

Project: **TATA** Description: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode

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Calculated:
03/05/2016 14:49/2.9.285

SHADOW - Main Result

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode

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) [DE KOOY]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1.63 2.87 3.52 5.73 7.72 6.68 6.73 6.21 4.59 3.23 1.94 1.13

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
482 397 465 535 463 457 814 1,283 1,342 881 649 580 8,348
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: Elevation Grid Data Object: TATA_EMDGrid_7.wpg (14)
Obstacles not used in calculation
Eye height: 1.5 m
Grid resolution: 10.0 m



WTGs

RD1	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
1	100,170	499,339	7.7	VESTAS V90 3000 90.0 !O! hub: 80.0 m ...	Yes	VESTAS	V90-3,000	3,000	90.0	80.0	1,507	16.1
2	100,392	499,837	11.6	VESTAS V90 3000 90.0 !O! hub: 80.0 m ...	Yes	VESTAS	V90-3,000	3,000	90.0	80.0	1,507	16.1
3	100,830	500,034	5.7	VESTAS V90 3000 90.0 !O! hub: 80.0 m ...	Yes	VESTAS	V90-3,000	3,000	90.0	80.0	1,507	16.1

Shadow receptor-Input

No.	East	North	Z	Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode
A	100,807	500,632	26.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
B	100,952	500,639	11.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
C	101,121	500,586	13.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
D	101,533	500,665	8.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
E	100,934	500,948	7.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
F	101,206	500,982	7.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
G	101,439	500,884	7.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
H	101,807	500,781	8.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
I	102,336	500,603	8.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
J	102,878	500,402	9.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
K	103,615	499,915	8.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
L	104,019	500,619	5.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
M	104,204	500,435	3.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
N	104,359	499,951	3.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
O	103,788	500,033	6.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"

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SHADOW - Main Result

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode

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	0:00	0	0:00	0:00
B	0:00	0	0:00	0:00
C	0:00	0	0:00	0:00
D	0:00	0	0:00	0:00
E	0:00	0	0:00	0:00
F	0:00	0	0:00	0:00
G	7:07	48	0:14	0:46
H	4:52	28	0:17	0:41
I	0:00	0	0:00	0:00
J	0:00	0	0:00	0:00
K	0:00	0	0:00	0:00
L	0:00	0	0:00	0:00
M	0:00	0	0:00	0:00
N	0:00	0	0:00	0:00
O	0:00	0	0:00	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
1	VESTAS V90 3000 90.0 !O! hub: 80.0 m (TOT: 125.0 m) (222)	0:00	0:00
2	VESTAS V90 3000 90.0 !O! hub: 80.0 m (TOT: 125.0 m) (223)	7:07	0:46
3	VESTAS V90 3000 90.0 !O! hub: 80.0 m (TOT: 125.0 m) (224)	4:52	0:41

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SHADOW - Calendar

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode Shadow receptor: A - Shadow Receptor: 1.0 x 1.0 Azimuth: 0.0° Slope: 90.0° (2)

Assumptions for shadow calculations

Reference year for calendar	2016	Sunshine probability S (Average daily sunshine hours) [DE KOOY]
		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
		1.63 2.87 3.52 5.73 7.72 6.68 6.73 6.21 4.59 3.23 1.94 1.13
		Operational time
		N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
		482 397 465 535 463 457 814 1,283 1,342 881 649 580 8,348
		Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:51 16:35	08:25 17:23	07:29 18:18	07:17 20:13	06:11 21:05	05:24 21:52	05:21 22:06	05:59 21:34	06:50 20:30	07:40 19:20	07:35 17:12	08:27 16:31
2	08:51 16:36	08:23 17:25	07:26 18:20	07:14 20:15	06:09 21:07	05:23 21:53	05:22 22:06	06:00 21:32	06:51 20:28	07:41 19:17	07:37 17:10	08:28 16:30
3	08:51 16:37	08:22 17:27	07:24 18:21	07:12 20:17	06:07 21:09	05:23 21:54	05:23 22:06	06:02 21:30	06:53 20:26	07:43 19:15	07:38 17:08	08:30 16:29
4	08:51 16:38	08:20 17:29	07:22 18:23	07:10 20:18	06:05 21:10	05:22 21:56	05:23 22:05	06:03 21:28	06:55 20:23	07:45 19:12	07:40 17:07	08:31 16:29
5	08:51 16:40	08:18 17:31	07:20 18:25	07:07 20:20	06:03 21:12	05:21 21:57	05:24 22:05	06:05 21:27	06:56 20:21	07:47 19:10	07:42 17:05	08:33 16:28
6	08:50 16:41	08:17 17:32	07:17 18:27	07:05 20:22	06:01 21:14	05:21 21:58	05:25 22:04	06:07 21:25	06:58 20:19	07:48 19:08	07:44 17:03	08:34 16:28
7	08:50 16:42	08:15 17:34	07:15 18:29	07:03 20:24	05:59 21:15	05:20 21:58	05:26 22:04	06:08 21:23	07:00 20:16	07:50 19:06	07:46 17:01	08:35 16:27
8	08:50 16:43	08:13 17:36	07:13 18:31	07:01 20:25	05:58 21:17	05:19 21:59	05:27 22:03	06:10 21:21	07:01 20:14	07:52 19:03	07:48 17:00	08:36 16:27
9	08:49 16:45	08:11 17:38	07:11 18:32	06:58 20:27	05:56 21:19	05:19 22:00	05:28 22:02	06:11 21:19	07:03 20:12	07:54 19:01	07:50 16:58	08:38 16:27
10	08:49 16:46	08:10 17:40	07:08 18:34	06:56 20:29	05:54 21:20	05:18 22:01	05:29 22:01	06:13 21:17	07:05 20:09	07:55 18:59	07:51 16:56	08:39 16:26
11	08:48 16:47	08:08 17:42	07:06 18:36	06:54 20:31	05:52 21:22	05:18 22:02	05:30 22:01	06:15 21:15	07:06 20:07	07:57 18:56	07:53 16:55	08:40 16:26
12	08:47 16:49	08:06 17:44	07:04 18:38	06:51 20:32	05:51 21:24	05:18 22:03	05:31 22:00	06:16 21:13	07:08 20:05	07:59 18:54	07:55 16:53	08:41 16:26
13	08:47 16:50	08:04 17:46	07:01 18:40	06:49 20:34	05:49 21:25	05:17 22:03	05:32 21:59	06:18 21:11	07:10 20:02	08:01 18:52	07:57 16:51	08:42 16:26
14	08:46 16:52	08:02 17:48	06:59 18:41	06:47 20:36	05:47 21:27	05:17 22:04	05:33 21:58	06:20 21:09	07:11 20:00	08:02 18:50	07:59 16:50	08:43 16:26
15	08:45 16:53	08:00 17:50	06:57 18:43	06:45 20:37	05:46 21:29	05:17 22:04	05:35 21:57	06:21 21:07	07:13 19:57	08:04 18:47	08:00 16:48	08:44 16:26
16	08:44 16:55	07:58 17:52	06:54 18:45	06:42 20:39	05:44 21:30	05:17 22:05	05:36 21:56	06:23 21:05	07:15 19:55	08:06 18:45	08:02 16:47	08:45 16:26
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18	08:43 16:58	07:54 17:55	06:50 18:48	06:38 20:43	05:41 21:33	05:17 22:06	05:38 21:54	06:26 21:01	07:18 19:50	08:09 18:41	08:06 16:44	08:46 16:27
19	08:42 17:00	07:52 17:57	06:47 18:50	06:36 20:44	05:40 21:35	05:17 22:06	05:40 21:52	06:28 20:59	07:20 19:48	08:11 18:39	08:07 16:43	08:47 16:27
20	08:41 17:02	07:50 17:59	06:45 18:52	06:34 20:46	05:38 21:36	05:17 22:06	05:41 21:51	06:30 20:57	07:21 19:46	08:13 18:36	08:09 16:42	08:48 16:27
21	08:39 17:03	07:48 18:01	06:43 18:54	06:31 20:48	05:37 21:38	05:17 22:07	05:42 21:50	06:31 20:55	07:23 19:43	08:15 18:34	08:11 16:40	08:48 16:28
22	08:38 17:05	07:46 18:03	06:40 18:56	06:29 20:50	05:35 21:39	05:17 22:07	05:44 21:49	06:33 20:53	07:25 19:41	08:17 18:32	08:13 16:39	08:49 16:28
23	08:37 17:07	07:44 18:05	06:38 18:57	06:27 20:51	05:34 21:41	05:17 22:07	05:45 21:47	06:35 20:50	07:26 19:38	08:18 18:30	08:14 16:38	08:49 16:29
24	08:36 17:08	07:42 18:07	06:36 18:59	06:25 20:53	05:33 21:42	05:18 22:07	05:46 21:46	06:36 20:48	07:28 19:36	08:20 18:28	08:16 16:37	08:50 16:29
25	08:35 17:10	07:40 18:08	06:33 19:01	06:23 20:55	05:32 21:43	05:18 22:07	05:48 21:45	06:38 20:46	07:30 19:34	08:22 18:26	08:18 16:36	08:50 16:30
26	08:33 17:12	07:37 18:10	06:31 19:03	06:21 20:57	05:30 21:45	05:18 22:07	05:49 21:43	06:40 20:44	07:31 19:31	08:24 18:24	08:19 16:35	08:50 16:31
27	08:32 17:14	07:35 18:12	06:28 20:04	06:19 20:58	05:29 21:46	05:19 22:07	05:51 21:42	06:41 20:42	07:33 19:29	08:26 18:22	08:21 16:34	08:51 16:31
28	08:31 17:16	07:33 18:14	06:26 20:06	06:17 21:00	05:28 21:47	05:19 22:07	05:52 21:40	06:43 20:39	07:35 19:27	08:27 18:20	08:22 16:33	08:51 16:32
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31	08:26 17:21		06:19 20:11		05:25 21:51		05:57 21:35	06:48 20:32		07:33 17:14		08:51 16:35
Potential sun hours	255	285	367	417	488	502	505	455	381	331	264	241
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)	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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SHADOW - Calendar

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode Shadow receptor: B - Shadow Receptor: 1.0 x 1.0 Azimuth: 0.0° Slope: 90.0° (3)

Assumptions for shadow calculations

Reference year for calendar 2016

Sunshine probability S (Average daily sunshine hours) [DE KOOY]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.63	2.87	3.52	5.73	7.72	6.68	6.73	6.21	4.59	3.23	1.94	1.13

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
482	397	465	535	463	457	814	1,283	1,342	881	649	580	8,348

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:51 16:35	08:25 17:23	07:29 18:18	07:17 20:13	06:11 21:05	05:24 21:52	05:21 22:06	05:59 21:34	06:50 20:30	07:40 19:19	07:35 17:12	08:27 16:31
2	08:51 16:36	08:23 17:25	07:26 18:20	07:14 20:15	06:09 21:07	05:23 21:53	05:22 22:06	06:00 21:32	06:51 20:28	07:41 19:17	07:37 17:10	08:28 16:30
3	08:51 16:37	08:22 17:27	07:24 18:21	07:12 20:17	06:07 21:09	05:23 21:54	05:23 22:06	06:02 21:30	06:53 20:26	07:43 19:15	07:38 17:08	08:30 16:29
4	08:51 16:38	08:20 17:29	07:22 18:23	07:10 20:18	06:05 21:10	05:22 21:56	05:23 22:05	06:03 21:28	06:55 20:23	07:45 19:12	07:40 17:07	08:31 16:29
5	08:51 16:40	08:18 17:31	07:20 18:25	07:07 20:20	06:03 21:12	05:21 21:57	05:24 22:05	06:05 21:27	06:56 20:21	07:47 19:10	07:42 17:05	08:33 16:28
6	08:50 16:41	08:17 17:32	07:17 18:27	07:05 20:22	06:01 21:14	05:21 21:58	05:25 22:04	06:06 21:25	06:58 20:19	07:48 19:08	07:44 17:03	08:34 16:28
7	08:50 16:42	08:15 17:34	07:15 18:29	07:03 20:24	05:59 21:15	05:20 21:58	05:26 22:04	06:08 21:23	07:00 20:16	07:50 19:06	07:46 17:01	08:35 16:27
8	08:49 16:43	08:13 17:36	07:13 18:31	07:00 20:25	05:58 21:17	05:19 21:59	05:27 22:03	06:10 21:21	07:01 20:14	07:52 19:03	07:48 16:59	08:36 16:27
9	08:49 16:45	08:11 17:38	07:11 18:32	06:58 20:27	05:56 21:19	05:19 22:00	05:28 22:02	06:11 21:19	07:03 20:12	07:54 19:01	07:49 16:58	08:38 16:27
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11	08:48 16:47	08:08 17:42	07:06 18:36	06:54 20:31	05:52 21:22	05:18 22:02	05:30 22:01	06:15 21:15	07:06 20:07	07:57 18:56	07:53 16:55	08:40 16:26
12	08:47 16:49	08:06 17:44	07:04 18:38	06:51 20:32	05:51 21:24	05:18 22:03	05:31 22:00	06:16 21:13	07:08 20:05	07:59 18:54	07:55 16:53	08:41 16:26
13	08:47 16:50	08:04 17:46	07:01 18:40	06:49 20:34	05:49 21:25	05:17 22:03	05:32 21:59	06:18 21:11	07:10 20:02	08:01 18:52	07:57 16:51	08:42 16:26
14	08:46 16:52	08:02 17:48	06:59 18:41	06:47 20:36	05:47 21:27	05:17 22:04	05:33 21:58	06:20 21:09	07:11 20:00	08:02 18:50	07:59 16:50	08:43 16:26
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16	08:44 16:55	07:58 17:52	06:54 18:45	06:42 20:39	05:44 21:30	05:17 22:05	05:36 21:56	06:23 21:05	07:15 19:55	08:06 18:45	08:02 16:47	08:45 16:26
17	08:43 16:57	07:56 17:53	06:52 18:47	06:40 20:41	05:43 21:32	05:17 22:05	05:37 21:55	06:25 21:03	07:16 19:53	08:08 18:43	08:04 16:46	08:45 16:26
18	08:43 16:58	07:54 17:55	06:50 18:48	06:38 20:43	05:41 21:33	05:17 22:06	05:38 21:54	06:26 21:01	07:18 19:50	08:09 18:41	08:06 16:44	08:46 16:27
19	08:42 17:00	07:52 17:57	06:47 18:50	06:36 20:44	05:40 21:35	05:17 22:06	05:40 21:52	06:28 20:59	07:20 19:48	08:11 18:39	08:07 16:43	08:47 16:27
20	08:41 17:02	07:50 17:59	06:45 18:52	06:34 20:46	05:38 21:36	05:17 22:06	05:41 21:51	06:30 20:57	07:21 19:46	08:13 18:36	08:09 16:42	08:48 16:27
21	08:39 17:03	07:48 18:01	06:43 18:54	06:31 20:48	05:37 21:38	05:17 22:07	05:42 21:50	06:31 20:55	07:23 19:43	08:15 18:34	08:11 16:40	08:48 16:28
22	08:38 17:05	07:46 18:03	06:40 18:56	06:29 20:50	05:35 21:39	05:17 22:07	05:44 21:49	06:33 20:53	07:25 19:41	08:17 18:32	08:13 16:39	08:49 16:28
23	08:37 17:07	07:44 18:05	06:38 18:57	06:27 20:51	05:34 21:41	05:17 22:07	05:45 21:47	06:35 20:50	07:26 19:38	08:18 18:30	08:14 16:38	08:49 16:29
24	08:36 17:08	07:42 18:07	06:36 18:59	06:25 20:53	05:33 21:42	05:18 22:07	05:46 21:46	06:36 20:48	07:28 19:36	08:20 18:28	08:16 16:37	08:50 16:29
25	08:35 17:10	07:40 18:08	06:33 19:01	06:23 20:55	05:32 21:43	05:18 22:07	05:48 21:44	06:38 20:46	07:30 19:34	08:22 18:26	08:18 16:36	08:50 16:30
26	08:33 17:12	07:37 18:10	06:31 19:03	06:21 20:57	05:30 21:45	05:18 22:07	05:49 21:43	06:40 20:44	07:31 19:31	08:24 18:24	08:19 16:35	08:50 16:31
27	08:32 17:14	07:35 18:12	06:28 20:04	06:19 20:58	05:29 21:46	05:19 22:07	05:51 21:42	06:41 20:42	07:33 19:29	08:26 18:22	08:21 16:34	08:51 16:31
28	08:31 17:16	07:33 18:14	06:26 20:06	06:17 21:00	05:28 21:47	05:19 22:07	05:52 21:40	06:43 20:39	07:35 19:27	08:27 18:20	08:22 16:33	08:51 16:32
29	08:29 17:17	07:31 18:16	06:24 20:08	06:15 21:02	05:27 21:49	05:20 22:07	05:54 20:37	06:45 19:24	07:36 18:18	08:29 17:18	08:24 16:32	08:51 16:33
30	08:28 17:19		06:21 20:10	06:13 21:04	05:26 21:50	05:20 22:07	05:55 21:37	06:46 20:35	07:38 19:22	07:31 17:16	08:25 16:31	08:51 16:34
31	08:26 17:21		06:19 20:11		05:25 21:51		05:57 21:35	06:48 20:32		07:33 17:14		08:51 16:35
Potential sun hours	255	285	367	417	488	502	505	455	381	331	264	241
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

