

Appendix 10-1 - WindPRO Shadow Flicker Modeling Report

SHADOW - Main Result

Calculation: 11303_15 wtgs_185th_Worst Case

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) [KILKENNY]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1.68 2.20 3.08 4.72 5.31 4.94 4.67 4.36 3.78 2.74 2.15 1.32

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

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: 11303_Shadow Model_185m
Receptor grid resolution: 1.0 m

All coordinates are in
Irish ITM-IRENET95 (IE), geocentric, GRS80

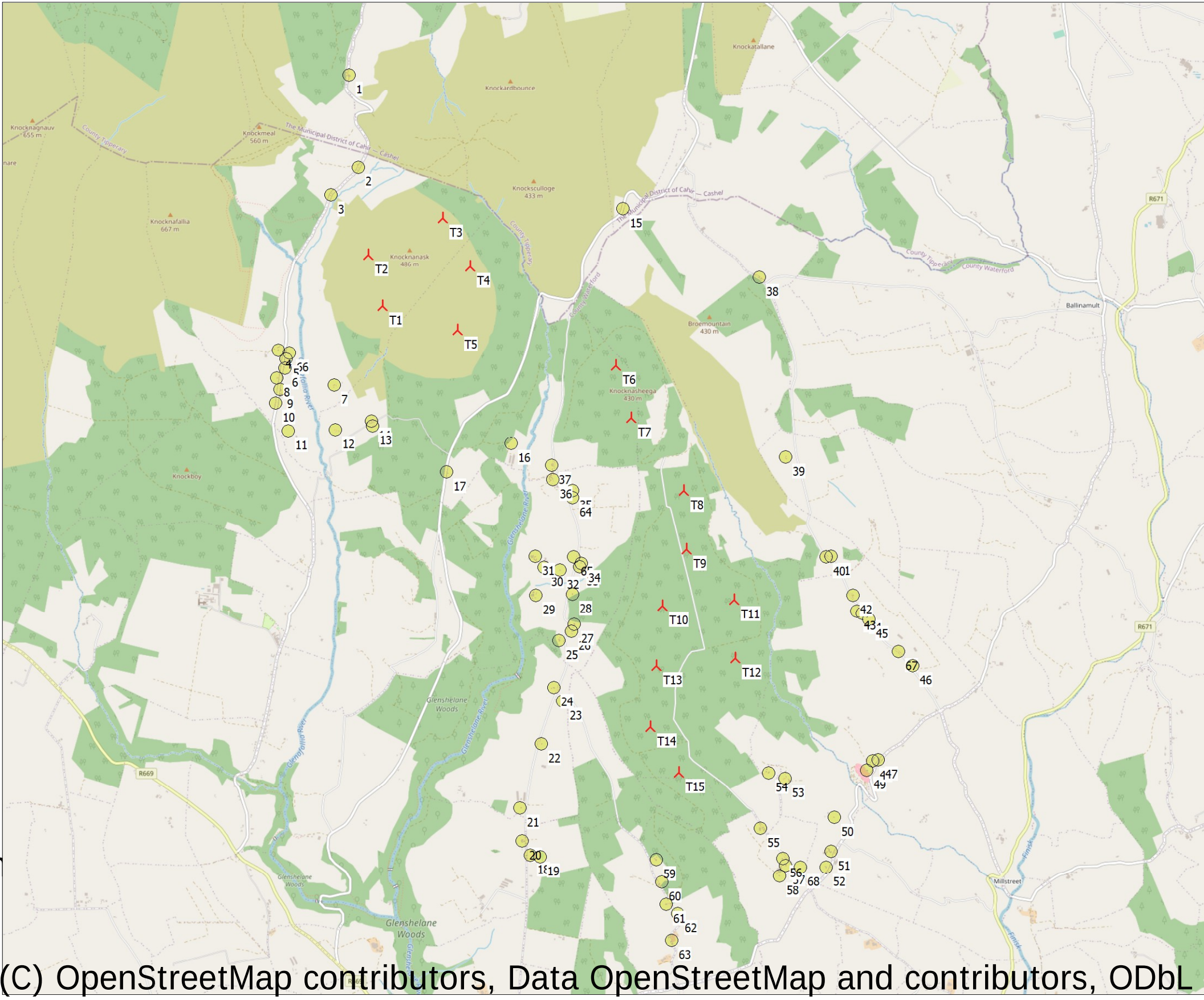
WTGs

	Easting	Northing	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]
			[m]									
T1	611,350	606,732	407.9	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T10	613,959	603,955	213.6	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T11	614,631	604,010	204.2	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T12	614,644	603,464	183.6	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T13	613,905	603,388	203.4	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T14	613,851	602,820	206.9	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T15	614,116	602,400	182.5	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T2	611,213	607,203	412.0	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T3	611,905	607,544	413.6	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T4	612,163	607,103	397.0	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T5	612,050	606,510	401.8	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T6	613,521	606,183	382.2	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T7	613,663	605,694	395.7	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T8	614,157	605,019	265.4	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T9	614,180	604,477	235.5	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7

Shadow receptor-Input

No.	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
1	611,034	608,880	284.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
2	611,116	608,017	358.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
3	610,865	607,760	326.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
4	610,377	606,320	263.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
5	610,450	606,238	244.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
6	610,438	606,153	239.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
7	610,896	605,992	237.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
8	610,367	606,058	239.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
9	610,395	605,951	231.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
10	610,354	605,821	224.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
11	610,472	605,568	207.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
12	610,909	605,577	209.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
13	611,255	605,611	245.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
14	611,246	605,659	246.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
15	613,581	607,637	298.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
16	612,547	605,452	225.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
17	611,944	605,186	235.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
18	612,734	601,625	191.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0

To be continued on next page...



