



Energy for
generations

Derrybrien Wind Farm Project

Gort Wind Farms Ltd.

Remedial Environmental Impact Assessment Report Chapter 6 - Shadow Flicker

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Date: July 2020

Engineering and Major Projects, One Dublin Airport Central, Dublin Airport, Cloghran, Co. Dublin,
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Appendix A – Wind turbine locations

Derrybrien Wind Farm turbine locations

Ref.	Easting / Northing	Elevation mOD	Ref.	Easting / Northing	Elevation mOD
T1	557684/704808	327.0	T37	560580/705246	325.7
T2	557901/704889	341.10	T38	560595/704993	307.2
T3	557800/704576	328.9	T39	560539/705611	332.0
T4	558020/704675	341.1	T40	560748/705303	319.3
T5	558204/704769	349.7	T41	560757/705092	307.3
T6	557929/704392	337.6	T42	560802/705640	320.7
T7	558144/704464	344.4	T43	560907/705189	302.1
T8	558382/704594	352.4	T44	560998/705620	311.0
T9	558531/704652	354.7	T45	561106/705251	296.1
T10	558752/704742	359.1	T46	561123/704992	288.4
T11	558953/704823	360.6	T47	558260/705362	343.2
T12	558042/704138	334.6	T48	558399/705440	343.4
T13	558256/704224	341.6	T49	558656/ 705542	338.5
T14	558454/704350	345.9	T50	558842/705636	338.4
T15	558647/704403	347.7	T51	559063/705738	331.6
T17	559072/704565	356.4	T52	559252/705786	325.9
T18	558170/703891	327.7	T53	558438/705185	353.2
T19	558372/703970	331.3	T54	558612/705266	357.4
T20	558580/704076	335.5	T55	558776/705350	352.3
T21	558781/704180	336.96	T56	558940/705429	344.1
T22	558975/704266	336.0	T57	559207/705587	337.0
T23	559210/704338	334.3	T58	559404/705601	336.2
T24	559596/705113	351.0	T59	558523/704942	359.3
T25	559698/704847	347.0	T60	558735/705022	359.3
T26	559864/704632	330.3	T61	558917/705117	363.0
T27	559768/705282	344.5	T62	559160/705279	358.6
T28	559957/704968	335.5	T63	559363/705300	353.1
T29	560059/704734	323.0	T64	559547/70540	348.3
T30	559993/705378	341.4	T65	559780/70549	341.5
T31	560165/705075	330.5	T66	559162/704922	358.8
T32	560240/704818	315.6	T67	559353/705023	356.8
T33	560176/705455	340.8	T68	559255/704674	353.5

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Ref.	Easting / Northing	Elevation mOD	Ref.	Easting / Northing	Elevation mOD
T34	560373/705158	330.9	T69	559479/70477	347.9
T35	560412/704913	310.1	T70	559467/704441	333.5
T36	560370/705537	337.4	T71	559667/704525	333.9

Sonnagh Old Wind Farm turbine locations

Ref.	Easting / Northing	Elevation mOD
T1	556955/709071	307
T2	556850/709198	296
T3	557062/709252	298
T4	556940/709421	285
T5	557260/709306	300
T6	557538/709093	300
T7	557472/708879	320
T8	557282/708864	320
T9	557721/709095	288

Appendix B – Shadow Flicker Calculation: Main Results

Derrybrien Wind Farm Project

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Derrybrien Wind Farm Shadow Flicker Calculation Results

Project:
Derrybrien - April 2020

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Calculated:
16/04/2020 12:18/3.3.247

SHADOW - Main Result

Calculation: Derrybrien SHADOW - 16 APRIL 2020 Worst case 5x5x1 (2000m from WTGs)

Assumptions for shadow calculations

Maximum distance for influence 2,000 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes
The calculated times are "worst case" given by the following assumptions:
The sun is shining all the day, from sunrise to sunset
The rotor plane is always perpendicular to the line from the WTG to the sun
The WTG is always operating

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: Derrybrien_OSI_1620_C_1420_C.wpd
Obstacles used in calculation
Eye height for map: 1.5 m
Grid resolution: 1.0 m
Topographic shadow included in calculation

