07:55	08:32		10:24 (E1)
20	17:08			18:00	18:47	20:36	21:21	21:50	21:38	20:50	19:44	18:39	16:48	16:35	34	10:58 (E1)
	08:26			07:40	06:42	06:35	05:45	05:26	05:48	06:32	07:19	08:05	07:57	08:32		10:25 (E1)
21	17:09			18:02	18:48	20:37	21:22	21:50	21:37	20:48	19:41	18:37	16:47	16:36	34	10:59 (E1)
	08:26			07:38	06:39	06:33	05:44	05:26	05:50	06:34	07:20	08:07	07:58	08:33		10:25 (E1)
22	17:11			18:04	18:50	20:39	21:24	21:50	21:36	20:46	19:39	18:35	16:46	16:36	34	10:59 (E1)
	08:24			07:36	06:37	06:31	05:42	05:27	05:51	06:35	07:22	08:09	08:00	08:33		10:26 (E1)
23	17:12			18:05	18:52	20:40	21:25	21:50	21:35	20:44	19:37	18:33	16:45	16:37	34	11:00 (E1)
	08:23			07:34	06:35	06:30	05:41	05:27	05:52	06:37	07:23	08:10	08:01	08:34		10:26 (E1)
24	17:14			18:07	18:53	20:42	21:26	21:51	21:34	20:42	19:35	18:31	16:44	16:37	34	11:00 (E1)
	08:22			07:32	06:33	06:28	05:40	05:27	05:53	06:38	07:25	08:12	08:03	08:34		10:27 (E1)
25	17:16			18:09	18:55	20:44	21:28	21:51	21:32	20:40	19:33	18:29	16:43	16:38	34	11:01 (E1)
	08:21			07:30	06:31	06:26	05:39	05:28	05:55	06:40	07:26	07:14	08:04	08:35		10:27 (E1)
26	17:17			18:11	18:56	20:45	21:29	21:51	21:31	20:38	19:30	17:28	16:42	16:38	34	11:01 (E1)
	08:20			07:28	06:29	06:24	05:38	05:28	05:56	06:41	07:28	07:15	08:06	08:35		10:27 (E1)
27	17:19			18:12	18:58	20:47	21:30	21:51	21:30	20:35	19:28	17:26	16:41	16:39	34	11:01 (E1)
	08:19			07:26	06:26	06:22	05:37	05:28	05:57	06:43	07:29	07:17	08:07	08:35		10:28 (E1)
28	17:21			18:14	18:59	20:48	21:31	21:51	21:28	20:33	19:26	17:24	16:41	16:40	33	11:01 (E1)
	08:17			07:24	06:24	06:20	05:36	05:29	05:59	06:44	07:31	07:19	08:09	08:36		10:28 (E1)
29	17:22			18:16	19:01	20:50	21:32	21:51	21:27	20:31	19:24	17:22	16:40	16:40	34	11:02 (E1)
	08:16			07:22	06:18	06:15	05:35	05:29	06:00	06:46	07:32	07:20	08:10	08:36		10:29 (E1)
30	17:24			20:03	20:51	21:34	21:51	21:26	20:29	19:22	17:20	16:39	16:41	16:41	33	11:02 (E1)
	08:15			07:20	06:16	06:16	05:34	05:30	06:01	06:47	07:34	07:22	08:12	08:36		10:31 (E1)
31	17:26			20:04	20:53		21:35	21:50	21:24	20:27	19:19	17:18	16:38	16:42	32	11:03 (E1)
	08:13			07:18			05:33		06:03	06:49		07:24		08:36		10:30 (E1)
	17:27			20:06			21:36		21:23	20:25		17:17		16:43	32	11:02 (E1)
Potential sun hours	267		281	368	413	478	489	493	449	380	334	273	253			
Total, worst case	259															920
Sun reduction	0,18															0,14
Oper. time red.	1,00															1,00
Wind dir. red.	0,58															0,58
Total reduction	0,11															0,08
Total, real	28															74

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

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

SHADOW - Calendar

Calculation: Real case E175 + Helzen Shadow receptor: B - Shadow Receptor: 5,0 × 2,0 Azimuth: 0,0° Slope: 90,0° (2)
Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [ST-HUBERT]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1,58 3,05 3,17 4,85 6,15 5,19 6,45 6,12 4,77 3,14 2,23 1,13

Operational time

N NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum
315 397 595 550 415 406 433 424 559 874 1.217 937 559 442 322 315 8.760