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Scale 1:40,000
New WTG
Shadow receptor

SHADOW - Main Result

Calculation: 11303_15 wtgs_185th_Worst Case

...continued from previous page

No.	Easting	Northing	Z	Width	Height	Elevation	Slope of	Direction mode	Eye height
			[m]	[m]	[m]	a.g.l.	window		(ZVI) a.g.l.
						[m]	[°]		[m]
19	612,828	601,615	192.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
20	612,656	601,758	190.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
21	612,640	602,063	187.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
22	612,840	602,659	204.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
23	613,038	603,061	195.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
24	612,951	603,181	185.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
25	613,001	603,624	168.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
26	613,118	603,712	180.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
27	613,140	603,773	181.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
28	613,123	604,057	188.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
29	612,781	604,042	165.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
30	612,857	604,306	179.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
31	612,773	604,404	182.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
32	613,003	604,279	186.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
33	613,191	604,315	198.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
34	613,201	604,344	200.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
35	613,121	605,013	237.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
36	612,936	605,123	227.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
37	612,926	605,250	233.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
38	614,858	607,004	244.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
39	615,106	605,334	243.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
40	615,485	604,405	217.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
41	615,533	604,415	222.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
42	615,737	604,053	187.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
43	615,775	603,904	183.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
44	615,819	603,889	183.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
45	615,887	603,829	179.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
46	616,292	603,396	154.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
47	615,976	602,525	137.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
48	615,927	602,514	137.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
49	615,866	602,423	130.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
50	615,567	601,985	139.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
51	615,540	601,667	147.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
52	615,494	601,519	150.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
53	615,109	602,345	167.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
54	614,957	602,397	174.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
55	614,884	601,882	164.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
56	615,087	601,600	158.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
57	615,117	601,539	157.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
58	615,062	601,437	155.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
59	613,909	601,587	182.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
60	613,964	601,383	178.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
61	614,005	601,171	171.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
62	614,109	601,081	165.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
63	614,059	600,840	156.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
64	613,121	604,950	232.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
65	613,134	604,399	198.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
66	610,479	606,289	244.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
67	616,164	603,533	162.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
68	615,252	601,522	154.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0

Calculation Results

Shadow receptor

Shadow, worst case				Shadow, expected values	
No.	Shadow hours	Shadow days	Max shadow	Shadow hours	
	per year	per year	hours per day	per year	
	[h/year]	[days/year]	[h/day]	[h/year]	
1	20:55	56	0:26	3:52	
2	74:49	149	0:41	16:10	
3	128:35	185	1:06	29:14	
4	42:46	97	0:37	12:57	
5	10:39	34	0:24	3:23	
6	11:11	37	0:23	3:33	
7	26:30	60	0:32	7:53	

To be continued on next page...

SHADOW - Main Result

Calculation: 11303_15 wtgs_185th_Worst Case

...continued from previous page

No.	Shadow, worst case		Shadow, expected values	
	Shadow hours	Shadow days	Max shadow	Shadow hours
	per year [h/year]	per year [days/year]	hours per day [h/day]	per year [h/year]
8	10:48	37	0:22	3:25
9	12:43	44	0:22	4:00
10	0:00	0	0:00	0:00
11	0:00	0	0:00	0:00
12	0:00	0	0:00	0:00
13	0:00	0	0:00	0:00
14	0:00	0	0:00	0:00
15	18:39	60	0:25	5:05
16	36:12	96	0:34	10:58
17	0:00	0	0:00	0:00
18	14:13	61	0:23	4:21
19	21:12	70	0:25	6:20
20	8:49	39	0:22	2:46
21	31:31	96	0:29	9:32
22	45:53	138	0:38	13:50
23	94:07	209	0:44	27:00
24	68:52	178	0:40	19:10
25	126:48	266	0:55	33:33
26	134:41	263	0:48	35:31
27	131:10	264	0:46	34:46
28	112:44	243	1:00	31:02
29	69:49	185	0:32	17:36
30	77:56	207	0:33	21:24
31	65:13	202	0:30	17:53
32	92:25	223	0:47	23:54
33	99:21	202	0:47	24:56
34	93:15	197	0:45	23:32
35	47:36	124	0:36	12:14
36	40:41	120	0:31	9:31
37	25:20	86	0:30	6:25
38	0:00	0	0:00	0:00
39	59:52	176	0:37	15:22
40	84:47	219	0:45	21:51
41	71:39	201	0:41	18:27
42	41:50	122	0:34	11:51
43	42:10	125	0:33	12:28
44	38:54	119	0:32	11:33
45	25:58	78	0:30	7:35
46	17:14	68	0:23	5:25
47	6:57	36	0:16	2:02
48	1:53	21	0:07	0:33
49	7:13	28	0:22	2:07
50	12:39	41	0:26	4:01
51	20:26	73	0:25	6:15
52	17:56	57	0:25	5:19
53	43:32	106	0:38	13:43
54	60:34	127	0:45	18:52
55	21:25	51	0:34	6:20
56	0:00	0	0:00	0:00
57	0:00	0	0:00	0:00
58	0:00	0	0:00	0:00
59	0:00	0	0:00	0:00
60	0:00	0	0:00	0:00
61	0:00	0	0:00	0:00
62	0:00	0	0:00	0:00
63	0:00	0	0:00	0:00
64	62:25	164	0:36	15:36
65	102:06	237	0:41	26:28
66	10:57	35	0:24	3:29
67	19:16	68	0:25	5:50
68	0:07	7	0:01	0:02

SHADOW - Main Result

Calculation: 11303_15 wtgs_185th_Worst Case

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

No.	Name	Worst case [h/year]	Expected [h/year]
	T1 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (2)	56:50	14:14
	T10 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (15)	209:57	57:43
	T11 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (11)	123:54	36:00
	T12 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (13)	115:43	29:10
	T13 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (10)	244:28	63:10
	T14 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (12)	196:36	50:18
	T15 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (14)	178:39	50:43
	T2 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (3)	103:22	21:57
	T3 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (5)	79:13	19:13
	T4 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (4)	42:32	10:01
	T5 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (1)	67:45	20:58
	T6 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (8)	0:00	0:00
	T7 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (7)	43:36	13:46
	T8 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (6)	162:13	47:46
	T9 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (9)	185:51	53:55

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.

The calculation of the total expected values for a given receptor assumes a weighted average directional reduction for all WTGs contributing to shadow flicker within the same day. In the case where shadow flicker from different WTGs is not concurrent within the day, the total expected time at a given receptor may deviate marginally from the individual flicker time caused by each turbine separately.

SHADOW - Main Result

Calculation: 11303_15 wtgs_185th_Worst Case_Cumulative
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