All coordinates are in
Irish ITM-IRENET95 (IE), geocentric, GR580

WTGs

	Easting	Northing	Z	Row data/Description	WTG type		Power, rated [kW]	Rotor diameter [m]	Hub height [m]	RPM
					Valid	Manufact.				
				[m]		Type-generator				
T01	557,684	704,808	330.1	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T02	557,902	704,889	341.7	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T03	557,800	704,577	336.9	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T04	558,020	704,675	346.7	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T05	558,204	704,769	351.0	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T06	557,930	704,392	341.6	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T07	558,145	704,465	347.5	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T08	558,383	704,594	353.1	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T09	558,532	704,653	356.8	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T10	558,752	704,742	360.0	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T11	558,953	704,823	360.0	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T12	558,043	704,138	337.2	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T13	558,256	704,225	340.0	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T14	558,454	704,350	347.1	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T15	558,648	704,403	350.3	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T17	559,073	704,566	351.9	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T18	558,170	703,891	329.0	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T19	558,373	703,970	332.4	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T20	558,581	704,076	336.8	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T21	558,781	704,180	337.9	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T22	558,976	704,266	335.4	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T23	559,210	704,338	334.3	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T24	559,596	705,114	350.8	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T25	559,699	704,847	346.5	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T26	559,865	704,633	329.9	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T27	559,768	705,282	345.0	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T28	559,958	704,969	335.2	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T29	560,059	704,734	322.9	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T30	559,993	705,378	340.0	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T31	560,165	705,075	330.8	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T32	560,240	704,818	315.7	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T33	560,176	705,455	340.0	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T34	560,373	705,158	330.0	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T35	560,412	704,913	310.1	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T36	560,371	705,537	338.2	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T37	560,580	705,246	324.7	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T38	560,595	704,994	307.6	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T39	560,539	705,611	330.0	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0
T40	560,749	705,303	318.0	VESTAS V52 850 52.0 !O! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	49.0 26.0

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Project:

Derrybrien - April 2020

Licensee:

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Calculated:

16/04/2020 12:18/3.3.247

SHADOW - Main Result

Calculation: Derrybrien SHADOW - 16 APRIL 2020 Worst case 5x5x1 (2000m from WTGs)

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	Easting	Northing	Z	Row data/Description	WTG type		Power, rated [kW]	Rotor diameter [m]	Hub height [m]	RPM
					Valid	Manufact.				
				[m]						
T41	560,757	705,092	307.3	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T42	560,802	705,640	320.0	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T43	560,907	705,189	303.7	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T44	560,998	705,620	312.6	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T45	561,106	705,251	299.6	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T46	561,123	704,992	288.7	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T47	558,261	705,362	342.6	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T48	558,399	705,440	342.4	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T49	558,656	705,542	340.8	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T50	558,842	705,636	335.1	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T51	559,063	705,738	330.8	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T52	559,252	705,786	325.7	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T53	558,438	705,185	353.7	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T54	558,612	705,266	360.0	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T55	558,776	705,350	353.2	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T56	558,941	705,429	345.6	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T57	559,207	705,587	337.8	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T58	559,404	705,601	336.3	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T59	558,523	704,943	360.0	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T60	558,735	705,022	360.0	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T61	558,917	705,117	360.0	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T62	559,160	705,279	360.0	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T63	559,363	705,300	354.3	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T64	559,547	705,405	348.2	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T65	559,780	705,491	340.0	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T66	559,162	704,922	360.0	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T67	559,353	705,023	358.1	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T68	559,256	704,675	352.3	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T69	559,479	704,775	349.6	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T70	559,467	704,441	334.2	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0
T71	559,667	704,525	332.3	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 7...	Yes	VESTAS	V52-850	850	52.0	26.0

Shadow receptor-Input

No.	Easting	Northing	Z	Width	Height	Elevation	Slope of	Direction mode	Eye height
				[m]	[m]	a.g.l. [m]	window [°]		(ZVI) a.g.l. [m]
R01	561,034	703,694	210.0	5.0	5.0	1.0	90.0	"Green house mode"	6.0

Calculation Results

Shadow receptor

Shadow, worst case

No.	Shadow hours per year	Shadow days per year	Max shadow hours per day
	[h/year]	[days/year]	[h/day]
R01	8:36	71	0:09

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

No.	Name	Worst case [h/year]
T01	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (150)	0:00
T02	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (151)	0:00
T03	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (152)	0:00
T04	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (153)	0:00
T05	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (154)	0:00
T06	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (155)	0:00
T07	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (156)	0:00
T08	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (157)	0:00
T09	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (158)	0:00
T10	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (159)	0:00
T11	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (160)	0:00