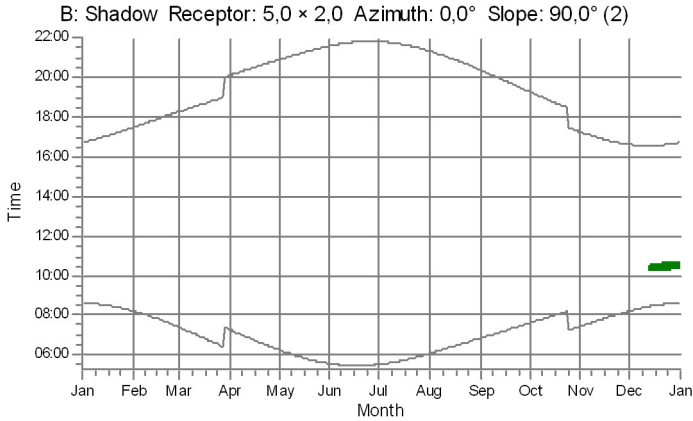
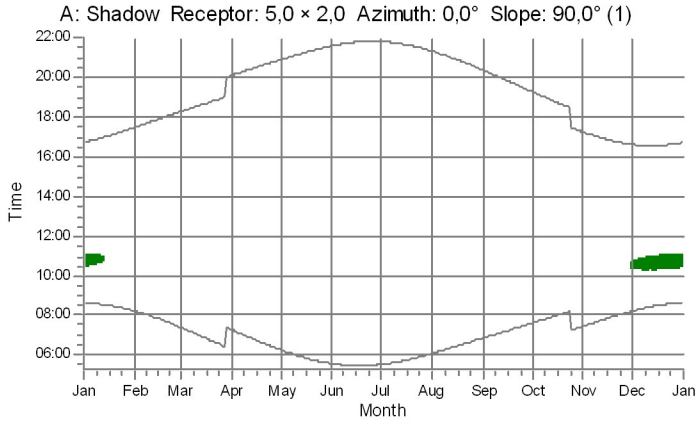
	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36 16:44	08:12 17:29	07:22 18:17	07:15 20:07	06:14 20:55	05:33 21:37	05:30 21:50	06:04 21:21	06:50 20:23	07:35 19:17	07:25 17:15	08:13 16:38
2	08:36 16:45	08:11 17:31	07:20 18:19	07:13 20:09	06:13 20:56	05:32 21:38	05:31 21:50	06:06 21:20	06:52 20:21	07:37 19:15	07:27 17:13	08:14 16:37
3	08:36 16:46	08:09 17:33	07:18 18:21	07:11 20:11	06:11 20:58	05:31 21:39	05:32 21:50	06:07 21:18	06:53 20:19	07:38 19:13	07:29 17:11	08:16 16:37
4	08:36 16:47	08:08 17:34	07:16 18:22	07:09 20:12	06:09 20:59	05:31 21:40	05:32 21:49	06:08 21:16	06:55 20:17	07:40 19:11	07:30 17:10	08:17 16:36
5	08:36 16:49	08:06 17:36	07:14 18:24	07:07 20:14	06:07 21:01	05:30 21:41	05:33 21:49	06:10 21:15	06:56 20:14	07:42 19:08	07:32 17:08	08:18 16:36
6	08:35 16:50	08:05 17:38	07:12 18:26	07:05 20:15	06:06 21:02	05:29 21:42	05:34 21:48	06:11 21:13	06:58 20:12	07:43 19:06	07:34 17:07	08:19 16:35
7	08:35 16:51	08:03 17:40	07:10 18:27	07:02 20:17	06:04 21:04	05:29 21:43	05:35 21:48	06:13 21:11	06:59 20:10	07:45 19:04	07:35 17:05	08:21 16:35
8	08:35 16:52	08:01 17:41	07:08 18:29	07:00 20:18	06:02 21:05	05:28 21:43	05:36 21:47	06:14 21:10	07:01 20:08	07:46 19:02	07:37 17:03	08:22 16:35
9	08:34 16:53	08:00 17:43	07:05 18:31	06:58 20:20	06:01 21:07	05:28 21:44	05:37 21:47	06:16 21:08	07:02 20:06	07:48 19:00	07:39 17:02	08:23 16:35
10	08:34 16:55	07:58 17:45	07:03 18:32	06:56 20:22	05:59 21:08	05:28 21:45	05:37 21:46	06:17 21:06	07:04 20:03	07:49 18:58	07:40 17:00	08:24 16:34
11	08:33 16:56	07:56 17:47	07:01 18:34	06:54 20:23	05:58 21:10	05:27 21:46	05:38 21:45	06:19 21:05	07:05 20:01	07:51 18:56	07:42 16:59	08:25 16:34
12	08:33 16:57	07:55 17:48	06:59 18:35	06:52 20:25	05:56 21:11	05:27 21:46	05:39 21:45	06:20 21:03	07:07 19:59	07:53 18:54	07:44 16:57	08:26 16:34
13	08:32 16:59	07:53 17:50	06:57 18:37	06:50 20:26	05:55 21:13	05:27 21:47	05:40 21:44	06:22 21:01	07:08 19:57	07:54 18:51	07:45 16:56	08:27 16:34
14	08:31 17:00	07:51 17:52	06:55 18:39	06:48 20:28	05:53 21:14	05:26 21:47	05:41 21:43	06:23 20:59	07:10 19:55	07:56 18:49	07:47 16:55	08:28 16:34
15	08:31 17:02	07:49 17:53	06:53 18:40	06:46 20:29	05:52 21:15	05:26 21:48	05:43 21:42	06:25 20:57	07:11 19:52	07:57 18:47	07:49 16:53	08:29 16:34
16	08:30 17:03	07:48 17:55	06:50 18:42	06:44 20:31	05:50 21:17	05:26 21:48	05:44 21:41	06:26 20:55	07:13 19:50	07:59 18:45	07:50 16:52	08:29 16:34
17	08:29 17:05	07:46 17:57	06:48 18:44	06:42 20:33	05:49 21:18	05:26 21:49	05:45 21:40	06:28 20:53	07:14 19:48	08:01 18:43	07:52 16:51	08:30 16:35
18	08:28 17:06	07:44 17:59	06:46 18:45	06:39 20:34	05:48 21:20	05:26 21:49	05:46 21:39	06:29 20:51	07:16 19:46	08:02 18:41	07:53 16:50	08:31 16:35
19	08:27 17:08	07:42 18:00	06:44 18:47	06:37 20:36	05:46 21:21	05:26 21:50	05:47 21:38	06:31 20:50	07:17 19:44	08:04 18:39	07:55 16:48	08:32 16:35
20	08:27 17:09	07:40 18:02	06:42 18:48	06:35 20:37	05:45 21:22	05:26 21:50	05:48 21:37	06:32 20:48	07:19 19:41	08:05 18:37	07:57 16:47	08:32 16:36
21	08:26 17:11	07:38 18:04	06:40 18:50	06:33 20:39	05:44 21:24	05:26 21:50	05:50 21:36	06:34 20:46	07:20 19:39	08:07 18:35	07:58 16:46	08:33 16:36
22	08:25 17:12	07:36 18:05	06:37 18:52	06:31 20:40	05:42 21:25	05:27 21:50	05:51 21:35	06:35 20:44	07:22 19:37	08:09 18:33	08:00 16:45	08:33 16:37
23	08:23 17:14	07:34 18:07	06:35 18:53	06:30 20:42	05:41 21:26	05:27 21:51	05:52 21:34	06:37 20:42	07:23 19:35	08:10 18:31	08:01 16:44	08:34 16:37
24	08:22 17:16	07:32 18:09	06:33 18:55	06:28 20:44	05:40 21:28	05:27 21:51	05:53 21:32	06:38 20:40	07:25 19:33	08:12 18:29	08:03 16:43	08:34 16:38
25	08:21 17:17	07:30 18:11	06:31 18:56	06:26 20:45	05:39 21:29	05:28 21:51	05:55 21:31	06:40 20:38	07:26 19:30	07:14 17:28	08:04 16:42	08:35 16:38
26	08:20 17:19	07:28 18:12	06:29 18:58	06:24 20:47	05:38 21:30	05:28 21:51	05:56 21:30	06:41 20:35	07:28 19:28	07:15 17:26	08:06 16:41	08:35 16:39
27	08:19 17:21	07:26 18:14	06:26 18:59	06:22 20:48	05:37 21:31	05:28 21:51	05:57 21:28	06:43 20:33	07:29 19:26	07:17 17:24	08:07 16:41	08:35 16:40
28	08:18 17:22	07:24 18:16	06:24 19:01	06:20 20:50	05:36 21:32	05:29 21:51	05:59 21:27	06:44 20:31	07:31 19:24	07:19 17:22	08:09 16:40	08:36 16:40
29	08:16 17:24		07:22 20:03	06:18 20:51	05:35 21:34	05:29 21:51	06:00 21:26	06:46 20:29	07:32 19:22	07:20 17:20	08:10 16:39	08:36 16:41
30	08:15 17:26		07:20 20:04	06:16 20:53	05:34 21:35	05:30 21:50	06:01 21:24	06:47 20:27	07:34 19:19	07:22 17:18	08:12 16:38	08:36 16:42
31	08:14 17:27		07:18 20:06		05:33 21:36		06:03 21:23	06:49 20:25		07:24 17:17	08:36 16:43	10:31 (E1)
Potential sun hours	267	281	368	413	478	489	493	449	380	334	273	253
Total, worst case												214
Sun reduction												0,14
Oper. time red.												1,00
Wind dir. red.												0,57
Total reduction												0,08
Total, real												17

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		

SHADOW - Calendar, graphical

Calculation: Real case E175 + Helzen



WTGs

E1: ENERCON E-175 EP5 6000 175.0 !OI hub: 162,0 m (TOT: 249,5 m) (2)

SHADOW - Calendar per WTG

Calculation: Real case E175 + Helzen WTG: E1 - ENERCON E-175 EP5 6000 175.0 !OI! hub: 162,0 m (TOT: 249,5 m) (2)
Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [ST-HUBERT]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1,58 3,05 3,17 4,85 6,15 5,19 6,45 6,12 4,77 3,14 2,23 1,13