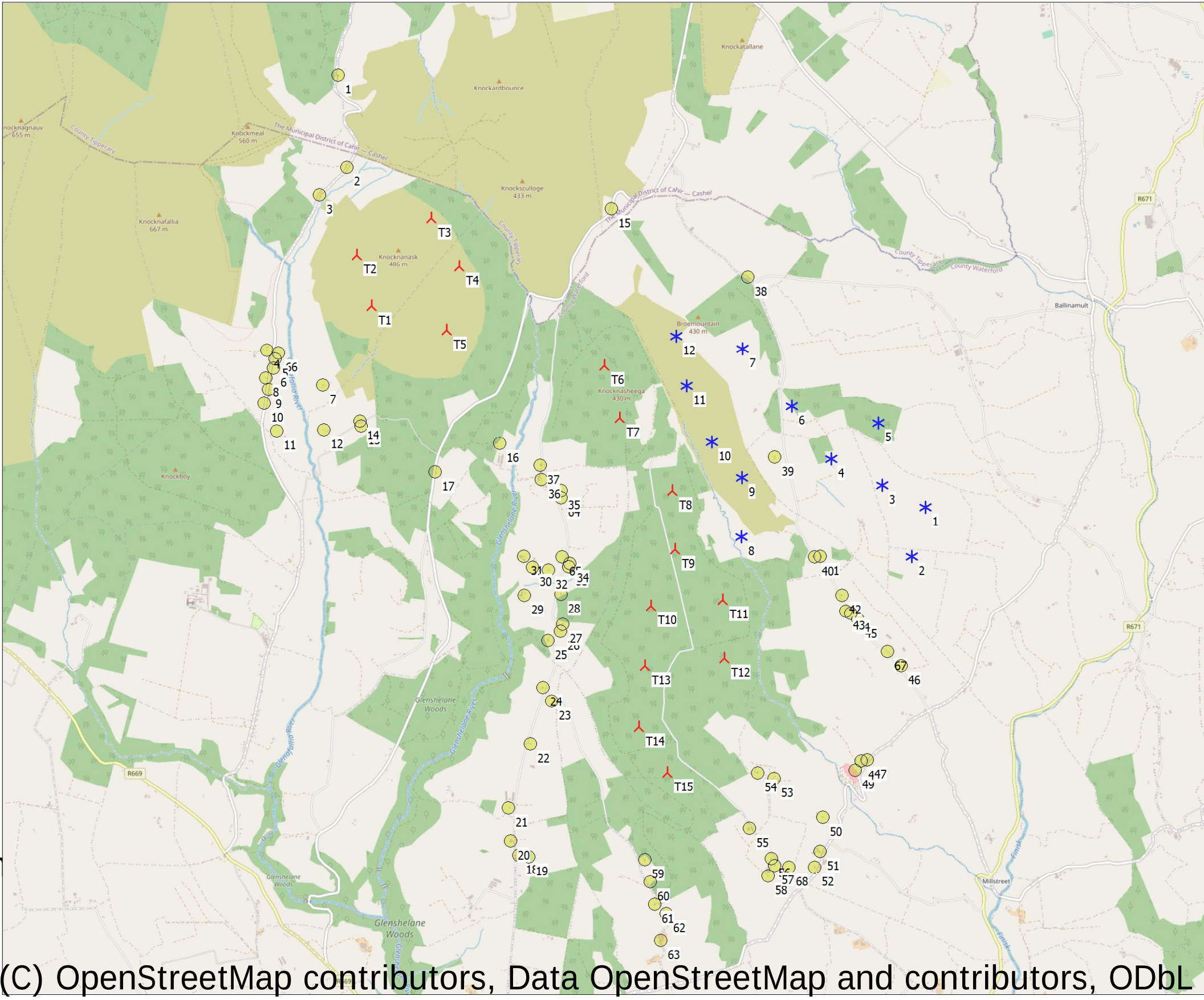
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [KILKENNY]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1.68 2.20 3.08 4.72 5.31 4.94 4.67 4.36 3.78 2.74 2.15 1.32

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

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: 11303_Shadow Model_185m
Receptor grid resolution: 1.0 m

All coordinates are in
Irish ITM-IRENET95 (IE), geocentric, GRS80



Scale 1:40,000
New WTG Existing WTG Shadow receptor

WTGs

	Easting	Northing	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]
1	616,513	604,876	164.2	VESTAS V162-7.2 7200 162.0 !O! hub:... Yes	VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5	
10	614,522	605,476	277.5	VESTAS V162-7.2 7200 162.0 !O! hub:... Yes	VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5	
11	614,284	605,998	340.8	VESTAS V162-7.2 7200 162.0 !O! hub:... Yes	VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5	
12	614,188	606,460	411.3	VESTAS V162-7.2 7200 162.0 !O! hub:... Yes	VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5	
2	616,391	604,419	164.0	VESTAS V162-7.2 7200 162.0 !O! hub:... Yes	VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5	
3	616,112	605,076	177.9	VESTAS V162-7.2 7200 162.0 !O! hub:... Yes	VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5	
4	615,638	605,321	203.2	VESTAS V162-7.2 7200 162.0 !O! hub:... Yes	VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5	
5	616,077	605,659	177.8	VESTAS V162-7.2 7200 162.0 !O! hub:... Yes	VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5	
6	615,263	605,811	244.0	VESTAS V162-7.2 7200 162.0 !O! hub:... Yes	VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5	
7	614,802	606,341	353.5	VESTAS V162-7.2 7200 162.0 !O! hub:... Yes	VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5	
8	614,800	604,594	213.6	VESTAS V162-7.2 7200 162.0 !O! hub:... Yes	VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5	
9	614,805	605,146	253.5	VESTAS V162-7.2 7200 162.0 !O! hub:... Yes	VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5	
T1	611,350	606,732	407.9	NORDEX N163/6.X 6800 163.0 !O! hub...Yes	NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7	
T10	613,959	603,955	213.6	NORDEX N163/6.X 6800 163.0 !O! hub...Yes	NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7	
T11	614,631	604,010	204.2	NORDEX N163/6.X 6800 163.0 !O! hub...Yes	NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7	
T12	614,644	603,464	183.6	NORDEX N163/6.X 6800 163.0 !O! hub...Yes	NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7	
T13	613,905	603,388	203.4	NORDEX N163/6.X 6800 163.0 !O! hub...Yes	NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7	
T14	613,851	602,820	206.9	NORDEX N163/6.X 6800 163.0 !O! hub...Yes	NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7	
T15	614,116	602,400	182.5	NORDEX N163/6.X 6800 163.0 !O! hub...Yes	NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7	
T2	611,213	607,203	412.0	NORDEX N163/6.X 6800 163.0 !O! hub...Yes	NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7	
T3	611,905	607,544	413.6	NORDEX N163/6.X 6800 163.0 !O! hub...Yes	NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7	
T4	612,163	607,103	397.0	NORDEX N163/6.X 6800 163.0 !O! hub...Yes	NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7	
T5	612,050	606,510	401.8	NORDEX N163/6.X 6800 163.0 !O! hub...Yes	NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7	
T6	613,521	606,183	382.2	NORDEX N163/6.X 6800 163.0 !O! hub...Yes	NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7	
T7	613,663	605,694	395.7	NORDEX N163/6.X 6800 163.0 !O! hub...Yes	NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7	
T8	614,157	605,019	265.4	NORDEX N163/6.X 6800 163.0 !O! hub...Yes	NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7	
T9	614,180	604,477	235.5	NORDEX N163/6.X 6800 163.0 !O! hub...Yes	NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7	

Shadow receptor-Input

No.	Easting	Northing	Z	Width	Height	Elevation	Slope of	Direction mode	Eye height
			a.g.l.	window					(ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
1	611,034	608,880	284.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
2	611,116	608,017	358.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
3	610,865	607,760	326.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
4	610,377	606,320	263.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
5	610,450	606,238	244.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0

To be continued on next page...

