REGIONE PUGLIA
PROVINCIA DI FOGGIA

Comune:
Bovino -Deliceto - Castelluccio dei Sauri
Località "Monte Livagni"

PROGETTO DEFINITIVO PER LA REALIZZAZIONE DI UN IMPIANTO DI PRODUZIONE DI ENERGIA ELETTRICA DA FONTE EOLICA E RELATIVE OPERE DI CONNESSIONE - 10 AEROGENERATORI -

Sezione:
OMBRA - OM

Titolo elaborato:
RELAZIONE SULL'EVOLUZIONE DELL'OMBRA INDOTTA DALL'IMPIANTO

N. Elaborato: OM.SIA01 Scala: -

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INDICE

1 PREMESSA

Il presente elaborato ha lo scopo di valutare in maniera tecnica l'eventuale impatto generato dall'evoluzione dell'ombra derivante dalla futura installazione di un impianto di produzione di energia da fonte eolica costituita da 10 aerogeneratori modello Vestas V136 di cui 7 potenza elettrica nominale pari a 3,0 MW e 3 aerogeneratori di potenza pari a 3,45 MW per una potenza complessiva pari a 31,35 MW.
Il progetto nel suo complesso riguarda la realizzazione di un impianto eolico costituito da dodici aerogeneratori da installare nel comune di Bovino (FG) in località "Monte Livagni" e con opere di connessione ricadenti anche nei Comuni di Castelluccio dei Sauri (FG) e Deliceto (FG). Proponente dell'iniziativa è la società WINDERG Srl.
La valutazione tecnica è eseguita con l'ausilio di un software di simulazione specifico per la progettazione degli impianti eolici WIND PRO®, costituito da un insieme di moduli di elaborazione orientati alla simulazione di una moltitudine di aspetti che caratterizzano le diverse fasi progettuali. Il modulo SHADOW è quello specifico per la valutazione dell'evoluzione dell'ombra e del flickering.
A seguire si riportano la tabella di riepilogo delle principali caratteristiche delle turbine considerate nel layout di progetto e di tutte le altre già insistenti sul territorio ed inserite nel modello di simulazione per la valutazione del potenziale effetto di Shadow/Flickering cui i recettori potrebbero essere soggetti.
Nello specifico gli aerogeneratori di progetto sono prodotti dalla Gamesa, modello G 126 di potenza nominale 2.625 kW e con altezza mozzo di 120 m s.l.t.

Tabella 1: Sintesi delle principali caratteristiche degli aerogeneratori di progetto

ID WTG	WGS84 Est [m]	WGS 84 Nord [m]	Modello aerogeneratore	Potenza [KW]	Altezza mozzo s.l.t. [m]	Altitudine s.l.m. [m]
A01	534894	4569512	VESTAS V136 3.000	3000	112,0	254
A02	535180	4569850	VESTAS V136 3.000	3000	112,0	256
A03	535553	4570129	VESTAS V136 3.000	3000	112,0	290
A04	535825	4570509	VESTAS V136 3.000	3000	112,0	280
A05	536083	4570874	VESTAS V136 3.000	3000	112,0	274
A06	536375	4571197	VESTAS V136 3.000	3000	112,0	260
A07	536681	4571535	VESTAS V136 3.000	3000	112,0	241
A08	536919	4569819	VESTAS V136-3.450	3450	112,0	240
A09	537303	4570052	VESTAS V136-3.450	3450	112,0	232
A10	537652	4570330	VESTAS V136-3.450	3450	112,0	224

Tabella 2: Caratteristiche delle turbine esistenti sul territorio inserite nel modello di simulazione e calcolo

ID WTG	Modello aerogeneratore	Potenza [KW]	Altezza mozzo s.l.t. [m]
E01	ENERCON E-70	2300	85,0
E02	ENERCON E-70	2300	85,0
E03	ENERCON E-70	2300	85,0
E04	ENERCON E-70	2300	85,0
E05	ENERCON E-70	2300	85,0
SE_09	ENERCON E-82	2000	84,5
SE_10	ENERCON E-82	2000	84,5
SE_11	ENERCON E-82	2000	84,5
SE_12	ENERCON E-82	2000	84,5
SE_13	ENERCON E-82	2000	84,5
LTW77-0.8 a	LEITWIND LTW77	800	61,5
NPS_Me01	Wincon 110 XT	60	37,0
NPS_Me02	Wincon 110 XT	60	37,0

2 CENNI SUL FENOMENO DELL'EVOLUZIONE DELL'OMBRA GENERATA DAGLI AEROGENERATORI

Le turbine eoliche, come altre strutture fortemente sviluppate in altezza, proiettano un'ombra sulle aree adiacenti in presenza della luce solare diretta (figura 1).

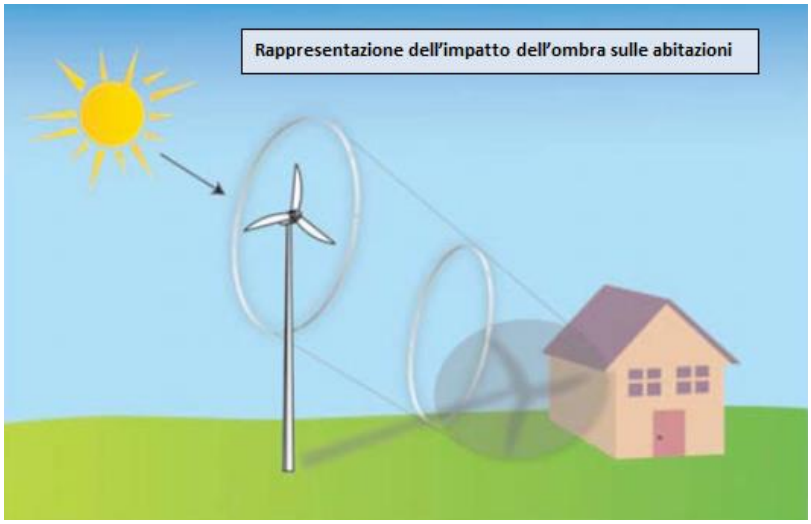


Figura 1: Rappresentazione grafica dell'impatto dell'ombra generata da una turbina eolica

Il cosiddetto fenomeno del "flickering", che consiste in un effetto di lampeggiamento che si verifica quando le pale del rotore in movimento "tagliano" la luce solare in maniera intermittente, può provocare fastidio agli abitanti dei fabbricati situati nei pressi della turbina. Alcune linee guida di paesi esteri, raccomandano una velocità di flicker non superiore a 3 "tagli" al secondo. Per la classica turbina eolica provvista di tre pale, questo effetto corrisponde quindi ad una completa rotazione del rotore in un secondo, equivalente a 60 giri al minuto (60 rpm). Le attuali turbine in commercio hanno una velocità di rotazione ben inferiore a tali valori, di solito intorno ai 20-25 rpm a pieno regime.

Una progettazione attenta è comunque fondamentale per evitare questo spiacevole fenomeno semplicemente prevedendo il luogo di incidenza dell'ombra e disponendo le turbine in maniera tale che l'ombra sulle zone sensibili non superi un certo numero di ore all'anno.

Il grafico in figura 2 riporta l'evoluzione annuale dell'ombra di una turbina considerando il caso peggiore di pale sempre in rotazione intorno al mozzo, e orientate sempre ortogonalmente al sole durante la sua evoluzione giornaliera.

Come è evidente dal grafico e dalla legenda, le ore annue di ombra sono sempre minori con l'aumentare della distanza dal pilone secondo una particolare geometria dettata dalla posizione geografica; da osservare che l'ombra arriva a proiettarsi anche sino ad una distanza di 1 km, anche se solo per pochi minuti all'anno.

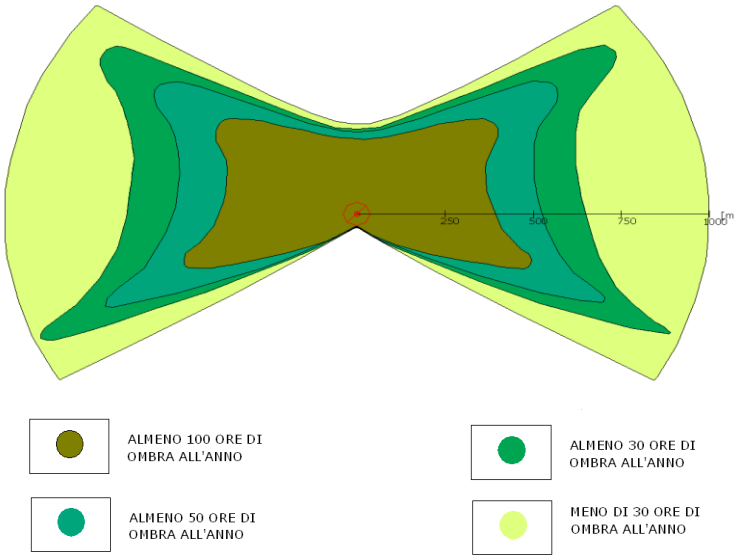


Figura 2: Evoluzione annuale tipo dell'ombra di una pala

Considerati i pochi precedenti esistenti (Germania) e le ipotesi così penalizzanti con cui è stata calcolato tale grafico, è ragionevole assumere la parte più interna del grafico come limite da non superarsi, ovvero l'area che supera le 100 ore all'anno di ombra dei punti di installazione. La fase di progettazione del layout d'impianto ha seguito tali principi.

3 INDIVIDUAZIONE DEI RECETTORI ED IPOTESI DI CALCOLO

Ai fini della previsione degli impatti indotti dall'impianto eolico di progetto sono stati individuati i "recettori sensibili".

Nel caso specifico sono state classificate recettori sensibili alcune strutture individuate come R01, R02….. R10 in virtù del loro stato di conservazione, presenza di requisiti minimi di abitabilità o possibilità di permanenza di attività umana e quant'altro similare. Per l'individuazione dei recettori interessati dalle simulazioni, si faccia riferimento allo specifico elaborato di progetto IR.SIA 01.

Le altre strutture presenti nell'area limitrofa alle turbine in oggetto, sono rappresentate ruderi, edifici non abitabili o individuati al catasto come UNITÀ' COLLABENTI e pertanto esclusi dall'analisi.

Nelle tabelle a seguire sono riportati i riferimenti geografici (coordinate) di tutti i recettori in oggetto e di tutte le sorgenti (turbine di progetto e già insistenti sul territorio) che potrebbero potenzialmente fornire un apporto nell'effetto di Shadow/Flickering. In successione alle tabelle dono proposte le immagini che individuano gli stessi elementi su stralcio cartografico IGM 1:50000 e su stralcio ortofoto planimetrico estratto da Google Earth. La simulazione è stata effettuata considerando tutte le turbine citate ai fini di una diretta valutazione dell'effetto singolo e **cumulativo** con gli impianti esistenti.

Tabella 3: - Elenco dei "recettori sensibili" presenti in tutto l'interno dell'area di impianto potenzialmente suscettibili dell'effetto legato al fenomeno di ombreggiamento

ID RECETTORE	WGS 84 33T Est [m]	WGS 84 33T Nord [m]	Quota [m]
R01	536783	4572170	213
R02	537062	4572068	226
R03	535161	4571396	232
R04	537625	4571429	230
R05	538118	4570272	216
R06	537604	4569760	227
R07	535410	4568990	300
R08	536668	4568721	257
R09	536996	4568731	253
R10	537132	4568755	251
R11	537864	4570025	220
R12	537429	4569463	236
R13	537427	4569222	240
R14	536811	4568994	250
R15	535160	4568556	302

Tabella 4: Layout – Inquadramento geografico degli aerogeneratori di progetto

ID WTG	WGS84 Est [m]	WGS 84 Nord [m]	Modello aerogeneratore	Potenza [KW]	Altezza mozzo s.l.t. [m]	Altitudine s.l.m. [m]
A01	534894	4569512	VESTAS V136 3.000	3000	112,0	254
A02	535180	4569850	VESTAS V136 3.000	3000	112,0	256
A03	535553	4570129	VESTAS V136 3.000	3000	112,0	290
A04	535825	4570509	VESTAS V136 3.000	3000	112,0	280
A05	536083	4570874	VESTAS V136 3.000	3000	112,0	274
A06	536375	4571197	VESTAS V136 3.000	3000	112,0	260
A07	536681	4571535	VESTAS V136 3.000	3000	112,0	241
A08	536919	4569819	VESTAS V136-3.450	3450	112,0	240
A09	537303	4570052	VESTAS V136-3.450	3450	112,0	232
A10	537652	4570330	VESTAS V136-3.450	3450	112,0	224

Tabella 5: Layout – Inquadramento geografico degli aerogeneratori di grande taglia presenti sul territorio e considerati nel modello di simulazione e stima previsionale dell'impatto acustico

ID WTG	UTM WGS84 Long. Est [m]	UTM WGS 84 Lat. Nord [m]	Modello aerogeneratore	Potenza [KW]	Altitudine s.l.m. [m]	Altezza mozzo s.l.t. [m]
E01	534669	4568660	ENERCON E-70	2300	320,0	85,0
E02	534592	4568452	ENERCON E-70	2300	328,7	85,0
E03	534736	4568278	ENERCON E-70	2300	326,1	85,0
E04	534979	4568302	ENERCON E-70	2300	316,1	85,0
E05	535208	4568323	ENERCON E-70	2300	289,6	85,0

ID WTG	UTM WGS84 Long. Est [m]	UTM WGS 84 Lat. Nord [m]	Modello aerogeneratore	Potenza [KW]	Altitudine s.l.m. [m]	Altezza mozzo s.l.t. [m]
SE_09	538072	4568208	ENERCON E-82	2000	244,8	84,5
SE_10	537590	4568478	ENERCON E-82	2000	250,0	84,5
SE_11	537460	4567855	ENERCON E-82	2000	259,3	84,5
SE_12	537165	4567660	ENERCON E-82	2000	266,4	84,5
SE_13	536768	4567351	ENERCON E-82	2000	278,4	84,5
SE_14	538592	4568273	ENERCON E-82	2000	236,3	84,5

ID WTG	UTM WGS84 Long. Est [m]	UTM WGS 84 Lat. Nord [m]	Modello aerogeneratore	Potenza [KW]	Altitudine s.l.m. [m]	Altezza mozzo s.l.t. [m]
LTW77-0.8 a	532970	4571243	LEITWIND LTW77	800	230,0	61,5

Tabella 6: Layout – Inquadramento geografico degli aerogeneratori di piccola taglia presenti sul territorio e considerati nel modello di simulazione e stima previsionale dell'impatto acustico

ID WTG	UTM WGS84 Long. Est [m]	UTM WGS 84 Lat. Nord [m]	Modello aerogeneratore	Potenza [KW]	Altitudine s.l.m. [m]	Altezza mozzo s.l.t. [m]
NPS_Me01	536868	4568474	Wincon 110 XT	60	260,0	37,0
NPS_Me02	535236	4571182	Wincon 110 XT	60	233,1	37,0

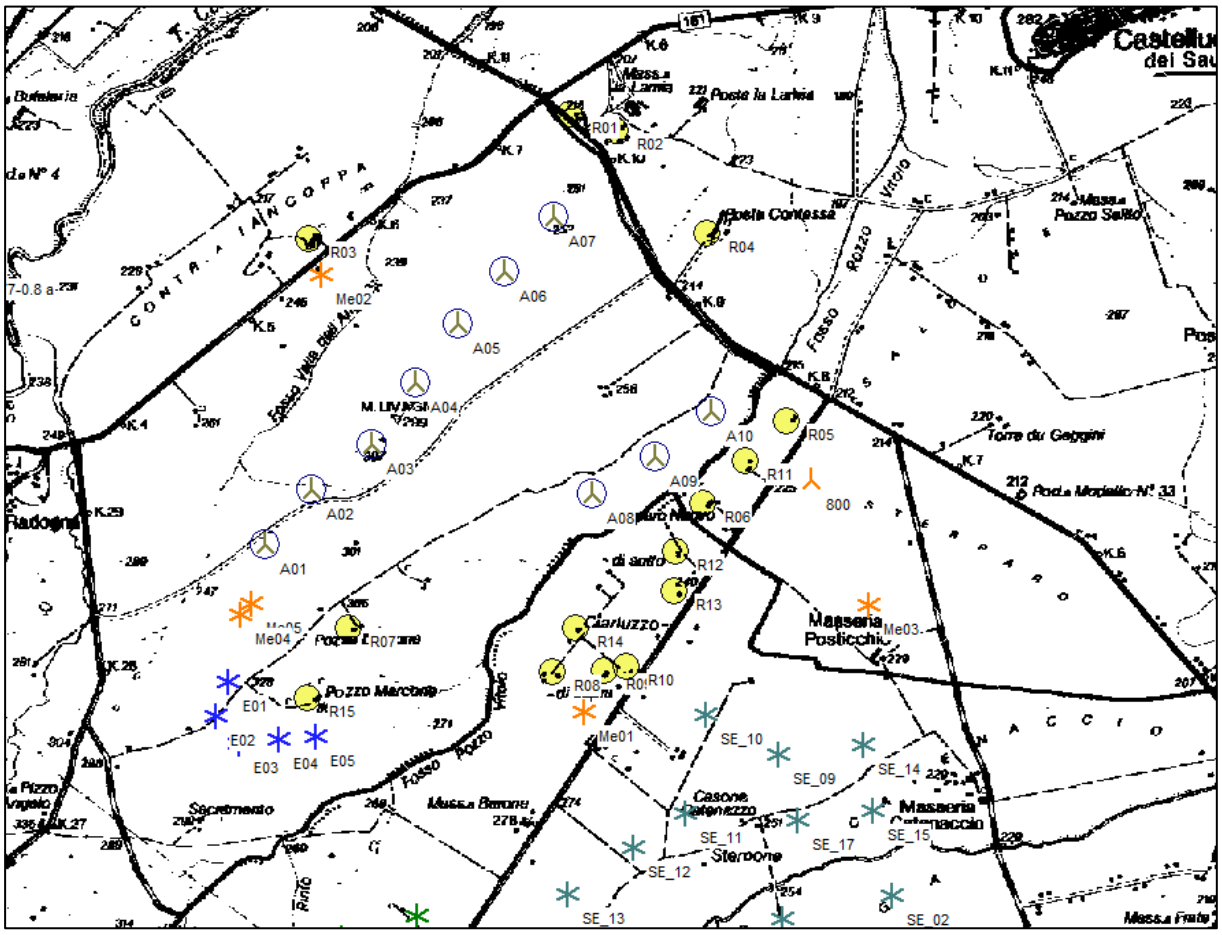


Figura 3: Inquadramento delle turbine di progetto e del recettore su stralcio cartografico IGM 1:50.000; turbina di progetto [ ], turbine esistenti [ ] e recettore [ ]

Figura 4: Inquadramento delle turbine di progetto, dei recettore e degli aerogeneratori esistenti su stralcio ortofoto 3D estratto da Google Earth. Nell'immagine sono visibili le turbine di progetto

La valutazione tecnica è stata eseguita con l'ausilio di un software di simulazione specifico per la progettazione degli impianti eolici WIND PRO®, costituito da un insieme di moduli di elaborazione orientati alla simulazione di una moltitudine di aspetti che caratterizzano le diverse fasi progettuali. Il modulo SHADOW è quello specifico per la valutazione dell'evoluzione dell'ombra e del flickering.