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
315	397	595	550	415	406	433	424	559	874	1.217	937	559	442	322	315	8.760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36 10:32-11:02/30 16:44	08:12 17:29	07:22 18:17	07:15 20:07	06:14 20:54	05:33 21:37	05:30 21:50	06:04 21:21	06:50 20:23	07:35 19:17	07:25 17:15	08:13 16:38
2	08:36 10:33-11:02/29 16:45	08:11 17:31	07:20 18:19	07:13 20:09	06:13 20:56	05:32 21:38	05:31 21:50	06:06 21:20	06:52 20:21	07:37 19:15	07:27 17:13	08:14 16:37
3	08:36 10:34-11:03/29 16:46	08:09 17:33	07:18 18:21	07:11 20:11	06:11 20:58	05:31 21:39	05:32 21:50	06:07 21:18	06:53 20:19	07:38 19:13	07:29 17:11	08:16 16:37
4	08:36 10:35-11:03/28 16:47	08:08 17:34	07:16 18:22	07:09 20:12	06:09 20:59	05:31 21:40	05:32 21:49	06:08 21:16	06:55 20:16	07:40 19:11	07:30 17:10	08:17 16:36
5	08:36 10:35-11:02/27 16:49	08:06 17:36	07:14 18:24	07:07 20:14	06:07 21:01	05:30 21:41	05:33 21:49	06:10 21:15	06:56 20:14	07:42 19:08	07:32 17:08	08:18 16:36
6	08:35 10:37-11:02/25 16:50	08:05 17:38	07:12 18:26	07:05 20:15	06:06 21:02	05:29 21:42	05:34 21:48	06:11 21:13	06:58 20:12	07:43 19:06	07:34 17:07	08:19 16:35
7	08:35 10:38-11:01/23 16:51	08:03 17:40	07:10 18:27	07:02 20:17	06:04 21:04	05:29 21:42	05:35 21:48	06:13 21:11	06:59 20:10	07:45 19:04	07:35 17:05	08:20 16:35
8	08:35 10:40-11:01/21 16:52	08:01 17:41	07:08 18:29	07:00 20:18	06:02 21:05	05:28 21:43	05:36 21:47	06:14 21:10	07:01 20:08	07:46 19:02	07:37 17:03	08:22 16:35
9	08:34 10:41-10:59/18 16:53	08:00 17:43	07:05 18:31	06:58 20:20	06:01 21:07	05:28 21:44	05:37 21:47	06:16 21:08	07:02 20:06	07:48 19:00	07:39 17:02	08:23 16:35
10	08:34 10:43-10:59/16 16:55	07:58 17:45	07:03 18:32	06:56 20:22	05:59 21:08	05:28 21:45	05:37 21:46	06:17 21:06	07:04 20:03	07:49 18:58	07:40 17:00	08:24 16:34
11	08:33 10:45-10:56/11 16:56	07:56 17:47	07:01 18:34	06:54 20:23	05:58 21:10	05:27 21:46	05:38 21:45	06:19 21:04	07:05 20:01	07:51 18:56	07:42 16:59	08:25 16:34
12	08:33 10:50-10:52/2 16:57	07:55 17:48	06:59 18:35	06:52 20:25	05:56 21:11	05:27 21:46	05:39 21:44	06:20 21:03	07:07 19:59	07:53 18:54	07:44 16:57	08:26 16:34
13	08:32 16:59	07:53 17:50	06:57 18:37	06:50 20:26	05:55 21:13	05:27 21:47	05:40 21:44	06:22 21:01	07:08 19:57	07:54 18:51	07:45 16:56	08:27 16:34
14	08:31 17:00	07:51 17:52	06:55 18:39	06:48 20:28	05:53 21:14	05:26 21:47	05:42 21:43	06:23 20:59	07:10 19:55	07:56 18:49	07:47 16:55	08:28 16:34
15	08:31 17:02	07:49 17:53	06:53 18:40	06:46 20:29	05:52 21:15	05:26 21:48	05:43 21:42	06:25 20:57	07:11 19:52	07:57 18:47	07:49 16:53	08:29 16:34
16	08:30 17:03	07:47 17:55	06:50 18:42	06:44 20:31	05:50 21:17	05:26 21:48	05:44 21:41	06:26 20:55	07:13 19:50	07:59 18:45	07:50 16:52	08:29 16:34
17	08:29 17:05	07:46 17:57	06:48 18:44	06:42 20:33	05:49 21:18	05:26 21:49	05:45 21:40	06:28 20:53	07:14 19:48	08:01 18:43	07:52 16:51	08:30 16:35
18	08:28 17:06	07:44 17:59	06:46 18:45	06:39 20:34	05:48 21:20	05:26 21:49	05:46 21:39	06:29 20:51	07:16 19:46	08:02 18:41	07:53 16:50	08:31 16:35
19	08:27 17:08	07:42 18:00	06:44 18:47	06:37 20:36	05:46 21:21	05:26 21:50	05:47 21:38	06:31 20:49	07:17 19:44	08:04 18:39	07:55 16:48	08:32 16:35
20	08:26 17:09	07:40 18:02	06:42 18:48	06:35 20:37	05:45 21:22	05:26 21:50	05:48 21:37	06:32 20:48	07:19 19:41	08:05 18:37	07:57 16:47	08:32 16:36
21	08:25 17:11	07:38 18:04	06:39 18:50	06:33 20:39	05:44 21:24	05:26 21:50	05:50 21:36	06:34 20:46	07:20 19:39	08:07 18:35	07:58 16:46	08:33 16:36
22	08:24 17:12	07:36 18:05	06:37 18:52	06:31 20:40	05:42 21:25	05:27 21:50	05:51 21:35	06:35 20:44	07:22 19:37	08:09 18:33	08:00 16:45	08:33 16:37
23	08:23 17:14	07:34 18:07	06:35 18:53	06:30 20:42	05:41 21:26	05:27 21:51	05:52 21:33	06:37 20:42	07:23 19:35	08:10 18:31	08:01 16:44	08:34 16:37
24	08:22 17:16	07:32 18:09	06:33 18:55	06:28 20:44	05:40 21:28	05:27 21:51	05:53 21:32	06:38 20:40	07:25 19:33	08:12 18:29	08:03 16:43	08:34 16:38
25	08:21 17:17	07:30 18:11	06:31 18:56	06:26 20:45	05:39 21:29	05:28 21:51	05:55 21:31	06:40 20:37	07:26 19:30	08:14 17:28	08:04 16:42	08:35 16:38
26	08:20 17:19	07:28 18:12	06:29 18:58	06:24 20:47	05:38 21:30	05:28 21:51	05:56 21:30	06:41 20:35	07:28 19:28	08:15 17:26	08:06 16:41	08:35 16:39
27	08:19 17:21	07:26 18:14	06:26 18:59	06:22 20:48	05:37 21:31	05:28 21:51	05:57 21:28	06:43 20:33	07:29 19:26	08:17 17:24	08:07 16:41	08:35 16:40
28	08:17 17:22	07:24 18:16	06:24 19:01	06:20 20:50	05:36 21:32	05:29 21:51	05:59 21:27	06:44 20:31	07:31 19:24	08:19 17:22	08:09 16:40	08:36 16:40
29	08:16 17:24		07:22 20:03	06:18 20:51	05:35 21:34	05:29 21:51	06:00 21:25	06:46 20:29	07:32 19:22	08:20 17:20	08:10 16:39	08:36 16:41
30	08:15 17:26		07:20 20:04	06:16 20:53	05:34 21:35	05:30 21:50	06:01 21:24	06:47 20:27	07:34 19:19	08:22 17:18	08:11 16:38	08:36 16:42
31	08:13 17:27		07:18 20:06		05:33 21:36		06:03 21:23	06:49 20:25		08:24 17:17		08:36 16:43
Potential sun hours	267	281	368	413	478	489	493	380	334	273	253	993
Sum of minutes with flicker	259	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