SHADOW - Main Result

Calculation: 11303_15 wtgs_185th_Worst Case_Cumulative

...continued from previous page

No.	Easting	Northing	Z	Width	Height	Elevation	Slope of	Direction mode	Eye height
						a.g.l.	window		(ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
6	610,438	606,153	239.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
7	610,896	605,992	237.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
8	610,367	606,058	239.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
9	610,395	605,951	231.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
10	610,354	605,821	224.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
11	610,472	605,568	207.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
12	610,909	605,577	209.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
13	611,255	605,611	245.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
14	611,246	605,659	246.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
15	613,581	607,637	298.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
16	612,547	605,452	225.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
17	611,944	605,186	235.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
18	612,734	601,625	191.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
19	612,828	601,615	192.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
20	612,656	601,758	190.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
21	612,640	602,063	187.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
22	612,840	602,659	204.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
23	613,038	603,061	195.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
24	612,951	603,181	185.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
25	613,001	603,624	168.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
26	613,118	603,712	180.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
27	613,140	603,773	181.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
28	613,123	604,057	188.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
29	612,781	604,042	165.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
30	612,857	604,306	179.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
31	612,773	604,404	182.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
32	613,003	604,279	186.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
33	613,191	604,315	198.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
34	613,201	604,344	200.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
35	613,121	605,013	237.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
36	612,936	605,123	227.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
37	612,926	605,250	233.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
38	614,858	607,004	244.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
39	615,106	605,334	243.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
40	615,485	604,405	217.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
41	615,533	604,415	222.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
42	615,737	604,053	187.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
43	615,775	603,904	183.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
44	615,819	603,889	183.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
45	615,887	603,829	179.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
46	616,292	603,396	154.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
47	615,976	602,525	137.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
48	615,927	602,514	137.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
49	615,866	602,423	130.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
50	615,567	601,985	139.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
51	615,540	601,667	147.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
52	615,494	601,519	150.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
53	615,109	602,345	167.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
54	614,957	602,397	174.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
55	614,884	601,882	164.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
56	615,087	601,600	158.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
57	615,117	601,539	157.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
58	615,062	601,437	155.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
59	613,909	601,587	182.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
60	613,964	601,383	178.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
61	614,005	601,171	171.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
62	614,109	601,081	165.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
63	614,059	600,840	156.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
64	613,121	604,950	232.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
65	613,134	604,399	198.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
66	610,479	606,289	244.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
67	616,164	603,533	162.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
68	615,252	601,522	154.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0

SHADOW - Main Result

Calculation: 11303_15 wtgs_185th_Worst Case_Cumulative

Calculation Results

Shadow, worst case				Shadow, expected values
No.	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]
1	20:55	56	0:26	3:52
2	74:49	149	0:41	16:10
3	128:35	185	1:06	29:14
4	42:46	97	0:37	12:57
5	10:39	34	0:24	3:23
6	11:11	37	0:23	3:33
7	26:30	60	0:32	7:53
8	10:48	37	0:22	3:25
9	12:43	44	0:22	4:00
10	0:00	0	0:00	0:00
11	0:00	0	0:00	0:00
12	0:00	0	0:00	0:00
13	0:00	0	0:00	0:00
14	0:00	0	0:00	0:00
15	61:04	124	0:50	13:01
16	47:36	115	0:52	14:34
17	0:00	0	0:00	0:00
18	14:13	61	0:23	4:21
19	21:12	70	0:25	6:20
20	8:49	39	0:22	2:46
21	31:31	96	0:29	9:32
22	45:53	138	0:38	13:50
23	94:07	209	0:44	27:00
24	68:52	178	0:40	19:10
25	126:48	266	0:55	33:33
26	145:28	268	0:55	38:53
27	141:22	279	0:49	37:58
28	132:46	283	1:00	37:05
29	69:49	185	0:32	17:36
30	79:12	207	0:33	21:48
31	67:08	202	0:36	18:30
32	104:07	268	0:47	27:35
33	115:36	261	0:47	29:58
34	108:48	250	0:45	28:24
35	68:45	187	0:49	18:45
36	63:11	198	0:45	16:17
37	25:20	86	0:30	6:25
38	115:53	157	0:57	25:06
39	414:23	362	2:39	116:13
40	163:24	278	1:13	46:29
41	135:48	260	1:05	38:32
42	139:55	214	1:31	41:23
43	53:45	162	0:33	15:53
44	51:17	162	0:32	15:12
45	35:12	117	0:30	10:18
46	17:14	68	0:23	5:25
47	6:57	36	0:16	2:02
48	1:53	21	0:07	0:33
49	7:13	28	0:22	2:07
50	12:39	41	0:26	4:01
51	20:26	73	0:25	6:15
52	17:56	57	0:25	5:19
53	43:32	106	0:38	13:43
54	60:34	127	0:45	18:52
55	21:25	51	0:34	6:20
56	0:00	0	0:00	0:00
57	0:00	0	0:00	0:00
58	0:00	0	0:00	0:00
59	0:00	0	0:00	0:00
60	0:00	0	0:00	0:00
61	0:00	0	0:00	0:00
62	0:00	0	0:00	0:00
63	0:00	0	0:00	0:00

To be continued on next page...

SHADOW - Main Result

Calculation: 11303_15 wtgs_185th_Worst Case_Cumulative

...continued from previous page

No.	Shadow, worst case			Shadow, expected values	
	Shadow hours	Shadow days	Max shadow	Shadow hours	
	per year [h/year]	per year [days/year]	hours per day [h/day]	per year [h/year]	
64	83:48	231	0:46	22:10	
65	115:34	279	0:45	30:43	
66	10:57	35	0:24	3:29	
67	19:16	68	0:25	5:50	
68	0:07	7	0:01	0:02	

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

No.	Name	Worst case [h/year]	Expected [h/year]
1	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (1)	1:15	0:18
10	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (10)	145:21	45:09
11	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (11)	14:57	4:38
12	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (12)	51:44	11:32
2	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (2)	79:49	23:57
3	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (3)	7:59	2:03
4	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (4)	64:25	19:37
5	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (5)	10:56	3:28
6	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (6)	0:00	0:00
7	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (7)	108:07	21:57
8	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (8)	149:47	46:18
9	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (9)	221:29	60:27
T1	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (2)	56:50	14:14
T10	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (15)	209:57	57:43
T11	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (11)	123:54	36:00
T12	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (13)	115:43	29:10
T13	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (10)	244:28	63:10
T14	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (12)	196:36	50:18
T15	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (14)	178:39	50:43
T2	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (3)	103:22	21:57
T3	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (5)	79:13	19:13
T4	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (4)	42:32	10:01
T5	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (1)	67:45	20:58
T6	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (8)	0:00	0:00
T7	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (7)	43:36	13:46
T8	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (6)	162:13	47:46
T9	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (9)	185:51	53:55

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.