I dati di input sono:

- modello DTM del terreno;
- modello delle turbine e loro caratteristiche dimensionali;
- definizione di aree sensibili o recettori;
- definizione di caratteristiche anemologiche dell'area per il calcolo del "real case" basato sulla effettiva distribuzione statistica dei dati del vento in relazione alle ore di funzionamento ed al posizionamento della navicella per la proiezione del rotore.
- definizione di dati meteorologici storici di una stazione di riferimento per il calcolo probabilistico delle ore di soleggiamento

La presente relazione è stata redatta allo scopo di analizzare l'effetto "flickering" indotto dagli aerogeneratori (di progetto ed esistenti) sui recettori, rappresentati dai nuclei abitativi presenti in un intorno di 1000 metri dalle turbine. In relazione a ciò, si fa presente che già in fase di scelta delle aree sulle quali ubicare l'impianto si è cercato di allontanarsi il più possibile dall'area urbana e dalle masserie adibite ad abitazione.

Nello studio viene comunque calcolato un " worst case" ovvero la condizione più sfavorevole possibile, in quanto si considera che:

- il sole splende per tutta la giornata, dall'alba al tramonto (cioè si è sempre in assenza

di copertura nuvolosa);

- il piano di rotazione delle pale è sempre perpendicolare alla direttrice sole-aerogeneratore (l'aerogeneratore "insegue" il sole);
- l'aerogeneratore è sempre operativo.

Inoltre, per le simulazioni, ogni singolo ricettore viene considerato in modalità "green house", cioè come se tutte le pareti esterne fossero esposte al fenomeno, senza considerare la presenza di finestre e/o porte dalle quali l'effetto arriva realmente all'interno dell'abitazione. Allo stesso tempo, si è trascurata la presenza degli alberi e di altri ostacoli che bordano le strade "intercettando" l'ombra degli aerogeneratori riducendo quindi il fastidio del flickering.

Ciò significa che i risultati ai quali si perverrà sono ampiamente cautelativi.

Per completezza, lo studio è stato effettuato anche tenendo conto dei dati statistici ricavati da una stazione anemometrica sita in adiacenza dell'aerogeneratore di progetto. In tal modo, viene ricavato il numero di ore di ombreggiamento più realistico, poiché, a differenza del caso precedente, si tiene conto delle ore stimate di funzionamento della turbina nell'arco di un anno, anche in funzione della direzione del vento che influisce sull'orientamento delle pale rispetto al sole e dunque sull'ombra proiettate sui ricettori

Tabella 7: Caratteristiche tecniche della turbina di progetto Vestas V136 – 3.0 e 3.45 MW

Performance Specification

V136-3.45 MW 50/60 Hz

Technical Specifications

OPERATIONAL DATA	
Rated power	3,450 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	22.5 m/s
Re cut-in wind speed	20 m/s
Wind class	IEC IIIA/IEC IIB
Standard operating temperature range	from -20°C to +45°C with de-rating above 30°C*
SOUND POWER	
(Noise modes dependent on site and country)	
ROTOR	
Rotor diameter	136 m
Swept area	14,527 m^2
Air brake	full blade feathering with 3 pitch cylinders
ELECTRICAL	
Frequency	50/60 Hz
Converter	full scale
GEARBOX	
Type	two planetary stages and one helical stage
TOWER	
Hub heights	82 m (IEC IIIA), 112 m (IEC IIIA), 132 m (IEC IIIA/DIBt2) and 149m (DIBtS)
NACELLE DIMENSIONS	
Height for transport	3.4 m
Height installed (incl. CoolerTop®)	6.9 m
Length	12.8 m
Width	4.2 m
HUB DIMENSIONS	
Max. transport height	3.8 m
Max. transport width	3.8 m
Max. transport length	5.5 m
BLADE DIMENSIONS	
Length	66.7 m
Max. chord	4.1 m
Max. weight per unit for transportation	70 metric tonnes

4 ANALISI DEI RISULTATI

Si riportano di seguito sinteticamente risultati in forma tabellare i risultati della simulazione per i recettori analizzati relativamente anche al contributo dato dalla presenza delle turbine già insistenti sul territorio:

Tabella 8: Risultati del calcolo

ID SHADOW RECEPTOR	WORST CASE VALORI ATTESI AL RECETTORE NELL'IPOTESI PEGGIORE POSSIBILE	REAL CASE VALORI REALI ATTESI AL RECETTORE
	Shadow ore/anno	Shadow ore/anno
R01	00:00	00:00
R02	12:01	03:13
R03	36:56:00	10:50
R04	37:11:00	13:08
R05	133:27:00	49:56:00
R06	45:37:00	17:20
R07	19:19	06:24
R08	09:06	02:41
R09	17:51	04:53
R10	32:53:00	08:19
R11	88:02:00	31:21:00
R12	08:12	03:31
R13	00:00	00:00
R14	17:36	04:11
R15	134:49:00	41:53:00

Dalle simulazioni effettuate, si evince che gli aerogeneratori di progetto (insieme a tutti gli esistenti considerati nell'area limitrofa e mostrati nelle immagini precedenti) generano fenomeno di shadow/flickering sul recettore (SR05) individuato nell'analisi che, nell'ipotesi peggiore ("worst case"), subisce il fenomeno per 133 ore e 27' l'anno che corrisponde, come valore reale atteso (ossia quello che tiene in conto anche i fattori derivati dai dati anemometrici di sito e della stazione meteorologica storica), a circa **50 ore annue** (49 ore e 56').

Tale caso ("real case"), seppure più realistico, è comunque cautelativo poiché non tiene conto della presenza di nubi e di vegetazione ad alto fusto.

E' stato elaborato un calendario dell'ombra riportato in appendice (rif. Appendice *Calendar*), che riporta in maniera grafica giorno per giorno, per tutto l'anno, la durata giornaliera del fenomeno, l'orario di inizio e di fine del fenomeno, nelle condizioni di caso reale. Dalla lettura del *"Calendar"* si legge che il fenomeno dell'ombreggiamento, si esplica sui recettori con intensità maggiore nel periodo compreso tra Gennaio, Maggio, Agosto e Dicembre nelle primissime ore della giornata, oppure al tramonto. Il fenomeno è comunque presente in maniera diffusa tutto l'anno. Nella figura che segue è riportato a titolo di esempio il grafico "calendar" dei un recettore non inerente il progetto in esame: le macchie individuano i momenti di shadow, la posizione nel grafico individua tempo e durata del fenomeno, il colore della macchia individua la turbina che causa il fenomeno.

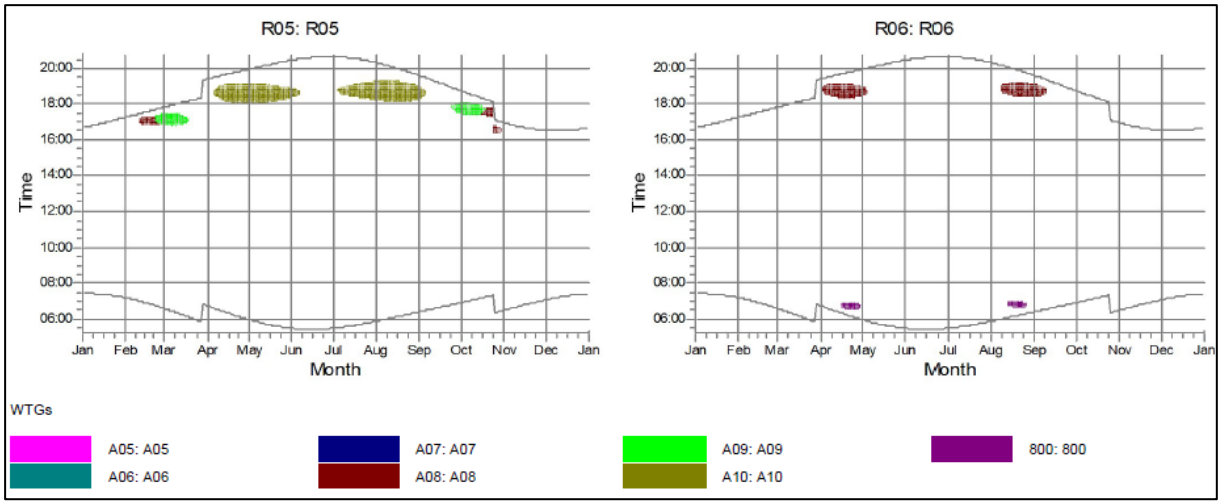


Figura 5: Rappresentazione grafica dell'ombreggiamento durante l'anno alle diverse fasce orarie e nei diversi mesi, i differenti colori sono utilizzati per distinguere le turbine che causano l'ombreggiamento.

L'allegato 2 riporta il dettaglio analitico di quanto espresso dal grafico precedente con gli specifici orari di inizio e di fine del fenomeno. A seguire è altresì riportata la sintesi grafica annuale (come mostra l'immagine precedente) dell'apporto di ombreggiamento a carico di ogni recettore ed il/gli aerogeneratore/i responsabile/i del fenomeno.

E' stata inoltre elaborata una mappa (report *Map, Allegato 3*) in cui vengono riportate, con diverse gradazioni di colore, le zone soggette ad una determinata durata del fenomeno dell'ombreggiamento oltre all'estensione areale nella quale il fenomeno risulta significativo.

Il fenomeno dell'ombreggiamento interessa marginalmente tratti di strade Provinciali, comunali e/o private per un numero di ore all'anno del tutto irrilevanti e cioè pari ad un massimo di 30 ore/anno, ma solo in alcuni tratti. Preme, tuttavia, evidenziare che nelle simulazioni non si è tenuto conto della possibile presenza di vegetazione capace di offrire un effetto "barriera" ai recettori e/o alle strade limitrofe. Inoltre, la percezione dell'impianto dalla strada risulterebbe essere "in movimento" e quindi legata alla breve permanenza delle automobili in transito, per cui il fastidio indotto sarebbe temporalmente limitato. A questo si aggiunge che le simulazioni sono state effettuate assumendo le "condizioni peggiori", sovrastimando pertanto l'effetto di flickering.

5 CONCLUSIONI

In conclusione, si può asseverare che i risultati ottenuti della elaborazioni evidenziano, pur considerando le condizioni più sfavorevoli, che **le turbine di progetto non generano un impatto di tipo ostativo per il fenomeno di shadow/flickering sui recettori oggetto dell'analisi.**

In via generale, va comunque sottolineato che, anche laddove via siano le condizioni più sfavorevoli di esposizione, come nel caso del recettore individuato come R05, il fenomeno di ombreggiamento si manifesterebbe per un periodo massimo di circa 50 ore/anno (**49 ore e 56'**) per l'elaborazione effettuata nelle condizioni più verosimili ("Real Case"), mentre si manifesterebbe per un periodo massimo di poco

superiore le 130 ore/anno (133 ore e 27') per l'elaborazione effettuata nelle condizioni peggiori possibili ("Worst Case") che ipotizza ad esempio una struttura costituita da tutte pareti in vetro e sempre esposta perpendicolarmente alla sorgente.

In ambedue i casi è comunque da rimarcare il grado di cautela utilizzato per la simulazione che non tiene in conto di tutte le possibili fonti di attenuazione dell'effetto cui ogni recettore è (o può essere) soggetto quali presenza di alberi, ostacoli, siepi e quant'altro possa attenuare il fenomeno dell'evoluzione giornaliera dell'ombra.

ALLEGATO 1: MAIN RESULT: QUADRO SINTETICO DEI RISULTATI DI CALCOLO nell'ipotesi elaborata di "Worst Case" e "Real Case"

Massimo Lepore / massimo.lepore@tenproject.it
Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Main Result

Calculation: GE.BOV01 SH/FL 2018_10

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) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

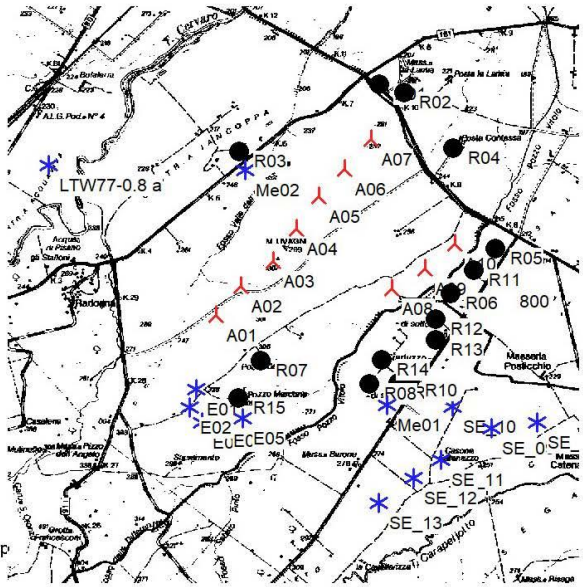
Operational hours are calculated from WTGs in calculation and wind distribution:
SD FL-SH

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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_ONLINEDATA_0.wp
Obstacles used in calculation
Eye height: 1,5 m
Grid resolution: 10 m



Scale 1:75.000

New WTG | Existing WTG | Shadow receptor

WTGs

	UTM WGS84 Zone: 33 East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
	UTM WGS84 Zone: 33		[m]					[kW]	[m]	[m]	[m]	[RPM]
800	538.273	4.569.904	220,0	800	Yes	ENERCON	E-53-800	800	53,0	73,3	996	29,0
E01	534.669	4.568.660	320,0	E01	Yes	ENERCON	E-70 E4 2,3 MW-2.300	2.300	71,0	85,0	1.643	20,0
E02	534.592	4.568.452	328,7	E02	Yes	ENERCON	E-70 E4 2,3 MW-2.300	2.300	71,0	85,0	1.643	20,0
E03	534.736	4.568.278	326,1	E03	Yes	ENERCON	E-70 E4 2,3 MW-2.300	2.300	71,0	85,0	1.643	20,0
E04	534.979	4.568.302	316,1	E04	Yes	ENERCON	E-70 E4 2,3 MW-2.300	2.300	71,0	85,0	1.643	20,0
E05	535.208	4.568.323	289,6	E05	Yes	ENERCON	E-70 E4 2,3 MW-2.300	2.300	71,0	85,0	1.643	20,0
A01	534.894	4.569.512	253,6	A01	No	VESTAS	V136-3.000	3.000	136,0	112,0	1.710	12,8
A02	535.180	4.569.850	255,9	A02	No	VESTAS	V136-3.000	3.000	136,0	112,0	1.710	12,8
A03	535.553	4.570.129	290,0	A03	No	VESTAS	V136-3.000	3.000	136,0	112,0	1.710	12,8
A04	535.825	4.570.509	280,0	A04	No	VESTAS	V136-3.000	3.000	136,0	112,0	1.710	12,8
A05	536.083	4.570.874	274,2	A05	No	VESTAS	V136-3.000	3.000	136,0	112,0	1.710	12,8
A06	536.375	4.571.197	260,0	A06	No	VESTAS	V136-3.000	3.000	136,0	112,0	1.710	12,8
A07	536.681	4.571.535	241,0	A07	No	VESTAS	V136-3.000	3.000	136,0	112,0	1.710	12,8
A08	536.919	4.569.821	240,0	A08	Yes	VESTAS	V136-3.45 -3.450	3.450	136,0	112,0	1.816	11,7
A09	537.304	4.570.050	232,2	A09	Yes	VESTAS	V136-3.45 -3.450	3.450	136,0	112,0	1.816	11,7
A10	537.652	4.570.330	224,1	A10	Yes	VESTAS	V136-3.45 -3.450	3.450	136,0	112,0	1.816	11,7
LTW77-0.8 a	532.970	4.571.243	230,0	LTW77-0.8 a	No	LEITWIND	LTW77 800 kW-800	800	77,0	61,5	2.000	20,0
Me01	536.868	4.568.474	260,0	Me01	Yes	NORTHERN POWER	NPS 60C-24-60	60	24,0	37,0	2.000	43,0
Me02	535.236	4.571.182	234,0	Me02	Yes	NORTHERN POWER	NPS 60C-24-60	60	24,0	37,0	2.000	43,0
SE_09	538.072	4.568.208	245,0	SE_09	No	ENERCON	E-82-2.000	2.000	82,0	84,5	1.551	19,5
SE_10	537.617	4.568.458	250,0	SE_10	No	ENERCON	E-82-2.000	2.000	82,0	84,5	1.551	19,5
SE_11	537.489	4.567.851	258,7	SE_11	No	ENERCON	E-82-2.000	2.000	82,0	84,5	1.551	19,5
SE_12	537.173	4.567.635	267,7	SE_12	No	ENERCON	E-82-2.000	2.000	82,0	84,5	1.551	19,5
SE_13	536.768	4.567.351	278,5	SE_13	No	ENERCON	E-82-2.000	2.000	82,0	84,5	1.551	19,5
SE_14	538.592	4.568.273	236,8	SE_14	No	ENERCON	E-82-2.000	2.000	82,0	84,5	1.551	19,5