Day in month	Sun rise (hh:mm)	Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)
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Project:	Description:	Printed/Page
TATA	Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode	03/05/2016 14:49 / 5
		Licensed user:
		Infinergy Limited Ltd
		16, West Borough
		GB-WIMBORNE BH21 1XB
		+44 1202 847680
		Stephen Sheldon / s.sheldon@infinergy.co.uk
		Calculated:
		03/05/2016 14:49/2.9.285

SHADOW - Calendar

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode Shadow receptor: C - Shadow Receptor: 1.0 x 1.0 Azimuth: 0.0° Slope: 90.0° (4)

Assumptions for shadow calculations

Reference year for calendar	2016	Sunshine probability S (Average daily sunshine hours) [DE KOOY]
		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
		1.63 2.87 3.52 5.73 7.72 6.68 6.73 6.21 4.59 3.23 1.94 1.13
		Operational time
		N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
		482 397 465 535 463 457 814 1,283 1,342 881 649 580 8,348
		Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:51 16:35	08:25 17:23	07:29 18:18	07:17 20:13	06:11 21:05	05:24 21:52	05:21 22:06	05:59 21:34	06:50 20:30	07:40 19:19	07:35 17:12	08:27 16:31
2	08:51 16:36	08:23 17:25	07:26 18:20	07:14 20:15	06:09 21:07	05:23 21:53	05:22 22:06	06:00 21:32	06:51 20:28	07:41 19:17	07:37 17:10	08:28 16:30
3	08:51 16:37	08:22 17:27	07:24 18:21	07:12 20:17	06:07 21:09	05:23 21:54	05:23 22:06	06:02 21:30	06:53 20:26	07:43 19:15	07:38 17:08	08:30 16:29
4	08:51 16:38	08:20 17:29	07:22 18:23	07:10 20:18	06:05 21:10	05:22 21:55	05:23 22:05	06:03 21:28	06:55 20:23	07:45 19:12	07:40 17:07	08:31 16:29
5	08:51 16:39	08:18 17:31	07:20 18:25	07:07 20:20	06:03 21:12	05:21 21:57	05:24 22:05	06:05 21:27	06:56 20:21	07:47 19:10	07:42 17:05	08:33 16:28
6	08:50 16:41	08:17 17:32	07:17 18:27	07:05 20:22	06:01 21:14	05:20 21:58	05:25 22:04	06:06 21:25	06:58 20:19	07:48 19:08	07:44 17:03	08:34 16:28
7	08:50 16:42	08:15 17:34	07:15 18:29	07:03 20:24	05:59 21:15	05:20 21:58	05:26 22:04	06:08 21:23	07:00 20:16	07:50 19:06	07:46 17:01	08:35 16:27
8	08:49 16:43	08:13 17:36	07:13 18:31	07:00 20:25	05:58 21:17	05:19 21:59	05:27 22:03	06:10 21:21	07:01 20:14	07:52 19:03	07:48 16:59	08:36 16:27
9	08:49 16:45	08:11 17:38	07:11 18:32	06:58 20:27	05:56 21:19	05:19 22:00	05:28 22:02	06:11 21:19	07:03 20:12	07:54 19:01	07:49 16:58	08:38 16:27
10	08:49 16:46	08:10 17:40	07:08 18:34	06:56 20:29	05:54 21:20	05:18 22:01	05:29 22:01	06:13 21:17	07:05 20:09	07:55 18:59	07:51 16:56	08:39 16:26
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12	08:47 16:49	08:06 17:44	07:04 18:38	06:51 20:32	05:51 21:24	05:18 22:03	05:31 22:00	06:16 21:13	07:08 20:05	07:59 18:54	07:55 16:53	08:41 16:26
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15	08:45 16:53	08:00 17:50	06:57 18:43	06:45 20:37	05:46 21:28	05:17 22:04	05:35 21:57	06:21 21:07	07:13 19:57	08:04 18:47	08:00 16:48	08:44 16:26
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Potential sun hours	255	285	367	417	488	502	505	455	381	331	264	241
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)	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: **TATA** Description: **Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode**

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03/05/2016 14:49 / 6

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Stephen Sheldon / s.sheldon@infinergy.co.uk
Calculated:
03/05/2016 14:49/2.9.285

SHADOW - Calendar

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode Shadow receptor: D - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (5)

Assumptions for shadow calculations

Reference year for calendar

2016

Sunshine probability S (Average daily sunshine hours) [DE KOOY]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.63	2.87	3.52	5.73	7.72	6.68	6.73	6.21	4.59	3.23	1.94	1.13

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
482	397	465	535	463	457	814	1,283	1,342	881	649	580	8,348

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:51 16:35	08:25 17:23	07:29 18:18	07:17 20:13	06:11 21:05	05:24 21:52	05:21 22:06	05:59 21:33	06:50 20:30	07:40 19:19	07:35 17:12	08:27 16:31
2	08:51 16:36	08:23 17:25	07:26 18:20	07:14 20:15	06:09 21:07	05:23 21:53	05:22 22:06	06:00 21:32	06:51 20:28	07:41 19:17	07:37 17:10	08:28 16:30
3	08:51 16:37	08:22 17:27	07:24 18:21	07:12 20:16	06:07 21:09	05:23 21:54	05:22 22:06	06:02 21:30	06:53 20:26	07:43 19:15	07:38 17:08	08:30 16:29
4	08:51 16:38	08:20 17:29	07:22 18:23	07:10 20:18	06:05 21:10	05:22 21:55	05:23 22:05	06:03 21:28	06:55 20:23	07:45 19:12	07:40 17:07	08:31 16:29
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6	08:50 16:41	08:17 17:32	07:17 18:27	07:05 20:22	06:01 21:14	05:20 21:57	05:25 22:04	06:06 21:25	06:58 20:19	07:48 19:08	07:44 17:03	08:34 16:28
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Potential sun hours	255	285	367	417	488	502	505	455	381	331	264	241
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project: **TATA** Description: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode

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Calculated:
03/05/2016 14:49/2.9.285

SHADOW - Calendar

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode Shadow receptor: E - Shadow Receptor: 1.0 x 1.0 Azimuth: 0.0° Slope: 90.0° (6)

Assumptions for shadow calculations

Reference year for calendar

2016

Sunshine probability S (Average daily sunshine hours) [DE KOOY]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.63	2.87	3.52	5.73	7.72	6.68	6.73	6.21	4.59	3.23	1.94	1.13

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
482	397	465	535	463	457	814	1,283	1,342	881	649	580	8,348

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:51 16:35	08:25 17:23	07:29 18:18	07:17 20:13	06:11 21:05	05:24 21:52	05:21 22:06	05:59 21:34	06:50 20:30	07:40 19:19	07:35 17:12	08:27 16:31
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7	08:50 16:42	08:15 17:34	07:15 18:29	07:03 20:24	05:59 21:15	05:20 21:58	05:26 22:04	06:08 21:23	07:00 20:16	07:50 19:06	07:46 17:01	08:35 16:27
8	08:50 16:43	08:13 17:36	07:13 18:31	07:00 20:25	05:58 21:17	05:19 21:59	05:27 22:03	06:10 21:21	07:01 20:14	07:52 19:03	07:48 16:59	08:36 16:27
9	08:49 16:45	08:11 17:38	07:11 18:32	06:58 20:27	05:56 21:19	05:19 22:00	05:28 22:02	06:11 21:19	07:03 20:12	07:54 19:01	07:50 16:58	08:38 16:27
10	08:49 16:46	08:10 17:40	07:08 18:34	06:56 20:29	05:54 21:20	05:18 22:01	05:29 22:01	06:13 21:17	07:05 20:09	07:55 18:59	07:51 16:56	08:39 16:26
11	08:48 16:47	08:08 17:42	07:06 18:36	06:54 20:31	05:52 21:22	05:18 22:02	05:30 22:01	06:15 21:15	07:06 20:07	07:57 18:56	07:53 16:55	08:40 16:26
12	08:47 16:49	08:06 17:44	07:04 18:38	06:51 20:32	05:51 21:24	05:18 22:03	05:31 22:00	06:16 21:13	07:08 20:05	07:59 18:54	07:55 16:53	08:41 16:26
13	08:47 16:50	08:04 17:46	07:01 18:40	06:49 20:34	05:49 21:25	05:17 22:03	05:32 21:59	06:18 21:11	07:10 20:02	08:01 18:52	07:57 16:51	08:42 16:26
14	08:46 16:52	08:02 17:48	06:59 18:41	06:47 20:36	05:47 21:27	05:17 22:04	05:33 21:58	06:20 21:09	07:11 20:00	08:02 18:50	07:59 16:50	08:43 16:26
15	08:45 16:53	08:00 17:50	06:57 18:43	06:45 20:37	05:46 21:29	05:17 22:04	05:34 21:57	06:21 21:07	07:13 19:57	08:04 18:47	08:00 16:48	08:44 16:26
16	08:44 16:55	07:58 17:52	06:54 18:45	06:42 20:39	05:44 21:30	05:17 22:05	05:36 21:56	06:23 21:05	07:15 19:55	08:06 18:45	08:02 16:47	08:45 16:26
17	08:43 16:57	07:56 17:53	06:52 18:47	06:40 20:41	05:43 21:32	05:17 22:05	05:37 21:55	06:25 21:03	07:16 19:53	08:08 18:43	08:04 16:46	08:45 16:26
18	08:43 16:58	07:54 17:55	06:50 18:48	06:38 20:43	05:41 21:33	05:17 22:06	05:38 21:54	06:26 21:01	07:18 19:50	08:09 18:41	08:06 16:44	08:46 16:27
19	08:42 17:00	07:52 17:57	06:47 18:50	06:36 20:44	05:40 21:35	05:17 22:06	05:40 21:52	06:28 20:59	07:20 19:48	08:11 18:39	08:07 16:43	08:47 16:27
20	08:41 17:02	07:50 17:59	06:45 18:52	06:34 20:46	05:38 21:36	05:17 22:06	05:41 21:51	06:30 20:57	07:21 19:46	08:13 18:36	08:09 16:42	08:48 16:27
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22	08:38 17:05	07:46 18:03	06:40 18:56	06:29 20:50	05:35 21:39	05:17 22:07	05:44 21:49	06:33 20:53	07:25 19:41	08:17 18:32	08:13 16:39	08:49 16:28
23	08:37 17:07	07:44 18:05	06:38 18:57	06:27 20:51	05:34 21:41	05:17 22:07	05:45 21:47	06:35 20:50	07:26 19:38	08:18 18:30	08:14 16:38	08:49 16:29
24	08:36 17:08	07:42 18:07	06:36 18:59	06:25 20:53	05:33 21:42	05:18 22:07	05:46 21:46	06:36 20:48	07:28 19:36	08:20 18:28	08:16 16:37	08:50 16:29
25	08:35 17:10	07:40 18:08	06:33 19:01	06:23 20:55	05:32 21:43	05:18 22:07	05:48 21:45	06:38 20:46	07:30 19:34	08:22 18:26	08:18 16:36	08:50 16:30
26	08:33 17:12	07:37 18:10	06:31 19:03	06:21 20:57	05:30 21:45	05:18 22:07	05:49 21:43	06:40 20:44	07:31 19:31	08:24 18:24	08:19 16:35	08:50 16:31
27	08:32 17:14	07:35 18:12	06:28 20:04	06:19 20:58	05:29 21:46	05:19 22:07	05:51 21:42	06:41 20:42	07:33 19:29	08:26 18:22	08:21 16:34	08:51 16:31
28	08:31 17:16	07:33 18:14	06:26 20:06	06:17 21:00	05:28 21:47	05:19 22:07	05:52 21:40	06:43 20:39	07:35 19:27	08:27 18:20	08:22 16:33	08:51 16:32
29	08:29 17:17	07:31 18:16	06:24 20:08	06:15 21:02	05:27 21:49	05:20 22:07	05:54 20:37	06:45 19:24	07:36 18:18	08:29 18:18	08:24 16:32	08:51 16:33
30	08:28 17:19		06:21 20:10	06:13 21:04	05:26 21:50	05:20 22:07	05:55 21:37	06:46 20:35	07:38 19:22	07:31 17:16	08:25 16:31	08:51 16:34
31	08:26 17:21		06:19 20:11		05:25 21:51		05:57 21:35	06:48 20:32		07:33 17:14		08:51 16:35
Potential sun hours	255	285	367	417	488	502	505	455	381	331	264	241
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project: **TATA** Description: **Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode**