The calculation of the total expected values for a given receptor assumes a weighted average directional reduction for all WTGs contributing to shadow flicker within the same day. In the case where shadow flicker from different WTGs is not concurrent within the day, the total expected time at a given receptor may deviate marginally from the individual flicker time caused by each turbine separately.

SHADOW - Main Result

Calculation: 11303_15 wtgs_185th_Real Case

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) [KILKENNY]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1.68 2.20 3.08 4.72 5.31 4.94 4.67 4.36 3.78 2.74 2.15 1.32

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

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: 11303_Shadow Model_185m
Receptor grid resolution: 1.0 m

All coordinates are in
Irish ITM-IRENET95 (IE), geocentric, GRS80

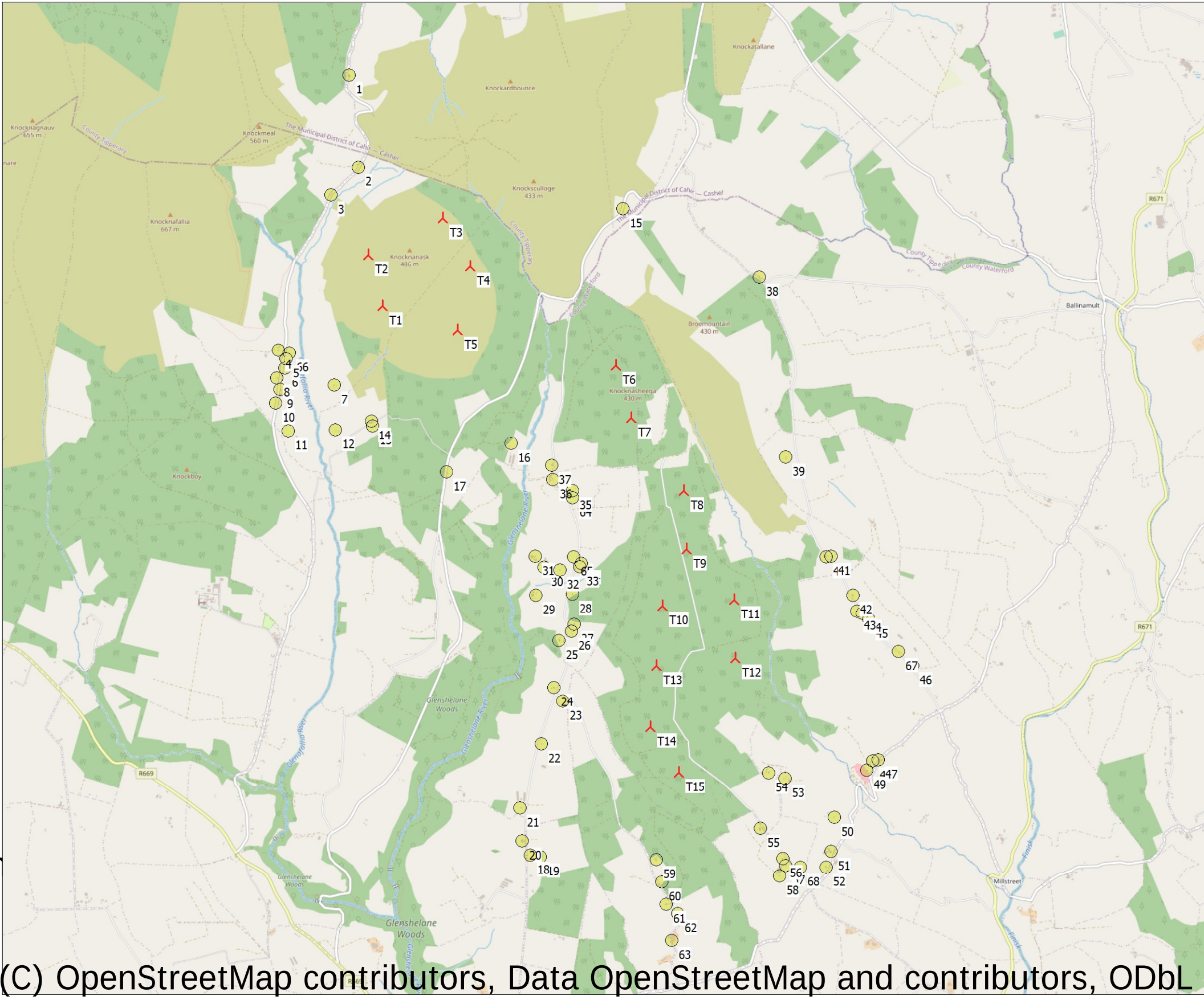
WTGs

	Easting	Northing	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]
			[m]									
T1	611,350	606,732	407.9	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T10	613,959	603,955	213.6	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T11	614,631	604,010	204.2	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T12	614,644	603,464	183.6	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T13	613,905	603,388	203.4	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T14	613,851	602,820	206.9	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T15	614,116	602,400	182.5	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T2	611,213	607,203	412.0	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T3	611,905	607,544	413.6	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T4	612,163	607,103	397.0	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T5	612,050	606,510	401.8	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T6	613,521	606,183	382.2	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T7	613,663	605,694	395.7	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T8	614,157	605,019	265.4	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T9	614,180	604,477	235.5	NORDEX N163/6.X 6800 163.0 !O! hub...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7

Shadow receptor-Input

No.	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
1	611,034	608,880	284.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
2	611,116	608,017	358.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
3	610,865	607,760	326.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
4	610,377	606,320	263.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
5	610,450	606,238	244.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
6	610,438	606,153	239.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
7	610,896	605,992	237.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
8	610,367	606,058	239.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
9	610,395	605,951	231.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
10	610,354	605,821	224.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
11	610,472	605,568	207.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
12	610,909	605,577	209.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
13	611,255	605,611	245.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
14	611,246	605,659	246.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
15	613,581	607,637	298.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
16	612,547	605,452	225.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
17	611,944	605,186	235.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
18	612,734	601,625	191.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0

To be continued on next page...