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23/10/2018 16:04/2.7.490

SHADOW - Main Result

Calculation: GE.BOV01 SH/FL 2018_10

Shadow receptor-Input

No.	Name	UTM WGS84 Zone: 33 East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
R01	R01	536.783	4.572.170	213,1	1,0	1,0	0,0	0,0	90,0	"Green house mode"
R02	R02	537.062	4.572.068	225,8	1,0	1,0	0,0	0,0	90,0	"Green house mode"
R03	R03	535.161	4.571.396	231,8	1,0	1,0	0,0	0,0	90,0	"Green house mode"
R04	R04	537.625	4.571.429	230,0	1,0	1,0	0,0	0,0	90,0	"Green house mode"
R05	R05	538.118	4.570.272	216,4	1,0	1,0	0,0	0,0	90,0	"Green house mode"
R06	R06	537.604	4.569.760	227,2	1,0	1,0	0,0	0,0	90,0	"Green house mode"
R07	R07	535.410	4.568.990	300,0	1,0	1,0	0,0	0,0	90,0	"Green house mode"
R08	R08	536.668	4.568.721	257,3	1,0	1,0	0,0	0,0	90,0	"Green house mode"
R09	R09	536.996	4.568.731	252,9	1,0	1,0	0,0	0,0	90,0	"Green house mode"
R10	R10	537.132	4.568.755	250,5	1,0	1,0	0,0	0,0	90,0	"Green house mode"
R11	R11	537.864	4.570.025	220,0	1,0	1,0	0,0	0,0	90,0	"Green house mode"
R12	R12	537.429	4.569.463	235,8	1,0	1,0	0,0	0,0	90,0	"Green house mode"
R13	R13	537.427	4.569.222	240,0	1,0	1,0	0,0	0,0	90,0	"Green house mode"
R14	R14	536.811	4.568.994	249,8	1,0	1,0	0,0	0,0	90,0	"Green house mode"
R15	R15	535.160	4.568.556	301,7	1,0	1,0	0,0	0,0	90,0	"Green house mode"

Calculation Results

Shadow receptor

No.	Name	Shadow, worst case Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow, expected values Shadow hours per year [h/year]
R01	R01	0:00	0	0:00	0:00
R02	R02	12:01	32	0:29	3:13
R03	R03	36:56	109	0:31	10:50
R04	R04	37:11	105	0:34	13:08
R05	R05	133:27	196	1:06	49:56
R06	R06	45:37	66	1:02	17:20
R07	R07	19:19	108	0:21	6:24
R08	R08	9:06	41	0:30	2:41
R09	R09	17:51	57	0:29	4:53
R10	R10	32:53	79	0:41	8:19
R11	R11	88:02	130	0:58	31:21
R12	R12	8:12	52	0:12	3:31
R13	R13	0:00	0	0:00	0:00
R14	R14	17:36	72	0:26	4:11
R15	R15	134:49	218	1:13	41:53

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

No.	Name	Worst case [h/year]	Expected [h/year]
800	800	28:53	10:20
E01	E01	34:17	12:37
E02	E02	21:20	7:04
E03	E03	22:11	6:50
E04	E04	69:38	19:24
E05	E05	5:42	1:33
A01	A01	0:00	0:00
A02	A02	0:00	0:00
A03	A03	0:00	0:00
A04	A04	0:00	0:00
A05	A05	26:35	7:18
A06	A06	20:53	6:47
A07	A07	38:40	13:08
A08	A08	70:18	25:11
A09	A09	79:51	29:06
A10	A10	101:21	39:22

To be continued on next page...

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Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Main Result

Calculation: GE.BOV01 SH/FL 2018_10

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
LTW77-0.8 a	LTW77-0.8 a	0:00	0:00
Me01	Me01	0:00	0:00
Me02	Me02	0:00	0:00
SE_09	SE_09	13:55	3:33
SE_10	SE_10	59:34	15:25
SE_11	SE_11	0:00	0:00
SE_12	SE_12	0:00	0:00
SE_13	SE_13	0:00	0:00
SE_14	SE_14	1:00	0:17

ALLEGATO 2: CALENDAR: DETTAGLIO ANALITICO GIORNALIERO DELL'EFFETTO "FLICKERING" CUI SONO SOGGETTI I RECETTORI ANALIZZATI

Massimo Lepore / massimo.lepore@tenproject.it

Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R01 - R01

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:25	07:11	06:35	06:44	05:58	05:28	05:29	05:53	06:24	06:54	06:29	07:04
	16:40	17:14	17:48	19:23	19:55	20:25	20:36	20:17	19:33	18:42	16:55	16:31
2	07:25	07:10	06:33	06:42	05:56	05:28	05:29	05:54	06:25	06:55	06:30	07:05
	16:40	17:15	17:50	19:24	19:56	20:26	20:36	20:16	19:32	18:41	16:54	16:30
3	07:25	07:09	06:32	06:40	05:55	05:28	05:30	05:55	06:26	06:56	06:31	07:06
	16:41	17:17	17:51	19:25	19:57	20:26	20:36	20:14	19:30	18:39	16:53	16:30
4	07:25	07:08	06:30	06:39	05:54	05:27	05:30	05:56	06:27	06:58	06:33	07:07
	16:42	17:18	17:52	19:26	19:58	20:27	20:35	20:13	19:28	18:37	16:52	16:30
5	07:25	07:07	06:29	06:37	05:52	05:27	05:31	05:57	06:28	06:59	06:34	07:08
	16:43	17:19	17:53	19:27	19:59	20:28	20:35	20:12	19:27	18:36	16:50	16:30
6	07:25	07:06	06:27	06:35	05:51	05:26	05:32	05:58	06:29	07:00	06:35	07:09
	16:44	17:20	17:54	19:28	20:00	20:28	20:35	20:11	19:25	18:34	16:49	16:30
7	07:25	07:05	06:25	06:34	05:50	05:26	05:32	05:59	06:30	07:01	06:36	07:10
	16:45	17:22	17:55	19:29	20:01	20:29	20:35	20:10	19:23	18:32	16:48	16:29
8	07:25	07:04	06:24	06:32	05:49	05:26	05:33	06:00	06:31	07:02	06:37	07:11
	16:46	17:23	17:57	19:30	20:02	20:30	20:34	20:08	19:22	18:31	16:47	16:29
9	07:25	07:02	06:22	06:30	05:48	05:26	05:33	06:01	06:32	07:03	06:39	07:12
	16:47	17:24	17:58	19:31	20:04	20:30	20:34	20:07	19:20	18:29	16:46	16:29
10	07:24	07:01	06:21	06:29	05:46	05:25	05:34	06:02	06:33	07:04	06:40	07:13
	16:48	17:25	17:59	19:33	20:05	20:31	20:34	20:06	19:18	18:27	16:45	16:29
11	07:24	07:00	06:19	06:27	05:45	05:25	05:35	06:03	06:34	07:05	06:41	07:14
	16:49	17:27	18:00	19:34	20:06	20:31	20:33	20:05	19:17	18:26	16:44	16:29
12	07:24	06:59	06:17	06:26	05:44	05:25	05:36	06:04	06:35	07:06	06:42	07:15
	16:50	17:28	18:01	19:35	20:07	20:32	20:33	20:03	19:15	18:24	16:43	16:30
13	07:24	06:58	06:16	06:24	05:43	05:25	05:36	06:05	06:36	07:07	06:43	07:15
	16:51	17:29	18:02	19:36	20:08	20:32	20:32	20:02	19:13	18:23	16:42	16:30
14	07:23	06:56	06:14	06:22	05:42	05:25	05:37	06:06	06:37	07:08	06:45	07:16
	16:52	17:30	18:03	19:37	20:09	20:33	20:32	20:01	19:11	18:21	16:41	16:30
15	07:23	06:55	06:12	06:21	05:41	05:25	05:38	06:07	06:38	07:09	06:46	07:17
	16:53	17:32	18:04	19:38	20:10	20:33	20:31	19:59	19:10	18:19	16:40	16:30
16	07:22	06:54	06:11	06:19	05:40	05:25	05:39	06:08	06:39	07:11	06:47	07:18
	16:55	17:33	18:06	19:39	20:11	20:34	20:30	19:58	19:08	18:18	16:39	16:30
17	07:22	06:52	06:09	06:18	05:39	05:25	05:39	06:09	06:40	07:12	06:48	07:18
	16:56	17:34	18:07	19:40	20:12	20:34	20:30	19:56	19:06	18:16	16:39	16:31
18	07:21	06:51	06:07	06:16	05:38	05:25	05:40	06:10	06:41	07:13	06:49	07:19
	16:57	17:35	18:08	19:41	20:13	20:34	20:29	19:55	19:05	18:15	16:38	16:31
19	07:21	06:50	06:06	06:15	05:37	05:25	05:41	06:11	06:42	07:14	06:51	07:20
	16:58	17:37	18:09	19:42	20:14	20:35	20:28	19:53	19:03	18:13	16:37	16:31
20	07:20	06:48	06:04	06:13	05:37	05:25	05:42	06:12	06:43	07:15	06:52	07:20
	16:59	17:38	18:10	19:43	20:15	20:35	20:28	19:52	19:01	18:12	16:36	16:32
21	07:20	06:47	06:02	06:12	05:36	05:25	05:43	06:13	06:44	07:16	06:53	07:21
	17:00	17:39	18:11	19:44	20:15	20:35	20:27	19:51	18:59	18:10	16:36	16:32
22	07:19	06:45	06:01	06:10	05:35	05:26	05:44	06:14	06:45	07:17	06:54	07:21
	17:02	17:40	18:12	19:45	20:16	20:35	20:26	19:49	18:58	18:09	16:35	16:33
23	07:19	06:44	05:59	06:09	05:34	05:26	05:45	06:15	06:46	07:18	06:55	07:22
	17:03	17:41	18:13	19:47	20:17	20:36	20:25	19:47	18:56	18:07	16:34	16:33
24	07:18	06:42	05:57	06:07	05:33	05:26	05:45	06:16	06:47	07:20	06:56	07:22
	17:04	17:43	18:14	19:48	20:18	20:36	20:25	19:46	18:54	18:06	16:34	16:34
25	07:17	06:41	05:55	06:06	05:33	05:26	05:46	06:17	06:48	06:21	06:58	07:23
	17:05	17:44	18:15	19:49	20:19	20:36	20:24	19:44	18:53	17:05	16:33	16:34
26	07:16	06:39	05:54	06:04	05:32	05:27	05:47	06:18	06:49	06:22	06:59	07:23
	17:07	17:45	18:16	19:50	20:20	20:36	20:23	19:43	18:51	17:03	16:33	16:35
27	07:16	06:38	05:52	06:03	05:31	05:27	05:48	06:19	06:50	06:23	07:00	07:23
	17:08	17:46	18:18	19:51	20:21	20:36	20:22	19:41	18:49	17:02	16:32	16:36
28	07:15	06:36	05:50	06:02	05:31	05:27	05:49	06:20	06:51	06:24	07:01	07:24
	17:09	17:47	18:19	19:52	20:22	20:36	20:21	19:40	18:47	17:00	16:32	16:36
29	07:14		06:49	06:00	05:30	05:28	05:50	06:21	06:52	06:25	07:02	07:24
	17:10		19:20	19:53	20:22	20:36	20:20	19:38	18:46	16:59	16:31	16:37
30	07:13		06:47	05:59	05:29	05:28	05:51	06:22	06:53	06:27	07:03	07:24
	17:12		19:21	19:54	20:23	20:36	20:19	19:36	18:44	16:58	16:31	16:38
31	07:12		06:45		05:29		05:52	06:23		06:28		07:24
	17:13		19:22		20:24		20:18	19:35		16:57		16:39
Potential sun hours	297	297	369	399	449	453	460	428	375	345	297	287
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

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Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R02 - R02

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

	January		February	March	April	May	June	July	August	September	October	November	December		
1	07:25	14:33 (A07)	07:11	06:35	06:44	05:58	05:28	05:29	05:53	06:24	06:54	06:29	07:04		
	16:40 22	14:55 (A07)	17:14	17:48	19:23	19:55	20:25	20:36	20:17	19:33	18:42	16:55	16:31		
2	07:25	14:35 (A07)	07:10	06:33	06:42	05:56	05:28	05:29	05:54	06:25	06:55	06:30	07:05		
	16:40 20	14:55 (A07)	17:15	17:50	19:24	19:56	20:26	20:36	20:16	19:32	18:41	16:54	16:30		
3	07:25	14:36 (A07)	07:09	06:32	06:40	05:55	05:27	05:30	05:55	06:26	06:56	06:31	07:06		
	16:41 18	14:54 (A07)	17:17	17:51	19:25	19:57	20:26	20:36	20:14	19:30	18:39	16:53	16:30		
4	07:25	14:38 (A07)	07:08	06:30	06:39	05:54	05:27	05:30	05:56	06:27	06:58	06:33	07:07		
	16:42 15	14:53 (A07)	17:18	17:52	19:26	19:58	20:27	20:35	20:13	19:28	18:37	16:52	16:30		
5	07:25	14:40 (A07)	07:07	06:29	06:37	05:52	05:27	05:31	05:57	06:28	06:59	06:34	07:08		
	16:43 12	14:52 (A07)	17:19	17:53	19:27	19:59	20:28	20:35	20:12	19:27	18:36	16:50	16:30		
6	07:25	14:44 (A07)	07:06	06:27	06:35	05:51	05:26	05:32	05:58	06:29	07:00	06:35	07:09		14:30 (A07)
	16:44 6	14:50 (A07)	17:20	17:54	19:28	20:00	20:28	20:35	20:11	19:25	18:34	16:49	16:30	6	14:36 (A07)
7	07:25		07:05	06:25	06:34	05:50	05:26	05:32	05:59	06:30	07:01	06:36	07:10		14:28 (A07)
	16:45		17:22	17:55	19:29	20:01	20:29	20:35	20:10	19:23	18:32	16:48	16:29	11	14:39 (A07)
8	07:25		07:04	06:24	06:32	05:49	05:26	05:33	06:00	06:31	07:02	06:37	07:11		14:26 (A07)
	16:46		17:23	17:57	19:30	20:02	20:30	20:34	20:08	19:22	18:31	16:47	16:29	15	14:41 (A07)
9	07:25		07:02	06:22	06:30	05:48	05:26	05:33	06:01	06:32	07:03	06:39	07:12		14:25 (A07)
	16:47		17:24	17:58	19:31	20:04	20:30	20:34	20:07	19:20	18:29	16:46	16:29	18	14:43 (A07)
10	07:24		07:01	06:20	06:29	05:46	05:25	05:34	06:02	06:33	07:04	06:40	07:13		14:25 (A07)
	16:48		17:25	17:59	19:33	20:05	20:31	20:34	20:06	19:18	18:27	16:45	16:29	20	14:45 (A07)
11	07:24		07:00	06:19	06:27	05:45	05:25	05:35	06:03	06:34	07:05	06:41	07:14		14:25 (A07)
	16:49		17:27	18:00	19:34	20:06	20:31	20:33	20:05	19:17	18:26	16:44	16:29	21	14:46 (A07)
12	07:24		06:59	06:17	06:26	05:44	05:25	05:36	06:04	06:35	07:06	06:42	07:15		14:23 (A07)
	16:50		17:28	18:01	19:35	20:07	20:32	20:33	20:03	19:15	18:24	16:43	16:30	24	14:47 (A07)
13	07:24		06:58	06:16	06:24	05:43	05:25	05:36	06:05	06:36	07:07	06:43	07:15		14:23 (A07)
	16:51		17:29	18:02	19:36	20:08	20:32	20:32	20:02	19:13	18:23	16:42	16:30	25	14:48 (A07)
14	07:23		06:56	06:14	06:22	05:42	05:25	05:37	06:06	06:37	07:08	06:45	07:16		14:24 (A07)
	16:52		17:30	18:03	19:37	20:09	20:33	20:32	20:01	19:11	18:21	16:41	16:30	25	14:49 (A07)
15	07:23		06:55	06:12	06:21	05:41	05:25	05:38	06:07	06:38	07:09	06:46	07:17		14:24 (A07)
	16:53		17:32	18:04	19:38	20:10	20:33	20:31	19:59	19:10	18:19	16:40	16:30	26	14:50 (A07)
16	07:22		06:54	06:11	06:19	05:40	05:25	05:39	06:08	06:39	07:11	06:47	07:18		14:23 (A07)
	16:55		17:33	18:05	19:39	20:11	20:34	20:30	19:58	19:08	18:18	16:39	16:30	27	14:50 (A07)
17	07:22		06:52	06:09	06:18	05:39	05:25	05:39	06:09	06:40	07:12	06:48	07:18		14:24 (A07)
	16:56		17:34	18:07	19:40	20:12	20:34	20:30	19:56	19:06	18:16	16:39	16:31	27	14:51 (A07)
18	07:21		06:51	06:07	06:16	05:38	05:25	05:40	06:10	06:41	07:13	06:49	07:19		14:24 (A07)
	16:57		17:35	18:08	19:41	20:13	20:34	20:29	19:55	19:05	18:15	16:38	16:31	28	14:52 (A07)
19	07:21		06:50	06:06	06:15	05:37	05:25	05:41	06:11	06:42	07:14	06:51	07:20		14:24 (A07)
	16:58		17:37	18:09	19:42	20:14	20:35	20:28	19:53	19:03	18:13	16:37	16:31	28	14:52 (A07)
20	07:20		06:48	06:04	06:13	05:36	05:25	05:42	06:12	06:43	07:15	06:52	07:20		14:25 (A07)
	16:59		17:38	18:10	19:43	20:14	20:35	20:28	19:52	19:01	18:12	16:36	16:32	29	14:54 (A07)
21	07:20		06:47	06:02	06:12	05:36	05:25	05:43	06:13	06:44	07:16	06:53	07:21		14:25 (A07)
	17:00		17:39	18:11	19:44	20:15	20:35	20:27	19:50	18:59	18:10	16:36	16:32	29	14:54 (A07)
22	07:19		06:45	06:00	06:10	05:35	05:26	05:44	06:14	06:45	07:17	06:54	07:21		14:26 (A07)
	17:02		17:40	18:12	19:45	20:16	20:35	20:26	19:49	18:58	18:09	16:35	16:33	29	14:55 (A07)
23	07:18		06:44	05:59	06:09	05:34	05:26	05:44	06:15	06:46	07:18	06:55	07:22		14:26 (A07)
	17:03		17:41	18:13	19:47	20:17	20:36	20:25	19:47	18:56	18:07	16:34	16:33	29	14:55 (A07)
24	07:18		06:42	05:57	06:07	05:33	05:26	05:45	06:16	06:47	07:20	06:56	07:22		14:26 (A07)
	17:04		17:43	18:14	19:48	20:18	20:36	20:24	19:46	18:54	18:06	16:34	16:34	28	14:54 (A07)
25	07:17		06:41	05:55	06:06	05:33	05:26	05:46	06:17	06:48	06:21	06:58	07:23		14:27 (A07)
	17:05		17:44	18:15	19:49	20:19	20:36	20:24	19:44	18:53	17:05	16:33	16:34	28	14:55 (A07)
26	07:16		06:39	05:54	06:04	05:32	05:27	05:47	06:18	06:49	06:22	06:59	07:23		14:28 (A07)
	17:07		17:45	18:16	19:50	20:20	20:36	20:23	19:43	18:51	17:03	16:33	16:35	27	14:55 (A07)
27	07:15		06:38	05:52	06:03	05:31	05:27	05:48	06:19	06:50	06:23	07:00	07:23		14:28 (A07)
	17:08		17:46	18:17	19:51	20:21	20:36	20:22	19:41	18:49	17:02	16:32	16:36	27	14:55 (A07)
28	07:15		06:36	05:50	06:02	05:31	05:27	05:49	06:20	06:51	06:24	07:01	07:24		14:30 (A07)
	17:09		17:47	18:19	19:52	20:22	20:36	20:21	19:40	18:47	17:00	16:32	16:36	26	14:56 (A07)
29	07:14			06:49	06:00	05:30	05:28	05:50	06:21	06:52	06:25	07:02	07:24		14:30 (A07)
	17:10			19:20	19:53	20:22	20:36	20:20	19:38	18:46	16:59	16:31	16:37	26	14:56 (A07)
30	07:13			06:47	05:59	05:29	05:28	05:51	06:22	06:53	06:27	07:03	07:24		14:31 (A07)
	17:12			19:21	19:54	20:23	20:36	20:19	19:36	18:44	16:58	16:31	16:38	25	14:56 (A07)
31	07:12			06:45		05:29		05:52	06:23		06:28		07:24		14:32 (A07)
	17:13			19:22		20:24		20:18	19:35		16:57		16:39	24	14:56 (A07)
Potential sun hours	297		297	369	399	449	453	460	428	375	345	297	287		
Total, worst case		93												628	
Sun reduction		0,43												0,41	
Oper. time red.		0,94												0,94	
Wind dir. red.		0,69												0,69	
Total reduction		0,28												0,27	
Total, real		26												168	