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SHADOW - Calendar

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode Shadow receptor: F - Shadow Receptor: 1.0 x 1.0 Azimuth: 0.0° Slope: 90.0° (7)

Assumptions for shadow calculations

Reference year for calendar

2016

Sunshine probability S (Average daily sunshine hours) [DE KOOY]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.63	2.87	3.52	5.73	7.72	6.68	6.73	6.21	4.59	3.23	1.94	1.13

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
482	397	465	535	463	457	814	1,283	1,342	881	649	580	8,348

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:51 16:35	08:25 17:23	07:29 18:18	07:17 20:13	06:11 21:05	05:24 21:52	05:21 22:06	05:59 21:34	06:50 20:30	07:40 19:19	07:35 17:12	08:27 16:31
2	08:51 16:36	08:23 17:25	07:26 18:20	07:14 20:15	06:09 21:07	05:23 21:53	05:22 22:06	06:00 21:32	06:51 20:28	07:41 19:17	07:37 17:10	08:28 16:30
3	08:51 16:37	08:22 17:27	07:24 18:21	07:12 20:17	06:07 21:09	05:23 21:54	05:22 22:06	06:02 21:30	06:53 20:26	07:43 19:15	07:38 17:08	08:30 16:29
4	08:51 16:38	08:20 17:29	07:22 18:23	07:10 20:18	06:05 21:10	05:22 21:56	05:23 22:05	06:03 21:28	06:55 20:23	07:45 19:12	07:40 17:07	08:31 16:29
5	08:51 16:39	08:18 17:31	07:20 18:25	07:07 20:20	06:03 21:12	05:21 21:57	05:24 22:05	06:05 21:27	06:56 20:21	07:47 19:10	07:42 17:05	08:33 16:28
6	08:50 16:41	08:17 17:32	07:17 18:27	07:05 20:22	06:01 21:14	05:20 21:58	05:25 22:04	06:06 21:25	06:58 20:19	07:48 19:08	07:44 17:03	08:34 16:28
7	08:50 16:42	08:15 17:34	07:15 18:29	07:03 20:24	05:59 21:15	05:20 21:58	05:26 22:04	06:08 21:23	07:00 20:16	07:50 19:06	07:46 17:01	08:35 16:27
8	08:49 16:43	08:13 17:36	07:13 18:31	07:00 20:25	05:57 21:17	05:19 21:59	05:27 22:03	06:10 21:21	07:01 20:14	07:52 19:03	07:48 16:59	08:36 16:27
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10	08:49 16:46	08:10 17:40	07:08 18:34	06:56 20:29	05:54 21:20	05:18 22:01	05:29 22:01	06:13 21:17	07:05 20:09	07:55 18:59	07:51 16:56	08:39 16:26
11	08:48 16:47	08:08 17:42	07:06 18:36	06:54 20:30	05:52 21:22	05:18 22:02	05:30 22:01	06:15 21:15	07:06 20:07	07:57 18:56	07:53 16:55	08:40 16:26
12	08:47 16:49	08:06 17:44	07:04 18:38	06:51 20:32	05:51 21:24	05:18 22:03	05:31 22:00	06:16 21:13	07:08 20:05	07:59 18:54	07:55 16:53	08:41 16:26
13	08:47 16:50	08:04 17:46	07:01 18:40	06:49 20:34	05:49 21:25	05:17 22:03	05:32 21:59	06:18 21:11	07:10 20:02	08:01 18:52	07:57 16:51	08:42 16:26
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15	08:45 16:53	08:00 17:50	06:57 18:43	06:45 20:37	05:46 21:28	05:17 22:04	05:34 21:57	06:21 21:07	07:13 19:57	08:04 18:47	08:00 16:48	08:44 16:26
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17	08:43 16:57	07:56 17:53	06:52 18:47	06:40 20:41	05:43 21:32	05:17 22:05	05:37 21:55	06:25 21:03	07:16 19:53	08:08 18:43	08:04 16:46	08:45 16:26
18	08:43 16:58	07:54 17:55	06:50 18:48	06:38 20:43	05:41 21:33	05:17 22:06	05:38 21:54	06:26 21:01	07:18 19:50	08:09 18:41	08:06 16:44	08:46 16:27
19	08:42 17:00	07:52 17:57	06:47 18:50	06:36 20:44	05:40 21:35	05:17 22:06	05:40 21:52	06:28 20:59	07:20 19:48	08:11 18:39	08:07 16:43	08:47 16:27
20	08:41 17:02	07:50 17:59	06:45 18:52	06:34 20:46	05:38 21:36	05:17 22:06	05:41 21:51	06:30 20:57	07:21 19:46	08:13 18:36	08:09 16:42	08:48 16:27
21	08:39 17:03	07:48 18:01	06:43 18:54	06:31 20:48	05:37 21:38	05:17 22:07	05:42 21:50	06:31 20:55	07:23 19:43	08:15 18:34	08:11 16:40	08:48 16:28
22	08:38 17:05	07:46 18:03	06:40 18:56	06:29 20:50	05:35 21:39	05:17 22:07	05:44 21:49	06:33 20:53	07:25 19:41	08:17 18:32	08:13 16:39	08:49 16:28
23	08:37 17:07	07:44 18:05	06:38 18:57	06:27 20:51	05:34 21:41	05:17 22:07	05:45 21:47	06:35 20:50	07:26 19:38	08:18 18:30	08:14 16:38	08:49 16:29
24	08:36 17:08	07:42 18:07	06:36 18:59	06:25 20:53	05:33 21:42	05:18 22:07	05:46 21:46	06:36 20:48	07:28 19:36	08:20 18:28	08:16 16:37	08:50 16:29
25	08:35 17:10	07:40 18:08	06:33 19:01	06:23 20:55	05:32 21:43	05:18 22:07	05:48 21:44	06:38 20:46	07:30 19:34	08:22 18:26	08:18 16:36	08:50 16:30
26	08:33 17:12	07:37 18:10	06:31 19:03	06:21 20:57	05:30 21:45	05:18 22:07	05:49 21:43	06:40 20:44	07:31 19:31	08:24 18:24	08:19 16:35	08:50 16:31
27	08:32 17:14	07:35 18:12	07:28 20:04	06:19 20:58	05:29 21:46	05:19 22:07	05:51 21:42	06:41 20:41	07:33 19:29	08:26 18:22	08:21 16:34	08:51 16:31
28	08:31 17:16	07:33 18:14	07:26 20:06	06:17 21:00	05:28 21:47	05:19 22:07	05:52 21:40	06:43 20:39	07:35 19:27	08:27 18:20	08:22 16:33	08:51 16:32
29	08:29 17:17	07:31 18:16	07:24 20:08	06:15 21:02	05:27 21:49	05:20 22:07	05:54 20:37	06:45 19:24	07:36 18:18	08:29 17:12	08:24 16:32	08:51 16:33
30	08:28 17:19		07:21 20:10	06:13 21:04	05:26 21:50	05:20 22:07	05:55 21:37	06:46 20:35	07:38 19:22	07:31 17:16	08:25 16:31	08:51 16:34
31	08:26 17:21		07:19 20:11		05:25 21:51		05:57 21:35	06:48 20:32		07:33 17:14		08:51 16:35
Potential sun hours	255	285	367	417	488	502	505	455	381	331	264	241
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project: **TATA** Description: **Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode**

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Calculated:
03/05/2016 14:49/2.9.285

SHADOW - Calendar

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode Shadow receptor: G - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (9)

Assumptions for shadow calculations

Reference year for calendar

2016

Sunshine probability S (Average daily sunshine hours) [DE KOOY]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1.63 2.87 3.52 5.73 7.72 6.68 6.73 6.21 4.59 3.23 1.94 1.13

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
482 397 465 535 463 457 814 1,283 1,342 881 649 580 8,348
Idle start wind speed: Cut in wind speed from power curve