SHADOW - Calendar per WTG

Calculation: Real case E175 + Helzen WTG: WEA1 - Siemens SWT-3.0-113 3000 113.0 !OI! hub: 142,5 m (TOT: 199,0 m) (7)
Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [ST-HUBERT]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1,58 3,05 3,17 4,85 6,15 5,19 6,45 6,12 4,77 3,14 2,23 1,13

Operational time

N NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum
315 397 595 550 415 406 433 424 559 874 1.217 937 559 442 322 315 8.760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36 16:44	08:12 17:29	07:22 18:17	07:15 20:07	06:14 20:54	05:33 21:37	05:30 21:50	06:04 21:21	06:50 20:23	07:35 19:17	07:25 17:15	08:13 16:38
2	08:36 16:45	08:10 17:31	07:20 18:19	07:13 20:09	06:13 20:56	05:32 21:38	05:31 21:50	06:06 21:19	06:52 20:21	07:37 19:15	07:27 17:13	08:14 16:37
3	08:36 16:46	08:09 17:33	07:18 18:21	07:11 20:10	06:11 20:57	05:31 21:39	05:32 21:49	06:07 21:18	06:53 20:19	07:38 19:13	07:28 17:11	08:15 16:37
4	08:36 16:47	08:08 17:34	07:16 18:22	07:09 20:12	06:09 20:59	05:31 21:40	05:32 21:49	06:08 21:16	06:55 20:16	07:40 19:11	07:30 17:10	08:17 16:36
5	08:35 16:49	08:06 17:36	07:14 18:24	07:07 20:14	06:07 21:00	05:30 21:41	05:33 21:49	06:10 21:15	06:56 20:14	07:41 19:08	07:32 17:08	08:18 16:36
6	08:35 16:50	08:04 17:38	07:12 18:26	07:05 20:15	06:06 21:02	05:29 21:41	05:34 21:48	06:11 21:13	06:58 20:12	07:43 19:06	07:33 17:07	08:19 16:35
7	08:35 16:51	08:03 17:40	07:10 18:27	07:02 20:17	06:04 21:04	05:29 21:42	05:35 21:48	06:13 21:11	06:59 20:10	07:45 19:04	07:35 17:05	08:20 16:35
8	08:34 16:52	08:01 17:41	07:07 18:29	07:00 20:18	06:02 21:05	05:28 21:43	05:36 21:47	06:14 21:10	07:01 20:08	07:46 19:02	07:37 17:03	08:21 16:35
9	08:34 16:53	08:00 17:43	07:05 18:30	06:58 20:20	06:01 21:07	05:28 21:44	05:37 21:46	06:16 21:08	07:02 20:06	07:48 19:00	07:38 17:02	08:23 16:35
10	08:34 16:55	07:58 17:45	07:03 18:32	06:56 20:21	05:59 21:08	05:28 21:45	05:38 21:46	06:17 21:06	07:04 20:03	07:49 18:58	07:40 17:00	08:24 16:34
11	08:33 16:56	07:56 17:46	07:01 18:34	06:54 20:23	05:58 21:09	05:27 21:45	05:38 21:45	06:19 21:04	07:05 20:01	07:51 18:56	07:42 16:59	08:25 16:34
12	08:33 16:57	07:54 17:48	06:59 18:35	06:52 20:25	05:56 21:11	05:27 21:46	05:39 21:44	06:20 21:03	07:07 19:59	07:52 18:53	07:43 16:57	08:26 16:34
13	08:32 16:59	07:53 17:50	06:57 18:37	06:50 20:26	05:55 21:12	05:27 21:47	05:40 21:44	06:22 21:01	07:08 19:57	07:54 18:51	07:45 16:56	08:27 16:34
14	08:31 17:00	07:51 17:52	06:55 18:39	06:48 20:28	05:53 21:14	05:27 21:47	05:42 21:43	06:23 20:59	07:09 19:55	07:56 18:49	07:47 16:55	08:28 16:34
15	08:31 17:02	07:49 17:53	06:52 18:40	06:46 20:29	05:52 21:15	05:26 21:48	05:43 21:42	06:25 20:57	07:11 19:52	07:57 18:47	07:48 16:53	08:28 16:34
16	08:30 17:03	07:47 17:55	06:50 18:42	06:44 20:31	05:50 21:17	05:26 21:48	05:44 21:41	06:26 20:55	07:12 19:50	07:59 18:45	07:50 16:52	08:29 16:35
17	08:29 17:05	07:46 17:57	06:48 18:43	06:41 20:32	05:49 21:18	05:26 21:49	05:45 21:40	06:28 20:53	07:14 19:48	08:00 18:43	07:52 16:51	08:30 16:35
18	08:28 17:06	07:44 17:59	06:46 18:45	06:39 20:34	05:48 21:19	05:26 21:49	05:46 21:39	06:29 20:51	07:15 19:46	08:02 18:41	07:53 16:50	08:31 16:35
19	08:27 17:08	07:42 18:00	06:44 18:47	06:37 20:36	05:46 21:21	05:26 21:49	05:47 21:38	06:31 20:49	07:17 19:44	08:04 18:39	07:55 16:48	08:31 16:35
20	08:26 17:09	07:40 18:02	06:42 18:48	06:35 20:37	05:45 21:22	05:26 21:50	05:48 21:37	06:32 20:47	07:19 19:41	08:05 18:37	07:56 16:47	08:32 16:36
21	08:25 17:11	07:38 18:04	06:39 18:50	06:33 20:39	05:44 21:24	05:27 21:50	05:50 21:36	06:34 20:45	07:20 19:39	08:07 18:35	07:58 16:46	08:33 16:36
22	08:24 17:12	07:36 18:05	06:37 18:51	06:31 20:40	05:43 21:25	05:27 21:50	05:51 21:35	06:35 20:43	07:22 19:37	08:09 18:33	08:00 16:45	08:33 16:37
23	08:23 17:14	07:34 18:07	06:35 18:53	06:29 20:42	05:41 21:26	05:27 21:50	05:52 21:33	06:37 20:41	07:23 19:35	08:10 18:31	08:01 16:44	08:34 16:37
24	08:22 17:16	07:32 18:09	06:33 18:55	06:28 20:43	05:40 21:27	05:27 21:50	05:53 21:32	06:38 20:39	07:25 19:32	08:12 18:29	08:03 16:43	08:34 16:38
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28	08:17 17:22	07:24 18:16	06:24 19:01	06:20 20:50	05:36 21:32	05:29 21:50	05:59 21:27	06:44 20:31	07:31 19:24	08:18 17:22	08:09 16:40	08:35 16:40
29	08:16 17:24		07:22 20:03	06:18 20:51	05:35 21:33	05:29 21:50	06:00 21:25	06:46 20:29	07:32 19:21	08:20 17:20	08:10 16:39	08:36 16:41
30	08:15 17:26		07:20 20:04	06:16 20:53	05:34 21:35	05:30 21:50	06:01 21:24	06:47 20:27	07:34 19:19	08:22 17:18	08:11 16:38	08:36 16:42
31	08:13 17:27		07:18 20:06		05:33 21:36		06:03 21:22	06:49 20:25		07:23 17:17		08:36 16:43
Potential sun hours	267	281	368	413	478	489	493	449	380	334	273	253
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

SHADOW - Calendar per WTG

Calculation: Real case E175 + Helzen WTG: WEA2 - Siemens SWT-3.0-113 3000 113.0 !OI! hub: 142,5 m (TOT: 199,0 m) (5)
Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [ST-HUBERT]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1,58 3,05 3,17 4,85 6,15 5,19 6,45 6,12 4,77 3,14 2,23 1,13