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Project:

Derrybrien - April 2020

Licensee:

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One Dublin Airport Central, Dublin Airport, Cloghran

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Calculated:

16/04/2020 12:18/3.3.247

SHADOW - Main Result

Calculation: Derrybrien SHADOW - 16 APRIL 2020 Worst case 5x5x1 (2000m from WTGs)

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No.	Name	Worst case [h/year]
T12	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (161)	0:00
T13	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (162)	0:00
T14	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (163)	0:00
T15	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (164)	0:00
T17	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (165)	0:00
T18	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (166)	0:00
T19	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (167)	0:00
T20	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (168)	0:00
T21	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (169)	0:00
T22	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (170)	0:00
T23	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (171)	1:03
T24	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (172)	0:00
T25	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (173)	0:00
T26	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (174)	0:00
T27	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (175)	0:00
T28	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (176)	0:00
T29	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (177)	0:00
T30	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (178)	0:00
T31	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (179)	0:00
T32	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (180)	0:00
T33	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (181)	0:00
T34	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (182)	0:00
T35	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (183)	0:00
T36	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (184)	0:00
T37	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (185)	0:00
T38	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (186)	0:00
T39	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (187)	0:00
T40	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (188)	0:00
T41	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (189)	0:00
T42	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (190)	0:00
T43	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (191)	0:00
T44	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (192)	0:00
T45	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (193)	0:00
T46	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (194)	0:00
T47	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (195)	0:00
T48	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (196)	0:00
T49	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (197)	0:00
T50	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (198)	0:00
T51	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (199)	0:00
T52	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (200)	0:00
T53	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (201)	0:00
T54	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (202)	0:00
T55	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (203)	0:00
T56	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (204)	0:00
T57	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (205)	0:00
T58	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (206)	0:00
T59	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (207)	0:00
T60	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (208)	0:00
T61	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (209)	0:00
T62	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (210)	0:00
T63	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (211)	0:00
T64	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (212)	0:00
T65	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (213)	0:00
T66	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (214)	0:00
T67	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (215)	0:00
T68	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (216)	0:00
T69	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (217)	0:00
T70	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (218)	1:49
T71	VESTAS V52 850 52.0 !OI! hub: 49.0 m (TOT: 75.0 m) (219)	5:44

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

Appendix C - Shadow Flicker Calculation: Shadow Calendar

Derrybrien Wind Farm Project

Remedial Environmental Impact Assessment Report

Derrybrien Wind Farm Shadow Flicker Calculation Results – Shadow Calendar

Project:

Derrybrien - April 2020

Licensed user:

ESB

One Dublin Airport Central, Dublin Airport, Cloghran

IE-DUBLIN K67 XF72

+353 1 703 7013

Andrew Gardner / andrew.gardner@esb.ie

Calculated:

16/04/2020 12:18/3.3.247

SHADOW - Calendar

Calculation: Derrybrien SHADOW - 16 APRIL 2020 Worst case 5x5x1 (2000m from Shadow receptor) - Shadow Receptor: 5.0 x 5.0 Azimuth: 0.0° Slope: 90.0° (538)

