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Appendix 11.1

Worst and Real Case Calculations

Keerglen Wind Farm

Mayo Planning Authority - Inspection Purposes Only

SHADOW - Main Result

Calculation: 2024-03-26_Keerglen_SHADOW_RC_8xV150-4.5-HH105m_muk

Assumptions for shadow calculations

Maximum distance for influence 1. WTG distance circle radius

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

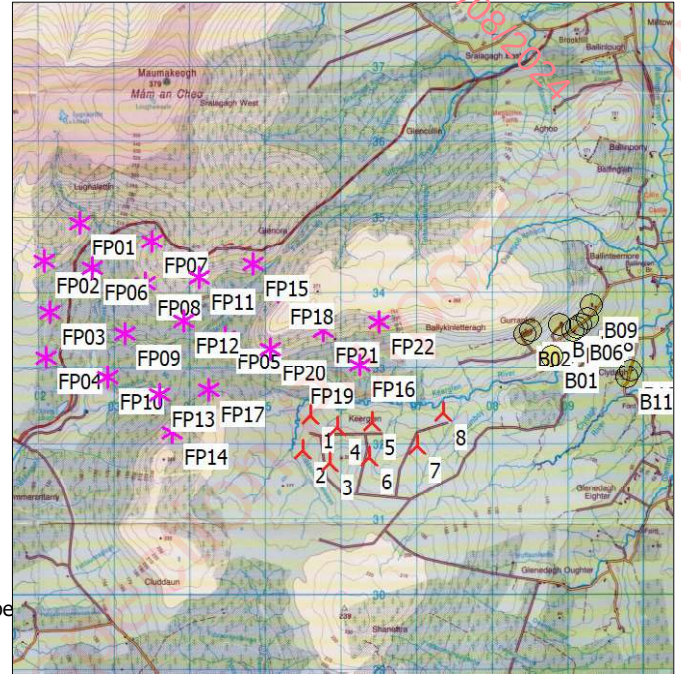
Operational hours are calculated from WTGs in calculation and wind distribution:

LiDAR_ZX_Keerglen_2023-04-26--2023-11-05+MCP

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
523 404 304 287 466 819 765 1'088 1'507 1'150 687 512 8'512

Monthly aggregation of real case reduction
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: Height Contours: Contourline_Keerglen_IB_2m_und_pe
Receptor grid resolution: 1.0 m

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



Scale 1:100'000
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	505'565	832'360	160.1	VESTAS V150 4500 150.0 !O! hub...Yes	VESTAS	V150-4'500	4'500	150.0	105.0	1'500	12.0	
2	505'470	831'909	168.3	VESTAS V150 4500 150.0 !O! hub...Yes	VESTAS	V150-4'500	4'500	150.0	105.0	1'500	12.0	
3	505'827	831'743	186.8	VESTAS V150 4500 150.0 !O! hub...Yes	VESTAS	V150-4'500	4'500	150.0	105.0	1'500	12.0	
4	505'920	832'214	161.1	VESTAS V150 4500 150.0 !O! hub...Yes	VESTAS	V150-4'500	4'500	150.0	105.0	1'500	12.0	
5	506'383	832'271	151.5	VESTAS V150 4500 150.0 !O! hub...Yes	VESTAS	V150-4'500	4'500	150.0	105.0	1'500	12.0	
6	506'344	831'817	168.4	VESTAS V150 4500 150.0 !O! hub...Yes	VESTAS	V150-4'500	4'500	150.0	105.0	1'500	12.0	
7	506'978	831'969	160.0	VESTAS V150 4500 150.0 !O! hub...Yes	VESTAS	V150-4'500	4'500	150.0	105.0	1'500	12.0	
8	507'325	832'404	133.2	VESTAS V150 4500 150.0 !O! hub...Yes	VESTAS	V150-4'500	4'500	150.0	105.0	1'500	12.0	
FP01	502'518	834'923	220.0	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP02	502'047	834'410	213.4	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP03	502'119	833'745	182.8	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP04	502'069	833'148	158.8	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP05	504'436	833'410	180.0	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP06	502'673	834'328	165.7	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP07	503'470	834'687	218.0	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP08	503'379	834'119	201.5	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP09	503'111	833'456	154.0	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP10	502'887	832'881	149.8	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP11	504'089	834'197	223.3	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP12	503'894	833'620	180.3	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP13	503'565	832'645	173.3	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP14	503'732	832'150	217.8	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP15	504'802	834'370	223.0	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP16	506'225	833'037	161.7	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP17	504'216	832'709	193.5	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP18	505'141	834'006	218.0	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP19	505'406	832'947	167.5	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP20	505'036	833'259	218.8	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP21	505'736	833'494	223.9	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	
FP22	506'474	833'610	224.6	VESTAS V162-7.2 7200 162.0 !O!... Yes	VESTAS	V162-7.2-7'200	7'200	162.0	99.0	1'620	12.1	