(C) OpenStreetMap contributors, Data OpenStreetMap and contributors, ODbL
Scale 1:40,000
New WTG
Shadow receptor

SHADOW - Main Result

Calculation: 11303_15 wtgs_185th_Real Case

...continued from previous page

No.	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
19	612,828	601,615	192.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
20	612,656	601,758	190.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
21	612,640	602,063	187.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
22	612,840	602,659	204.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
23	613,038	603,061	195.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
24	612,951	603,181	185.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
25	613,001	603,624	168.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
26	613,118	603,712	180.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
27	613,140	603,773	181.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
28	613,123	604,057	188.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
29	612,781	604,042	165.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
30	612,857	604,306	179.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
31	612,773	604,404	182.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
32	613,003	604,279	186.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
33	613,191	604,315	198.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
34	613,201	604,344	200.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
35	613,121	605,013	237.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
36	612,936	605,123	227.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
37	612,926	605,250	233.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
38	614,858	607,004	244.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
39	615,106	605,334	243.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
40	615,485	604,405	217.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
41	615,533	604,415	222.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
42	615,737	604,053	187.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
43	615,775	603,904	183.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
44	615,819	603,889	183.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
45	615,887	603,829	179.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
46	616,292	603,396	154.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
47	615,976	602,525	137.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
48	615,927	602,514	137.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
49	615,866	602,423	130.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
50	615,567	601,985	139.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
51	615,540	601,667	147.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
52	615,494	601,519	150.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
53	615,109	602,345	167.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
54	614,957	602,397	174.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
55	614,884	601,882	164.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
56	615,087	601,600	158.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
57	615,117	601,539	157.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
58	615,062	601,437	155.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
59	613,909	601,587	182.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
60	613,964	601,383	178.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
61	614,005	601,171	171.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
62	614,109	601,081	165.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
63	614,059	600,840	156.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
64	613,121	604,950	232.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
65	613,134	604,399	198.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
66	610,479	606,289	244.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
67	616,164	603,533	162.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
68	615,252	601,522	154.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0

Calculation Results

Shadow receptor	
Shadow, expected values	
No.	Shadow hours
	per year
	[h/year]
1	3:52
2	16:10
3	29:14
4	12:57
5	3:23
6	3:33
7	7:53

To be continued on next page...

SHADOW - Main Result

Calculation: 11303_15 wtgs_185th_Real Case

...continued from previous page
Shadow, expected values

No.	Shadow hours per year [h/year]
8	3:25
9	4:00
10	0:00
11	0:00
12	0:00
13	0:00
14	0:00
15	5:05
16	10:58
17	0:00
18	4:21
19	6:20
20	2:46
21	9:32
22	13:50
23	27:00
24	19:10
25	33:33
26	35:31
27	34:46
28	31:02
29	17:36
30	21:24
31	17:53
32	23:54
33	24:56
34	23:32
35	12:14
36	9:31
37	6:25
38	0:00
39	15:22
40	21:51
41	18:27
42	11:51
43	12:28
44	11:33
45	7:35
46	5:25
47	2:02
48	0:33
49	2:07
50	4:01
51	6:15
52	5:19
53	13:43
54	18:52
55	6:20
56	0:00
57	0:00
58	0:00
59	0:00
60	0:00
61	0:00
62	0:00
63	0:00
64	15:36
65	26:28
66	3:29
67	5:50
68	0:02

SHADOW - Main Result

Calculation: 11303_15 wtgs_185th_Real Case

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

No.	Name	Expected [h/year]
	T1 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (2)	14:14
	T10 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (15)	57:43
	T11 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (11)	36:00
	T12 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (13)	29:10
	T13 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (10)	63:10
	T14 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (12)	50:18
	T15 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (14)	50:43
	T2 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (3)	21:57
	T3 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (5)	19:13
	T4 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (4)	10:01
	T5 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (1)	20:58
	T6 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (8)	0:00
	T7 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (7)	13:46
	T8 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (6)	47:46
	T9 NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (9)	53:55

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.

The calculation of the total expected values for a given receptor assumes a weighted average directional reduction for all WTGs contributing to shadow flicker within the same day. In the case where shadow flicker from different WTGs is not concurrent within the day, the total expected time at a given receptor may deviate marginally from the individual flicker time caused by each turbine separately.

SHADOW - Main Result

Calculation: 11303_15 wtgs_185th_Real Case_Cumulative
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