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

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

Massimo Lepore / massimo.lepore@tenproject.it
Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R03 - R03

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

	January		February		March		April		May	June
1	07:25		07:11		07:43 (A05)	06:35		06:44	07:02 (A07)	05:58	05:29
	16:40		17:14	29	08:12 (A05)	17:49		19:23	07:08 (A07)	19:55	20:25
2	07:25		07:10		07:43 (A05)	06:33		06:42	07:01 (A07)	05:56	05:28
	16:41		17:15	30	08:13 (A05)	17:50		19:24	07:10 (A07)	19:56	20:26
3	07:25		07:09		07:43 (A05)	06:32		06:40	06:59 (A07)	05:55	05:28
	16:41		17:17	30	08:13 (A05)	17:51		19:25	07:11 (A07)	19:57	20:26
4	07:25		07:08		07:43 (A05)	06:30		06:39	06:57 (A07)	05:54	05:27
	16:42		17:18	30	08:13 (A05)	17:52		19:26	07:11 (A07)	19:58	20:27
5	07:25		07:07		07:43 (A05)	06:29		06:37	06:56 (A07)	05:52	05:27
	16:43		17:19	31	08:14 (A05)	17:53		19:27	07:12 (A07)	19:59	20:28
6	07:25		07:06		07:44 (A05)	06:27	06:49 (A06)	06:35	06:54 (A07)	05:51	05:27
	16:44		17:20	30	08:14 (A05)	17:54	11 07:00 (A06)	19:28	18 07:12 (A07)	20:00	20:28
7	07:25		07:05		07:44 (A05)	06:25	06:46 (A06)	06:34	06:52 (A07)	05:50	05:26
	16:45		17:22	30	08:14 (A05)	17:55	16 07:02 (A06)	19:29	19 07:11 (A07)	20:02	20:29
8	07:25		07:04		07:44 (A05)	06:24	06:45 (A06)	06:32	06:51 (A07)	05:49	05:26
	16:46		17:23	29	08:13 (A05)	17:57	19 07:04 (A06)	19:30	20 07:11 (A07)	20:03	20:30
9	07:25		07:03		07:44 (A05)	06:22	06:43 (A06)	06:31	06:50 (A07)	05:48	05:26
	16:47		17:24	29	08:13 (A05)	17:58	22 07:05 (A06)	19:32	20 07:10 (A07)	20:04	20:30
10	07:24		07:01		07:45 (A05)	06:21	06:42 (A06)	06:29	06:51 (A07)	05:47	05:26
	16:48		17:25	27	08:12 (A05)	17:59	23 07:05 (A06)	19:33	19 07:10 (A07)	20:05	20:31
11	07:24		07:00		07:46 (A05)	06:19	06:41 (A06)	06:27	06:52 (A07)	05:45	05:25
	16:49		17:27	26	08:12 (A05)	18:00	25 07:06 (A06)	19:34	16 07:08 (A07)	20:06	20:31
12	07:24		06:59		07:46 (A05)	06:17	06:40 (A06)	06:26	06:53 (A07)	05:44	05:25
	16:50		17:28	24	08:10 (A05)	18:01	26 07:06 (A06)	19:35	13 07:06 (A07)	20:07	20:32
13	07:24		06:58		07:48 (A05)	06:16	06:40 (A06)	06:24	06:55 (A07)	05:43	05:25
	16:51		17:29	21	08:09 (A05)	18:02	25 07:05 (A06)	19:36	9 07:04 (A07)	20:08	20:32
14	07:23		06:56		07:50 (A05)	06:14	06:40 (A06)	06:23		05:42	05:25
	16:52		17:30	18	08:08 (A05)	18:03	25 07:05 (A06)	19:37		20:09	20:33
15	07:23		06:55		07:52 (A05)	06:12	06:40 (A06)	06:21		05:41	05:25
	16:54		17:32	14	08:06 (A05)	18:04	25 07:05 (A06)	19:38		20:10	20:33
16	07:22		06:54		07:56 (A05)	06:11	06:40 (A06)	06:19		05:40	05:25
	16:55		17:33	5	08:01 (A05)	18:06	23 07:03 (A06)	19:39		20:11	20:34
17	07:22		06:52			06:09	06:41 (A06)	06:18		05:39	05:25
	16:56		17:34			18:07	22 07:03 (A06)	19:40		20:12	20:34
18	07:22		06:51			06:07	06:41 (A06)	06:16		05:38	05:25
	16:57		17:35			18:08	20 07:01 (A06)	19:41		20:13	20:34
19	07:21		06:50			06:06	06:42 (A06)	06:15		05:37	05:25
	16:58		17:37			18:09	17 06:59 (A06)	19:42		20:14	20:35
20	07:20		06:48			06:04	06:44 (A06)	06:13		05:37	05:25
	16:59		17:38			18:10	14 06:58 (A06)	19:43		20:15	20:35
21	07:20		06:47			06:02	06:48 (A06)	06:12		05:36	05:26
	17:01		17:39			18:11	5 06:53 (A06)	19:44		20:16	20:35
22	07:19		06:45			06:01		06:10		05:35	05:26
	17:02		17:40			18:12		19:46		20:16	20:35
23	07:19	07:51 (A05)	06:44			05:59		06:09		05:34	05:26
	17:03	9 08:00 (A05)	17:41			18:13		19:47		20:17	20:36
24	07:18	07:50 (A05)	06:42			05:57		06:07		05:33	05:26
	17:04	14 08:04 (A05)	17:43			18:14		19:48		20:18	20:36
25	07:17	07:48 (A05)	06:41			05:56		06:06		05:33	05:27
	17:05	17 08:05 (A05)	17:44			18:15		19:49		20:19	20:36
26	07:16	07:47 (A05)	06:39			05:54		06:04		05:32	05:27
	17:07	20 08:07 (A05)	17:45			18:16		19:50		20:20	20:36
27	07:16	07:46 (A05)	06:38			05:52		06:03		05:31	05:27
	17:08	22 08:08 (A05)	17:46			18:18		19:51		20:21	20:36
28	07:15	07:45 (A05)	06:36			05:50		06:02		05:31	05:28
	17:09	24 08:09 (A05)	17:47			18:19		19:52		20:22	20:36
29	07:14	07:44 (A05)				06:49		06:00		05:30	05:28
	17:10	26 08:10 (A05)				19:20		19:53		20:23	20:36
30	07:13	07:44 (A05)				06:47		05:59		05:30	05:28
	17:12	27 08:11 (A05)				19:21		19:54		20:23	20:36
31	07:12	07:43 (A05)				06:45				05:29	
	17:13	29 08:12 (A05)				19:22				20:24	
Potential sun hours	297		297			369		399		449	453
Total, worst case		188		403		318		191			
Sun reduction		0,43		0,44		0,44		0,51			
Oper. time red.		0,94		0,94		0,94		0,94			
Wind dir. red.		0,60		0,60		0,66		0,70			
Total reduction		0,24		0,25		0,28		0,33			
Total, real		45		99		88		64			

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)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Massimo Lepore / massimo.lepore@tenproject.it
Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R03 - R03

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

	July		August		September			October			November			December
1	05:29		05:53		06:24		06:51 (A07)	06:54		07:20 (A06)	06:29		07:15 (A05)	07:04
	20:36		20:17		19:33	16	07:07 (A07)	18:42	25	07:45 (A06)	16:55	27	07:42 (A05)	16:31
2	05:29		05:54		06:25		06:49 (A07)	06:56		07:20 (A06)	06:30		07:14 (A05)	07:05
	20:36		20:16		19:32	19	07:08 (A07)	18:41	25	07:45 (A06)	16:54	29	07:43 (A05)	16:30
3	05:30		05:55		06:26		06:48 (A07)	06:57		07:20 (A06)	06:31		07:13 (A05)	07:06
	20:36		20:15		19:30	20	07:08 (A07)	18:39	24	07:44 (A06)	16:53	30	07:43 (A05)	16:30
4	05:30		05:56		06:27		06:48 (A07)	06:58		07:20 (A06)	06:33		07:14 (A05)	07:07
	20:35		20:13		19:28	20	07:08 (A07)	18:37	23	07:43 (A06)	16:52	30	07:44 (A05)	16:30
5	05:31		05:57		06:28		06:49 (A07)	06:59		07:21 (A06)	06:34		07:13 (A05)	07:08
	20:35		20:12		19:27	19	07:08 (A07)	18:36	20	07:41 (A06)	16:51	31	07:44 (A05)	16:30
6	05:32		05:58		06:29		06:50 (A07)	07:00		07:22 (A06)	06:35		07:13 (A05)	07:09
	20:35		20:11		19:25	18	07:08 (A07)	18:34	18	07:40 (A06)	16:49	31	07:44 (A05)	16:30
7	05:32		05:59		06:30		06:51 (A07)	07:01		07:23 (A06)	06:36		07:13 (A05)	07:10
	20:35		20:10		19:23	16	07:07 (A07)	18:32	14	07:37 (A06)	16:48	30	07:43 (A05)	16:30
8	05:33		06:00		06:31		06:52 (A07)	07:02		07:26 (A06)	06:37		07:14 (A05)	07:11
	20:34		20:09		19:22	14	07:06 (A07)	18:31	8	07:34 (A06)	16:47	30	07:44 (A05)	16:30
9	05:34		06:01		06:32		06:53 (A07)	07:03			06:39		07:14 (A05)	07:12
	20:34		20:07		19:20	12	07:05 (A07)	18:29			16:46	30	07:44 (A05)	16:30
10	05:34		06:02		06:33		06:54 (A07)	07:04			06:40		07:14 (A05)	07:13
	20:34		20:06		19:18	10	07:04 (A07)	18:27			16:45	29	07:43 (A05)	16:30
11	05:35		06:03		06:34		06:55 (A07)	07:05			06:41		07:15 (A05)	07:14
	20:33		20:05		19:17	6	07:01 (A07)	18:26			16:44	28	07:43 (A05)	16:30
12	05:36		06:04		06:35		06:56 (A07)	07:06			06:42		07:16 (A05)	07:15
	20:33		20:03		19:15	2	06:58 (A07)	18:24			16:43	27	07:43 (A05)	16:30
13	05:36		06:05		06:36			07:07			06:43		07:16 (A05)	07:15
	20:32		20:02		19:13			18:23			16:42	26	07:42 (A05)	16:30
14	05:37		06:06		06:37			07:08			06:45		07:17 (A05)	07:16
	20:32		20:01		19:12			18:21			16:41	24	07:41 (A05)	16:30
15	05:38		06:07		06:38			07:09			06:46		07:19 (A05)	07:17
	20:31		19:59		19:10			18:20			16:40	22	07:41 (A05)	16:30
16	05:39		06:08		06:39			07:11			06:47		07:20 (A05)	07:18
	20:31		19:58		19:08			18:18			16:39	20	07:40 (A05)	16:30
17	05:39		06:09		06:40			07:12			06:48		07:21 (A05)	07:18
	20:30		19:56		19:06			18:16			16:39	17	07:38 (A05)	16:31
18	05:40		06:10		06:41			07:13			06:49		07:24 (A05)	07:19
	20:29		19:55		19:05			18:15			16:38	14	07:38 (A05)	16:31
19	05:41		06:11		06:42			07:14			06:51		07:26 (A05)	07:20
	20:29		19:54		19:03			18:13			16:37	9	07:35 (A05)	16:31
20	05:42		06:12		06:43			07:15			06:52			07:20
	20:28		19:52		19:01			18:12			16:36			16:32
21	05:43		06:13		06:44			07:16			06:53			07:21
	20:27		19:51		18:59			18:10			16:36			16:32
22	05:44		06:14		06:45			07:17			06:54			07:21
	20:26		19:49		18:58			18:09			16:35			16:33
23	05:45		06:15		06:46		07:29 (A06)	07:18			06:55			07:22
	20:25		19:48		18:56	11	07:40 (A06)	18:08			16:34			16:33
24	05:45		06:16		06:47		07:26 (A06)	07:20			06:56			07:22
	20:25		19:46		18:54	16	07:42 (A06)	18:06			16:34			16:34
25	05:46		06:17		06:48		07:24 (A06)	06:21			06:58			07:23
	20:24		19:44		18:53	19	07:43 (A06)	17:05			16:33			16:34
26	05:47		06:18		06:49		07:23 (A06)	06:22		07:24 (A05)	06:59			07:23
	20:23		19:43		18:51	21	07:44 (A06)	17:03	8	07:32 (A05)	16:33			16:35
27	05:48		06:19		06:50		07:21 (A06)	06:23		07:21 (A05)	07:00			07:23
	20:22		19:41		18:49	24	07:45 (A06)	17:02	14	07:35 (A05)	16:32			16:36
28	05:49		06:20		06:51		07:20 (A06)	06:24		07:19 (A05)	07:01			07:24
	20:21		19:40		18:47	25	07:45 (A06)	17:01	19	07:38 (A05)	16:32			16:36
29	05:50		06:21		06:52		07:21 (A06)	06:25		07:17 (A05)	07:02			07:24
	20:20		19:38		18:46	25	07:46 (A06)	16:59	22	07:39 (A05)	16:31			16:37
30	05:51		06:22	06:55 (A07)	06:53		07:20 (A06)	06:27		07:16 (A05)	07:03			07:24
	20:19		19:37	9 07:04 (A07)	18:44	26	07:46 (A06)	16:58	24	07:40 (A05)	16:31			16:38
31	05:52		06:23	06:52 (A07)				06:28		07:15 (A05)				07:24
	20:18		19:35	14 07:06 (A07)				16:57	26	07:41 (A05)				16:39
Potential sun hours	460		428		375			345			297			287
Total, worst case				23			339			270			484	
Sun reduction				0,68			0,61			0,52			0,47	
Oper. time red.				0,94			0,94			0,94			0,94	
Wind dir. red.				0,70			0,68			0,64			0,60	
Total reduction				0,45			0,39			0,31			0,26	
Total, real				10			133			84			127	

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

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

Massimo Lepore / massimo.lepore@tenproject.it
Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R04 - R04