Operational time

N NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum
315 397 595 550 415 406 433 424 559 874 1.217 937 559 442 322 315 8.760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36 16:44	08:12 17:29	07:22 18:17	07:15 20:07	06:14 20:54	05:33 21:37	05:30 21:50	06:04 21:21	06:50 20:23	07:35 19:17	07:25 17:15	08:13 16:38
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Potential sun hours	267	281	368	413	478	489	493	449	380	334	273	253
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

SHADOW - Calendar per WTG

Calculation: Real case E175 + Helzen WTG: WEA3 - Siemens SWT-3.0-113 3000 113.0 !OI! hub: 142,5 m (TOT: 199,0 m) (4)
Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [ST-HUBERT]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1,58 3,05 3,17 4,85 6,15 5,19 6,45 6,12 4,77 3,14 2,23 1,13

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
315	397	595	550	415	406	433	424	559	874	1.217	937	559	442	322	315	8.760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36 16:44	08:12 17:29	07:22 18:17	07:15 20:07	06:14 20:54	05:33 21:37	05:30 21:50	06:04 21:21	06:50 20:23	07:35 19:17	07:25 17:15	08:13 16:38
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Potential sun hours	267	281	368	413	478	489	493	449	380	334	273	253
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

SHADOW - Calendar per WTG

Calculation: Real case E175 + Helzen WTG: WEA4 - Siemens SWT-3.0-113 3000 113.0 !OI! hub: 142,5 m (TOT: 199,0 m) (2)
Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [ST-HUBERT]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1,58 3,05 3,17 4,85 6,15 5,19 6,45 6,12 4,77 3,14 2,23 1,13

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
315	397	595	550	415	406	433	424	559	874	1.217	937	559	442	322	315	8.760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36 16:44	08:12 17:29	07:22 18:17	07:15 20:07	06:14 20:54	05:33 21:37	05:30 21:50	06:04 21:21	06:50 20:23	07:35 19:17	07:25 17:15	08:13 16:38
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24	08:22 17:16	07:32 18:09	06:33 18:55	06:28 20:44	05:40 21:27	05:27 21:51	05:53 21:32	06:38 20:39	07:25 19:32	08:12 18:29	08:03 16:43	08:34 16:38
25	08:21 17:17	07:30 18:11	06:31 18:56	06:26 20:45	05:39 21:29	05:28 21:51	05:55 21:31	06:40 20:37	07:26 19:30	08:14 17:28	08:04 16:42	08:35 16:38
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27	08:19 17:21	07:26 18:14	06:26 18:59	06:22 20:48	05:37 21:31	05:28 21:51	05:57 21:28	06:43 20:33	07:29 19:26	08:17 17:24	08:07 16:41	08:35 16:40
28	08:17 17:22	07:24 18:16	06:24 19:01	06:20 20:50	05:36 21:32	05:29 21:51	05:59 21:27	06:44 20:31	07:31 19:24	08:19 17:22	08:09 16:40	08:36 16:40
29	08:16 17:24		07:22 20:03	06:18 20:51	05:35 21:33	05:29 21:50	06:00 21:25	06:46 20:29	07:32 19:21	08:20 17:20	08:10 16:39	08:36 16:41
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31	08:13 17:27		07:18 20:06		05:33 21:36		06:03 21:23	06:49 20:25		07:24 17:17		08:36 16:43
Potential sun hours	267	281	368	413	478	489	493	449	380	334	273	253
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

SHADOW - Calendar per WTG

Calculation: Real case E175 + Helzen WTG: WEA5 - Siemens SWT-3.0-113 3000 113.0 !OI! hub: 142,5 m (TOT: 199,0 m) (1)
Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [ST-HUBERT]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1,58 3,05 3,17 4,85 6,15 5,19 6,45 6,12 4,77 3,14 2,23 1,13

Operational time

N NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum
315 397 595 550 415 406 433 424 559 874 1.217 937 559 442 322 315 8.760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36 16:44	08:12 17:29	07:22 18:17	07:15 20:07	06:14 20:54	05:33 21:37	05:30 21:50	06:04 21:21	06:50 20:23	07:35 19:17	07:25 17:15	08:13 16:38
2	08:36 16:45	08:11 17:31	07:20 18:19	07:13 20:09	06:13 20:56	05:32 21:38	05:31 21:50	06:06 21:20	06:52 20:21	07:37 19:15	07:27 17:13	08:14 16:37
3	08:36 16:46	08:09 17:33	07:18 18:21	07:11 20:11	06:11 20:58	05:31 21:39	05:32 21:49	06:07 21:18	06:53 20:19	07:38 19:13	07:29 17:11	08:15 16:37
4	08:36 16:47	08:08 17:34	07:16 18:22	07:09 20:12	06:09 20:59	05:31 21:40	05:32 21:49	06:08 21:16	06:55 20:16	07:40 19:11	07:30 17:10	08:17 16:36
5	08:35 16:49	08:06 17:36	07:14 18:24	07:07 20:14	06:07 21:01	05:30 21:41	05:33 21:49	06:10 21:15	06:56 20:14	07:42 19:08	07:32 17:08	08:18 16:36
6	08:35 16:50	08:05 17:38	07:12 18:26	07:05 20:15	06:06 21:02	05:29 21:42	05:34 21:48	06:11 21:13	06:58 20:12	07:43 19:06	07:34 17:07	08:19 16:35
7	08:35 16:51	08:03 17:40	07:10 18:27	07:02 20:17	06:04 21:04	05:29 21:42	05:35 21:48	06:13 21:11	06:59 20:10	07:45 19:04	07:35 17:05	08:20 16:35
8	08:35 16:52	08:01 17:41	07:08 18:29	07:00 20:18	06:02 21:05	05:28 21:43	05:36 21:47	06:14 21:10	07:01 20:08	07:46 19:02	07:37 17:03	08:22 16:35
9	08:34 16:53	08:00 17:43	07:05 18:31	06:58 20:20	06:01 21:07	05:28 21:44	05:37 21:47	06:16 21:08	07:02 20:06	07:48 19:00	07:39 17:02	08:23 16:35
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11	08:33 16:56	07:56 17:47	07:01 18:34	06:54 20:23	05:58 21:10	05:27 21:46	05:38 21:45	06:19 21:04	07:05 20:01	07:51 18:56	07:42 16:59	08:25 16:34
12	08:33 16:57	07:55 17:48	06:59 18:35	06:52 20:25	05:56 21:11	05:27 21:46	05:39 21:44	06:20 21:03	07:07 19:59	07:53 18:54	07:44 16:58	08:26 16:34
13	08:32 16:59	07:53 17:50	06:57 18:37	06:50 20:26	05:55 21:13	05:27 21:47	05:41 21:44	06:22 21:01	07:08 19:57	07:54 18:51	07:45 16:56	08:27 16:34
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31	08:13 17:27		07:18 20:06		05:33 21:36		06:03 21:23	06:49 20:25		07:24 17:17		08:36 16:43
Potential sun hours	267	281	368	413	478	489	493	449	380	334	273	253
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

SHADOW - Calendar per WTG

Calculation: Real case E175 + Helzen WTG: WEA6 - Siemens SWT-3.0-113 3000 113.0 !OI! hub: 142,5 m (TOT: 199,0 m) (6)
Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [ST-HUBERT]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1,58 3,05 3,17 4,85 6,15 5,19 6,45 6,12 4,77 3,14 2,23 1,13