Assumptions for shadow calculations

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	January	February	March	April	May	June
1	08:49	08:20	07:24	07:11	06:03	20:17 (T23) 05:16
	16:28	17:18	18:12	20:08	21:02	7 20:24 (T23) 21:50
2	08:49	08:18	07:22	07:08	06:01	20:17 (T23) 05:15
	16:29	17:19	18:14	20:10	21:04	7 20:24 (T23) 21:51
3	08:49	08:17	07:20	07:06	05:59	20:17 (T23) 05:14
	16:30	17:21	18:15	20:12	21:05	6 20:23 (T23) 21:52
4	08:48	08:15	07:17	07:04	05:57	20:17 (T23) 05:13
	16:31	17:23	18:17	20:14	21:07	5 20:22 (T23) 21:54
5	08:48	08:13	07:15	07:01	05:56	05:12
	16:32	17:25	18:19	20:15	21:09	21:55
6	08:48	08:11	07:13	06:59	05:54	05:12
	16:34	17:27	18:21	20:17	21:11	21:56
7	08:47	08:10	07:10	06:57	05:52	05:11
	16:35	17:29	18:23	20:19	21:12	21:57
8	08:47	08:08	07:08	06:54	05:50	05:10
	16:36	17:31	18:25	20:21	21:14	21:57
9	08:46	08:06	07:06	06:52	05:48	05:10
	16:38	17:33	18:27	20:23	21:16	21:58
10	08:46	08:04	07:03	06:50	05:46	05:09
	16:39	17:35	18:28	20:24	21:17	21:59
11	08:45	08:02	07:01	06:47	05:44	05:09
	16:41	17:37	18:30	20:26	21:19	22:00
12	08:44	08:00	06:59	06:45	05:43	05:09
	16:42	17:39	18:32	20:28	21:21	22:01
13	08:43	07:58	06:56	06:43	05:41	20:37 (T70) 05:08
	16:44	17:41	18:34	20:30	21:22	3 20:40 (T70) 22:01
14	08:43	07:56	06:54	06:40	05:39	20:35 (T70) 05:08
	16:45	17:43	18:36	20:32	21:24	6 20:41 (T70) 22:02
15	08:42	07:54	06:52	06:38	05:38	20:35 (T70) 05:08
	16:47	17:45	18:38	20:33	21:26	7 20:42 (T70) 22:03
16	08:41	07:52	06:49	06:36	05:36	20:34 (T70) 05:08
	16:49	17:47	18:39	20:35	21:27	8 20:42 (T70) 22:03
17	08:40	07:50	06:47	06:33	05:35	20:34 (T70) 05:08
	16:50	17:49	18:41	20:37	21:29	9 20:43 (T70) 22:04
18	08:39	07:48	06:44	06:31	05:33	20:35 (T70) 05:08
	16:52	17:51	18:43	20:39	21:31	8 20:43 (T70) 22:04
19	08:38	07:46	06:42	06:29	05:31	20:35 (T70) 05:08
	16:54	17:53	18:45	20:41	21:32	7 20:42 (T70) 22:04
20	08:37	07:44	06:40	06:27	05:30	20:36 (T70) 05:08
	16:55	17:54	18:47	20:42	21:34	5 20:41 (T70) 22:05
21	08:36	07:42	06:37	06:25	05:29	20:37 (T70) 05:08
	16:57	17:56	18:49	20:44	21:35	4 20:41 (T70) 22:05
22	08:34	07:40	06:35	06:22	05:27	05:08
	16:59	17:58	18:50	20:46	21:37	22:05
23	08:33	07:37	06:32	06:20	05:26	05:08
	17:01	18:00	18:52	20:48	21:38	22:05
24	08:32	07:35	06:30	06:18	05:25	05:09
	17:02	18:02	18:54	20:49	21:40	22:05
25	08:30	07:33	06:28	06:16	05:23	05:09
	17:04	18:04	18:56	20:51	21:41	22:05
26	08:29	07:31	06:25	06:14	05:22	05:09
	17:06	18:06	18:58	20:53	21:42	22:05
27	08:28	07:29	06:23	06:12	05:21	05:10
	17:08	18:08	18:59	20:55	21:44	22:05
28	08:26	07:26	06:20	06:10	05:20	05:10
	17:10	18:10	19:01	20:57	21:45	22:05
29	08:25		07:18	06:07	05:19	05:11
	17:12		20:03	20:58	21:46	22:05
30	08:23		07:16	06:05	20:18 (T23) 05:18	05:12
	17:14		20:05	21:00	5 20:23 (T23) 21:48	22:05
31	08:22		07:13		05:17	20:58 (T71) 22:05
	17:16		20:06		21:49	2 21:00 (T71)
Potential sun hours	254	275	367	418	490	506
Total, worst case				5	84	247

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

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

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16/04/2020 13:27 / 1



Derrybrien Wind Farm Project

Remedial Environmental Impact Assessment Report

Project:
Derrybrien - April 2020

Location:
ESB
One Dublin Airport Central, Dublin Airport, Cloghran
IE-DUBLIN K67 XF72
+353 1 703 7013
Andrew Gardner / andrew.gardner@esb.ie
Calculated:
16/04/2020 12:18/3.3.247

SHADOW - Calendar

Calculation: Derrybrien SHADOW - 16 APRIL 2020 Worst case 5x5x1 (2000m from shadow receptor) - Shadow Receptor: 5.0 x 5.0 Azimuth: 0.0° Slope: 90.0° (538)