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

	January	February		March		April		May	June
1	07:25	07:11		06:35		06:44		05:58	05:28
	16:40	17:14		17:48		19:23		19:55	20:25
2	07:25	07:10		06:33		06:42		05:56	05:28
	16:40	17:15		17:50		19:24		19:56	20:26
3	07:25	07:09		06:32		06:40		05:55	05:27
	16:41	17:17		17:51		19:25		19:57	20:26
4	07:25	07:08		06:30		17:22 (A06)	06:39	05:54	05:27
	16:42	17:18		17:52	4	17:26 (A06)	19:26	19:58	20:27
5	07:25	07:07		06:29		17:17 (A06)	06:37	18:50 (A07)	05:52	05:27
	16:43	17:19		17:53	12	17:29 (A06)	19:27	13	19:03 (A07)	19:59	20:28
6	07:25	07:06		06:27		17:15 (A06)	06:35	18:47 (A07)	05:51	05:26
	16:44	17:20		17:54	17	17:32 (A06)	19:28	18	19:05 (A07)	20:00	20:28
7	07:25	07:05		06:25		17:13 (A06)	06:34	18:44 (A07)	05:50	05:26
	16:45	17:22		17:55	20	17:33 (A06)	19:29	22	19:06 (A07)	20:01	20:29
8	07:25	07:04		06:24		17:13 (A06)	06:32	18:43 (A07)	05:49	05:26
	16:46	17:23		17:57	21	17:34 (A06)	19:30	25	19:08 (A07)	20:02	20:30
9	07:24	07:02		06:22		17:11 (A06)	06:30	18:41 (A07)	05:48	05:26
	16:47	17:24		17:58	23	17:34 (A06)	19:31	28	19:09 (A07)	20:03	20:30
10	07:24	07:01		06:20		17:10 (A06)	06:29	18:40 (A07)	05:46	05:25
	16:48	17:25		17:59	24	17:34 (A06)	19:33	29	19:09 (A07)	20:05	20:31
11	07:24	07:00		06:19		17:10 (A06)	06:27	18:39 (A07)	05:45	05:25
	16:49	17:27		18:00	25	17:35 (A06)	19:34	31	19:10 (A07)	20:06	20:31
12	07:24	06:59		06:17		17:10 (A06)	06:26	18:38 (A07)	05:44	05:25
	16:50	17:28		18:01	24	17:34 (A06)	19:35	32	19:10 (A07)	20:07	20:32
13	07:24	06:58		06:16		17:09 (A06)	06:24	18:38 (A07)	05:43	05:25
	16:51	17:29		18:02	25	17:34 (A06)	19:36	33	19:11 (A07)	20:08	20:32
14	07:23	06:56		17:00 (A05)	06:14		17:10 (A06)	06:22	18:37 (A07)	05:42	05:25
	16:52	17:30	7	17:07 (A05)	18:03	24	17:34 (A06)	19:37	33	19:10 (A07)	20:09	20:33
15	07:23	06:55		16:57 (A05)	06:12		17:10 (A06)	06:21	18:37 (A07)	05:41	05:25
	16:53	17:32	12	17:09 (A05)	18:04	23	17:33 (A06)	19:38	34	19:11 (A07)	20:10	20:33
16	07:22	06:54		16:56 (A05)	06:11		17:11 (A06)	06:19	18:37 (A07)	05:40	05:25
	16:55	17:33	14	17:10 (A05)	18:05	20	17:31 (A06)	19:39	33	19:10 (A07)	20:11	20:34
17	07:22	06:52		16:55 (A05)	06:09		17:12 (A06)	06:18	18:36 (A07)	05:39	05:25
	16:56	17:34	17	17:12 (A05)	18:07	18	17:30 (A06)	19:40	33	19:09 (A07)	20:12	20:34
18	07:21	06:51		16:54 (A05)	06:07		17:13 (A06)	06:16	18:37 (A07)	05:38	05:25
	16:57	17:35	18	17:12 (A05)	18:08	15	17:28 (A06)	19:41	32	19:09 (A07)	20:13	20:34
19	07:21	06:50		16:54 (A05)	06:06		17:16 (A06)	06:15	18:36 (A07)	05:37	05:25
	16:58	17:36	19	17:13 (A05)	18:09	9	17:25 (A06)	19:42	32	19:08 (A07)	20:14	20:35
20	07:20	06:48		16:53 (A05)	06:04			06:13	18:37 (A07)	05:36	05:25
	16:59	17:38	19	17:12 (A05)	18:10			19:43	30	19:07 (A07)	20:14	20:35
21	07:20	06:47		16:53 (A05)	06:02			06:12	18:38 (A07)	05:36	05:25
	17:00	17:39	20	17:13 (A05)	18:11			19:44	29	19:07 (A07)	20:15	20:35
22	07:19	06:45		16:54 (A05)	06:00			06:10	18:38 (A07)	05:35	05:26
	17:02	17:40	19	17:13 (A05)	18:12			19:45	27	19:05 (A07)	20:16	20:35
23	07:18	06:44		16:54 (A05)	05:59			06:09	18:40 (A07)	05:34	05:26
	17:03	17:41	18	17:12 (A05)	18:13			19:46	25	19:05 (A07)	20:17	20:36
24	07:18	06:42		16:55 (A05)	05:57			06:07	18:40 (A07)	05:33	05:26
	17:04	17:43	16	17:11 (A05)	18:14			19:48	23	19:03 (A07)	20:18	20:36
25	07:17	06:41		16:56 (A05)	05:55			06:06	18:42 (A07)	05:33	05:26
	17:05	17:44	13	17:09 (A05)	18:15			19:49	19	19:01 (A07)	20:19	20:36
26	07:16	06:39		16:57 (A05)	05:54			06:04	18:43 (A07)	05:32	05:27
	17:07	17:45	10	17:07 (A05)	18:16			19:50	15	18:58 (A07)	20:20	20:36
27	07:15	06:38			05:52			06:03	18:47 (A07)	05:31	05:27
	17:08	17:46			18:17			19:51	8	18:55 (A07)	20:21	20:36
28	07:15	06:36			05:50			06:02		05:31	05:27
	17:09	17:47			18:19			19:52		20:22	20:36
29	07:14				06:49			06:00		05:30	05:28
	17:10				19:20			19:53		20:22	20:36
30	07:13				06:47			05:59		05:29	05:28
	17:12				19:21			19:54		20:23	20:36
31	07:12				06:45					05:29	
	17:13				19:22					20:24	
Potential sun hours	297	297			369			399		449	453
Total, worst case			202			304			604		
Sun reduction			0,44			0,44			0,51		
Oper. time red.			0,94			0,94			0,94		
Wind dir. red.			0,71			0,70			0,67		
Total reduction			0,30			0,30			0,32		
Total, real			60			90			194		

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

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

Massimo Lepore / massimo.lepore@tenproject.it
Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R04 - R04

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

	July	August		September		October		November	December
1	05:29	05:53		06:24	18:38 (A07)	06:54	17:48 (A06)	06:29	07:04
	20:36	20:17		19:33 31	19:09 (A07)	18:42 25	18:13 (A06)	16:55	16:31
2	05:29	05:54		06:25	18:39 (A07)	06:55	17:49 (A06)	06:30	07:05
	20:36	20:16		19:32 29	19:08 (A07)	18:41 25	18:14 (A06)	16:54	16:30
3	05:30	05:55		06:26	18:39 (A07)	06:56	17:49 (A06)	06:31	07:06
	20:36	20:14		19:30 28	19:07 (A07)	18:39 24	18:13 (A06)	16:53	16:30
4	05:30	05:56		06:27	18:40 (A07)	06:58	17:49 (A06)	06:33	07:07
	20:35	20:13		19:28 25	19:05 (A07)	18:37 23	18:12 (A06)	16:52	16:30
5	05:31	05:57		06:28	18:41 (A07)	06:59	17:49 (A06)	06:34	07:08
	20:35	20:12		19:27 23	19:04 (A07)	18:36 22	18:11 (A06)	16:50	16:30
6	05:31	05:58		06:29	18:43 (A07)	07:00	17:49 (A06)	06:35	07:09
	20:35	20:11		19:25 18	19:01 (A07)	18:34 21	18:10 (A06)	16:49	16:30
7	05:32	05:59		06:30	18:45 (A07)	07:01	17:50 (A06)	06:36	07:10
	20:35	20:10		19:23 13	18:58 (A07)	18:32 18	18:08 (A06)	16:48	16:29
8	05:33	06:00		06:31		07:02	17:52 (A06)	06:37	07:11
	20:34	20:08		19:22		18:31 14	18:06 (A06)	16:47	16:29
9	05:33	06:01		06:32		07:03	17:54 (A06)	06:39	07:12
	20:34	20:07		19:20		18:29 9	18:03 (A06)	16:46	16:29
10	05:34	06:02		06:33		07:04		06:40	07:13
	20:33	20:06		19:18		18:27		16:45	16:29
11	05:35	06:03		06:34		07:05		06:41	07:14
	20:33	20:05		19:17		18:26		16:44	16:29
12	05:36	06:04		06:35		07:06		06:42	07:14
	20:33	20:03		19:15		18:24		16:43	16:30
13	05:36	06:05		06:36		07:07		06:43	07:15
	20:32	20:02		19:13		18:23		16:42	16:30
14	05:37	06:06		06:37		07:08		06:45	07:16
	20:32	20:01		19:11		18:21		16:41	16:30
15	05:38	06:07		06:38		07:09	17:32 (A05)	06:46	07:17
	20:31	19:59		19:10		18:19 5	17:37 (A05)	16:40	16:30
16	05:39	06:08	18:53 (A07)	06:39		07:10	17:29 (A05)	06:47	07:17
	20:30	19:58 10	19:03 (A07)	19:08		18:18 11	17:40 (A05)	16:39	16:30
17	05:39	06:09	18:49 (A07)	06:40		07:12	17:27 (A05)	06:48	07:18
	20:30	19:56 16	19:05 (A07)	19:06		18:16 14	17:41 (A05)	16:39	16:31
18	05:40	06:10	18:47 (A07)	06:41		07:13	17:25 (A05)	06:49	07:19
	20:29	19:55 20	19:07 (A07)	19:05		18:15 17	17:42 (A05)	16:38	16:31
19	05:41	06:11	18:46 (A07)	06:42		07:14	17:25 (A05)	06:51	07:19
	20:28	19:53 23	19:09 (A07)	19:03		18:13 18	17:43 (A05)	16:37	16:31
20	05:42	06:12	18:44 (A07)	06:43		07:15	17:24 (A05)	06:52	07:20
	20:28	19:52 26	19:10 (A07)	19:01		18:12 19	17:43 (A05)	16:36	16:32
21	05:43	06:13	18:43 (A07)	06:44		07:16	17:24 (A05)	06:53	07:21
	20:27	19:50 27	19:10 (A07)	18:59		18:10 19	17:43 (A05)	16:36	16:32
22	05:44	06:14	18:42 (A07)	06:45		07:17	17:23 (A05)	06:54	07:21
	20:26	19:49 29	19:11 (A07)	18:58		18:09 20	17:43 (A05)	16:35	16:33
23	05:44	06:15	18:41 (A07)	06:46		07:18	17:23 (A05)	06:55	07:22
	20:25	19:47 30	19:11 (A07)	18:56		18:07 19	17:42 (A05)	16:34	16:33
24	05:45	06:16	18:40 (A07)	06:47	18:00 (A06)	07:20	17:25 (A05)	06:56	07:22
	20:24	19:46 32	19:12 (A07)	18:54 7	18:07 (A06)	18:06 17	17:42 (A05)	16:34	16:34
25	05:46	06:17	18:39 (A07)	06:48	17:57 (A06)	06:21	16:25 (A05)	06:57	07:23
	20:24	19:44 33	19:12 (A07)	18:53 13	18:10 (A06)	17:05 16	16:41 (A05)	16:33	16:34
26	05:47	06:18	18:39 (A07)	06:49	17:54 (A06)	06:22	16:26 (A05)	06:59	07:23
	20:23	19:43 33	19:12 (A07)	18:51 17	18:11 (A06)	17:03 14	16:40 (A05)	16:33	16:35
27	05:48	06:19	18:39 (A07)	06:50	17:52 (A06)	06:23	16:27 (A05)	07:00	07:23
	20:22	19:41 33	19:12 (A07)	18:49 20	18:12 (A06)	17:02 11	16:38 (A05)	16:32	16:36
28	05:49	06:20	18:38 (A07)	06:51	17:51 (A06)	06:24	16:31 (A05)	07:01	07:24
	20:21	19:40 33	19:11 (A07)	18:47 22	18:13 (A06)	17:00 5	16:36 (A05)	16:32	16:36
29	05:50	06:21	18:38 (A07)	06:52	17:50 (A06)	06:25		07:02	07:24
	20:20	19:38 33	19:11 (A07)	18:46 23	18:13 (A06)	16:59		16:31	16:37
30	05:51	06:22	18:38 (A07)	06:53	17:49 (A06)	06:27		07:03	07:24
	20:19	19:36 32	19:10 (A07)	18:44 24	18:13 (A06)	16:58		16:31	16:38
31	05:52	06:23	18:38 (A07)			06:28			07:24
	20:18	19:35 32	19:10 (A07)			16:57			16:39
Potential sun hours	460	428		375		345		297	287
Total, worst case		442		293		386			
Sun reduction		0,68		0,61		0,52			
Oper. time red.		0,94		0,94		0,94			
Wind dir. red.		0,67		0,69		0,71			
Total reduction		0,44		0,40		0,35			
Total, real		193		116		135			

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

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

Massimo Lepore / massimo.lepore@tenproject.it
Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R05 - R05

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

	January	February		March		April		May		June	
1	07:25	07:11		06:35		06:44		05:58		05:28	
	16:40	17:14		17:48	33	16:49 (A09) / 17:22 (A09)		19:23	19:55	66	19:04 (A10) / 20:25	28	18:19 (A10) / 18:47 (A10)
2	07:25	07:10		06:33		06:42		05:56		05:28	
	16:40	17:15		17:50	34	16:48 (A09) / 17:22 (A09)		19:24	19:56	66	17:58 (A10) / 19:04 (A10)	25	18:21 (A10) / 18:46 (A10)
3	07:25	07:09		06:32		06:40		05:55		05:28	
	16:41	17:17		17:51	35	16:48 (A09) / 17:23 (A09)		19:25	19:57	65	17:58 (A10) / 19:03 (A10)	22	18:22 (A10) / 18:44 (A10)
4	07:25	07:08		06:30		06:39		05:54		05:27	
	16:42	17:18		17:52	36	16:47 (A09) / 17:23 (A09)		19:26	19:58	65	17:58 (A10) / 20:26	20	18:23 (A10) / 18:43 (A10)
5	07:25	07:07		06:28		06:37		05:52		05:27	
	16:43	17:19		17:53	36	16:46 (A09) / 17:22 (A09)		19:27	19:59	65	17:58 (A10) / 20:27	17	18:25 (A10) / 18:42 (A10)
6	07:25	07:06		06:27		06:35		05:51		05:26	
	16:44	17:20		17:54	37	16:46 (A09) / 17:23 (A09)		19:28	20:00	64	17:59 (A10) / 20:28	13	18:27 (A10) / 18:40 (A10)
7	07:25	07:05		06:25		06:34		05:50		05:26	
	16:45	17:22		17:55	37	16:45 (A09) / 17:22 (A09)		19:29	18:30 (A10) / 18:40 (A10)	10	17:59 (A10) / 20:01	64	19:03 (A10) / 20:29	9	18:29 (A10) / 18:38 (A10)
8	07:25	07:04		06:24		06:32		05:49		05:26	
	16:46	17:23		17:56	37	16:46 (A09) / 17:23 (A09)		19:30	18:25 (A10) / 18:47 (A10)	22	20:02	62	18:00 (A10) / 19:02 (A10)	20:30	
9	07:24	07:02		06:22		06:30		05:48		05:26	
	16:47	17:24		17:58	36	16:46 (A09) / 17:22 (A09)		19:31	18:20 (A10) / 18:50 (A10)	30	20:03	62	17:59 (A10) / 19:01 (A10)	20:30	
10	07:24	07:01		06:20		06:29		05:46		05:25	
	16:48	17:25		17:59	36	16:45 (A09) / 17:21 (A09)		19:32	18:17 (A10) / 18:52 (A10)	35	20:04	61	18:00 (A10) / 19:01 (A10)	20:31	
11	07:24	07:00		06:19		06:27		05:45		05:25	
	16:49	17:27		18:00	35	16:46 (A09) / 17:21 (A09)		19:34	18:15 (A10) / 18:54 (A10)	39	20:05	60	18:00 (A10) / 19:00 (A10)	20:31	
12	07:24	06:59		16:53 (A08) / 18:03		06:17		06:26		05:44			18:01 (A10) / 19:00 (A10)	20:32	
	16:50	17:28	11	17:04 (A08) / 18:01	32	16:47 (A09) / 17:19 (A09)		19:35	18:13 (A10) / 18:56 (A10)	43	20:07	59	18:01 (A10) / 19:00 (A10)	20:32	
13	07:23	06:57		16:51 (A08) / 18:02		06:16		06:24		05:43			18:01 (A10) / 19:00 (A10)	20:32	
	16:51	17:29	15	17:06 (A08) / 18:02	31	16:47 (A09) / 17:18 (A09)		19:36	18:11 (A10) / 18:57 (A10)	46	20:08	59	18:02 (A10) / 19:00 (A10)	20:32	
14	07:23	06:56		16:50 (A08) / 18:03		06:14		06:22		05:42			18:02 (A10) / 19:00 (A10)	20:33	
	16:52	17:30	18	17:08 (A08) / 18:03	28	16:49 (A09) / 17:17 (A09)		19:37	18:09 (A10) / 18:58 (A10)	49	20:09	57	18:02 (A10) / 18:59 (A10)	20:33	
15	07:23	06:55		16:48 (A08) / 18:04		06:12		06:21		05:41			18:02 (A10) / 18:59 (A10)	20:33	
	16:53	17:32	21	17:09 (A08) / 18:04	26	16:49 (A09) / 17:15 (A09)		19:38	18:08 (A10) / 19:00 (A10)	52	20:10	56	18:03 (A10) / 18:58 (A10)	20:33	
16	07:22	06:54		16:48 (A08) / 18:05		06:11		06:19		05:40			18:04 (A10) / 18:59 (A10)	20:34	
	16:55	17:33	22	17:10 (A08) / 18:05	22	16:51 (A09) / 17:13 (A09)		19:39	18:06 (A10) / 19:00 (A10)	54	20:11	55	18:04 (A10) / 18:59 (A10)	20:34	
17	07:22	06:52		16:48 (A08) / 18:07		06:09		06:18		05:39			18:05 (A10) / 18:59 (A10)	20:34	
	16:56	17:34	23	17:11 (A08) / 18:07	18	16:53 (A09) / 17:11 (A09)		19:40	18:05 (A10) / 19:00 (A10)	55	20:12	54	18:04 (A10) / 18:58 (A10)	20:34	
18	07:21	06:51		16:47 (A08) / 18:07		06:07		06:16		05:38			18:05 (A10) / 18:58 (A10)	20:34	
	16:57	17:35	24	17:11 (A08) / 18:08	10	16:57 (A09) / 17:07 (A09)		19:41	18:04 (A10) / 19:02 (A10)	58	20:12	52	18:05 (A10) / 18:57 (A10)	20:34	
19	07:21	06:49		16:47 (A08) / 06:05				06:15		05:37			18:06 (A10) / 18:57 (A10)	20:35	
	16:58	17:36	25	17:12 (A08) / 18:09				19:42	18:02 (A10) / 19:02 (A10)	60	20:13	51	18:06 (A10) / 18:57 (A10)	20:35	
20	07:20	06:48		16:46 (A08) / 06:04				06:13		05:36			18:07 (A10) / 18:56 (A10)	20:35	
	16:59	17:38	25	17:11 (A08) / 18:10				19:43	18:02 (A10) / 19:03 (A10)	61	20:14	50	18:07 (A10) / 18:56 (A10)	20:35	
21	07:20	06:47		16:47 (A08) / 06:02				06:12		05:36			18:07 (A10) / 18:55 (A10)	20:35	
	17:00	17:39	24	17:11 (A08) / 18:11				19:44	18:02 (A10) / 19:04 (A10)	62	20:15	48	18:08 (A10) / 18:55 (A10)	20:35	
22	07:19	06:45		16:46 (A08) / 06:00				06:10		05:35			18:08 (A10) / 18:55 (A10)	20:35	
	17:02	17:40	24	17:10 (A08) / 18:12				19:45	18:01 (A10) / 19:03 (A10)	62	20:16	47	18:09 (A10) / 18:55 (A10)	20:35	
23	07:18	06:44		16:47 (A08) / 05:59				06:09		05:34			18:09 (A10) / 18:54 (A10)	20:35	
	17:03	17:41	23	17:10 (A08) / 18:13				19:46	18:00 (A10) / 19:04 (A10)	64	20:17	45	18:10 (A10) / 18:54 (A10)	20:35	
24	07:18	06:42		16:47 (A08) / 05:57				06:07		05:33			18:10 (A10) / 18:53 (A10)	20:36	
	17:04	17:43	27	17:14 (A09) / 18:14				19:48	17:59 (A10) / 19:04 (A10)	65	20:18	43	18:11 (A10) / 18:53 (A10)	20:36	
25	07:17	06:41		16:49 (A08) / 05:55				06:06		05:33			18:11 (A10) / 18:53 (A10)	20:36	
	17:05	17:44	28	17:17 (A09) / 18:15				19:49	17:59 (A10) / 19:04 (A10)	65	20:19	42	18:12 (A10) / 18:52 (A10)	20:36	
26	07:16	06:39		16:50 (A08) / 05:54				06:04		05:32			18:12 (A10) / 18:52 (A10)	20:36	
	17:07	17:45	28	17:18 (A09) / 18:16				19:50	17:58 (A10) / 19:04 (A10)	66	20:20	40	18:12 (A10) / 18:52 (A10)	20:36	
27	07:15	06:38		16:51 (A09) / 05:52				06:03		05:31			18:12 (A10) / 18:50 (A10)	20:36	
	17:08	17:46	29	17:20 (A09) / 18:17				19:51	17:58 (A10) / 19:04 (A10)	66	20:21	38	18:14 (A10) / 18:50 (A10)	20:36	
28	07:15	06:36		16:50 (A09) / 05:50				06:02		05:31			18:15 (A10) / 18:50 (A10)	20:36	
	17:09	17:47	30	17:20 (A09) / 18:19				19:52	17:58 (A10) / 19:04 (A10)	66	20:22	36	18:15 (A10) / 18:49 (A10)	20:36	
29	07:14			06:49				06:00		05:30			18:15 (A10) / 18:49 (A10)	20:36	
	17:10			19:20				19:53	17:58 (A10) / 19:04 (A10)	66	20:22	34	18:17 (A10) / 18:49 (A10)	20:36	
30	07:13			06:47				05:59		05:29			18:17 (A10) / 18:49 (A10)	20:36	
	17:12			19:21				19:54	17:58 (A10) / 19:04 (A10)	66	20:23	32	18:49 (A10) / 20:36		
31	07:12			06:45						05:29			18:17 (A10) /		
	17:13			19:22						20:24	30	18:47 (A10) /			
Potential sun hours	297	297		369		399		449		453	
Total, worst case		397		559		1262		1628		134	
Sun reduction		0,44		0,44		0,51		0,57		0,62	
Oper. time red.		0,94		0,94		0,94		0,94		0,94	
Wind dir. red.		0,71		0,70		0,67		0,67		0,67	
Total reduction		0,30		0,30		0,32		0,36		0,39	
Total, real		117		165		405		589		53	