		[January		[February	[March		[April		[May		[June	[July		[August	[September	[October		[November		[December	
	1	08:51	15:54 (2)	08:25	07:29	07:17	06:11	05:24	05:21	05:59	06:50	07:40	07:35							08:27	15:42 (2)
		16:35	8 16:02 (2)	17:23	18:18	20:13	21:05	21:52	22:06	21:34	20:30	19:19	17:12							16:31	12 15:54 (2)
	2	08:51	15:55 (2)	08:23	07:26	07:14	06:09	05:23	05:22	06:00	06:51	07:41	07:37							08:28	15:43 (2)
		16:36	8 16:03 (2)	17:25	18:20	20:15	21:07	21:53	22:06	21:32	20:28	19:17	17:10							16:30	12 15:55 (2)
	3	08:51	15:54 (2)	08:22	07:24	07:12	06:07	05:23	05:22	06:02	06:53	07:43	07:38							08:30	15:42 (2)
		16:37	10 16:04 (2)	17:27	18:21	20:17	21:09	21:54	22:06	21:30	20:26	19:15	17:08							16:29	13 15:55 (2)
	4	08:51	15:55 (2)	08:20	07:22	07:10	06:05	05:22	05:23	06:03	06:55	07:45	07:40							08:31	15:43 (2)
		16:38	10 16:05 (2)	17:29	18:23	20:18	21:10	21:55	22:05	21:28	20:23	19:12	17:07							16:29	13 15:56 (2)
	5	08:51	15:56 (2)	08:18	07:20	07:07	06:03	05:21	05:24	06:05	06:56	07:47	07:42							08:32	15:42 (2)
		16:39	11 16:07 (2)	17:31	18:25	20:20	21:12	21:57	22:05	21:27	20:21	19:10	17:05							16:28	14 15:56 (2)
	6	08:50	15:56 (2)	08:17	07:17	07:05	06:01	05:20	05:25	06:06	06:58	07:48	07:44							08:34	15:43 (2)
		16:41	12 16:08 (2)	17:32	18:27	20:22	21:14	21:58	22:04	21:25	20:19	19:08	17:03							16:28	13 15:56 (2)
	7	08:50	15:57 (2)	08:15	07:15	07:03	05:59	05:20	05:26	06:08	07:00	07:50	07:46							08:35	15:43 (2)
		16:42	13 16:10 (2)	17:34	18:29	20:23	21:15	21:58	22:04	21:23	20:16	19:05	17:01							16:27	12 15:55 (2)
	8	08:49	15:57 (2)	08:13	07:13	07:00	05:57	05:19	05:27	06:10	07:01	07:52	07:48							08:36	15:43 (2)
		16:43	14 16:11 (2)	17:36	18:31	20:25	21:17	21:59	22:03	21:21	20:14	19:03	16:59							16:27	11 15:54 (2)
	9	08:49	15:58 (2)	08:11	07:11	06:58	05:56	05:19	05:28	06:11	07:03	07:54	07:49							08:38	15:43 (2)
		16:45	13 16:11 (2)	17:38	18:32	20:27	21:19	22:00	22:02	21:19	20:12	19:01	16:58							16:27	10 15:53 (2)
	10	08:49	15:59 (2)	08:10	07:08	06:56	05:54	05:18	05:29	06:13	07:05	07:55	07:51							08:39	15:44 (2)
		16:46	13 16:12 (2)	17:40	18:34	20:29	21:20	22:01	22:01	21:17	20:09	18:59	16:56							16:26	10 15:54 (2)
	11	08:48	16:00 (2)	08:08	07:06	06:54	05:52	05:18	05:30	06:15	07:06	07:57	07:53							08:40	15:45 (2)
		16:47	12 16:12 (2)	17:42	18:36	20:30	21:22	22:02	22:01	21:15	20:07	18:56	16:55							16:26	8 15:53 (2)
	12	08:47	16:00 (2)	08:06	07:04	06:51	05:51	05:18	05:31	06:16	07:08	07:59	07:55							08:41	15:45 (2)
		16:49	12 16:12 (2)	17:44	18:38	20:32	21:24	22:03	22:00	21:13	20:05	18:54	16:53							16:26	8 15:53 (2)
	13	08:47	16:01 (2)	08:04	07:01	06:49	05:49	05:17	05:32	06:18	07:10	08:01	07:57							08:42	15:45 (2)
		16:50	10 16:11 (2)	17:46	18:40	20:34	21:25	22:03	21:59	21:11	20:02	18:52	16:51							16:26	8 15:53 (2)
	14	08:46	16:03 (2)	08:02	06:59	06:47	05:47	05:17	05:33	06:20	07:11	08:02	07:59							08:43	15:46 (2)
		16:52	7 16:10 (2)	17:48	18:41	20:36	21:27	22:04	21:58	21:09	20:00	18:50	16:50							16:26	7 15:53 (2)
	15	08:45	16:05 (2)	08:00	06:57	06:45	05:46	05:17	05:34	06:21	07:13	08:04	08:00							08:44	15:47 (2)
		16:53	4 16:09 (2)	17:50	18:43	20:37	21:28	22:04	21:57	21:07	19:57	18:47	16:48							16:26	6 15:53 (2)
	16	08:44		07:58	06:54	06:42	05:44	05:17	05:36	06:23	07:15	08:06	08:02							08:45	15:47 (2)
		16:55		17:51	18:45	20:39	21:30	22:05	21:56	21:05	19:55	18:45	16:47							16:26	6 15:53 (2)
	17	08:43		07:56	06:52	06:40	05:43	05:17	05:37	06:25	07:16	08:08	08:04							08:45	15:47 (2)
		16:57		17:53	18:47	20:41	21:32	22:05	21:55	21:03	19:53	18:43	16:46							16:26	5 15:52 (2)
	18	08:43		07:54	06:50	06:38	05:41	05:17	05:38	06:26	07:18	08:09	08:06							08:46	15:48 (2)
		16:58		17:55	18:48	20:43	21:33	22:06	21:54	21:01	19:50	18:41	16:44							16:27	5 15:53 (2)
	19	08:42		07:52	06:47	06:36	05:40	05:17	05:40	06:28	07:20	08:11	08:07							08:47	15:48 (2)
		17:00		17:57	18:50	20:44	21:35	22:06	21:52	20:59	19:48	18:39	16:43							16:27	5 15:53 (2)
	20	08:40		07:50	06:45	06:34	05:38	05:17	05:41	06:30	07:21	08:13	08:09							08:48	15:48 (2)
		17:01		17:59	18:52	20:46	21:36	22:06	21:51	20:57	19:46	18:36	16:42							16:27	5 15:53 (2)
	21	08:39		07:48	06:43	06:31	05:37	05:17	05:42	06:31	07:23	08:15	08:11							08:48	15:49 (2)
		17:03		18:01	18:54	20:48	21:38	22:07	21:50	20:55	19:43	18:34	16:40							16:28	5 15:54 (2)
	22	08:38		07:46	06:40	06:29	05:35	05:17	05:44	06:33	07:25	08:17	08:13							08:49	15:49 (2)
		17:05		18:03	18:55	20:50	21:39	22:07	21:49	20:52	19:41	18:32	16:39							16:28	5 15:54 (2)
	23	08:37		07:44	06:38	06:27	05:34	05:17	05:45	06:35	07:26	08:18	08:14							08:49	15:50 (2)
		17:07		18:05	18:57	20:51	21:41	22:07	21:47	20:50	19:38	18:30	16:38							16:29	5 15:55 (2)
	24	08:36		07:42	06:36	06:25	05:33	05:18	05:46	06:36	07:28	08:20	08:16							08:50	15:50 (2)
		17:08		18:07	18:59	20:53	21:42	22:07	21:46	20:48	19:36	18:28	16:37							16:29	5 15:55 (2)
	25	08:35		07:40	06:33	06:23	05:32	05:18	05:48	06:38	07:30	08:22	08:18							08:50	15:52 (2)
		17:10		18:08	19:01	20:55	21:43	22:07	21:44	20:46	19:34	18:26	16:36							16:30	5 15:57 (2)
	26	08:33		07:37	06:31	06:21	05:30	05:18	05:49	06:40	07:31	08:24	08:19							08:50	15:52 (2)
		17:12		18:10	19:03	20:57	21:45	22:07	21:43	20:44	19:31	18:24	16:35							16:30	5 15:57 (2)
	27	08:32		07:35	07:28	06:19	05:29	05:19	05:51	06:41	07:33	08:26	08:21							08:51	15:52 (2)
		17:14		18:12	20:04	20:58	21:46	22:07	21:42	20:41	19:29	18:22	16:34							16:31	6 15:58 (2)
	28	08:31		07:33	07:26	06:17	05:28	05:19	05:52	06:43	07:35	08:27	08:22							08:51	15:52 (2)
		17:16		18:14	20:06	21:00	21:47	22:07	21:40	20:39	19:27	18:20	16:33							16:32	7 15:59 (2)
	29	08:29		07:31	07:24	06:15	05:27	05:20	05:54	06:45	07:36	08:29	08:24							08:51	15:53 (2)
		17:17		18:16	20:08	21:02	21:49	22:07	21:38	20:37	19:24	18:18	16:32							16:33	7 16:00 (2)
	30	08:28			07:21	06:13	05:26	05:20	05:55	06:46	07:38	07:31	08:25							08:51	15:53 (2)
		17:19			20:10	21:04	21:50	22:07	21:37	20:35	19:22	17:16	16:31							16:34	8 16:01 (2)
	31	08:26			07:19		05:25		05:57	06:48		07:33								08:51	15:54 (2)
		17:21			20:11		21:51		21:35	20:32		17:14								16:35	8 16:02 (2)
Potential sun hours		255		285	367	417	488	502	505	455	381	331	264							241	
Total, worst case		157																		249	
Sun reduction		0.20																		0.15	
Oper. time red.		0.95																		0.95	
Wind dir. red.		0.69																		0.69	
Total reduction		0.13																		0.10	
Total, real		20																		24	

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

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

Project: **TATA** Description: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode

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SHADOW - Calendar

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode Shadow receptor: H - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (10)

Assumptions for shadow calculations

Reference year for calendar

2016

Sunshine probability S (Average daily sunshine hours) [DE KOOY]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1.63 2.87 3.52 5.73 7.72 6.68 6.73 6.21 4.59 3.23 1.94 1.13

Operational time

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

482 397 465 535 463 457 814 1,283 1,342 881 649 580 8,348

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:51 16:35	08:25 17:23	16:34 (3) 18:18	07:29 20:13	06:11 21:05	05:24 21:52	05:21 22:06	05:58 21:33	06:50 20:30	07:40 19:19	07:35 17:12	08:27 16:31
2	08:51 16:36	08:23 17:25	16:36 (3) 18:20	07:26 20:15	06:09 21:07	05:23 21:53	05:22 22:06	06:00 21:32	06:51 20:28	07:41 19:17	07:37 17:10	08:28 16:30
3	08:51 16:37	08:22 17:27	16:43 (3) 18:21	07:24 20:16	06:07 21:09	05:23 21:54	05:22 22:06	06:02 21:30	06:53 20:26	07:43 19:15	07:38 17:08	08:30 16:29
4	08:51 16:38	08:20 17:29	18:23 20:18	07:10 20:18	06:05 21:10	05:22 21:55	05:23 22:05	06:03 21:28	06:55 20:23	07:45 19:12	07:40 17:06	08:31 16:29
5	08:50 16:39	08:18 17:31	18:25 20:20	07:07 20:20	06:03 21:12	05:21 21:56	05:24 22:05	06:05 21:27	06:56 20:21	07:47 19:10	07:42 17:05	08:32 16:28
6	08:50 16:41	08:17 17:32	18:27 20:22	07:05 21:14	06:01 21:57	05:20 22:04	05:25 22:04	06:06 21:25	06:58 20:19	07:48 19:08	07:44 17:03	08:34 16:28
7	08:50 16:42	08:15 17:34	18:29 20:23	07:03 21:15	05:59 21:58	05:20 22:04	05:26 22:04	06:08 21:23	07:00 20:16	07:50 19:05	07:46 17:01	08:35 16:27
8	08:49 16:43	08:13 17:36	18:30 20:25	07:00 21:17	05:57 21:59	05:19 22:03	05:27 22:03	06:10 21:21	07:01 20:14	07:52 19:03	07:48 16:59	08:36 16:27
9	08:49 16:45	08:11 17:38	18:32 20:27	06:58 21:19	05:56 22:00	05:19 22:02	05:28 22:02	06:11 21:19	07:03 20:12	07:53 19:01	07:49 16:58	08:37 16:27
10	08:48 16:46	08:09 17:40	18:34 20:29	06:56 21:20	05:54 22:01	05:18 22:01	05:29 22:01	06:13 21:17	07:04 20:09	07:55 18:59	07:51 16:56	16:06 (3) 16:26
11	08:48 16:47	08:08 17:42	18:36 20:30	06:54 21:22	05:52 22:02	05:18 22:01	05:30 22:01	06:15 21:15	07:06 20:07	07:57 18:56	07:53 16:54	16:05 (3) 16:26
12	08:47 16:49	08:06 17:44	18:36 20:32	06:51 21:24	05:51 22:02	05:18 22:00	05:31 22:00	06:16 21:13	07:08 20:04	07:59 18:54	07:55 16:53	16:04 (3) 16:26
13	08:47 16:50	08:04 17:46	18:39 20:34	06:49 21:25	05:49 22:03	05:17 22:03	05:32 21:59	06:18 21:11	07:09 20:02	08:00 18:52	07:57 16:51	16:03 (3) 16:26
14	08:46 16:52	08:02 17:48	18:41 20:36	06:47 21:27	05:47 22:04	05:17 21:58	05:33 21:58	06:20 21:09	07:11 20:00	08:02 18:50	07:59 16:50	16:03 (3) 16:26
15	08:45 16:53	08:00 17:50	18:43 20:37	06:45 21:28	05:46 22:04	05:17 21:57	05:34 21:57	06:21 21:07	07:13 19:57	08:04 18:47	08:00 16:48	16:02 (3) 16:26
16	08:44 16:55	07:58 17:51	18:43 20:39	06:42 21:30	05:44 22:05	05:17 21:56	05:36 21:56	06:23 21:05	07:14 19:55	08:06 18:45	08:02 16:47	16:02 (3) 16:26
17	08:43 16:57	07:56 17:53	18:45 20:41	06:40 21:32	05:43 22:05	05:17 21:55	05:37 21:55	06:25 21:03	07:16 19:53	08:08 18:43	08:04 16:46	16:03 (3) 16:26
18	08:42 16:58	07:54 17:55	18:47 20:43	06:38 21:33	05:41 22:06	05:17 21:54	05:38 21:54	06:26 21:01	07:18 19:50	08:09 18:41	08:06 16:44	16:03 (3) 16:27
19	08:41 17:00	07:52 17:57	18:48 20:44	06:36 21:35	05:40 22:06	05:17 21:52	05:40 21:52	06:28 20:59	07:19 19:48	08:11 18:39	08:07 16:43	16:03 (3) 16:27
20	08:40 17:01	16:30 (3) 17:59	18:50 20:46	06:34 21:36	05:38 22:06	05:17 21:51	05:41 21:51	06:29 20:57	07:21 19:45	08:13 18:36	08:09 16:42	16:04 (3) 16:27
21	08:39 17:03	16:29 (3) 18:01	18:52 20:48	06:34 21:38	05:37 22:07	05:17 21:50	05:42 21:50	06:31 20:55	07:23 19:43	08:15 18:34	08:11 16:40	16:05 (3) 16:28
22	08:38 17:05	16:29 (3) 18:03	18:54 20:50	06:31 21:39	05:37 22:07	05:17 21:49	05:44 21:49	06:33 20:52	07:24 19:41	08:17 18:32	08:13 16:39	16:05 (3) 16:28
23	08:37 17:07	16:29 (3) 18:05	18:55 20:51	06:30 21:40	05:36 22:07	05:17 21:47	05:45 21:47	06:34 20:50	07:26 19:38	08:18 18:30	08:14 16:38	16:06 (3) 16:29
24	08:36 17:08	16:29 (3) 18:07	18:57 20:53	06:29 21:42	05:35 22:07	05:17 21:46	05:46 21:46	06:36 20:48	07:28 19:36	08:20 18:28	08:16 16:37	16:07 (3) 16:29
25	08:35 17:10	16:29 (3) 18:08	18:59 20:54	06:28 21:43	05:34 22:07	05:18 21:44	05:48 21:44	06:38 20:46	07:30 19:34	08:22 18:26	08:18 16:36	16:08 (3) 16:30
26	08:33 17:12	16:29 (3) 18:10	19:01 20:57	06:31 21:45	05:30 22:07	05:18 21:43	05:49 21:43	06:39 20:44	07:31 19:31	08:24 18:24	08:19 16:35	16:09 (3) 16:31
27	08:32 17:14	16:30 (3) 18:12	19:02 20:58	06:29 21:46	05:29 22:07	05:19 21:41	05:51 21:41	06:41 20:41	07:33 19:29	08:26 18:22	08:21 16:34	16:10 (3) 16:31
28	08:31 17:16	16:30 (3) 18:14	19:07 21:00	06:28 21:47	05:28 22:07	05:19 21:40	05:52 21:40	06:43 20:39	07:35 19:27	08:27 18:20	08:22 16:33	16:11 (3) 16:32
29	08:29 17:17	16:31 (3) 18:16	19:08 21:02	06:27 21:49	05:27 22:07	05:19 21:38	05:54 21:38	06:44 20:37	07:36 19:24	08:29 18:18	08:24 16:32	16:12 (3) 16:33
30	08:28 17:19	16:31 (3) 18:17	19:09 21:03	06:26 21:50	05:26 22:07	05:20 21:37	05:55 21:37	06:46 20:35	07:38 19:22	07:31 17:16	08:25 16:31	16:13 (3) 16:34
31	08:26 17:21	16:32 (3) 18:18	19:10 21:04	06:25 21:51	05:25 22:08	05:19 21:35	05:57 21:35	06:48 20:32	07:40 17:14	07:33 16:31	08:26 16:35	16:14 (3) 16:35
Potential sun hours	255	285	367	417	488	502	505	455	381	331	264	241
Total, worst case	126	18									148	
Sun reduction	0.20	0.29									0.22	
Oper. time red.	0.95	0.95									0.95	
Wind dir. red.	0.69	0.69									0.69	
Total reduction	0.13	0.19									0.14	
Total, real	16	3									21	

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

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

Project: **TATA** Description: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode

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03/05/2016 14:49 / 11

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Calculated:
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SHADOW - Calendar

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode Shadow receptor: I - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (11)

Assumptions for shadow calculations

Reference year for calendar

2016

Sunshine probability S (Average daily sunshine hours) [DE KOOY]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.63	2.87	3.52	5.73	7.72	6.68	6.73	6.21	4.59	3.23	1.94	1.13

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
482	397	465	535	463	457	814	1,283	1,342	881	649	580	8,348