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
315	397	595	550	415	406	433	424	559	874	1.217	937	559	442	322	315	8.760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36 16:44	08:12 17:29	07:22 18:17	07:15 20:07	06:14 20:54	05:33 21:37	05:30 21:50	06:04 21:21	06:50 20:23	07:35 19:17	07:25 17:15	08:13 16:38
2	08:36 16:45	08:11 17:31	07:20 18:19	07:13 20:09	06:13 20:56	05:32 21:38	05:31 21:50	06:06 21:20	06:52 20:21	07:37 19:15	07:27 17:13	08:14 16:37
3	08:36 16:46	08:09 17:33	07:18 18:21	07:11 20:11	06:11 20:58	05:31 21:39	05:32 21:50	06:07 21:18	06:53 20:19	07:38 19:13	07:29 17:11	08:16 16:37
4	08:36 16:47	08:08 17:34	07:16 18:22	07:09 20:12	06:09 20:59	05:31 21:40	05:33 21:49	06:08 21:16	06:55 20:16	07:40 19:11	07:30 17:10	08:17 16:36
5	08:36 16:49	08:06 17:36	07:14 18:24	07:07 20:14	06:07 21:01	05:30 21:41	05:33 21:49	06:10 21:15	06:56 20:14	07:42 19:08	07:32 17:08	08:18 16:36
6	08:35 16:50	08:05 17:38	07:12 18:26	07:05 20:15	06:06 21:02	05:29 21:42	05:34 21:48	06:11 21:13	06:58 20:12	07:43 19:06	07:34 17:07	08:19 16:35
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11	08:33 16:56	07:56 17:47	07:01 18:34	06:54 20:23	05:58 21:10	05:27 21:46	05:39 21:45	06:19 21:04	07:05 20:01	07:51 18:56	07:42 16:59	08:25 16:34
12	08:33 16:57	07:55 17:48	06:59 18:35	06:52 20:25	05:56 21:11	05:27 21:46	05:39 21:44	06:20 21:03	07:07 19:59	07:53 18:54	07:44 16:58	08:26 16:34
13	08:32 16:59	07:53 17:50	06:57 18:37	06:50 20:26	05:55 21:13	05:27 21:47	05:41 21:44	06:22 21:01	07:08 19:57	07:54 18:51	07:45 16:56	08:27 16:34
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22	08:24 17:13	07:36 18:05	06:37 18:52	06:32 20:40	05:43 21:25	05:27 21:50	05:51 21:35	06:35 20:44	07:22 19:37	08:09 18:33	08:00 16:45	08:33 16:37
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27	08:19 17:21	07:26 18:14	06:26 18:59	06:22 20:48	05:37 21:31	05:28 21:51	05:57 21:28	06:43 20:33	07:29 19:26	08:17 17:24	08:07 16:41	08:35 16:40
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29	08:16 17:24		07:22 20:03	06:18 20:51	05:35 21:34	05:29 21:51	06:00 21:25	06:46 20:29	07:32 19:22	08:20 17:20	08:10 16:39	08:36 16:41
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31	08:13 17:28		07:18 20:06		05:33 21:36		06:03 21:23	06:49 20:25		07:24 17:17		08:36 16:43
Potential sun hours	267	281	368	413	478	489	493	449	380	334	273	253
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

SHADOW - Calendar per WTG

Calculation: Real case E175 + Helzen WTG: WEA7 - Siemens SWT-3.0-113 3000 113.0 !OI! hub: 142,5 m (TOT: 199,0 m) (3)
Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [ST-HUBERT]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1,58 3,05 3,17 4,85 6,15 5,19 6,45 6,12 4,77 3,14 2,23 1,13

Operational time

N NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum
315 397 595 550 415 406 433 424 559 874 1.217 937 559 442 322 315 8.760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36 16:44	08:12 17:29	07:22 18:17	07:15 20:07	06:14 20:55	05:33 21:37	05:30 21:50	06:04 21:21	06:50 20:23	07:35 19:17	07:25 17:15	08:13 16:38
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9	08:34 16:53	08:00 17:43	07:05 18:31	06:58 20:20	06:01 21:07	05:28 21:44	05:37 21:47	06:16 21:08	07:02 20:06	07:48 19:00	07:39 17:02	08:23 16:35
10	08:34 16:55	07:58 17:45	07:03 18:32	06:56 20:22	05:59 21:08	05:28 21:45	05:38 21:46	06:17 21:06	07:04 20:03	07:49 18:58	07:40 17:00	08:24 16:34
11	08:33 16:56	07:56 17:47	07:01 18:34	06:54 20:23	05:58 21:10	05:27 21:46	05:39 21:45	06:19 21:04	07:05 20:01	07:51 18:56	07:42 16:59	08:25 16:34
12	08:33 16:57	07:55 17:48	06:59 18:35	06:52 20:25	05:56 21:11	05:27 21:46	05:40 21:44	06:20 21:03	07:07 19:59	07:53 18:54	07:44 16:58	08:26 16:34
13	08:32 16:59	07:53 17:50	06:57 18:37	06:50 20:26	05:55 21:13	05:27 21:47	05:41 21:44	06:22 21:01	07:08 19:57	07:54 18:52	07:45 16:56	08:27 16:34
14	08:31 17:00	07:51 17:52	06:55 18:39	06:48 20:28	05:53 21:14	05:27 21:47	05:42 21:43	06:23 20:59	07:10 19:55	07:56 18:49	07:47 16:55	08:28 16:34
15	08:31 17:02	07:49 17:53	06:53 18:40	06:46 20:29	05:52 21:15	05:26 21:48	05:43 21:42	06:25 20:57	07:11 19:52	07:57 18:47	07:49 16:53	08:29 16:34
16	08:30 17:03	07:48 17:55	06:50 18:42	06:44 20:31	05:50 21:17	05:26 21:48	05:44 21:41	06:26 20:55	07:13 19:50	07:59 18:45	07:50 16:52	08:29 16:35
17	08:29 17:05	07:46 17:57	06:48 18:44	06:42 20:33	05:49 21:18	05:26 21:49	05:45 21:40	06:28 20:53	07:14 19:48	08:01 18:43	07:52 16:51	08:30 16:35
18	08:28 17:06	07:44 17:59	06:46 18:45	06:40 20:34	05:48 21:20	05:26 21:49	05:46 21:39	06:29 20:51	07:16 19:46	08:02 18:41	07:53 16:50	08:31 16:35
19	08:27 17:08	07:42 18:00	06:44 18:47	06:38 20:36	05:46 21:21	05:26 21:50	05:47 21:38	06:31 20:49	07:17 19:44	08:04 18:39	07:55 16:49	08:32 16:35
20	08:26 17:09	07:40 18:02	06:42 18:48	06:35 20:37	05:45 21:22	05:26 21:50	05:48 21:37	06:32 20:48	07:19 19:41	08:05 18:37	07:57 16:47	08:32 16:36
21	08:25 17:11	07:38 18:04	06:40 18:50	06:33 20:39	05:44 21:24	05:27 21:50	05:50 21:36	06:34 20:46	07:20 19:39	08:07 18:35	07:58 16:46	08:33 16:36
22	08:24 17:13	07:36 18:06	06:37 18:52	06:32 20:40	05:43 21:25	05:27 21:50	05:51 21:35	06:35 20:44	07:22 19:37	08:09 18:33	08:00 16:45	08:33 16:37
23	08:23 17:14	07:34 18:07	06:35 18:53	06:30 20:42	05:41 21:26	05:27 21:51	05:52 21:33	06:37 20:42	07:23 19:35	08:10 18:31	08:01 16:44	08:34 16:37
24	08:22 17:16	07:32 18:09	06:33 18:55	06:28 20:44	05:40 21:28	05:27 21:51	05:53 21:32	06:38 20:40	07:25 19:33	08:12 18:29	08:03 16:43	08:34 16:38
25	08:21 17:17	07:30 18:11	06:31 18:56	06:26 20:45	05:39 21:29	05:28 21:51	05:55 21:31	06:40 20:38	07:26 19:30	08:14 17:28	08:04 16:42	08:35 16:38
26	08:20 17:19	07:28 18:12	06:29 18:58	06:24 20:47	05:38 21:30	05:28 21:51	05:56 21:30	06:41 20:35	07:28 19:28	08:15 17:26	08:06 16:42	08:35 16:39
27	08:19 17:21	07:26 18:14	06:26 18:59	06:22 20:48	05:37 21:31	05:28 21:51	05:57 21:28	06:43 20:33	07:29 19:26	08:17 17:24	08:07 16:41	08:35 16:40
28	08:17 17:22	07:24 18:16	06:24 19:01	06:20 20:50	05:36 21:32	05:29 21:51	05:59 21:27	06:44 20:31	07:31 19:24	08:19 17:22	08:09 16:40	08:36 16:40
29	08:16 17:24		07:22 20:03	06:18 20:51	05:35 21:34	05:29 21:51	06:00 21:26	06:46 20:29	07:32 19:22	08:20 17:20	08:10 16:39	08:36 16:41
30	08:15 17:26		07:20 20:04	06:16 20:53	05:34 21:35	05:30 21:50	06:01 21:24	06:47 20:27	07:34 19:19	08:22 17:18	08:12 16:39	08:36 16:42
31	08:13 17:28		07:18 20:06		05:34 21:36		06:03 21:23	06:49 20:25		07:24 17:17		08:36 16:43
Potential sun hours	267	281	368	413	478	489	493	449	380	334	273	253
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