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

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

Massimo Lepore / massimo.lepore@tenproject.it
Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R05 - R05

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

	July		August		September		October		November	December
1	05:29		05:53		18:11 (A10)	06:24	18:14 (A10)	06:54	17:26 (A09)	06:29	07:04
	20:36		20:17	60	19:11 (A10)	19:33 39	18:53 (A10)	18:42 32	17:58 (A09)	16:55	16:31
2	05:29		05:54		18:10 (A10)	06:25	18:16 (A10)	06:55	17:25 (A09)	06:30	07:05
	20:36		20:15	61	19:11 (A10)	19:32 35	18:51 (A10)	18:41 34	17:59 (A09)	16:54	16:30
3	05:30		05:55		18:10 (A10)	06:26	18:18 (A10)	06:56	17:24 (A09)	06:31	07:06
	20:35		20:14	62	19:12 (A10)	19:30 30	18:48 (A10)	18:39 35	17:59 (A09)	16:53	16:30
4	05:30		05:56		18:10 (A10)	06:27	18:22 (A10)	06:57	17:23 (A09)	06:32	07:07
	20:35		20:13	62	19:12 (A10)	19:28 22	18:44 (A10)	18:37 36	17:59 (A09)	16:52	16:30
5	05:31	18:37 (A10)	05:57		18:09 (A10)	06:28	18:27 (A10)	06:59	17:23 (A09)	06:34	07:08
	20:35 6	18:43 (A10)	20:12	63	19:12 (A10)	19:27 11	18:38 (A10)	18:36 36	17:59 (A09)	16:50	16:30
6	05:32	18:34 (A10)	05:58		18:09 (A10)	06:29		07:00	17:22 (A09)	06:35	07:09
	20:35 11	18:45 (A10)	20:11	63	19:12 (A10)	19:25		18:34 37	17:59 (A09)	16:49	16:30
7	05:32	18:32 (A10)	05:59		18:08 (A10)	06:30		07:01	17:22 (A09)	06:36	07:10
	20:35 16	18:48 (A10)	20:10	65	19:13 (A10)	19:23		18:32 37	17:59 (A09)	16:48	16:29
8	05:33	18:30 (A10)	06:00		18:08 (A10)	06:31		07:02	17:21 (A09)	06:37	07:11
	20:34 19	18:49 (A10)	20:08	65	19:13 (A10)	19:22		18:31 37	17:58 (A09)	16:47	16:29
9	05:33	18:29 (A10)	06:01		18:08 (A10)	06:32		07:03	17:21 (A09)	06:38	07:12
	20:34 22	18:51 (A10)	20:07	65	19:13 (A10)	19:20		18:29 36	17:57 (A09)	16:46	16:29
10	05:34	18:29 (A10)	06:02		18:07 (A10)	06:33		07:04	17:21 (A09)	06:40	07:13
	20:33 24	18:53 (A10)	20:06	66	19:13 (A10)	19:18		18:27 36	17:57 (A09)	16:45	16:29
11	05:35	18:27 (A10)	06:03		18:07 (A10)	06:34		07:05	17:21 (A09)	06:41	07:14
	20:33 26	18:53 (A10)	20:05	66	19:13 (A10)	19:16		18:26 35	17:56 (A09)	16:44	16:29
12	05:36	18:26 (A10)	06:04		18:07 (A10)	06:35		07:06	17:21 (A09)	06:42	07:14
	20:33 29	18:55 (A10)	20:03	66	19:13 (A10)	19:15		18:24 34	17:55 (A09)	16:43	16:30
13	05:36	18:25 (A10)	06:05		18:07 (A10)	06:36		07:07	17:23 (A09)	06:43	07:15
	20:32 31	18:56 (A10)	20:02	65	19:12 (A10)	19:13		18:23 32	17:55 (A09)	16:42	16:30
14	05:37	18:25 (A10)	06:06		18:06 (A10)	06:37		07:08	17:24 (A09)	06:45	07:16
	20:31 33	18:58 (A10)	20:00	66	19:12 (A10)	19:11		18:21 29	17:53 (A09)	16:41	16:30
15	05:38	18:23 (A10)	06:07		18:06 (A10)	06:38		07:09	17:24 (A08)	06:46	07:17
	20:31 35	18:58 (A10)	19:59	66	19:12 (A10)	19:10		18:19 28	17:52 (A09)	16:40	16:30
16	05:39	18:22 (A10)	06:08		18:05 (A10)	06:39		07:10	17:22 (A08)	06:47	07:17
	20:30 37	18:59 (A10)	19:58	66	19:11 (A10)	19:08		18:18 28	17:50 (A09)	16:39	16:30
17	05:39	18:22 (A10)	06:09		18:05 (A10)	06:40		07:12	17:20 (A08)	06:48	07:18
	20:30 39	19:01 (A10)	19:56	65	19:10 (A10)	19:06		18:16 27	17:47 (A09)	16:39	16:31
18	05:40	18:21 (A10)	06:10		18:05 (A10)	06:41		07:13	17:19 (A08)	06:49	07:19
	20:29 41	19:02 (A10)	19:55	65	19:10 (A10)	19:04		18:15 25	17:44 (A09)	16:38	16:31
19	05:41	18:20 (A10)	06:11		18:05 (A10)	06:42		07:14	17:19 (A08)	06:50	07:19
	20:28 43	19:03 (A10)	19:53	64	19:09 (A10)	19:03		18:13 23	17:42 (A08)	16:37	16:31
20	05:42	18:19 (A10)	06:12		18:05 (A10)	06:43		07:15	17:18 (A08)	06:52	07:20
	20:28 44	19:03 (A10)	19:52	64	19:09 (A10)	19:01		18:12 24	17:42 (A08)	16:36	16:32
21	05:43	18:18 (A10)	06:13		18:05 (A10)	06:44		07:16	17:17 (A08)	06:53	07:21
	20:27 46	19:04 (A10)	19:50	63	19:08 (A10)	18:59		18:10 25	17:42 (A08)	16:36	16:32
22	05:44	18:18 (A10)	06:14		18:06 (A10)	06:45		07:17	17:17 (A08)	06:54	07:21
	20:26 47	19:05 (A10)	19:49	61	19:07 (A10)	18:58		18:09 25	17:42 (A08)	16:35	16:33
23	05:44	18:17 (A10)	06:15		18:06 (A10)	06:46		07:18	17:16 (A08)	06:55	07:22
	20:25 49	19:06 (A10)	19:47	60	19:06 (A10)	18:56		18:07 25	17:41 (A08)	16:34	16:33
24	05:45	18:16 (A10)	06:16		18:06 (A10)	06:47		07:19	17:17 (A08)	06:56	07:22
	20:24 51	19:07 (A10)	19:46	59	19:05 (A10)	18:54		18:06 25	17:42 (A08)	16:34	16:34
25	05:46	18:16 (A10)	06:17		18:07 (A10)	06:48	17:41 (A09)	06:21	16:18 (A08)	06:57	07:22
	20:24 52	19:08 (A10)	19:44	57	19:04 (A10)	18:52 6	17:47 (A09)	17:05 23	16:41 (A08)	16:33	16:34
26	05:47	18:15 (A10)	06:18		18:08 (A10)	06:49	17:36 (A09)	06:22	16:18 (A08)	06:59	07:23
	20:23 53	19:08 (A10)	19:43	55	19:03 (A10)	18:51 15	17:51 (A09)	17:03 22	16:40 (A08)	16:33	16:35
27	05:48	18:15 (A10)	06:19		18:08 (A10)	06:50	17:33 (A09)	06:23	16:18 (A08)	07:00	07:23
	20:22 54	19:09 (A10)	19:41	54	19:02 (A10)	18:49 21	17:54 (A09)	17:02 20	16:38 (A08)	16:32	16:36
28	05:49	18:13 (A10)	06:20		18:09 (A10)	06:51	17:31 (A09)	06:24	16:19 (A08)	07:01	07:24
	20:21 56	19:09 (A10)	19:40	52	19:01 (A10)	18:47 24	17:55 (A09)	17:00 17	16:36 (A08)	16:32	16:36
29	05:50	18:13 (A10)	06:21		18:10 (A10)	06:52	17:29 (A09)	06:25	16:21 (A08)	07:02	07:24
	20:20 56	19:09 (A10)	19:38	49	18:59 (A10)	18:46 27	17:56 (A09)	16:59 15	16:36 (A08)	16:31	16:37
30	05:51	18:12 (A10)	06:22		18:11 (A10)	06:53	17:27 (A09)	06:27	16:24 (A08)	07:03	07:24
	20:19 58	19:10 (A10)	19:36	46	18:57 (A10)	18:44 30	17:57 (A09)	16:58 9	16:33 (A08)	16:31	16:38
31	05:52	18:11 (A10)	06:23		18:13 (A10)			06:28			07:24
	20:18 59	19:10 (A10)	19:35	42	18:55 (A10)			16:57			16:39
Potential sun hours	460		428		375			345		297	287
Total, worst case	1037		1883		260			847			
Sun reduction	0,69		0,68		0,61			0,52			
Oper. time red.	0,94		0,94		0,94			0,94			
Wind dir. red.	0,67		0,67		0,69			0,71			
Total reduction	0,43		0,43		0,40			0,35			
Total, real	451		817		103			296			