SHADOW - Main Result

Calculation: 2024-03-26_Keerglen_SHADOW_RC_8xV150-4.5-HH105m_muk

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]
B01	508'775	833'147	98.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
B02	508'407	833'440	144.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
B03	508'489	833'494	145.0	1.0	1.0	1.0	90.0	"Green house mode"	2.0
B04	508'873	833'571	109.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
B05	509'049	833'489	95.6	1.0	1.0	1.0	90.0	"Green house mode"	2.0
B06	509'106	833'536	94.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
B07	509'152	833'573	93.4	1.0	1.0	1.0	90.0	"Green house mode"	2.0
B08	509'237	833'650	93.1	1.0	1.0	1.0	90.0	"Green house mode"	2.0
B09	509'292	833'820	96.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
B10	509'812	832'965	65.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
B11	509'767	832'871	67.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0

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]	
B01	0:00	0	0:00	0:00	
B02	11:30	50	0:24	1:18	
B03	0:00	0	0:00	0:00	
B04	0:00	0	0:00	0:00	
B05	0:00	0	0:00	0:00	
B06	0:00	0	0:00	0:00	
B07	0:00	0	0:00	0:00	
B08	0:00	0	0:00	0:00	
B09	0:00	0	0:00	0:00	
B10	0:00	0	0:00	0:00	
B11	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 V150 4500 150.0 !O! hub: 105.0 m (TOT: 180.0 m) (10)	0:00	0:00
2	VESTAS V150 4500 150.0 !O! hub: 105.0 m (TOT: 180.0 m) (11)	0:00	0:00
3	VESTAS V150 4500 150.0 !O! hub: 105.0 m (TOT: 180.0 m) (12)	0:00	0:00
4	VESTAS V150 4500 150.0 !O! hub: 105.0 m (TOT: 180.0 m) (13)	0:00	0:00
5	VESTAS V150 4500 150.0 !O! hub: 105.0 m (TOT: 180.0 m) (14)	0:00	0:00
6	VESTAS V150 4500 150.0 !O! hub: 105.0 m (TOT: 180.0 m) (15)	0:00	0:00
7	VESTAS V150 4500 150.0 !O! hub: 105.0 m (TOT: 180.0 m) (16)	0:00	0:00
8	VESTAS V150 4500 150.0 !O! hub: 105.0 m (TOT: 180.0 m) (17)	11:30	1:18
FP01	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (165)	0:00	0:00
FP02	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (166)	0:00	0:00
FP03	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (167)	0:00	0:00
FP04	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (168)	0:00	0:00
FP05	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (169)	0:00	0:00
FP06	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (170)	0:00	0:00
FP07	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (171)	0:00	0:00
FP08	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (172)	0:00	0:00
FP09	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (173)	0:00	0:00
FP10	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (174)	0:00	0:00
FP11	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (175)	0:00	0:00
FP12	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (176)	0:00	0:00
FP13	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (177)	0:00	0:00
FP14	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (178)	0:00	0:00
FP15	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (179)	0:00	0:00
FP16	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (180)	0:00	0:00
FP17	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (181)	0:00	0:00
FP18	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (182)	0:00	0:00
FP19	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (183)	0:00	0:00
FP20	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (184)	0:00	0:00
FP21	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (185)	0:00	0:00
FP22	VESTAS V162-7.2 7200 162.0 !O! hub: 99.0 m (TOT: 180.0 m) (186)	0:00	0:00