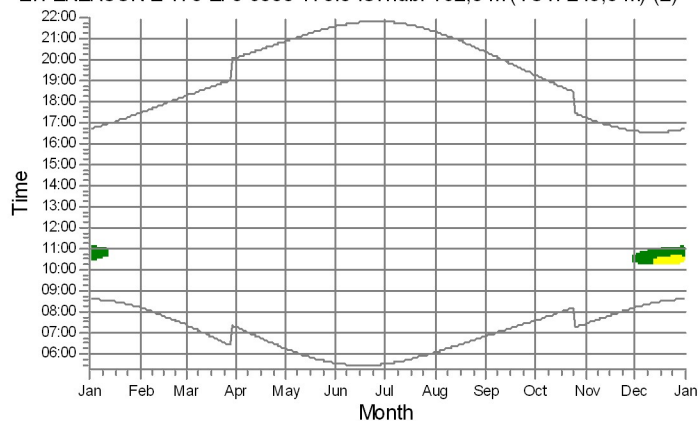
Table layout: For each day in each month the following matrix apply

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

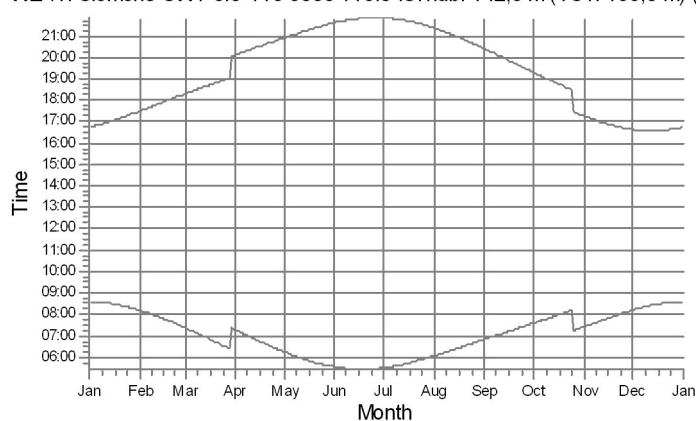
SHADOW - Calendar per WTG, graphical

Calculation: Real case E175 + Helzen

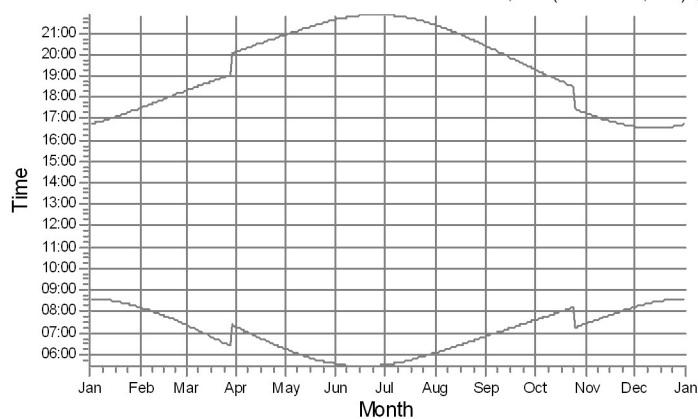
E1: ENERCON E-175 EP5 6000 175.0 !O! hub: 162,0 m (TOT: 249,5 m) (2)



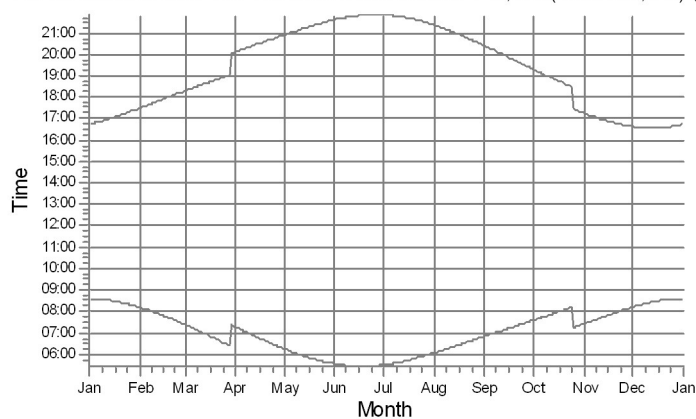
WEA1: Siemens SWT-3.0-113 3000 113.0 !O! hub: 142,5 m (TOT: 199,0 m) (7)



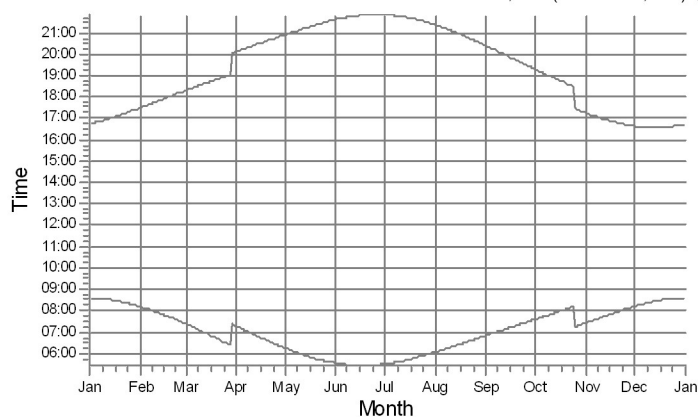
WEA2: Siemens SWT-3.0-113 3000 113.0 !O! hub: 142,5 m (TOT: 199,0 m) (8)



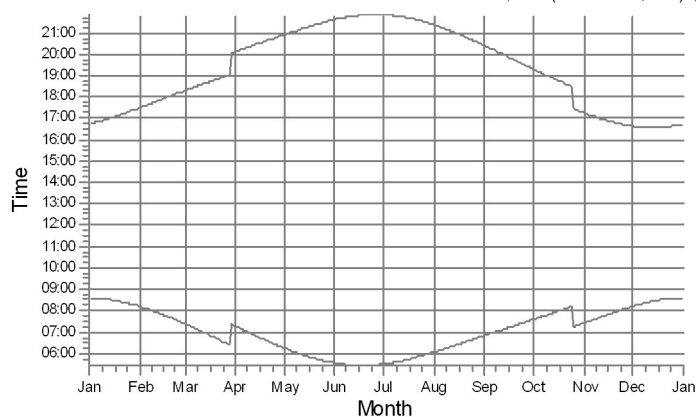
WEA3: Siemens SWT-3.0-113 3000 113.0 !O! hub: 142,5 m (TOT: 199,0 m) (4)