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

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

Massimo Lepore / massimo.lepore@tenproject.it

Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R06 - R06

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:25	07:11	06:35	06:44	05:58	18:24 (A08)	05:28	05:29	05:53	06:24	18:21 (A08)	06:54	06:29	07:04
	16:40	17:14	17:48	19:23	19:55 29	18:53 (A08)	20:25	20:36	20:17	19:33 41	19:02 (A08)	18:42	16:55	16:31
2	07:25	07:10	06:33	06:42	05:56	18:26 (A08)	05:28	05:29	05:54	06:25	18:21 (A08)	06:55	06:30	07:05
	16:40	17:15	17:50	19:24	19:56 25	18:51 (A08)	20:26	20:36	20:16	19:32 40	19:01 (A08)	18:41	16:54	16:30
3	07:25	07:09	06:32	06:40	18:39 (A08) 05:55	18:27 (A08)	05:28	05:30	05:55	06:26	18:22 (A08)	06:56	06:31	07:06
	16:41	17:17	17:51	19:25 11	18:50 (A08) 19:57 21	18:48 (A08)	20:26	20:35	20:14	19:30 37	18:59 (A08)	18:39	16:53	16:30
4	07:25	07:08	06:30	06:39	18:34 (A08) 05:54	18:30 (A08)	05:27	05:30	05:56	06:27	18:23 (A08)	06:58	06:32	07:07
	16:42	17:18	17:52	19:26 20	18:54 (A08) 19:58 16	18:46 (A08)	20:27	20:35	20:13	19:28 35	18:58 (A08)	18:37	16:52	16:30
5	07:25	07:07	06:29	06:37	18:32 (A08) 05:52	18:34 (A08)	05:27	05:31	05:57	06:28	18:24 (A08)	06:59	06:34	07:08
	16:43	17:19	17:53	19:27 25	18:57 (A08) 19:59 8	18:42 (A08)	20:28	20:35	20:12	19:27 32	18:56 (A08)	18:36	16:50	16:30
6	07:25	07:06	06:27	06:35	18:29 (A08) 05:51		05:26	05:32	05:58	06:29	18:25 (A08)	07:00	06:35	07:09
	16:44	17:20	17:54	19:28 29	18:58 (A08) 20:00		20:28	20:35	20:11	19:25 29	18:54 (A08)	18:34	16:49	16:30
7	07:25	07:05	06:25	06:34	18:27 (A08) 05:50		05:26	05:32	05:59	06:30	18:27 (A08)	07:01	06:36	07:10
	16:45	17:22	17:55	19:29 32	18:59 (A08) 20:01		20:29	20:35	20:10	19:23 25	18:52 (A08)	18:32	16:48	16:30
8	07:25	07:04	06:24	06:32	18:26 (A08) 05:49		05:26	05:33	06:00 18:42 (A08)	06:31	18:29 (A08)	07:02	06:37	07:11
	16:46	17:23	17:57	19:30 35	19:01 (A08) 20:02		20:30	20:34	20:08 11 18:53 (A08)	19:22 20	18:49 (A08)	18:31	16:47	16:29
9	07:24	07:02	06:22	06:30	18:24 (A08) 05:48		05:26	05:33	06:01 18:39 (A08)	06:32	18:33 (A08)	07:03	06:39	07:12
	16:47	17:24	17:58	19:31 37	19:01 (A08) 20:03		20:30	20:34	20:07 18 18:57 (A08)	19:20 12	18:45 (A08)	18:29	16:46	16:29
10	07:24	07:01	06:20	06:29	18:22 (A08) 05:46		05:25	05:34	06:02 18:36 (A08)	06:33		07:04	06:40	07:13
	16:48	17:25	17:59	19:33 40	19:02 (A08) 20:04		20:31	20:33	20:06 23 18:59 (A08)	19:18		18:27	16:45	16:29
11	07:24	07:00	06:19	06:27	18:22 (A08) 05:45		05:25	05:35	06:03 18:34 (A08)	06:34		07:05	06:41	07:14
	16:49	17:27	18:00	19:34 41	19:03 (A08) 20:06		20:31	20:33	20:05 26 19:00 (A08)	19:16		18:26	16:44	16:30
12	07:24	06:59	06:17	06:26	18:20 (A08) 05:44		05:25	05:36	06:04 18:32 (A08)	06:35		07:06	06:42	07:14
	16:50	17:28	18:01	19:35 43	19:03 (A08) 20:07		20:32	20:33	20:03 30 19:02 (A08)	19:15		18:24	16:43	16:30
13	07:23	06:57	06:16	06:24	18:20 (A08) 05:43		05:25	05:36	06:05 06:46 (800)	06:36		07:07	06:43	07:15
	16:51	17:29	18:02	19:36 44	19:04 (A08) 20:08		20:32	20:32	20:02 37 19:03 (A08)	19:13		18:23	16:42	16:30
14	07:23	06:56	06:14	06:22	18:19 (A08) 05:42		05:25	05:37	06:06 06:43 (800)	06:37		07:08	06:45	07:16
	16:52	17:30	18:03	19:37 44	19:03 (A08) 20:09		20:33	20:32	20:00 44 19:04 (A08)	19:11		18:21	16:41	16:30
15	07:23	06:55	06:12	06:21	18:19 (A08) 05:41		05:25	05:38	06:07 06:42 (800)	06:38		07:09	06:46	07:17
	16:54	17:32	18:04	19:38 45	19:04 (A08) 20:10		20:33	20:31	19:59 49 19:05 (A08)	19:10		18:19	16:40	16:30
16	07:22	06:54	06:11	06:19	18:18 (A08) 05:40		05:25	05:39	06:08 06:40 (800)	06:39		07:10	06:47	07:17
	16:55	17:33	18:05	19:39 45	19:03 (A08) 20:11		20:34	20:30	19:58 54 19:05 (A08)	19:08		18:18	16:39	16:30
17	07:22	06:52	06:09	06:18	06:38 (800) 05:39		05:25	05:39	06:09 06:38 (800)	06:40		07:12	06:48	07:18
	16:56	17:34	18:07	19:40 54	19:03 (A08) 20:12		20:34	20:30	19:56 57 19:05 (A08)	19:06		18:16	16:39	16:31
18	07:21	06:51	06:07	06:16	06:36 (800) 05:38		05:25	05:40	06:10 06:38 (800)	06:41		07:13	06:49	07:19
	16:57	17:35	18:08	19:41 57	19:03 (A08) 20:12		20:34	20:29	19:55 58 19:05 (A08)	19:05		18:15	16:38	16:31
19	07:21	06:49	06:06	06:15	06:34 (800) 05:37		05:25	05:41	06:11 06:37 (800)	06:42		07:14	06:50	07:19
	16:58	17:37	18:09	19:42 60	19:02 (A08) 20:13		20:35	20:28	19:53 61 19:06 (A08)	19:03		18:13	16:37	16:31
20	07:20	06:48	06:04	06:13	06:34 (800) 05:37		05:25	05:42	06:12 06:37 (800)	06:43		07:15	06:52	07:20
	16:59	17:38	18:10	19:43 61	19:02 (A08) 20:14		20:35	20:28	19:52 62 19:06 (A08)	19:01		18:12	16:36	16:32
21	07:20	06:47	06:02	06:12	06:33 (800) 05:36		05:25	05:43	06:13 06:37 (800)	06:44		07:16	06:53	07:21
	17:00	17:39	18:11	19:44 62	19:02 (A08) 20:15		20:35	20:27	19:50 62 19:06 (A08)	18:59		18:10	16:36	16:32
22	07:19	06:45	06:00	06:10	06:32 (800) 05:35		05:26	05:44	06:14 06:37 (800)	06:45		07:17	06:54	07:21
	17:02	17:40	18:12	19:45 62	19:01 (A08) 20:16		20:35	20:26	19:49 62 19:06 (A08)	18:58		18:09	16:35	16:33
23	07:18	06:44	05:59	06:09	06:32 (800) 05:34		05:26	05:45	06:15 06:38 (800)	06:46		07:18	06:55	07:22
	17:03	17:41	18:13	19:46 62	19:01 (A08) 20:17		20:35	20:25	19:47 61 19:06 (A08)	18:56		18:07	16:34	16:33
24	07:18	06:42	05:57	06:07	06:32 (800) 05:33		05:26	05:45	06:16 06:38 (800)	06:47		07:20	06:56	07:22
	17:04	17:43	18:14	19:48 60	19:00 (A08) 20:18		20:36	20:24	19:46 60 19:06 (A08)	18:54		18:06	16:34	16:34
25	07:17	06:41	05:55	06:06	06:32 (800) 05:33		05:26	05:46	06:17 06:39 (800)	06:48		06:21	06:57	07:22
	17:05	17:44	18:15	19:49 59	19:00 (A08) 20:19		20:36	20:24	19:44 57 19:06 (A08)	18:53		17:05	16:33	16:34
26	07:16	06:39	05:54	06:04	06:32 (800) 05:32		05:27	05:47	06:18 06:41 (800)	06:49		06:22	06:59	07:23
	17:07	17:45	18:16	19:50 55	18:58 (A08) 20:20		20:36	20:23	19:43 54 19:06 (A08)	18:51		17:03	16:33	16:35
27	07:15	06:38	05:52	06:03	06:33 (800) 05:31		05:27	05:48	06:19 18:20 (A08)	06:50		06:23	07:00	07:23
	17:08	17:46	18:17	19:51 53	18:58 (A08) 20:21		20:36	20:22	19:41 45 19:05 (A08)	18:49		17:02	16:32	16:36
28	07:15	06:36	05:50	06:02	06:34 (800) 05:31		05:28	05:49	06:20 18:20 (A08)	06:51		06:24	07:01	07:24
	17:09	17:47	18:19	19:52 49	18:57 (A08) 20:22		20:36	20:21	19:40 45 19:05 (A08)	18:47		17:00	16:32	16:36
29	07:14		06:49	06:00	06:35 (800) 05:30		05:28	05:50	06:21 18:20 (A08)	06:52		06:25	07:02	07:24
	17:10		19:20	19:53 43	18:55 (A08) 20:22		20:36	20:20	19:38 44 19:04 (A08)	18:46		16:59	16:31	16:37
30	07:13		06:47	05:59	06:39 (800) 05:29		05:28	05:51	06:22 18:20 (A08)	06:53		06:27	07:03	07:24
	17:12		19:21	19:54 33	18:54 (A08) 20:23		20:36	20:19	19:36 43 19:03 (A08)	18:44		16:58	16:31	16:38
31	07:12		06:45		05:29			05:52	06:23 18:20 (A08)			06:28		07:24
	17:13		19:22		20:24			20:18	19:35 43 19:03 (A08)			16:57		16:39
Potential sun hours	297	297	369	399	449	453	460	428	375	345	297	287
Total, worst case				1261	99			1106	271			
Sun reduction				0,51	0,57			0,68	0,61			
Oper. time red.				0,94	0,94			0,94	0,94			
Wind dir. red.				0,68	0,68			0,68	0,68			
Total reduction				0,33	0,36			0,44	0,39			
Total, real				410	36			488	106			

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)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Massimo Lepore / massimo.lepore@tenproject.it
Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R07 - R07

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

	January		February		March	April	May		June	
1	07:25		07:11		06:35	06:44	05:58		05:29	05:50 (A08)
	16:40		17:14		17:49	19:23	19:55		20:25	2 05:51 (A08)
2	07:25		07:10		06:33	06:42	05:56		05:28	05:50 (A08)
	16:41		17:15		17:50	19:24	19:56		20:26	2 05:52 (A08)
3	07:25		07:09		06:32	06:40	05:55		05:28	05:49 (A08)
	16:41		17:17		17:51	19:25	19:57		20:26	2 05:51 (A08)
4	07:25		07:08		06:30	06:39	05:54		05:27	05:49 (A08)
	16:42		17:18		17:52	19:26	19:58		20:27	3 05:52 (A08)
5	07:25		07:07		06:29	06:37	05:53		05:27	05:49 (A08)
	16:43		17:19		17:53	19:27	19:59		20:28	3 05:52 (A08)
6	07:25		07:06		06:27	06:35	05:51		05:27	05:48 (A08)
	16:44		17:20		17:54	19:28	20:00		20:28	4 05:52 (A08)
7	07:25		07:05		06:25	06:34	05:50		05:26	05:48 (A08)
	16:45		17:22		17:55	19:29	20:01		20:29	4 05:52 (A08)
8	07:25		07:04		06:24	06:32	05:49		05:26	05:48 (A08)
	16:46		17:23		17:57	19:30	20:02		20:30	4 05:52 (A08)
9	07:25		07:02	16:40 (E01)	06:22	06:31	05:48		05:26	05:48 (A08)
	16:47		17:24	10 16:50 (E01)	17:58	19:32	20:04		20:30	4 05:52 (A08)
10	07:24		07:01	16:39 (E01)	06:21	06:29	05:47		05:26	05:48 (A08)
	16:48		17:26	13 16:52 (E01)	17:59	19:33	20:05		20:31	5 05:53 (A08)
11	07:24		07:00	16:38 (E01)	06:19	06:27	05:46		05:25	05:48 (A08)
	16:49		17:27	16 16:54 (E01)	18:00	19:34	20:06		20:31	5 05:53 (A08)
12	07:24		06:59	16:36 (E01)	06:17	06:26	05:44		05:25	05:47 (A08)
	16:50		17:28	18 16:54 (E01)	18:01	19:35	20:07		20:32	5 05:52 (A08)
13	07:24		06:58	16:36 (E01)	06:16	06:24	05:43		05:25	05:47 (A08)
	16:51		17:29	19 16:55 (E01)	18:02	19:36	20:08		20:32	5 05:52 (A08)
14	07:23	16:11 (E02)	06:56	16:36 (E01)	06:14	06:23	05:42		05:25	05:47 (A08)
	16:53	6 16:17 (E02)	17:30	20 16:56 (E01)	18:03	19:37	20:09		20:33	5 05:52 (A08)
15	07:23	16:09 (E02)	06:55	16:35 (E01)	06:12	06:21	05:41		05:25	05:47 (A08)
	16:54	10 16:19 (E02)	17:32	21 16:56 (E01)	18:04	19:38	20:10		20:33	5 05:52 (A08)
16	07:22	16:09 (E02)	06:54	16:35 (E01)	06:11	06:19	05:40		05:25	05:47 (A08)
	16:55	12 16:21 (E02)	17:33	21 16:56 (E01)	18:06	19:39	20:11		20:34	5 05:52 (A08)
17	07:22	16:08 (E02)	06:52	16:36 (E01)	06:09	06:18	05:39		05:25	05:48 (A08)
	16:56	13 16:21 (E02)	17:34	20 16:56 (E01)	18:07	19:40	20:12		20:34	6 05:54 (A08)
18	07:21	16:08 (E02)	06:51	16:36 (E01)	06:07	06:16	05:38		05:25	05:48 (A08)
	16:57	15 16:23 (E02)	17:35	19 16:55 (E01)	18:08	19:41	20:13		20:34	6 05:54 (A08)
19	07:21	16:08 (E02)	06:50	16:37 (E01)	06:06	06:15	05:38		05:25	05:48 (A08)
	16:58	15 16:23 (E02)	17:37	18 16:55 (E01)	18:09	19:42	20:14		20:35	6 05:54 (A08)
20	07:20	16:07 (E02)	06:48	16:37 (E01)	06:04	06:13	05:37		05:25	05:48 (A08)
	16:59	17 16:24 (E02)	17:38	16 16:53 (E01)	18:10	19:43	20:14		20:35	6 05:54 (A08)
21	07:20	16:08 (E02)	06:47	16:39 (E01)	06:02	06:12	05:36		05:26	05:48 (A08)
	17:01	17 16:25 (E02)	17:39	13 16:52 (E01)	18:11	19:44	20:15		20:35	6 05:54 (A08)
22	07:19	16:08 (E02)	06:45	16:41 (E01)	06:01	06:10	05:35		05:26	05:48 (A08)
	17:02	17 16:25 (E02)	17:40	9 16:50 (E01)	18:12	19:45	20:16		20:35	6 05:54 (A08)
23	07:19	16:08 (E02)	06:44		05:59	06:09	05:34		05:26	05:49 (A08)
	17:03	17 16:25 (E02)	17:41		18:13	19:47	20:17		20:36	6 05:55 (A08)
24	07:18	16:08 (E02)	06:42		05:57	06:07	05:33		05:26	05:49 (A08)
	17:04	17 16:25 (E02)	17:43		18:14	19:48	20:18		20:36	6 05:55 (A08)
25	07:17	16:09 (E02)	06:41		05:56	06:06	05:33		05:27	05:49 (A08)
	17:05	17 16:26 (E02)	17:44		18:15	19:49	20:19		20:36	6 05:55 (A08)
26	07:16	16:09 (E02)	06:39		05:54	06:05	05:32		05:27	05:50 (A08)
	17:07	17 16:26 (E02)	17:45		18:16	19:50	20:20		20:36	5 05:55 (A08)
27	07:16	16:10 (E02)	06:38		05:52	06:03	05:31		05:27	05:50 (A08)
	17:08	16 16:26 (E02)	17:46		18:18	19:51	20:21		20:36	5 05:55 (A08)
28	07:15	16:11 (E02)	06:36		05:50	06:02	05:31		05:28	05:50 (A08)
	17:09	14 16:25 (E02)	17:47		18:19	19:52	20:22		20:36	5 05:55 (A08)
29	07:14	16:12 (E02)			06:49	06:00	05:30		05:28	05:51 (A08)
	17:10	13 16:25 (E02)			19:20	19:53	20:22		20:36	5 05:56 (A08)
30	07:13	16:13 (E02)			06:47	05:59	05:30		05:29	05:51 (A08)
	17:12	10 16:23 (E02)			19:21	19:54	20:23		20:36	5 05:56 (A08)
31	07:12	16:16 (E02)			06:45		05:29	05:51 (A08)		
	17:13	5 16:21 (E02)			19:22		20:24	2 05:52 (A08)		
Potential sun hours	297		297		369	399	449		453	
Total, worst case		248		233				2		142
Sun reduction		0,43		0,44				0,57		0,62
Oper. time red.		0,94		0,94				0,94		0,94
Wind dir. red.		0,71		0,72				0,72		0,72
Total reduction		0,29		0,30				0,39		0,42
Total, real		72		69				1		59

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)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Massimo Lepore / massimo.lepore@tenproject.it
Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R07 - R07

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

	July		August	September	October		November		December
1	05:29		05:52 (A08)	05:53	06:24	06:54	06:29		16:09 (E01)	07:04
	20:36	5	05:57 (A08)	20:17	19:33	18:42	16:55	13	16:22 (E01)	16:31
2	05:29		05:52 (A08)	05:54	06:25	06:56	06:30		16:11 (E01)	07:05
	20:36	5	05:57 (A08)	20:16	19:32	18:41	16:54	9	16:20 (E01)	16:31
3	05:30		05:53 (A08)	05:55	06:26	06:57	06:31			07:06
	20:36	5	05:58 (A08)	20:14	19:30	18:39	16:53			16:30
4	05:31		05:53 (A08)	05:56	06:27	06:58	06:33			07:07
	20:35	4	05:57 (A08)	20:13	19:28	18:37	16:52			16:30
5	05:31		05:54 (A08)	05:57	06:28	06:59	06:34			07:08
	20:35	4	05:58 (A08)	20:12	19:27	18:36	16:51			16:30
6	05:32		05:54 (A08)	05:58	06:29	07:00	06:35			07:09
	20:35	4	05:58 (A08)	20:11	19:25	18:34	16:49			16:30
7	05:32		05:55 (A08)	05:59	06:30	07:01	06:36			07:10
	20:35	3	05:58 (A08)	20:10	19:23	18:32	16:48			16:30
8	05:33		05:56 (A08)	06:00	06:31	07:02	06:37			07:11
	20:34	3	05:59 (A08)	20:08	19:22	18:31	16:47			16:30
9	05:34		05:56 (A08)	06:01	06:32	07:03	06:39			07:12
	20:34	3	05:59 (A08)	20:07	19:20	18:29	16:46			16:30
10	05:34		05:57 (A08)	06:02	06:33	07:04	06:40			07:13
	20:34	2	05:59 (A08)	20:06	19:18	18:28	16:45			16:30
11	05:35		05:58 (A08)	06:03	06:34	07:05	06:41		15:47 (E02)	07:14
	20:33	2	05:59 (A08)	20:05	19:17	18:26	16:44	7	15:54 (E02)	16:30
12	05:36		05:58 (A08)	06:04	06:35	07:06	06:42		15:45 (E02)	07:14
	20:33	2	05:59 (A08)	20:03	19:15	18:24	16:43	10	15:55 (E02)	16:30
13	05:36			06:05	06:36	07:07	06:43		15:44 (E02)	07:15
	20:32			20:02	19:13	18:23	16:42	13	15:57 (E02)	16:30
14	05:37			06:06	06:37	07:08	06:45		15:43 (E02)	07:16
	20:32			20:01	19:11	18:21	16:41	14	15:57 (E02)	16:30
15	05:38			06:07	06:38	07:09	06:46		15:43 (E02)	07:17
	20:31			19:59	19:10	18:20	16:40	16	15:59 (E02)	16:30
16	05:39			06:08	06:39	07:11	06:47		15:42 (E02)	07:18
	20:30			19:58	19:08	18:18	16:40	17	15:59 (E02)	16:31
17	05:40			06:09	06:40	07:12	06:48		15:42 (E02)	07:18
	20:30			19:56	19:06	18:16	16:39	17	15:59 (E02)	16:31
18	05:40			06:10	06:41	07:13	06:49		15:42 (E02)	07:19
	20:29			19:55	19:05	18:15	16:38	17	15:59 (E02)	16:31
19	05:41			06:11	06:42	07:14	17:15 (E01)	06:51		15:43 (E02)	07:20
	20:28			19:53	19:03	18:13	3	17:18 (E01)	16:37	17	16:00 (E02)	16:32
20	05:42			06:12	06:43	07:15		17:11 (E01)	06:52		15:43 (E02)	07:20
	20:28			19:52	19:01	18:12	11	17:22 (E01)	16:36	17	16:00 (E02)	16:32
21	05:43			06:13	06:44	07:16		17:09 (E01)	06:53		15:43 (E02)	07:21
	20:27			19:51	18:59	18:10	14	17:23 (E01)	16:36	17	16:00 (E02)	16:32
22	05:44			06:14	06:45	07:17		17:07 (E01)	06:54		15:43 (E02)	07:21
	20:26			19:49	18:58	18:09	17	17:24 (E01)	16:35	17	16:00 (E02)	16:33
23	05:45			06:15	06:46	07:18		17:06 (E01)	06:55		15:45 (E02)	07:22
	20:25			19:48	18:56	18:08	19	17:25 (E01)	16:34	15	16:00 (E02)	16:33
24	05:46			06:16	06:47	07:20		17:06 (E01)	06:56		15:45 (E02)	07:22
	20:24			19:46	18:54	18:06	20	17:26 (E01)	16:34	15	16:00 (E02)	16:34
25	05:46			06:17	06:48	06:21		16:05 (E01)	06:58		15:46 (E02)	07:23
	20:24			19:44	18:53	17:05	21	16:26 (E01)	16:33	13	15:59 (E02)	16:35
26	05:47			06:18	06:49	06:22		16:05 (E01)	06:59		15:47 (E02)	07:23
	20:23			19:43	18:51	17:03	21	16:26 (E01)	16:33	12	15:59 (E02)	16:35
27	05:48			06:19	06:50	06:23		16:05 (E01)	07:00		15:48 (E02)	07:23
	20:22			19:41	18:49	17:02	20	16:25 (E01)	16:32	10	15:58 (E02)	16:36
28	05:49			06:20	06:51	06:24		16:06 (E01)	07:01		15:51 (E02)	07:24
	20:21			19:40	18:47	17:01	20	16:26 (E01)	16:32	7	15:58 (E02)	16:36
29	05:50			06:21	06:52	06:25		16:06 (E01)	07:02			07:24
	20:20			19:38	18:46	16:59	19	16:25 (E01)	16:31			16:37
30	05:51			06:22	06:53	06:27		16:06 (E01)	07:03			07:24
	20:19			19:37	18:44	16:58	18	16:24 (E01)	16:31			16:38
31	05:52			06:23		06:28		16:07 (E01)				07:24
	20:18			19:35		16:57	16	16:23 (E01)				16:39
Potential sun hours	460			428	375	345			297			287
Total, worst case		42					219			273		
Sun reduction		0,69					0,52			0,47		
Oper. time red.		0,94					0,94			0,94		
Wind dir. red.		0,72					0,72			0,71		
Total reduction		0,46					0,35			0,32		
Total, real		19					77			86		