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:51 16:35	08:25 17:23	07:29 18:18	07:17 20:13	06:11 21:05	05:24 21:52	05:21 22:06	05:58 21:33	06:49 20:30	07:40 19:19	07:35 17:12	08:27 16:31
2	08:51 16:36	08:23 17:25	07:26 18:20	07:14 20:15	06:09 21:07	05:23 21:53	05:22 22:06	06:00 21:32	06:51 20:28	07:41 19:17	07:37 17:10	08:28 16:30
3	08:51 16:37	08:22 17:27	07:24 18:21	07:12 20:16	06:07 21:09	05:23 21:54	05:22 22:06	06:02 21:30	06:53 20:26	07:43 19:15	07:38 17:08	08:30 16:29
4	08:51 16:38	08:20 17:29	07:22 18:23	07:10 20:18	06:05 21:10	05:22 21:55	05:23 22:05	06:03 21:28	06:54 20:23	07:45 19:12	07:40 17:06	08:31 16:29
5	08:50 16:39	08:18 17:31	07:20 18:25	07:07 20:20	06:03 21:12	05:21 21:56	05:24 22:05	06:05 21:26	06:56 20:21	07:47 19:10	07:42 17:05	08:32 16:28
6	08:50 16:41	08:17 17:32	07:17 18:27	07:05 20:22	06:01 21:14	05:20 21:57	05:25 22:04	06:06 21:25	06:58 20:19	07:48 19:08	07:44 17:03	08:34 16:28
7	08:50 16:42	08:15 17:34	07:15 18:29	07:03 20:23	05:59 21:15	05:20 21:58	05:26 22:03	06:08 21:23	06:59 20:16	07:50 19:05	07:46 17:01	08:35 16:27
8	08:49 16:43	08:13 17:36	07:13 18:30	07:00 20:25	05:57 21:17	05:19 21:59	05:27 22:03	06:10 21:21	07:01 20:14	07:52 19:03	07:48 16:59	08:36 16:27
9	08:49 16:45	08:11 17:38	07:10 18:32	06:58 20:27	05:56 21:19	05:19 22:00	05:28 22:02	06:11 21:19	07:03 20:12	07:53 19:01	07:49 16:58	08:37 16:27
10	08:48 16:46	08:09 17:40	07:08 18:34	06:56 20:29	05:54 21:20	05:18 22:01	05:29 22:01	06:13 21:17	07:04 20:09	07:55 18:59	07:51 16:56	08:39 16:26
11	08:48 16:47	08:08 17:42	07:06 18:36	06:54 20:30	05:52 21:22	05:18 22:02	05:30 22:01	06:15 21:15	07:06 20:07	07:57 18:56	07:53 16:54	08:40 16:26
12	08:47 16:49	08:06 17:44	07:04 18:38	06:51 20:32	05:50 21:24	05:18 22:02	05:31 22:00	06:16 21:13	07:08 20:04	07:59 18:54	07:55 16:53	08:41 16:26
13	08:47 16:50	08:04 17:46	07:01 18:39	06:49 20:34	05:49 21:25	05:17 22:03	05:32 21:59	06:18 21:11	07:09 20:02	08:00 18:52	07:57 16:51	08:42 16:26
14	08:46 16:52	08:02 17:48	06:59 18:41	06:47 20:36	05:47 21:27	05:17 22:04	05:33 21:58	06:20 21:09	07:11 20:00	08:02 18:50	07:58 16:50	08:43 16:26
15	08:45 16:53	08:00 17:50	06:57 18:43	06:45 20:37	05:46 21:28	05:17 22:04	05:34 21:57	06:21 21:07	07:13 19:57	08:04 18:47	08:00 16:48	08:44 16:26
16	08:44 16:55	07:58 17:51	06:54 18:45	06:42 20:39	05:44 21:30	05:17 22:05	05:36 21:56	06:23 21:05	07:14 19:55	08:06 18:45	08:02 16:47	08:45 16:26
17	08:43 16:56	07:56 17:53	06:52 18:47	06:40 20:41	05:42 21:32	05:17 22:05	05:37 21:55	06:24 21:03	07:16 19:53	08:08 18:43	08:04 16:45	08:45 16:26
18	08:42 16:58	07:54 17:55	06:50 18:48	06:38 20:43	05:41 21:33	05:17 22:06	05:38 21:54	06:26 21:01	07:18 19:50	08:09 18:41	08:06 16:44	08:46 16:26
19	08:41 17:00	07:52 17:57	06:47 18:50	06:36 20:44	05:40 21:35	05:17 22:06	05:40 21:52	06:28 20:59	07:19 19:48	08:11 18:39	08:07 16:43	08:47 16:27
20	08:40 17:01	07:50 17:59	06:45 18:52	06:34 20:46	05:38 21:36	05:17 22:06	05:41 21:51	06:29 20:57	07:21 19:45	08:13 18:36	08:09 16:42	08:47 16:27
21	08:39 17:03	07:48 18:01	06:43 18:54	06:31 20:48	05:37 21:38	05:17 22:07	05:42 21:50	06:31 20:55	07:23 19:43	08:15 18:34	08:11 16:40	08:48 16:28
22	08:38 17:05	07:46 18:03	06:40 18:55	06:29 20:50	05:35 21:39	05:17 22:07	05:44 21:49	06:33 20:52	07:24 19:41	08:16 18:32	08:12 16:39	08:49 16:28
23	08:37 17:07	07:44 18:05	06:38 18:57	06:27 20:51	05:34 21:40	05:17 22:07	05:45 21:47	06:34 20:50	07:26 19:38	08:18 18:30	08:14 16:38	08:49 16:29
24	08:36 17:08	07:42 18:07	06:35 18:59	06:25 20:53	05:33 21:42	05:18 22:07	05:46 21:46	06:36 20:48	07:28 19:36	08:20 18:28	08:16 16:37	08:50 16:29
25	08:35 17:10	07:39 18:08	06:33 19:01	06:23 20:55	05:32 21:43	05:18 22:07	05:48 21:44	06:38 20:46	07:30 19:34	08:22 18:26	08:17 16:36	08:50 16:30
26	08:33 17:12	07:37 18:10	06:31 19:02	06:21 20:57	05:30 21:45	05:18 22:07	05:49 21:43	06:39 20:44	07:31 19:31	08:24 18:24	08:19 16:35	08:50 16:30
27	08:32 17:14	07:35 18:12	06:28 20:04	06:19 20:58	05:29 21:46	05:19 22:07	05:51 21:41	06:41 20:41	07:33 19:29	08:26 18:22	08:21 16:34	08:50 16:31
28	08:31 17:16	07:33 18:14	06:26 20:06	06:17 21:00	05:28 21:47	05:19 22:07	05:52 21:40	06:43 20:39	07:35 19:26	08:27 18:20	08:22 16:33	08:51 16:32
29	08:29 17:17	07:31 18:16	06:24 20:08	06:15 21:02	05:27 21:49	05:20 22:07	05:54 21:38	06:44 20:37	07:36 19:24	08:29 18:18	08:24 16:32	08:51 16:33
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Potential sun hours	255	285	367	417	488	502	505	455	381	331	264	241
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
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Table layout: For each day in each month the following matrix apply

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

Project: **TATA** Description: **Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode**

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Calculated:
03/05/2016 14:49/2.9.285

SHADOW - Calendar

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode Shadow receptor: J - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (12

Assumptions for shadow calculations

Reference year for calendar

2016

Sunshine probability S (Average daily sunshine hours) [DE KOOY]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.63	2.87	3.52	5.73	7.72	6.68	6.73	6.21	4.59	3.23	1.94	1.13

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
482	397	465	535	463	457	814	1,283	1,342	881	649	580	8,348

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:51 16:35	08:25 17:23	07:29 18:18	07:17 20:13	06:11 21:05	05:24 21:52	05:21 22:06	05:58 21:33	06:49 20:30	07:40 19:19	07:35 17:12	08:27 16:31
2	08:51 16:36	08:23 17:25	07:26 18:19	07:14 20:15	06:09 21:07	05:23 21:53	05:22 22:06	06:00 21:32	06:51 20:28	07:41 19:17	07:37 17:10	08:28 16:30
3	08:51 16:37	08:21 17:27	07:24 18:21	07:12 20:16	06:07 21:09	05:23 21:54	05:22 22:06	06:02 21:30	06:53 20:25	07:43 19:15	07:38 17:08	08:30 16:29
4	08:51 16:38	08:20 17:29	07:22 18:23	07:10 20:18	06:05 21:10	05:22 21:55	05:23 22:05	06:03 21:28	06:54 20:23	07:45 19:12	07:40 17:06	08:31 16:29
5	08:50 16:39	08:18 17:30	07:20 18:25	07:07 20:20	06:03 21:12	05:21 21:56	05:24 22:05	06:05 21:26	06:56 20:21	07:46 19:10	07:42 17:05	08:32 16:28
6	08:50 16:41	08:16 17:32	07:17 18:27	07:05 20:22	06:01 21:14	05:20 21:57	05:25 22:04	06:06 21:25	06:58 20:19	07:48 19:08	07:44 17:03	08:34 16:28
7	08:50 16:42	08:15 17:34	07:15 18:29	07:03 20:23	05:59 21:15	05:20 21:58	05:26 22:03	06:08 21:23	06:59 20:16	07:50 19:05	07:46 17:01	08:35 16:27
8	08:49 16:43	08:13 17:36	07:13 18:30	07:00 20:25	05:57 21:17	05:19 21:59	05:27 22:03	06:10 21:21	07:01 20:14	07:52 19:03	07:48 16:59	08:36 16:27
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Potential sun hours	255	285	367	417	488	502	505	455	381	331	264	241
Total, worst case												
Sun reduction												
Oper. time red.												
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Total reduction												
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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: **TATA** Description: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode

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Stephen Sheldon / s.sheldon@infinergy.co.uk
Calculated:
03/05/2016 14:49/2.9.285

SHADOW - Calendar

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode Shadow receptor: K - Shadow Receptor: 1.0 x 1.0 Azimuth: 0.0° Slope: 90.0° (13)

Assumptions for shadow calculations

Reference year for calendar

2016

Sunshine probability S (Average daily sunshine hours) [DE KOOY]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1.63 2.87 3.52 5.73 7.72 6.68 6.73 6.21 4.59 3.23 1.94 1.13

Operational time

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

482 397 465 535 463 457 814 1,283 1,342 881 649 580 8,348

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:51 16:35	08:25 17:23	07:28 18:18	07:17 20:13	06:11 21:05	05:24 21:52	05:21 22:06	05:58 21:33	06:49 20:30	07:40 19:19	07:35 17:12	08:27 16:31
2	08:51 16:36	08:23 17:25	07:26 18:19	07:14 20:15	06:09 21:07	05:23 21:53	05:22 22:06	06:00 21:32	06:51 20:28	07:41 19:17	07:36 17:10	08:28 16:30
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Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
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Table layout: For each day in each month the following matrix apply

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

Project:	Description:	Printed/Page
TATA	Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode	03/05/2016 14:49 / 14
		Licensed user:
		Infinergy Limited Ltd
		16, West Borough
		GB-WIMBORNE BH21 1XB
		+44 1202 847680
		Stephen Sheldon / s.sheldon@infinergy.co.uk
		Calculated:
		03/05/2016 14:49/2.9.285

SHADOW - Calendar

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode Shadow receptor: L - Shadow Receptor: 1.0 x 1.0 Azimuth: 0.0° Slope: 90.0° (14

Assumptions for shadow calculations

Reference year for calendar	2016	Sunshine probability S (Average daily sunshine hours) [DE KOOY]
		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
		1.63 2.87 3.52 5.73 7.72 6.68 6.73 6.21 4.59 3.23 1.94 1.13
		Operational time
		N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
		482 397 465 535 463 457 814 1,283 1,342 881 649 580 8,348
		Idle start wind speed: Cut in wind speed from power curve

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6	08:50 16:41	08:16 17:32	07:17 18:27	07:05 20:22	06:01 21:14	05:20 21:57	05:25 22:04	06:06 21:25	06:58 20:18	07:48 19:08	07:44 17:03	08:34 16:28
7	08:50 16:42	08:15 17:34	07:15 18:29	07:03 20:23	05:59 21:15	05:20 21:58	05:26 22:03	06:08 21:23	06:59 20:16	07:50 19:05	07:46 17:01	08:35 16:27
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31	08:26 17:21		06:19 20:11		05:25 21:51		05:57 21:35	06:48 20:32		07:33 17:14		08:51 16:35
Potential sun hours	255	285	367	417	488	502	505	455	381	331	264	241
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)	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Last time (hh:mm) with flicker	(WTG causing flicker last time)
	Minutes with flicker		

Project:	Description:	Printed/Page
TATA	Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode	03/05/2016 14:49 / 15
		Licensed user:
		Infinergy Limited Ltd
		16, West Borough
		GB-WIMBORNE BH21 1XB
		+44 1202 847680
		Stephen Sheldon / s.sheldon@infinergy.co.uk
		Calculated:
		03/05/2016 14:49/2.9.285

SHADOW - Calendar

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode Shadow receptor: M - Shadow Receptor: 1.0 x 1.0 Azimuth: 0.0° Slope: 90.0° (15)

Assumptions for shadow calculations

Reference year for calendar	2016	Sunshine probability S (Average daily sunshine hours) [DE KOOY]
		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
		1.63 2.87 3.52 5.73 7.72 6.68 6.73 6.21 4.59 3.23 1.94 1.13
		Operational time
		N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
		482 397 465 535 463 457 814 1,283 1,342 881 649 580 8,348
		Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:51 16:35	08:25 17:23	07:28 18:18	07:17 20:13	06:11 21:05	05:24 21:52	05:21 22:06	05:58 21:33	06:49 20:30	07:40 19:19	07:35 17:12	08:27 16:30
2	08:51 16:36	08:23 17:25	07:26 18:19	07:14 20:15	06:09 21:07	05:23 21:53	05:22 22:06	06:00 21:32	06:51 20:28	07:41 19:17	07:36 17:10	08:28 16:30
3	08:51 16:37	08:21 17:27	07:24 18:21	07:12 20:16	06:07 21:08	05:22 21:54	05:22 22:05	06:02 21:30	06:53 20:25	07:43 19:15	07:38 17:08	08:30 16:29
4	08:51 16:38	08:20 17:29	07:22 18:23	07:10 20:18	06:05 21:10	05:22 21:55	05:23 22:05	06:03 21:28	06:54 20:23	07:45 19:12	07:40 17:06	08:31 16:29
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31	08:26 17:21		07:19 20:11		05:25 21:51		05:57 21:35	06:48 20:32		07:33 17:14		08:51 16:35
Potential sun hours	255	285	367	417	488	502	505	455	381	331	264	241
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)	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Last time (hh:mm) with flicker	(WTG causing flicker last time)
	Minutes with flicker		