WEA4: Siemens SWT-3.0-113 3000 113.0 !O! hub: 142,5 m (TOT: 199,0 m) (3)



WEA5: Siemens SWT-3.0-113 3000 113.0 !O! hub: 142,5 m (TOT: 199,0 m) (1)



Shadow receptors



A: Shadow Receptor: 5,0 × 2,0 Azimuth: 0,0° Slope: 90,0° (1)

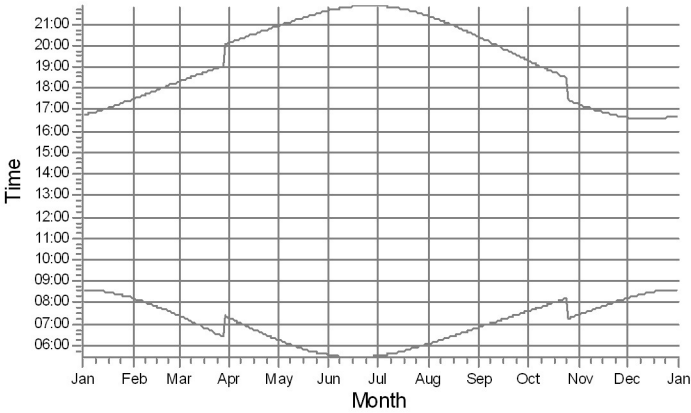


B: Shadow Receptor: 5,0 × 2,0 Azimuth: 0,0° Slope: 90,0° (2)

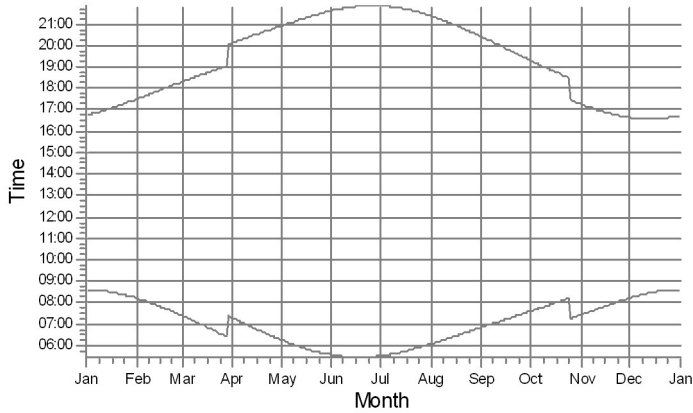
SHADOW - Calendar per WTG, graphical

Calculation: Real case E175 + Helzen

WEA6: Siemens SWT-3.0-113 3000 113.0 !O! hub: 142,5 m (TOT: 199,0 m) (t



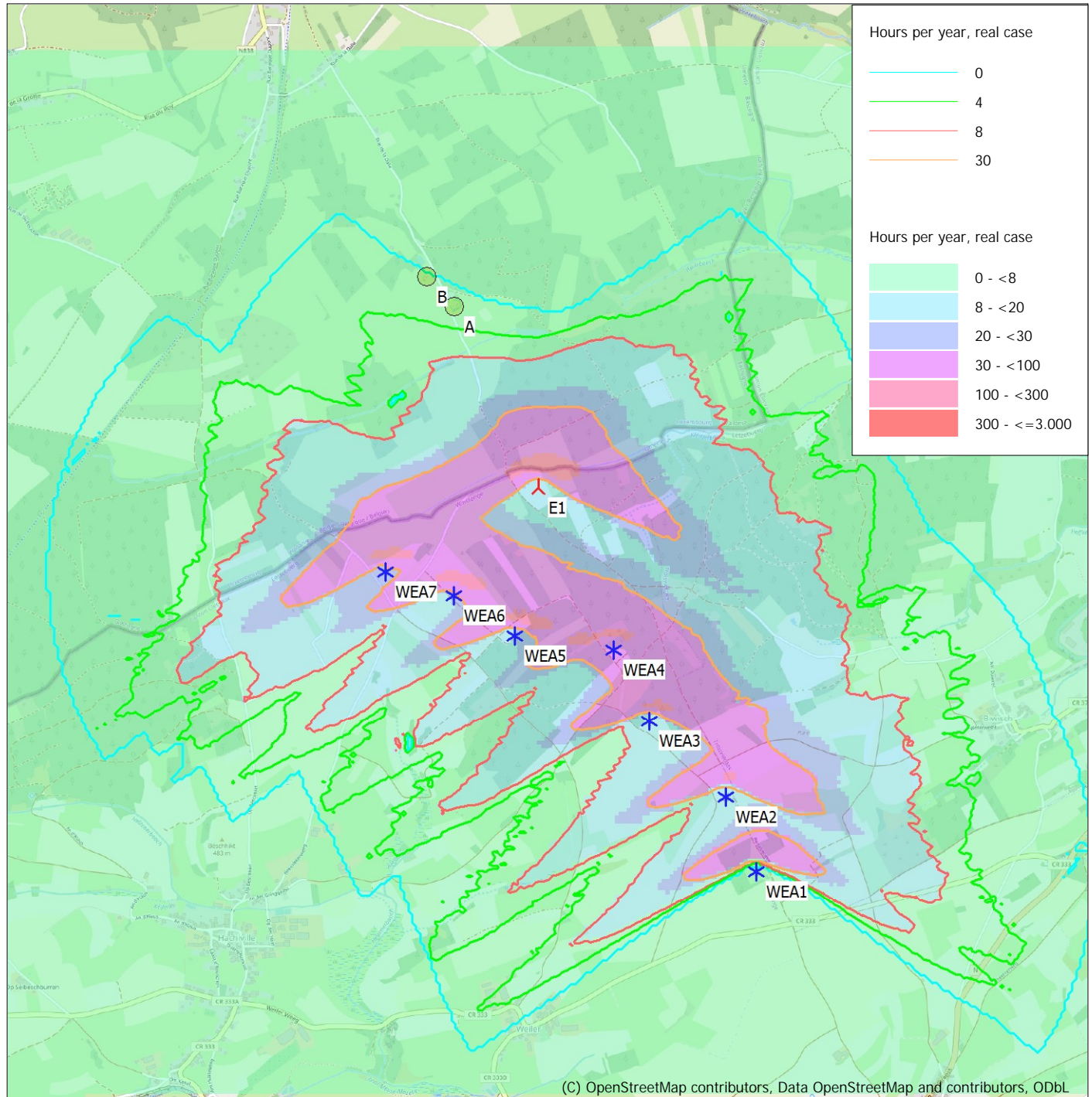
WEA7: Siemens SWT-3.0-113 3000 113.0 !O! hub: 142,5 m (TOT: 199,0 m) (3



Shadow receptors

SHADOW - Map

Calculation: Real case E175 + Helzen



New WTG

Existing WTG

Shadow receptor

Map: EMD OpenStreetMap , Print scale 1:30.000, Map center Luxemburgian TM-LUREF (LU) East: 63.960 North: 132.280

Flicker map level: Maille-alti Assistant création projet (Luxembourgish Elevation Model - 5m)

Time step: 3 minutes, Day step: 7 days, Map resolution: 20 m, Visibility resolution: 10 m, Eye height: 1,5 m