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Calculated:
13/04/2022 10:39/3.5.552

SHADOW - Main Result

Calculation: 6276 Tullaghmore Shadow Flicker Model

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) [BELMULLET]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.36	2.16	2.65	4.82	5.79	4.41	4.42	4.07	3.73	2.48	1.71	0.89

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW
105	446	469	439	320	243	313	364	493	744	1,485	1,500

W	WNW	NW	NNW	Sum
800	526	307	206	8,760

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: OSI Height Data for Tullaghmore (6276)
Obstacles used in calculation
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 Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	503,287	746,695	113.0	T1	Yes	VESTAS	V162-6.2-6,200	6,200	162.0	104.0	2,041	0.0
2	503,309	747,273	154.3	T2	Yes	VESTAS	V162-6.2-6,200	6,200	162.0	104.0	2,041	0.0
3	502,859	747,639	232.0	T3	Yes	VESTAS	V162-6.2-6,200	6,200	162.0	104.0	2,041	0.0
4	502,074	747,424	137.5	T4	Yes	VESTAS	V162-6.2-6,200	6,200	162.0	104.0	2,041	0.0
5	502,555	747,063	139.0	T5	Yes	VESTAS	V162-6.2-6,200	6,200	162.0	104.0	2,041	0.0
6	502,698	746,581	112.6	T6	Yes	VESTAS	V162-6.2-6,200	6,200	162.0	104.0	2,041	0.0

Shadow receptor-Input

No.	Name	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]
A	H1	501,225	747,115	25.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5
B	H2	501,270	747,149	29.4	2.0	2.0	0.5	90.0	"Green house mode"	2.5
C	H3	501,323	747,107	27.6	2.0	2.0	0.5	90.0	"Green house mode"	2.5
D	H4	501,340	747,069	24.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
E	H5	501,384	747,071	28.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
F	H6	501,454	746,997	25.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
G	H7	501,588	746,771	36.4	2.0	2.0	0.5	90.0	"Green house mode"	2.5
H	H8	501,696	746,731	41.6	2.0	2.0	0.5	90.0	"Green house mode"	2.5
I	H9	501,794	746,564	47.0	2.0	2.0	0.5	90.0	"Green house mode"	2.5
J	H10	502,281	745,862	55.5	2.0	2.0	0.5	90.0	"Green house mode"	2.5
K	H11	502,330	745,853	56.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
L	H12	502,357	745,782	56.4	2.0	2.0	0.5	90.0	"Green house mode"	2.5
M	H13	501,955	746,273	47.0	2.0	2.0	0.5	90.0	"Green house mode"	2.5
N	H14	501,860	745,408	57.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5
O	H15	502,010	745,481	45.2	2.0	2.0	0.5	90.0	"Green house mode"	2.5
P	H16	502,186	745,220	46.2	2.0	2.0	0.5	90.0	"Green house mode"	2.5
Q	H17	502,485	744,803	45.0	2.0	2.0	0.5	90.0	"Green house mode"	2.5
R	H18	502,504	744,746	43.5	2.0	2.0	0.5	90.0	"Green house mode"	2.5
S	H19	503,214	748,889	38.9	2.0	2.0	0.5	90.0	"Green house mode"	2.5
T	H20	503,262	748,926	44.7	2.0	2.0	0.5	90.0	"Green house mode"	2.5
U	H21	503,280	749,009	37.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5

To be continued on next page...

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SHADOW - Main Result

Calculation: 6276 Tullaghmore Shadow Flicker Model

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No.	Name	Easting	Northing	Z [m]	Width [m]	Height [m]	Elevation a.g.l. [m]	Slope of window [°]	Direction mode	Eye height (ZVI) a.g.l. [m]
V	H22	503,257	748,989	36.2	2.0	2.0	0.5	90.0	"Green house mode"	2.5
W	H23	503,343	749,202	28.2	2.0	2.0	0.5	90.0	"Green house mode"	2.5
X	H24	502,442	749,450	37.5	2.0	2.0	0.5	90.0	"Green house mode"	2.5
Y	H25	502,176	749,349	28.2	2.0	2.0	0.5	90.0	"Green house mode"	2.5
Z	H26	502,054	749,272	25.2	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AA	H27	501,642	749,331	59.4	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AB	H28	501,979	745,485	46.0	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AC	H29	503,411	749,483	13.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AD	H30	502,215	749,413	34.5	2.0	2.0	0.5	90.0	"Green house mode"	2.5

Calculation Results

Shadow receptor

		Shadow, worst case			Shadow, expected values
No.	Name	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	H1	77:42	160	0:44	15:24
B	H2	84:23	163	0:47	16:38
C	H3	83:25	172	0:49	16:02
D	H4	72:16	165	0:50	13:49
E	H5	71:56	165	0:52	13:38
F	H6	67:34	149	0:53	12:37
G	H7	84:17	158	0:54	16:58
H	H8	91:53	153	0:59	18:31
I	H9	63:44	136	0:56	13:33
J	H10	0:00	0	0:00	0:00
K	H11	0:00	0	0:00	0:00
L	H12	0:00	0	0:00	0:00
M	H13	72:57	114	0:50	15:44
N	H14	0:00	0	0:00	0:00
O	H15	0:00	0	0:00	0:00
P	H16	0:00	0	0:00	0:00
Q	H17	0:00	0	0:00	0:00
R	H18	0:00	0	0:00	0:00
S	H19	31:00	68	0:31	3:12
T	H20	27:44	64	0:30	2:50
U	H21	23:31	58	0:28	2:19
V	H22	24:45	60	0:29	2:27
W	H23	13:26	42	0:23	1:13
X	H24	0:00	0	0:00	0:00
Y	H25	12:41	44	0:21	0:53
Z	H26	19:15	58	0:23	1:25
AA	H27	0:00	0	0:00	0:00
AB	H28	0:00	0	0:00	0:00
AC	H29	1:01	11	0:07	0:05
AD	H30	6:53	30	0:17	0:28

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

No.	Name	Worst case [h/year]	Expected [h/year]
1	T1	51:12	10:20
2	T2	56:24	12:29
3	T3	117:34	16:34
4	T4	65:34	13:55
5	T5	112:28	23:54
6	T6	135:55	26:10

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.