Project:	Description:	Printed/Page
TATA	Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode	03/05/2016 14:49 / 16
		Licensed user:
		Infinergy Limited Ltd
		16, West Borough
		GB-WIMBORNE BH21 1XB
		+44 1202 847680
		Stephen Sheldon / s.sheldon@infinergy.co.uk
		Calculated:
		03/05/2016 14:49/2.9.285

SHADOW - Calendar

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode Shadow receptor: N - Shadow Receptor: 1.0 x 1.0 Azimuth: 0.0° Slope: 90.0° (16)

Assumptions for shadow calculations

Reference year for calendar	2016	Sunshine probability S (Average daily sunshine hours) [DE KOOY]
		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
		1.63 2.87 3.52 5.73 7.72 6.68 6.73 6.21 4.59 3.23 1.94 1.13
		Operational time
		N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
		482 397 465 535 463 457 814 1,283 1,342 881 649 580 8,348
		Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:51 16:35	08:25 17:23	07:28 18:18	07:17 20:13	06:11 21:05	05:24 21:52	05:21 22:06	05:58 21:33	06:49 20:30	07:40 19:19	07:35 17:12	08:27 16:30
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22	08:38 17:05	07:46 18:03	06:40 18:55	06:29 20:49	05:35 21:39	05:17 22:07	05:43 21:48	06:33 20:52	07:24 19:41	08:16 18:32	08:12 16:39	08:48 16:28
23	08:37 17:07	07:44 18:05	06:38 18:57	06:27 20:51	05:34 21:40	05:17 22:07	05:45 21:47	06:34 20:50	07:26 19:38	08:18 18:30	08:14 16:38	08:49 16:28
24	08:36 17:08	07:41 18:06	06:35 18:59	06:25 20:53	05:33 21:42	05:17 22:07	05:46 21:46	06:36 20:48	07:28 19:36	08:20 18:28	08:16 16:37	08:49 16:29
25	08:34 17:10	07:39 18:08	06:33 19:01	06:23 20:55	05:31 21:43	05:18 22:07	05:48 21:44	06:38 20:46	07:29 19:33	08:22 18:26	08:17 16:36	08:50 16:30
26	08:33 17:12	07:37 18:10	06:31 19:02	06:21 20:56	05:30 21:44	05:18 22:07	05:49 21:43	06:39 20:44	07:31 19:31	08:24 18:24	08:19 16:35	08:50 16:30
27	08:32 17:14	07:35 18:12	07:28 20:04	06:19 20:58	05:29 21:46	05:19 22:07	05:51 21:41	06:41 20:41	07:33 19:29	08:25 18:22	08:21 16:34	08:50 16:31
28	08:30 17:15	07:33 18:14	07:26 20:06	06:17 21:00	05:28 21:47	05:19 22:07	05:52 21:40	06:43 20:39	07:34 19:26	08:27 18:20	08:22 16:33	08:51 16:32
29	08:29 17:17	07:31 18:16	07:24 20:08	06:15 21:02	05:27 21:48	05:20 22:07	05:54 21:38	06:44 20:37	07:36 19:24	08:29 18:18	08:24 16:32	08:51 16:33
30	08:28 17:19		07:21 20:09	06:13 21:03	05:26 21:50	05:20 22:06	05:55 21:37	06:46 20:35	07:38 19:22	07:31 17:16	08:25 16:31	08:51 16:34
31	08:26 17:21		07:19 20:11		05:25 21:51		05:57 21:35	06:48 20:32		07:33 17:14		08:51 16:35
Potential sun hours	255	285	367	417	488	502	505	455	381	331	264	241
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)	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: **TATA** Description: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode

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03/05/2016 14:49/2.9.285

SHADOW - Calendar

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode Shadow receptor: O - Shadow Receptor: 1.0 x 1.0 Azimuth: 0.0° Slope: 90.0° (17)

Assumptions for shadow calculations

Reference year for calendar

2016

Sunshine probability S (Average daily sunshine hours) [DE KOOY]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.63	2.87	3.52	5.73	7.72	6.68	6.73	6.21	4.59	3.23	1.94	1.13

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
482	397	465	535	463	457	814	1,283	1,342	881	649	580	8,348

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:51 16:35	08:25 17:23	07:28 18:18	07:17 20:13	06:11 21:05	05:24 21:52	05:21 22:06	05:58 21:33	06:49 20:30	07:40 19:19	07:35 17:12	08:27 16:31
2	08:51 16:36	08:23 17:25	07:26 18:19	07:14 20:15	06:09 21:07	05:23 21:53	05:22 22:06	06:00 21:32	06:51 20:28	07:41 19:17	07:36 17:10	08:28 16:30
3	08:51 16:37	08:21 17:27	07:24 18:21	07:12 20:16	06:07 21:08	05:22 21:54	05:22 22:05	06:02 21:30	06:53 20:25	07:43 19:15	07:38 17:08	08:30 16:29
4	08:51 16:38	08:20 17:29	07:22 18:23	07:10 20:18	06:05 21:10	05:22 21:55	05:23 22:05	06:03 21:28	06:54 20:23	07:45 19:12	07:40 17:06	08:31 16:29
5	08:50 16:39	08:18 17:30	07:20 18:25	07:07 20:20	06:03 21:12	05:21 21:56	05:24 22:04	06:05 21:26	06:56 20:21	07:46 19:10	07:42 17:05	08:32 16:28
6	08:50 16:41	08:16 17:32	07:17 18:27	07:05 20:22	06:01 21:14	05:20 21:57	05:25 22:04	06:06 21:25	06:58 20:18	07:48 19:08	07:44 17:03	08:34 16:28
7	08:50 16:42	08:15 17:34	07:15 18:29	07:03 20:23	05:59 21:15	05:20 21:58	05:26 22:03	06:08 21:23	06:59 20:16	07:50 19:05	07:46 17:01	08:35 16:27
8	08:49 16:43	08:13 17:36	07:13 18:30	07:00 20:25	05:57 21:17	05:19 21:59	05:27 22:03	06:10 21:21	07:01 20:14	07:52 19:03	07:47 16:59	08:36 16:27
9	08:49 16:44	08:11 17:38	07:10 18:32	06:58 20:27	05:56 21:19	05:19 22:00	05:28 22:02	06:11 21:19	07:03 20:11	07:53 19:01	07:49 16:58	08:37 16:27
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11	08:48 16:47	08:08 17:42	07:06 18:36	06:53 20:30	05:52 21:22	05:18 22:02	05:30 22:00	06:14 21:15	07:06 20:07	07:57 18:56	07:53 16:54	08:40 16:26
12	08:47 16:49	08:06 17:44	07:03 18:38	06:51 20:32	05:50 21:23	05:17 22:02	05:31 22:00	06:16 21:13	07:08 20:04	07:59 18:54	07:55 16:53	08:41 16:26
13	08:46 16:50	08:04 17:46	07:01 18:39	06:49 20:34	05:49 21:25	05:17 22:03	05:32 21:59	06:18 21:11	07:09 20:02	08:00 18:52	07:57 16:51	08:42 16:26
14	08:46 16:52	08:02 17:48	06:59 18:41	06:47 20:36	05:47 21:27	05:17 22:04	05:33 21:58	06:19 21:09	07:11 20:00	08:02 18:49	07:58 16:50	08:43 16:26
15	08:45 16:53	08:00 17:49	06:57 18:43	06:44 20:37	05:46 21:28	05:17 22:04	05:34 21:57	06:21 21:07	07:13 19:57	08:04 18:47	08:00 16:48	08:44 16:26
16	08:44 16:55	07:58 17:51	06:45 18:45	06:42 20:39	05:44 21:30	05:17 22:05	05:36 21:56	06:23 21:05	07:14 19:55	08:06 18:45	08:02 16:47	08:44 16:26
17	08:43 16:56	07:56 17:53	06:52 18:47	06:40 20:41	05:42 21:31	05:17 22:05	05:37 21:55	06:24 21:03	07:16 19:53	08:07 18:43	08:04 16:45	08:45 16:26
18	08:42 16:58	07:54 17:55	06:50 18:48	06:38 20:43	05:41 21:33	05:17 22:06	05:38 21:53	06:26 21:01	07:18 19:50	08:09 18:41	08:05 16:44	08:46 16:26
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20	08:40 17:01	07:50 17:59	06:45 18:52	06:33 20:46	05:38 21:36	05:17 22:06	05:41 21:51	06:29 20:57	07:21 19:45	08:13 18:36	08:09 16:41	08:47 16:27
21	08:39 17:03	07:48 18:01	06:42 18:54	06:31 20:48	05:37 21:37	05:17 22:07	05:42 21:50	06:31 20:54	07:23 19:43	08:15 18:34	08:11 16:40	08:48 16:27
22	08:38 17:05	07:46 18:03	06:40 18:55	06:29 20:50	05:35 21:39	05:17 22:07	05:44 21:48	06:33 20:52	07:24 19:41	08:16 18:32	08:12 16:39	08:49 16:28
23	08:37 17:07	07:44 18:05	06:38 18:57	06:27 20:51	05:34 21:40	05:17 22:07	05:45 21:47	06:34 20:50	07:26 19:38	08:18 18:30	08:14 16:38	08:49 16:28
24	08:36 17:08	07:42 18:06	06:35 18:59	06:25 20:53	05:33 21:42	05:17 22:07	05:46 21:46	06:36 20:48	07:28 19:36	08:20 18:28	08:16 16:37	08:49 16:29
25	08:34 17:10	07:39 18:08	06:33 19:01	06:23 20:55	05:32 21:43	05:18 22:07	05:48 21:44	06:38 20:46	07:29 19:33	08:22 18:26	08:17 16:36	08:50 16:30
26	08:33 17:12	07:37 18:10	06:31 19:02	06:21 20:56	05:30 21:44	05:18 22:07	05:49 21:43	06:39 20:44	07:31 19:31	08:24 18:24	08:19 16:35	08:50 16:30
27	08:32 17:14	07:35 18:12	06:28 20:04	06:19 20:58	05:29 21:46	05:19 22:07	05:51 21:41	06:41 20:41	07:33 19:29	08:25 18:22	08:21 16:34	08:50 16:31
28	08:30 17:16	07:33 18:14	06:26 20:06	06:17 21:00	05:28 21:47	05:19 22:07	05:52 21:40	06:43 20:39	07:34 19:26	08:27 18:20	08:22 16:33	08:51 16:32
29	08:29 17:17	07:31 18:16	06:24 20:08	06:15 21:02	05:27 21:48	05:20 22:07	05:54 21:38	06:44 20:37	07:36 19:24	08:29 18:18	08:24 16:32	08:51 16:33
30	08:28 17:19		06:21 20:09	06:13 21:03	05:26 21:50	05:20 22:06	05:55 21:37	06:46 20:35	07:38 19:22	07:31 17:16	08:25 16:31	08:51 16:34
31	08:26 17:21		06:19 20:11		05:25 21:51		05:57 21:35	06:48 20:32		07:33 17:14		08:51 16:35
Potential sun hours	255	285	367	417	488	502	505	455	381	331	264	241
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:

TATA

Description:

Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode

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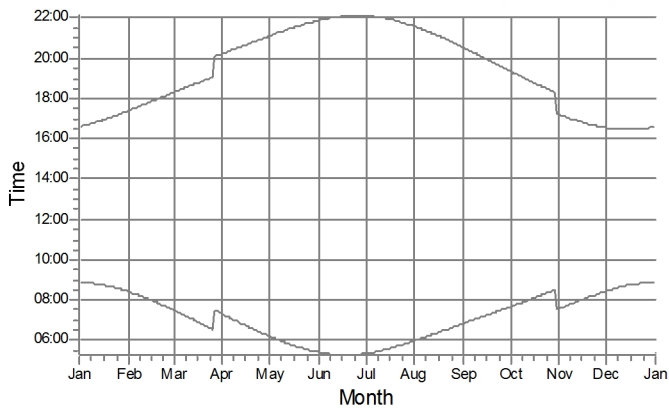
Stephen Sheldon / s.sheldon@infinergy.co.uk

Calculated:

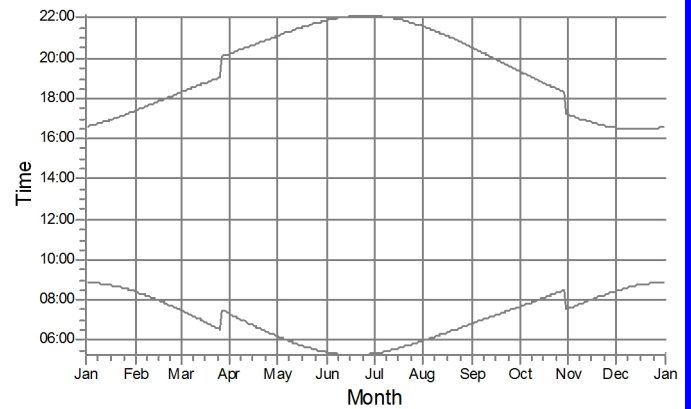
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SHADOW - Calendar, graphical**Calculation:** Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode

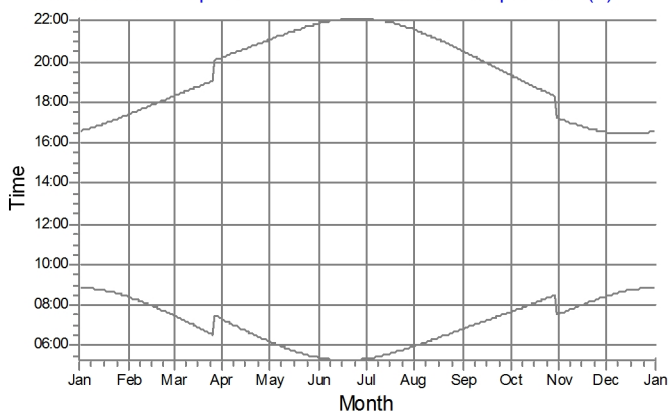
A: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (2)



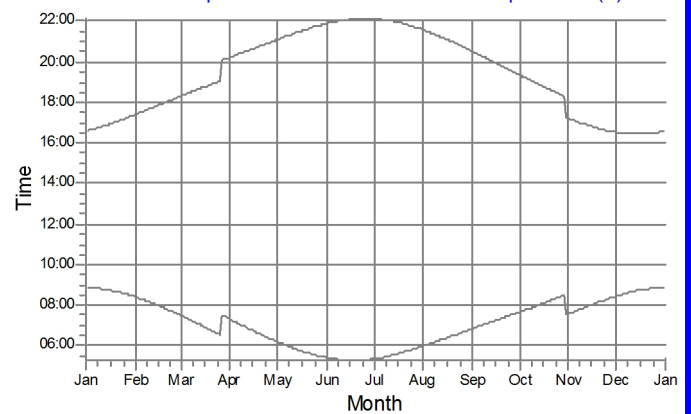
B: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (3)



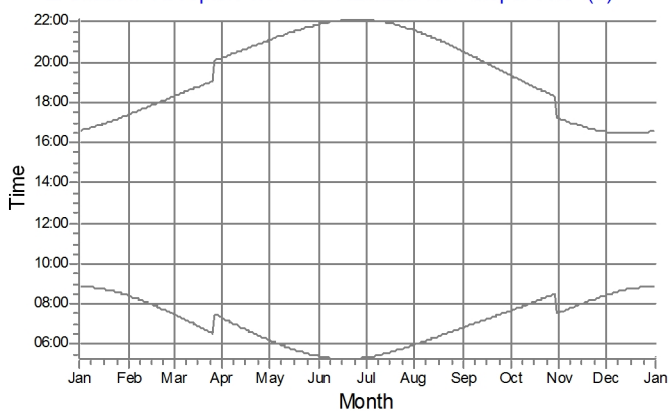
C: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (4)



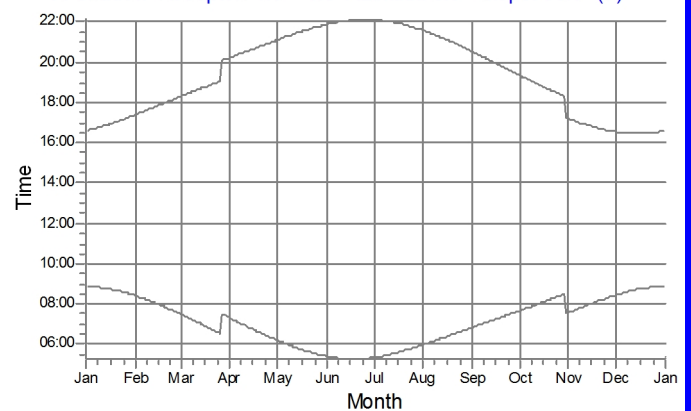
D: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (5)



E: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (6)



F: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (7)



WTGs

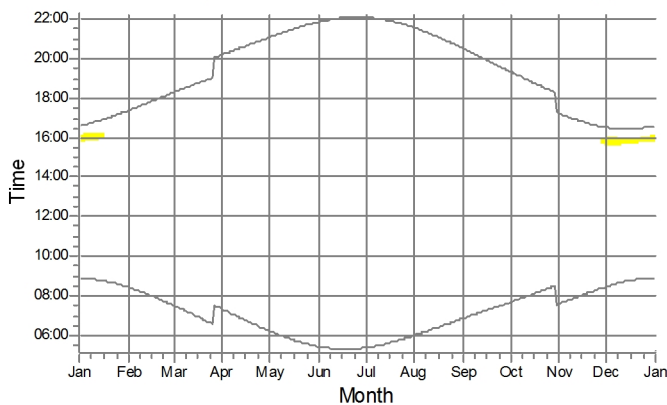
Project: TATA
 Description: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode

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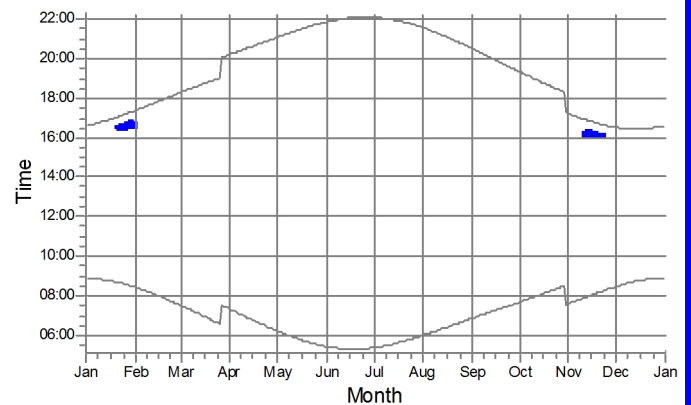
SHADOW - Calendar, graphical

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode

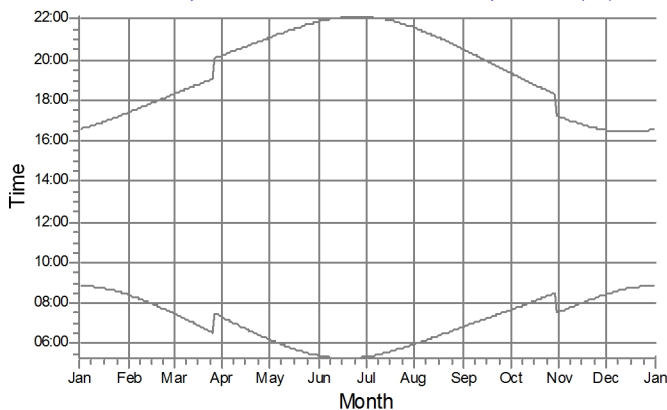
G: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (9)



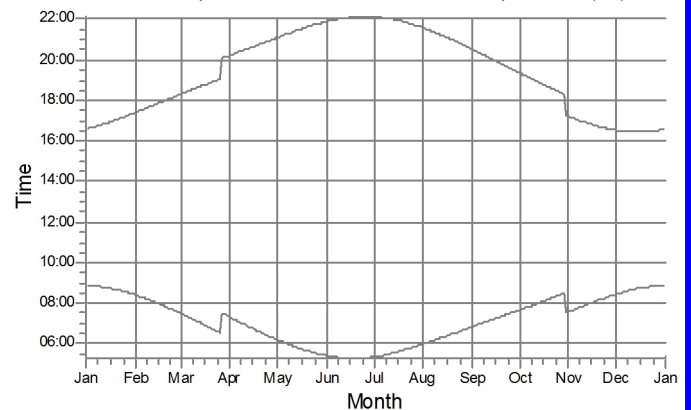
H: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (10)



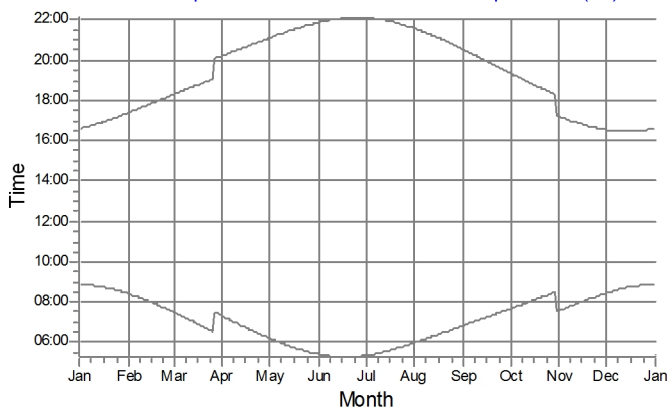
I: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (11)



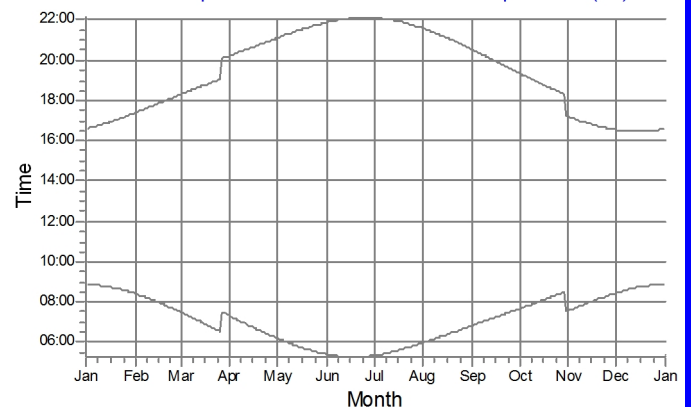
J: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (12)



K: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (13)



L: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (14)



WTGs

- 2: VESTAS V90 3000 90.0 !O! hub: 80.0 m (TOT: 125.0 m) (223)
- 3: VESTAS V90 3000 90.0 !O! hub: 80.0 m (TOT: 125.0 m) (224)

Project:

TATA

Description:

Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode

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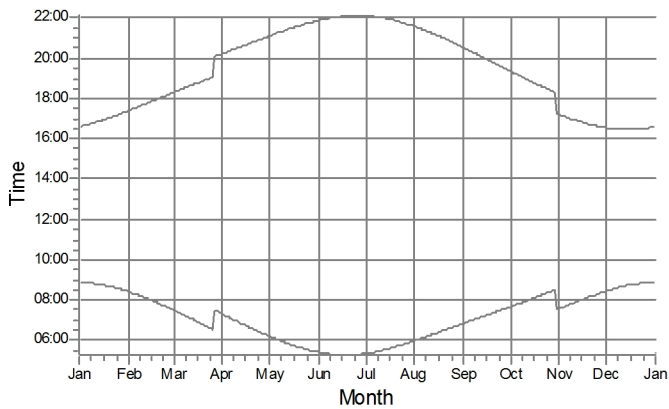
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Calculated:

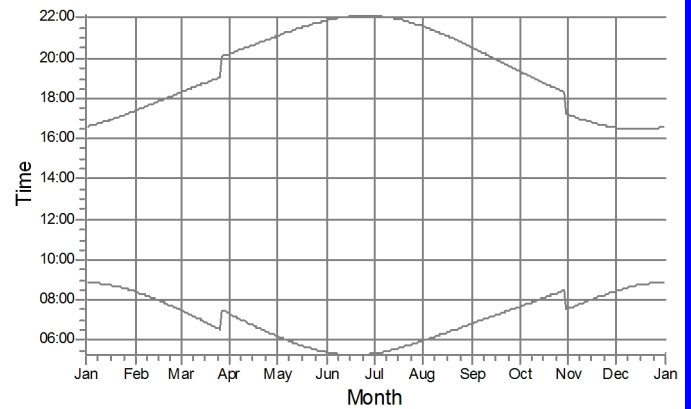
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SHADOW - Calendar, graphical**Calculation:** Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode

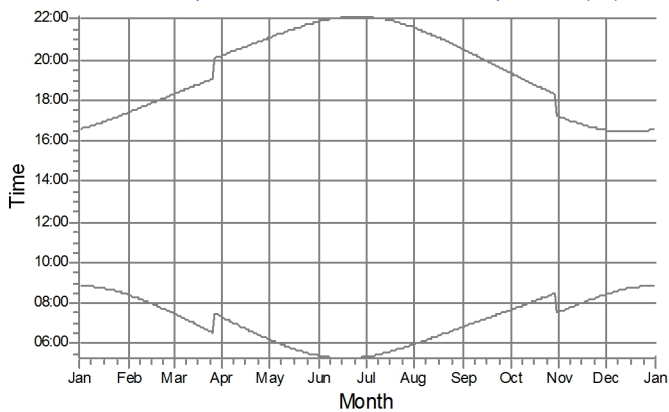
M: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (15)



N: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (16)



O: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (17)



WTGs

Project: **TATA** Description: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode

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SHADOW - Calendar per WTG

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode WTG: 1 - VESTAS V90 3000 90.0 !O! hub: 80.0 m (TOT: 125.0 m) (222)

Assumptions for shadow calculations

Reference year for calendar

2016

Sunshine probability S (Average daily sunshine hours) [DE KOOY]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1.63 2.87 3.52 5.73 7.72 6.68 6.73 6.21 4.59 3.23 1.94 1.13