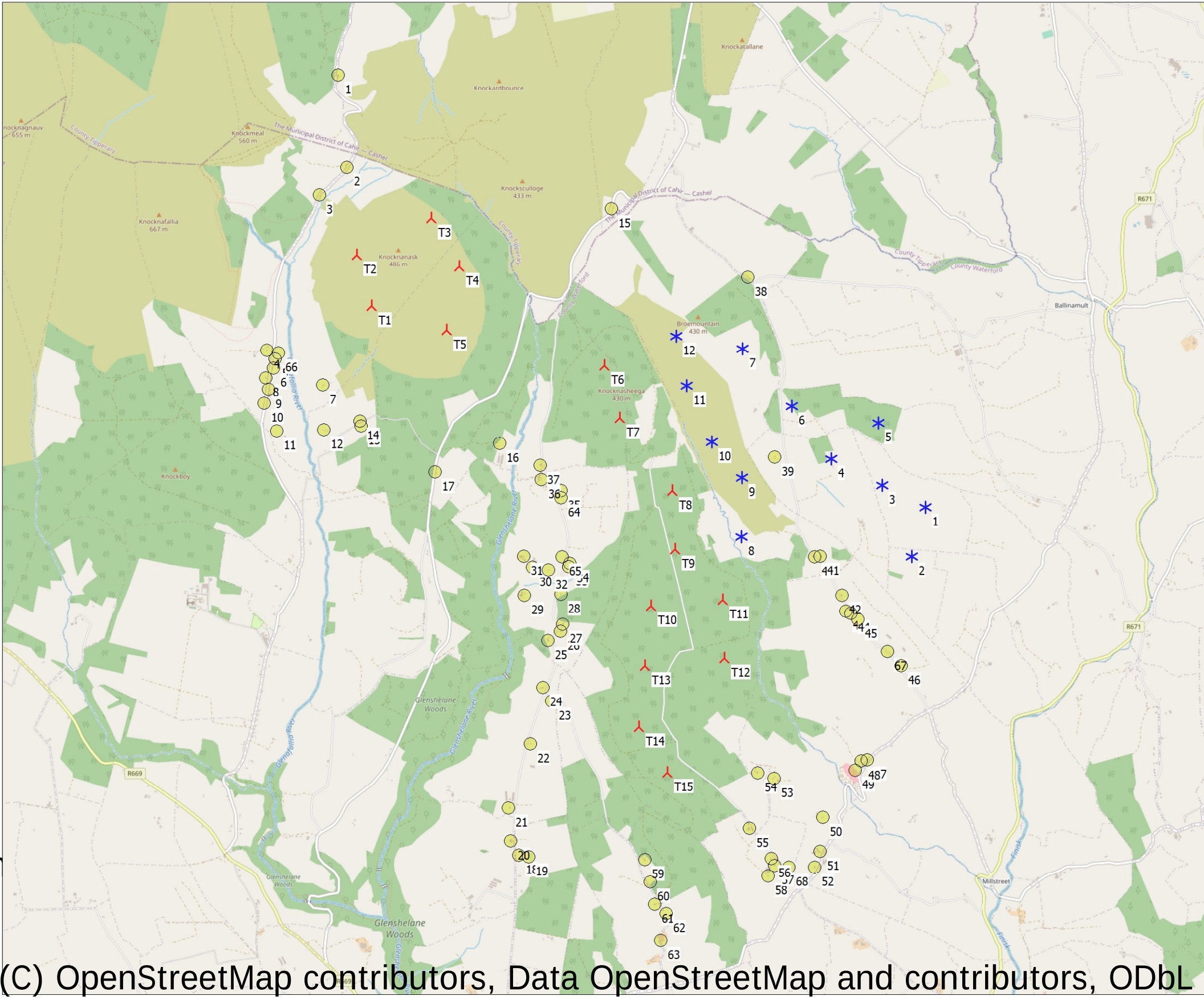
1 minutes

Sunshine probability S (Average daily sunshine hours) [KILKENNY]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1.68 2.20 3.08 4.72 5.31 4.94 4.67 4.36 3.78 2.74 2.15 1.32

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

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: 11303_Shadow Model_185m
Receptor grid resolution: 1.0 m

All coordinates are in
Irish ITM-IRENET95 (IE), geocentric, GRS80



Scale 1:40,000
New WTG Existing WTG Shadow receptor

WTGs

	Easting	Northing	Z	Row data/Description	WTG type			Shadow data				
					Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM [RPM]
			[m]									
1	616,513	604,876	164.2	VESTAS V162-7.2 7200 162.0 !O! hub:...Yes		VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5
10	614,522	605,476	277.5	VESTAS V162-7.2 7200 162.0 !O! hub:...Yes		VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5
11	614,284	605,998	340.8	VESTAS V162-7.2 7200 162.0 !O! hub:...Yes		VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5
12	614,188	606,460	411.3	VESTAS V162-7.2 7200 162.0 !O! hub:...Yes		VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5
2	616,391	604,419	164.0	VESTAS V162-7.2 7200 162.0 !O! hub:...Yes		VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5
3	616,112	605,076	177.9	VESTAS V162-7.2 7200 162.0 !O! hub:...Yes		VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5
4	615,638	605,321	203.2	VESTAS V162-7.2 7200 162.0 !O! hub:...Yes		VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5
5	616,077	605,659	177.8	VESTAS V162-7.2 7200 162.0 !O! hub:...Yes		VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5
6	615,263	605,811	244.0	VESTAS V162-7.2 7200 162.0 !O! hub:...Yes		VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5
7	614,802	606,341	353.5	VESTAS V162-7.2 7200 162.0 !O! hub:...Yes		VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5
8	614,800	604,594	213.6	VESTAS V162-7.2 7200 162.0 !O! hub:...Yes		VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5
9	614,805	605,146	253.5	VESTAS V162-7.2 7200 162.0 !O! hub:...Yes		VESTAS	V162-7.2-7,200	7,200	162.0	104.0	2,041	9.5
T1	611,350	606,732	407.9	NORDEX N163/6.X 6800 163.0 !O! hub:...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T10	613,959	603,955	213.6	NORDEX N163/6.X 6800 163.0 !O! hub:...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T11	614,631	604,010	204.2	NORDEX N163/6.X 6800 163.0 !O! hub:...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T12	614,644	603,464	183.6	NORDEX N163/6.X 6800 163.0 !O! hub:...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T13	613,905	603,388	203.4	NORDEX N163/6.X 6800 163.0 !O! hub:...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T14	613,851	602,820	206.9	NORDEX N163/6.X 6800 163.0 !O! hub:...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T15	614,116	602,400	182.5	NORDEX N163/6.X 6800 163.0 !O! hub:...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T2	611,213	607,203	412.0	NORDEX N163/6.X 6800 163.0 !O! hub:...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T3	611,905	607,544	413.6	NORDEX N163/6.X 6800 163.0 !O! hub:...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T4	612,163	607,103	397.0	NORDEX N163/6.X 6800 163.0 !O! hub:...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T5	612,050	606,510	401.8	NORDEX N163/6.X 6800 163.0 !O! hub:...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T6	613,521	606,183	382.2	NORDEX N163/6.X 6800 163.0 !O! hub:...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T7	613,663	605,694	395.7	NORDEX N163/6.X 6800 163.0 !O! hub:...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T8	614,157	605,019	265.4	NORDEX N163/6.X 6800 163.0 !O! hub:...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7
T9	614,180	604,477	235.5	NORDEX N163/6.X 6800 163.0 !O! hub:...Yes		NORDEX	N163/6.X-6,800	6,800	163.0	103.5	1,789	10.7

Shadow receptor-Input

No.	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
1	611,034	608,880	284.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
2	611,116	608,017	358.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
3	610,865	607,760	326.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
4	610,377	606,320	263.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
5	610,450	606,238	244.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0

To be continued on next page...