Project:
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ABO
WIND

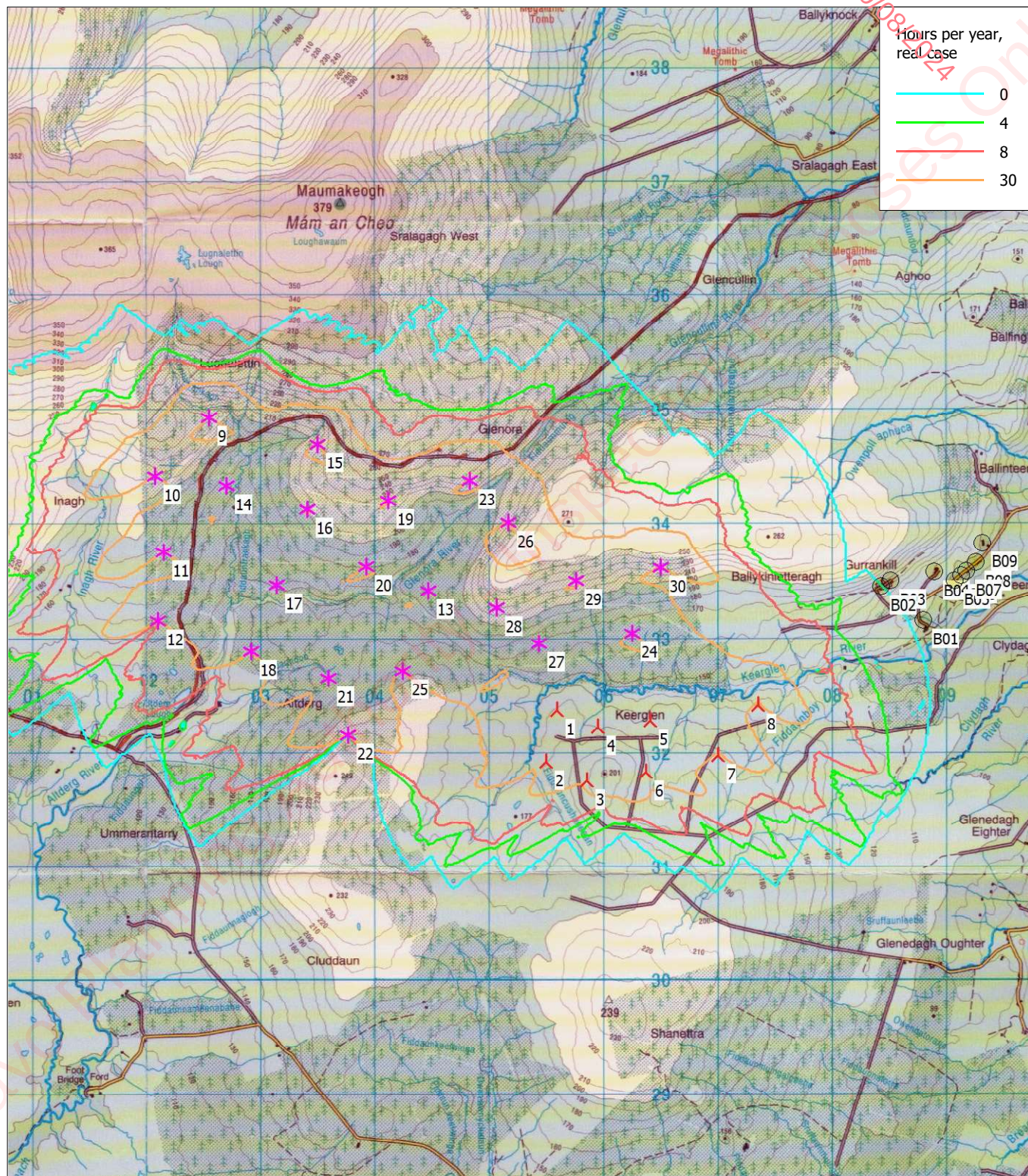
SHADOW - Main Result

Calculation: 2024-03-26_Keerglen_SHADOW_RC_8xV150-4.5-HH105m_muk

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

SHADOW - Map

Calculation: 2024-03-26_Keerglen_SHADOW_RC_8xV150-4.5-HH105m_muk



Map: L 23 Mayo , Print scale 1:50'000, Map center Irish ITM-IRENET95 (IE), geocentric, GRS80 East: 505'160 North: 833'340
 New WTG Existing WTG Shadow receptor
 Flicker map level: Height Contours: Contourline_Keerglen_IB_2m_und_perHand_and_AB_200224_UTM_Z29_ETRS89.map (8)
 Time step: 3 minutes, Day step: 7 days, Map resolution: 20 m, Visibility resolution: 10 m, Eye height: 2.0 m