Operational time

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

482 397 465 535 463 457 814 1,283 1,342 881 649 580 8,348

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:51 16:35	08:25 17:23	07:29 18:18	07:17 20:13	06:11 21:05	05:24 21:52	05:21 22:06	05:59 21:34	06:50 20:30	07:40 19:20	07:35 17:12	08:27 16:31
2	08:51 16:36	08:23 17:25	07:26 18:20	07:14 20:15	06:09 21:07	05:24 21:53	05:22 22:06	06:00 21:32	06:51 20:28	07:42 19:17	07:37 17:10	08:28 16:30
3	08:51 16:37	08:22 17:27	07:24 18:21	07:12 20:17	06:07 21:09	05:23 21:54	05:23 22:06	06:02 21:30	06:53 20:26	07:43 19:15	07:38 17:08	08:30 16:29
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5	08:51 16:40	08:18 17:31	07:20 18:25	07:07 20:20	06:03 21:12	05:21 21:57	05:24 22:05	06:05 21:27	06:56 20:21	07:47 19:10	07:42 17:05	08:33 16:28
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7	08:50 16:42	08:15 17:34	07:15 18:29	07:03 20:24	05:59 21:15	05:20 21:58	05:26 22:04	06:08 21:23	07:00 20:16	07:50 19:06	07:46 17:01	08:35 16:27
8	08:49 16:43	08:13 17:36	07:13 18:31	07:01 20:25	05:58 21:17	05:19 21:59	05:27 22:03	06:10 21:21	07:01 20:14	07:52 19:03	07:48 17:00	08:36 16:27
9	08:49 16:45	08:11 17:38	07:11 18:32	06:58 20:27	05:56 21:19	05:19 22:00	05:28 22:02	06:11 21:19	07:03 20:12	07:54 19:01	07:50 16:58	08:38 16:27
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12	08:47 16:49	08:06 17:44	07:04 18:38	06:51 20:32	05:51 21:24	05:18 22:02	05:31 22:00	06:16 21:13	07:08 20:05	07:59 18:54	07:55 16:53	08:41 16:26
13	08:47 16:50	08:04 17:46	07:01 18:40	06:49 20:34	05:49 21:25	05:17 22:03	05:32 21:59	06:18 21:11	07:10 20:02	08:01 18:52	07:57 16:51	08:42 16:26
14	08:46 16:52	08:02 17:48	06:59 18:41	06:47 20:36	05:47 21:27	05:17 22:04	05:33 21:58	06:20 21:09	07:11 20:00	08:02 18:50	07:59 16:50	08:43 16:26
15	08:45 16:53	08:00 17:50	06:57 18:43	06:45 20:38	05:46 21:28	05:17 22:04	05:35 21:57	06:21 21:07	07:13 19:57	08:04 18:47	08:00 16:49	08:44 16:26
16	08:44 16:55	07:58 17:52	06:54 18:45	06:42 20:39	05:44 21:30	05:17 22:05	05:36 21:56	06:23 21:05	07:15 19:55	08:06 18:45	08:02 16:47	08:45 16:26
17	08:43 16:57	07:56 17:54	06:52 18:47	06:40 20:41	05:43 21:32	05:17 22:05	05:37 21:55	06:25 21:03	07:16 19:53	08:08 18:43	08:04 16:46	08:45 16:26
18	08:43 16:58	07:54 17:55	06:50 18:48	06:38 20:43	05:41 21:33	05:17 22:06	05:38 21:54	06:26 21:01	07:18 19:50	08:09 18:41	08:06 16:44	08:46 16:27
19	08:42 17:00	07:52 17:57	06:47 18:50	06:36 20:44	05:40 21:35	05:17 22:06	05:40 21:52	06:28 20:59	07:20 19:48	08:11 18:39	08:07 16:43	08:47 16:27
20	08:41 17:02	07:50 17:59	06:45 18:52	06:34 20:46	05:38 21:36	05:17 22:06	05:41 21:51	06:30 20:57	07:21 19:46	08:13 18:37	08:09 16:42	08:48 16:27
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22	08:38 17:05	07:46 18:03	06:40 18:56	06:29 20:50	05:36 21:39	05:17 22:07	05:44 21:49	06:33 20:53	07:25 19:41	08:17 18:32	08:13 16:39	08:49 16:28
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25	08:35 17:10	07:40 18:09	06:33 19:01	06:23 20:55	05:32 21:43	05:18 22:07	05:48 21:44	06:38 20:46	07:30 19:34	08:22 18:26	08:18 16:36	08:50 16:30
26	08:33 17:12	07:37 18:10	06:31 19:03	06:21 20:57	05:31 21:45	05:18 22:07	05:50 21:43	06:40 20:44	07:31 19:31	08:24 18:24	08:19 16:35	08:50 16:31
27	08:32 17:14	07:35 18:12	06:29 20:04	06:19 20:58	05:29 21:46	05:19 22:07	05:51 21:42	06:41 20:42	07:33 19:29	08:26 18:22	08:21 16:34	08:51 16:31
28	08:31 17:16	07:33 18:14	06:26 20:06	06:17 21:00	05:28 21:47	05:19 22:07	05:52 21:40	06:43 20:39	07:35 19:27	08:27 18:20	08:22 16:33	08:51 16:32
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31	08:26 17:21		07:19 20:11		05:25 21:51		05:57 21:35	06:48 20:32		07:33 17:14		08:51 16:35
Potential sun hours	255	285	367	417	488	502	505	455	381	331	264	241
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: **TATA** Description: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode

Printed/Page
03/05/2016 14:49 / 22

Licensed user:
Infinergy Limited Ltd
16, West Borough
GB-WIMBORNE BH21 1XB
+44 1202 847680
Stephen Sheldon / s.sheldon@infinergy.co.uk
Calculated:
03/05/2016 14:49/2.9.285

SHADOW - Calendar per WTG

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode WTG: 2 - VESTAS V90 3000 90.0 !O! hub: 80.0 m (TOT: 125.0 m) (223)

Assumptions for shadow calculations

Reference year for calendar

2016

Sunshine probability S (Average daily sunshine hours) [DE KOOY]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1.63 2.87 3.52 5.73 7.72 6.68 6.73 6.21 4.59 3.23 1.94 1.13

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
482 397 465 535 463 457 814 1,283 1,342 881 649 580 8,348
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:51 15:54-16:02/8 16:35 08:51 15:55-16:03/8 16:36	08:25 17:23 08:23 17:25	07:29 18:18 07:26 18:20	07:17 20:13 07:14 20:15	06:11 21:05 06:09 21:07	05:24 21:52 05:24 21:53	05:21 22:06 05:22 22:06	05:59 21:34 06:00 21:32	06:50 20:30 06:51 20:28	07:40 19:20 07:41 19:17	07:35 17:12 07:37 17:10	
3	08:51 15:54-16:04/10 16:37	08:22 17:27 08:20 17:29	07:24 18:21 07:22 18:23	07:12 20:17 07:10 20:18	06:07 21:09 06:05 21:10	05:23 21:54 05:22 21:56	05:23 22:06 05:23 22:05	06:02 21:30 06:03 21:28	06:53 20:26 06:55 20:23	07:43 19:15 07:45 19:13	07:38 17:08 07:40 17:07	
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Potential sun hours	255	285	367	417	488	502	505	455	381	331	264	241
Sum of minutes with flicker	157	0	0	0	0	0	0	0	0	0	21	249

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:	Description:	Printed/Page
TATA	Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode	03/05/2016 14:49 / 23
		Licensed user:
		Infinergy Limited Ltd
		16, West Borough
		GB-WIMBORNE BH21 1XB
		+44 1202 847680
		Stephen Sheldon / s.sheldon@infinergy.co.uk
		Calculated:
		03/05/2016 14:49/2.9.285

SHADOW - Calendar per WTG

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode WTG: 3 - VESTAS V90 3000 90.0 !O! hub: 80.0 m (TOT: 125.0 m) (224)

Assumptions for shadow calculations

Reference year for calendar

2016

Sunshine probability S (Average daily sunshine hours) [DE KOOY]

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1.63 2.87 3.52 5.73 7.72 6.68 6.73 6.21 4.59 3.23 1.94 1.13

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
482 397 465 535 463 457 814 1,283 1,342 881 649 580 8,348
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:51 16:35	08:25 17:23	16:34-16:45/11	07:29 18:18	07:17 20:13	06:11 21:05	05:24 21:52	05:21 22:06	05:59 21:34	06:50 20:30	07:35 19:20	08:27 17:12
2	08:51 16:36	08:23 17:25	16:36-16:43/7	07:26 18:20	07:14 20:15	06:09 21:07	05:23 21:53	05:22 22:06	06:00 21:32	06:51 20:28	07:41 19:17	08:28 17:10
3	08:51 16:37	08:22 17:27		07:24 18:21	07:12 20:17	06:07 21:09	05:23 21:54	05:23 22:06	06:02 21:30	06:53 20:26	07:43 19:15	08:30 17:08
4	08:51 16:38	08:20 17:29		07:22 18:23	07:10 20:18	06:05 21:10	05:22 21:55	05:23 22:05	06:03 21:28	06:55 20:23	07:45 19:12	08:31 17:07
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18	08:43 16:58	07:54 17:55		06:50 18:48	06:38 20:43	05:41 21:33	05:17 22:06	05:38 21:54	06:26 21:01	07:18 19:50	08:09 18:41	16:03-16:14/11
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20	08:40 17:02	16:30-16:31/1	07:50 17:59	06:45 18:52	06:34 20:46	05:38 21:36	05:17 22:06	05:41 21:51	06:30 20:57	07:21 19:46	08:13 18:36	16:04-16:12/8
21	08:39 17:03	16:29-16:32/3	07:48 18:01	06:43 18:54	06:31 20:48	05:37 21:38	05:17 22:07	05:42 21:50	06:31 20:55	07:23 19:43	08:15 18:34	16:05-16:10/5
22	08:38 17:05	16:29-16:34/5	07:46 18:03	06:40 18:56	06:29 20:50	05:35 21:39	05:17 22:07	05:44 21:49	06:33 20:53	07:25 19:41	08:17 18:32	16:05-16:08/3
23	08:37 17:07	16:29-16:37/8	07:44 18:05	06:38 18:57	06:27 20:51	05:34 21:41	05:17 22:07	05:45 21:47	06:35 20:50	07:26 19:38	08:18 18:30	16:06-16:07/1
24	08:36 17:08	16:29-16:38/9	07:42 18:07	06:36 18:59	06:25 20:53	05:33 21:42	05:18 22:07	05:47 21:46	06:36 20:48	07:28 19:36	08:20 18:28	16:06-16:08/1
25	08:35 17:10	16:29-16:40/11	07:40 18:08	06:33 19:01	06:23 20:55	05:32 21:43	05:18 22:07	05:48 21:44	06:38 20:46	07:30 19:34	08:22 18:26	16:07-16:08/1
26	08:33 17:12	16:29-16:42/13	07:37 18:10	06:31 19:03	06:21 20:57	05:30 21:45	05:18 22:07	05:49 21:43	06:40 20:44	07:31 19:31	08:24 18:24	16:08-16:09/1
27	08:32 17:14	16:30-16:44/14	07:35 18:12	07:28 20:04	06:19 20:58	05:29 21:46	05:19 22:07	05:51 21:42	06:41 20:42	07:33 19:29	08:26 18:22	16:09-16:10/1
28	08:31 17:16	16:30-16:46/16	07:33 18:14	07:26 20:06	06:17 21:00	05:28 21:47	05:19 22:07	05:52 21:40	06:43 20:39	07:35 19:27	08:27 18:20	16:10-16:11/1
29	08:29 17:18	16:31-16:47/16	07:31 18:16	07:24 20:08	06:15 21:02	05:27 21:49	05:20 22:07	05:54 21:38	06:45 20:37	07:36 19:24	08:29 18:18	16:11-16:12/1
30	08:28 17:19	16:31-16:47/16		07:21 20:10	06:13 21:04	05:26 21:50	05:20 22:07	05:55 21:37	06:46 20:35	07:38 19:22	07:31 17:16	16:12-16:13/1
31	08:26 17:21	16:32-16:46/14		07:19 20:11		05:25 21:51		05:57 21:35	06:48 20:32		07:33 17:14	16:13-16:14/1
Potential sun hours	255	285	367	417	488	502	505	455	381	331	264	241
Sum of minutes with flicker	126	18	0	0	0	0	0	0	0	0	148	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

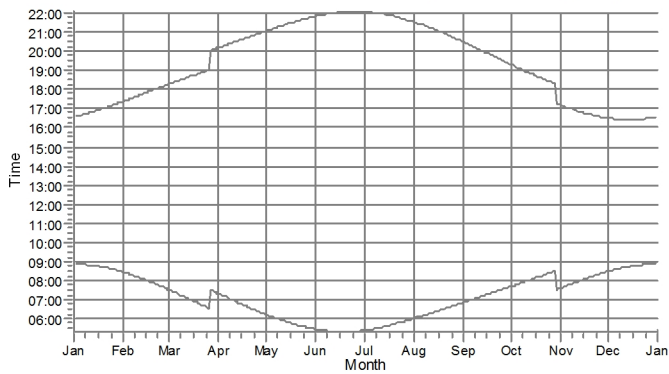
Project: TATA
 Description: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode

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 Calculated:
 03/05/2016 14:49/2.9.285

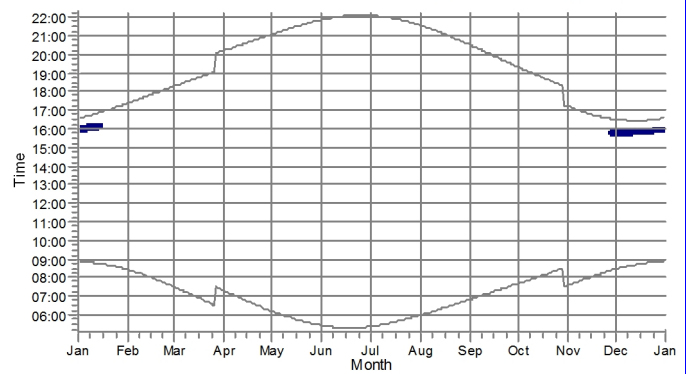
SHADOW - Calendar per WTG, graphical

Calculation: Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode

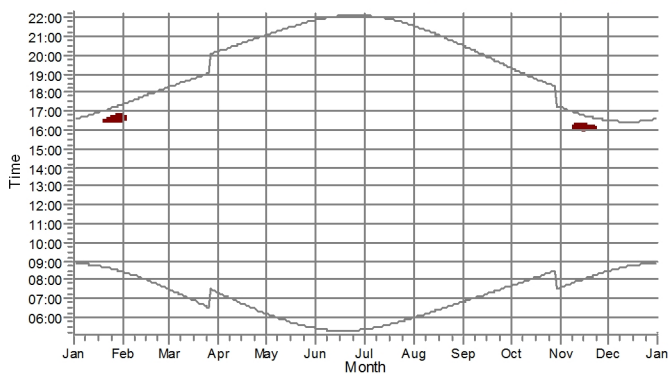
1: VESTAS V90 3000 90.0 ! hub: 80.0 m (TOT: 125.0 m) (222)



2: VESTAS V90 3000 90.0 ! hub: 80.0 m (TOT: 125.0 m) (223)



3: VESTAS V90 3000 90.0 ! hub: 80.0 m (TOT: 125.0 m) (224)



Shadow receptors



G: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (9)



H: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 90.0° (10)

Project:

TATA

Description:

Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode

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03/05/2016 14:49/2.9.285

SHADOW - Map**Calculation:** Shadow Flicker Layout 9 WTG 3,4,5 Real Case 125m Tip - Greenhouse Mode

New WTG

Shadow receptor