SHADOW - Main Result

Calculation: 11303_15 wtgs_185th_Real Case_Cumulative

...continued from previous page

No.	Easting	Northing	Z	Width	Height	Elevation	Slope of	Direction mode	Eye height
						a.g.l.	window		(ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
6	610,438	606,153	239.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
7	610,896	605,992	237.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
8	610,367	606,058	239.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
9	610,395	605,951	231.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
10	610,354	605,821	224.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
11	610,472	605,568	207.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
12	610,909	605,577	209.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
13	611,255	605,611	245.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
14	611,246	605,659	246.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
15	613,581	607,637	298.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
16	612,547	605,452	225.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
17	611,944	605,186	235.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
18	612,734	601,625	191.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
19	612,828	601,615	192.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
20	612,656	601,758	190.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
21	612,640	602,063	187.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
22	612,840	602,659	204.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
23	613,038	603,061	195.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
24	612,951	603,181	185.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
25	613,001	603,624	168.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
26	613,118	603,712	180.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
27	613,140	603,773	181.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
28	613,123	604,057	188.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
29	612,781	604,042	165.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
30	612,857	604,306	179.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
31	612,773	604,404	182.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
32	613,003	604,279	186.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
33	613,191	604,315	198.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
34	613,201	604,344	200.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
35	613,121	605,013	237.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
36	612,936	605,123	227.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
37	612,926	605,250	233.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
38	614,858	607,004	244.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
39	615,106	605,334	243.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
40	615,485	604,405	217.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
41	615,533	604,415	222.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
42	615,737	604,053	187.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
43	615,775	603,904	183.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
44	615,819	603,889	183.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
45	615,887	603,829	179.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
46	616,292	603,396	154.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
47	615,976	602,525	137.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
48	615,927	602,514	137.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
49	615,866	602,423	130.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
50	615,567	601,985	139.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
51	615,540	601,667	147.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
52	615,494	601,519	150.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
53	615,109	602,345	167.3	1.0	1.0	1.0	90.0	"Green house mode"	2.0
54	614,957	602,397	174.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
55	614,884	601,882	164.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
56	615,087	601,600	158.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
57	615,117	601,539	157.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
58	615,062	601,437	155.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
59	613,909	601,587	182.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
60	613,964	601,383	178.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
61	614,005	601,171	171.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
62	614,109	601,081	165.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
63	614,059	600,840	156.7	1.0	1.0	1.0	90.0	"Green house mode"	2.0
64	613,121	604,950	232.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
65	613,134	604,399	198.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
66	610,479	606,289	244.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
67	616,164	603,533	162.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
68	615,252	601,522	154.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0

SHADOW - Main Result

Calculation: 11303_15 wtgs_185th_Real Case_Cumulative

Calculation Results

Shadow receptor				Shadow, expected values	
No.	Shadow, worst case		Max shadow hours per day	Shadow hours	
	Shadow hours per year [h/year]	Shadow days per year [days/year]		per year [h/year]	
1	20:55	56	0:26	3:52	
2	74:49	149	0:41	16:10	
3	128:35	185	1:06	29:14	
4	42:46	97	0:37	12:57	
5	10:39	34	0:24	3:23	
6	11:11	37	0:23	3:33	
7	26:30	60	0:32	7:53	
8	10:48	37	0:22	3:25	
9	12:43	44	0:22	4:00	
10	0:00	0	0:00	0:00	
11	0:00	0	0:00	0:00	
12	0:00	0	0:00	0:00	
13	0:00	0	0:00	0:00	
14	0:00	0	0:00	0:00	
15	61:04	124	0:50	13:01	
16	47:36	115	0:52	14:34	
17	0:00	0	0:00	0:00	
18	14:13	61	0:23	4:21	
19	21:12	70	0:25	6:20	
20	8:49	39	0:22	2:46	
21	31:31	96	0:29	9:32	
22	45:53	138	0:38	13:50	
23	94:07	209	0:44	27:00	
24	68:52	178	0:40	19:10	
25	126:48	266	0:55	33:33	
26	145:28	268	0:55	38:53	
27	141:22	279	0:49	37:58	
28	132:46	283	1:00	37:05	
29	69:49	185	0:32	17:36	
30	79:12	207	0:33	21:48	
31	67:08	202	0:36	18:30	
32	104:07	268	0:47	27:35	
33	115:36	261	0:47	29:58	
34	108:48	250	0:45	28:24	
35	68:45	187	0:49	18:45	
36	63:11	198	0:45	16:17	
37	25:20	86	0:30	6:25	
38	115:53	157	0:57	25:06	
39	414:23	362	2:39	116:13	
40	163:24	278	1:13	46:29	
41	135:48	260	1:05	38:32	
42	139:55	214	1:31	41:23	
43	53:45	162	0:33	15:53	
44	51:17	162	0:32	15:12	
45	35:12	117	0:30	10:18	
46	17:14	68	0:23	5:25	
47	6:57	36	0:16	2:02	
48	1:53	21	0:07	0:33	
49	7:13	28	0:22	2:07	
50	12:39	41	0:26	4:01	
51	20:26	73	0:25	6:15	
52	17:56	57	0:25	5:19	
53	43:32	106	0:38	13:43	
54	60:34	127	0:45	18:52	
55	21:25	51	0:34	6:20	
56	0:00	0	0:00	0:00	
57	0:00	0	0:00	0:00	
58	0:00	0	0:00	0:00	
59	0:00	0	0:00	0:00	
60	0:00	0	0:00	0:00	
61	0:00	0	0:00	0:00	
62	0:00	0	0:00	0:00	
63	0:00	0	0:00	0:00	

To be continued on next page...

SHADOW - Main Result

Calculation: 11303_15 wtgs_185th_Real Case_Cumulative

...continued from previous page

No.	Shadow, worst case			Shadow, expected values	
	Shadow hours	Shadow days	Max shadow	Shadow hours	
	per year [h/year]	per year [days/year]	hours per day [h/day]	per year [h/year]	
64	83:48	231	0:46	22:10	
65	115:34	279	0:45	30:43	
66	10:57	35	0:24	3:29	
67	19:16	68	0:25	5:50	
68	0:07	7	0:01	0:02	

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

No.	Name	Worst case [h/year]	Expected [h/year]
1	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (1)	1:15	0:18
10	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (10)	145:21	45:09
11	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (11)	14:57	4:38
12	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (12)	51:44	11:32
2	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (2)	79:49	23:57
3	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (3)	7:59	2:03
4	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (4)	64:25	19:37
5	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (5)	10:56	3:28
6	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (6)	0:00	0:00
7	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (7)	108:07	21:57
8	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (8)	149:47	46:18
9	VESTAS V162-7.2 7200 162.0 !O! hub: 104.0 m (TOT: 185.0 m) (9)	221:29	60:27
T1	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (2)	56:50	14:14
T10	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (15)	209:57	57:43
T11	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (11)	123:54	36:00
T12	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (13)	115:43	29:10
T13	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (10)	244:28	63:10
T14	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (12)	196:36	50:18
T15	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (14)	178:39	50:43
T2	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (3)	103:22	21:57
T3	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (5)	79:13	19:13
T4	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (4)	42:32	10:01
T5	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (1)	67:45	20:58
T6	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (8)	0:00	0:00
T7	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (7)	43:36	13:46
T8	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (6)	162:13	47:46
T9	NORDEX N163/6.X 6800 163.0 !O! hub: 103.5 m (TOT: 185.0 m) (9)	185:51	53:55

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.

The calculation of the total expected values for a given receptor assumes a weighted average directional reduction for all WTGs contributing to shadow flicker within the same day. In the case where shadow flicker from different WTGs is not concurrent within the day, the total expected time at a given receptor may deviate marginally from the individual flicker time caused by each turbine separately.