Assumptions for shadow calculations

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	July	August	September	October	November	December
1	05:12	21:00 (T71)	05:51	06:43	07:35	08:24
	22:05	9 21:09 (T71)	21:31	20:26	19:14	16:22
2	05:13	21:01 (T71)	05:52	06:45	07:36	08:26
	22:04	9 21:10 (T71)	21:29	20:24	19:11	16:22
3	05:14	21:01 (T71)	05:54	06:47	07:38	08:27
	22:04	9 21:10 (T71)	21:27	20:21	19:09	16:21
4	05:14	21:01 (T71)	05:56	06:48	07:40	08:29
	22:03	9 21:10 (T71)	21:25	20:19	19:07	16:20
5	05:15	21:01 (T71)	05:57	06:50	07:42	08:30
	22:03	9 21:10 (T71)	21:23	20:16	19:04	16:20
6	05:16	21:02 (T71)	05:59	06:52	07:43	08:32
	22:02	9 21:11 (T71)	21:22	20:14	19:02	16:19
7	05:17	21:02 (T71)	06:01	06:53	07:45	08:33
	22:02	9 21:11 (T71)	21:20	20:12	19:00	16:19
8	05:18	21:03 (T71)	06:02	06:55	07:47	08:34
	22:01	8 21:11 (T71)	21:18	20:09	18:57	16:19
9	05:19	21:03 (T71)	06:04	20:28 (T23)	06:57	07:49
	22:00	8 21:11 (T71)	21:16	20:30 (T23)	07:49	07:46
10	05:20	21:04 (T71)	06:06	20:27 (T23)	06:57	07:46
	21:59	6 21:10 (T71)	21:14	20:32 (T23)	07:51	07:48
11	05:21	21:04 (T71)	06:07	20:25 (T23)	07:51	07:48
	21:59	6 21:10 (T71)	21:12	20:05	18:53	16:18
12	05:22	21:05 (T71)	06:09	20:25 (T23)	07:52	07:50
	21:58	4 21:09 (T71)	21:10	20:02	18:50	16:18
13	05:24		06:11	20:26 (T23)	07:54	07:52
	21:57		06:09	20:00	18:48	16:18
14	05:25		06:12	20:26 (T23)	07:56	07:54
	21:56		06:08	20:31 (T23)	18:46	16:17
15	05:26		06:14	07:05	18:46	16:17
	21:55		06:16	19:57	18:44	16:17
16	05:27		06:16	07:05	18:44	16:17
	21:54		06:17	19:55	18:43	16:17
17	05:28		06:17	07:07	18:43	16:17
	21:52		06:19	19:52	18:41	16:17
18	05:30		06:19	07:09	18:41	16:17
	21:51		06:21	19:50	18:39	16:18
19	05:31		06:21	07:10	18:39	16:18
	21:50		06:22	19:48	18:37	16:18
20	05:33		06:23	07:12	18:37	16:18
	21:49		06:24	19:45	18:34	16:18
21	05:34		06:24	07:14	18:34	16:18
	21:48		06:25	19:43	18:32	16:18
22	05:35		06:26	07:16	18:32	16:18
	21:46		06:28	19:40	18:30	16:19
23	05:37	20:47 (T70)	06:28	07:17	18:30	16:19
	21:45	5 20:52 (T70)	06:29	19:40	18:28	16:19
24	05:38	20:46 (T70)	06:29	07:19	18:28	16:19
	21:43	6 20:52 (T70)	06:31	19:38	18:26	16:19
25	05:40	20:45 (T70)	06:31	07:21	18:26	16:19
	21:42	7 20:52 (T70)	06:32	19:36	18:24	16:19
26	05:41	20:45 (T70)	06:33	07:23	18:23	16:20
	21:40	8 20:53 (T70)	06:35	19:31	18:21	16:20
27	05:43	20:45 (T70)	06:35	07:24	18:21	16:20
	21:39	8 20:53 (T70)	06:37	19:28	18:19	16:21
28	05:44	20:46 (T70)	06:36	07:26	18:19	16:21
	21:37	7 20:53 (T70)	06:38	19:26	18:17	16:22
29	05:46	20:46 (T70)	06:38	07:28	18:17	16:22
	21:36	6 20:52 (T70)	06:40	19:24	18:15	16:22
30	05:47	20:46 (T70)	06:40	07:31	18:15	16:22
	21:34	5 20:51 (T70)	06:41	19:21	18:13	16:24
31	05:49		06:41	07:33	18:13	16:24
	21:32		06:42	19:19	17:25	16:24
Potential sun hours	508	457	382	330	262	237
Total, worst case	147	33				

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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