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

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

Massimo Lepore / massimo.lepore@tenproject.it

Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R08 - R08

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

	January	February		March		April	May	June	July	August	September	October		November	December
1	07:25	07:11		06:35		06:58 (SE_10)	06:44	05:58	05:29	05:29	05:53	06:24	06:54		06:29	07:04
	16:40	17:14		17:48	27	17:23 (E05)	19:23	19:55	20:25	20:36	20:17	19:33	18:42		16:55	16:31
2	07:25	07:10		06:33		06:58 (SE_10)	06:42	05:56	05:28	05:29	05:54	06:25	06:55		06:30	07:05
	16:41	17:15		17:50	23	17:21 (E05)	19:24	19:56	20:26	20:36	20:16	19:32	18:41		16:54	16:30
3	07:25	07:09		06:32		07:00 (SE_10)	06:40	05:55	05:28	05:30	05:55	06:26	06:56		06:31	07:06
	16:41	17:17		17:51	12	07:12 (SE_10)	19:25	19:57	20:26	20:36	20:14	19:30	18:39		16:53	16:30
4	07:25	07:08		06:30		07:03 (SE_10)	06:39	05:54	05:27	05:30	05:56	06:27	06:58		06:33	07:07
	16:42	17:18		17:52	5	07:08 (SE_10)	19:26	19:58	20:27	20:35	20:13	19:28	18:37		16:52	16:30
5	07:25	07:07		06:29			06:37	05:52	05:27	05:31	05:57	06:28	06:59		06:34	07:08
	16:43	17:19		17:53			19:27	19:59	20:28	20:35	20:12	19:27	18:36		16:51	16:30
6	07:25	07:06		06:27			06:35	05:51	05:27	05:32	05:58	06:29	07:00		06:35	07:09
	16:44	17:20		17:54			19:28	20:00	20:28	20:35	20:11	19:25	18:34		16:49	16:30
7	07:25	07:05		06:25			06:34	05:50	05:26	05:32	05:59	06:30	07:01		06:36	07:10
	16:45	17:22		17:55			19:29	20:01	20:29	20:35	20:10	19:23	18:32		16:48	16:30
8	07:25	07:04		06:24			06:32	05:49	05:26	05:33	06:00	06:31	07:02		06:37	07:11
	16:46	17:23		17:57			19:30	20:02	20:30	20:34	20:08	19:22	18:31		16:47	16:30
9	07:24	07:02		06:22			06:31	05:48	05:26	05:34	06:01	06:32	07:03		06:39	07:12
	16:47	17:24		17:58			19:31	20:03	20:30	20:34	20:07	19:20	18:29		16:46	16:30
10	07:24	07:01		06:20			06:29	05:47	05:26	05:34	06:02	06:33	07:04	07:35 (SE_10)	06:40	07:13
	16:48	17:25		17:59			19:33	20:05	20:31	20:33	20:06	19:18	18:27	9 07:44 (SE_10)	16:45	16:30
11	07:24	07:00	07:20 (SE_09)	06:19			06:27	05:45	05:25	05:35	06:03	06:34	07:05	07:33 (SE_10)	06:41	07:14
	16:49	17:27	2 07:21 (SE_09)	18:00			19:34	20:06	20:31	20:33	20:05	19:17	18:26	18 17:53 (E05)	16:44	16:30
12	07:24	06:59	07:18 (SE_09)	06:17			06:26	05:44	05:25	05:36	06:04	06:35	07:06	07:31 (SE_10)	06:42	07:14
	16:50	17:28	3 07:21 (SE_09)	18:01			19:35	20:07	20:32	20:33	20:03	19:15	18:24	25 17:55 (E05)	16:43	16:30
13	07:23	06:58	07:17 (SE_09)	06:16			06:24	05:43	05:25	05:36	06:05	06:36	07:07	07:31 (SE_10)	06:43	07:15
	16:51	17:29	5 07:22 (SE_09)	18:02			19:36	20:08	20:32	20:32	20:02	19:13	18:23	28 17:56 (E05)	16:42	16:30
14	07:23	06:56	07:16 (SE_09)	06:14			06:22	05:42	05:25	05:37	06:06	06:37	07:08	07:30 (SE_10)	06:45	07:16
	16:52	17:30	6 07:22 (SE_09)	18:03			19:37	20:09	20:33	20:32	20:01	19:11	18:21	30 17:56 (E05)	16:41	16:30
15	07:23	06:55	07:14 (SE_09)	06:12			06:21	05:41	05:25	05:38	06:07	06:38	07:09	07:30 (SE_10)	06:46	07:17
	16:54	17:32	7 07:21 (SE_09)	18:04			19:38	20:10	20:33	20:31	19:59	19:10	18:19	30 17:56 (E05)	16:40	16:30
16	07:22	06:54	07:13 (SE_09)	06:11			06:19	05:40	05:25	05:39	06:08	06:39	07:10	07:31 (SE_10)	06:47	07:17
	16:55	17:33	7 07:20 (SE_09)	18:06			19:39	20:11	20:34	20:30	19:58	19:08	18:18	27 17:55 (E05)	16:39	16:30
17	07:22	06:52	07:12 (SE_09)	06:09			06:18	05:39	05:25	05:39	06:09	06:40	07:12	07:32 (SE_10)	06:48	07:18
	16:56	17:34	7 07:19 (SE_09)	18:07			19:40	20:12	20:34	20:30	19:56	19:06	18:16	23 17:53 (E05)	16:39	16:31
18	07:21	06:51		06:07			06:16	05:38	05:25	05:40	06:10	06:41	07:13	07:33 (SE_10)	06:49	07:19
	16:57	17:35		18:08			19:41	20:13	20:34	20:29	19:55	19:05	18:15	14 07:47 (SE_10)	16:38	16:31
19	07:21	06:50		06:06			06:15	05:37	05:25	05:41	06:11	06:42	07:14	07:35 (SE_10)	06:51	07:19
	16:58	17:37		18:09			19:42	20:13	20:35	20:28	19:53	19:03	18:13	12 07:47 (SE_10)	16:37	16:31
20	07:20	06:48	07:07 (SE_10)	06:04			06:13	05:37	05:25	05:42	06:12	06:43	07:15	07:36 (SE_10)	06:52	07:20
	16:59	17:38	4 07:11 (SE_10)	18:10			19:43	20:14	20:35	20:28	19:52	19:01	18:12	10 07:46 (SE_10)	16:36	16:32
21	07:20	06:47	07:06 (SE_10)	06:02			06:12	05:36	05:26	05:43	06:13	06:44	07:16	07:37 (SE_10)	06:53	07:21
	17:01	17:39	8 07:14 (SE_10)	18:11			19:44	20:15	20:35	20:27	19:50	18:59	18:10	7 07:44 (SE_10)	16:36	16:32
22	07:19	06:45	07:05 (SE_10)	06:01			06:10	05:35	05:26	05:44	06:14	06:45	07:17	07:38 (SE_10)	06:54	07:21
	17:02	17:40	11 07:16 (SE_10)	18:12			19:45	20:16	20:35	20:26	19:49	18:58	18:09	3 07:41 (SE_10)	16:35	16:33
23	07:18	06:44	07:03 (SE_10)	05:59			06:09	05:34	05:26	05:45	06:15	06:46	07:18		06:55	07:22
	17:03	17:41	13 07:16 (SE_10)	18:13			19:46	20:17	20:36	20:25	19:47	18:56	18:07		16:34	16:33
24	07:18	06:42	07:02 (SE_10)	05:57			06:07	05:33	05:26	05:45	06:16	06:47	07:20	07:44 (SE_09)	06:56	07:22
	17:04	17:43	19 17:21 (E05)	18:14			19:48	20:18	20:36	20:24	19:46	18:54	18:06	3 07:47 (SE_09)	16:34	16:34
25	07:17	06:41	07:00 (SE_10)	05:55			06:06	05:33	05:27	05:46	06:17	06:48	06:21	06:42 (SE_09)	06:57	07:23
	17:05	17:44	24 17:22 (E05)	18:15			19:49	20:19	20:36	20:24	19:44	18:53	17:05	7 06:49 (SE_09)	16:33	16:34
26	07:16	06:39	06:58 (SE_10)	05:54			06:04	05:32	05:27	05:47	06:18	06:49	06:22	06:43 (SE_09)	06:59	07:23
	17:07	17:45	29 17:23 (E05)	18:16			19:50	20:20	20:36	20:23	19:43	18:51	17:03	7 06:50 (SE_09)	16:33	16:35
27	07:15	06:38	06:57 (SE_10)	05:52			06:03	05:31	05:27	05:48	06:19	06:50	06:23	06:44 (SE_09)	07:00	07:23
	17:08	17:46	30 17:23 (E05)	18:17			19:51	20:21	20:36	20:22	19:41	18:49	17:02	7 06:51 (SE_09)	16:32	16:36
28	07:15	06:36	06:57 (SE_10)	05:50			06:02	05:31	05:28	05:49	06:20	06:51	06:24	06:46 (SE_09)	07:01	07:24
	17:09	17:47	29 17:23 (E05)	18:19			19:52	20:22	20:36	20:21	19:40	18:47	17:01	6 06:52 (SE_09)	16:32	16:36
29	07:14			06:49			06:00	05:30	05:28	05:50	06:21	06:52	06:25	06:47 (SE_09)	07:02	07:24
	17:10			19:20			19:53	20:22	20:36	20:20	19:38	18:46	16:59	4 06:51 (SE_09)	16:31	16:37
30	07:13			06:47			05:59	05:30	05:28	05:51	06:22	06:53	06:27	06:48 (SE_09)	07:03	07:24
	17:12			19:21			19:54	20:23	20:36	20:19	19:36	18:44	16:58	3 06:51 (SE_09)	16:31	16:38
31	07:12			06:45				05:29		05:52	06:23		06:28	06:49 (SE_09)		07:24
	17:13			19:22				20:24		20:18	19:35		16:57	2 06:50 (SE_09)		16:39
Potential sun hours	297	297		369		399	449	453	460	428	375	345		297	287
Total, worst case			204		67								275		
Sun reduction			0,44		0,44								0,52		
Oper. time red.			0,94		0,94								0,94		
Wind dir. red.			0,65		0,65								0,65		
Total reduction			0,27		0,27								0,32		
Total, real			55		18								88		

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)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Massimo Lepore / massimo.lepore@tenproject.it

Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R09 - R09

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:25	07:11	06:35	06:44	05:58	05:28	05:29	05:53	06:24	06:54	06:29	07:04
	16:40	17:14 11 07:42 (SE_09)	17:48	19:23	19:55	20:25	20:36	20:17	19:33	18:42	16:55 27 07:21 (SE_10)	16:31
2	07:25	07:10	06:33	06:42	05:56	05:28	05:29	05:54	06:25	06:55	06:30	07:05
	16:41	17:15 12 07:42 (SE_09)	17:50	19:24	19:56	20:26	20:36	20:16	19:32	18:41	16:54 25 07:20 (SE_10)	16:30
3	07:25	07:09	06:32	06:40	05:55	05:28	05:30	05:55	06:26	06:56	06:31	07:06
	16:41	17:17 13 07:42 (SE_09)	17:51	19:25	19:57	20:26	20:35	20:14	19:30	18:39	16:53 24 07:19 (SE_10)	16:30
4	07:25	07:08	06:30	06:39	05:54	05:27	05:30	05:56	06:27	06:58	06:33	07:07
	16:42	17:18 15 07:43 (SE_10)	17:52	19:26	19:58	20:27	20:35	20:13	19:28	18:37	16:52 21 07:17 (SE_10)	16:30
5	07:25	07:07	06:29	06:37	05:52	05:27	05:31	05:57	06:28	06:59	06:34	07:08
	16:43	17:19 18 07:45 (SE_10)	17:53	19:27	19:59	20:28	20:35	20:12	19:27	18:36	16:51 19 07:17 (SE_10)	16:30
6	07:25	07:06	06:27	06:35	05:51	05:27	05:32	05:58	06:29	07:00	06:35	07:09
	16:44	17:20 19 07:47 (SE_10)	17:54	19:28	20:00	20:28	20:35	20:11	19:25	18:34	16:49 18 07:15 (SE_10)	16:30
7	07:25	07:05	06:25	06:34	05:50	05:26	05:32	05:59	06:30	07:01	06:36	07:10
	16:45	17:22 22 07:49 (SE_10)	17:55	19:29	20:01	20:29	20:35	20:10	19:23	18:32	16:48 14 07:12 (SE_09)	16:30
8	07:25	07:04	06:24	06:32	05:49	05:26	05:33	06:00	06:31	07:02	06:37	07:11
	16:46	17:23 24 07:49 (SE_10)	17:57	19:30	20:02	20:30	20:34	20:08	19:22	18:31	16:47 13 07:13 (SE_09)	16:30
9	07:24	07:02	06:22	06:30	05:48	05:26	05:34	06:01	06:32	07:03	06:39	07:12
	16:47	17:24 25 07:50 (SE_10)	17:58	19:31	20:03	20:30	20:34	20:07	19:20	18:29	16:46 12 07:13 (SE_09)	16:30
10	07:24	07:01	06:20	06:29	05:47	05:26	05:34	06:02	06:33	07:04	06:40	07:13
	16:48	17:25 27 07:51 (SE_10)	17:59	19:33	20:04	20:31	20:33	20:06	19:18	18:27	16:45 11 07:13 (SE_09)	16:30
11	07:24	07:00	06:19	06:27	05:45	05:25	05:35	06:03	06:34	07:05	06:41	07:14
	16:49	17:27 28 07:52 (SE_10)	18:00	19:34	20:06	20:31	20:33	20:05	19:17	18:26	16:44 9 07:12 (SE_09)	16:30
12	07:24	06:59	06:17	06:26	05:44	05:25	05:36	06:04	06:35	07:06	06:42	07:14
	16:50	17:28 28 07:51 (SE_10)	18:01	19:35	20:07	20:32	20:33	20:03	19:15	18:24	16:43 8 07:13 (SE_09)	16:30
13	07:23	06:58	06:16	06:24	05:43	05:25	05:36	06:05	06:36	07:07	06:43	07:15
	16:51	17:29 29 07:52 (SE_10)	18:02	19:36	20:08	20:32	20:32	20:02	19:13	18:23	16:42 6 07:12 (SE_09)	16:30
14	07:23	06:56	06:14	06:22	05:42	05:25	05:37	06:06	06:37	07:08	06:45	07:16
	16:52	17:30 28 07:52 (SE_10)	18:03	19:37	20:09	20:33	20:32	20:01	19:11	18:21	16:41 4 07:11 (SE_09)	16:30
15	07:23	06:55	06:12	06:21	05:41	05:25	05:38	06:07	06:38	07:09	06:46	07:17
	16:54	17:32 28 07:51 (SE_10)	18:04	19:38	20:10	20:33	20:31	19:59	19:10	18:19	16:40 2 07:10 (SE_09)	16:30
16	07:22	06:54	06:11	06:19	05:40	05:25	05:39	06:08	06:39	07:10	06:47	07:17
	16:55	17:33 28 07:52 (SE_10)	18:06	19:39	20:11	20:34	20:30	19:58	19:08	18:18	16:39	16:30
17	07:22	06:52	06:09	06:18	05:39	05:25	05:39	06:09	06:40	07:12	06:48	07:18
	16:56	17:34 27 07:51 (SE_10)	18:07	19:40	20:12	20:34	20:30	19:56	19:06	18:16	16:39	16:31
18	07:21	06:51	06:07	06:16	05:38	05:25	05:40	06:10	06:41	07:13	08:06 (SE_10) 06:49	07:19
	16:57	17:35 26 07:50 (SE_10)	18:08	19:41	20:13	20:34	20:29	19:55	19:05	18:15 4	08:10 (SE_10) 16:38	16:31
19	07:21	06:50	06:06	06:15	05:37	05:25	05:41	06:11	06:42	07:14	08:02 (SE_10) 06:50	07:19
	16:58	17:37 25 07:50 (SE_10)	18:09	19:42	20:13	20:35	20:28	19:53	19:03	18:13 13	08:15 (SE_10) 16:37	16:31
20	07:20	06:48	06:04	06:13	05:37	05:25	05:42	06:12	06:43	07:15	07:59 (SE_10) 06:52	07:20
	16:59	17:38 22 07:48 (SE_10)	18:10	19:43	20:14	20:35	20:28	19:52	19:01	18:12 18	08:17 (SE_10) 16:36	16:32
21	07:20	06:47	06:02	06:12	05:36	05:26	05:43	06:13	06:44	07:16	07:58 (SE_10) 06:53	07:21
	17:01	17:39 20 07:47 (SE_10)	18:11	19:44	20:15	20:35	20:27	19:50	18:59	18:10 20	08:18 (SE_10) 16:36	16:32
22	07:19	06:45	06:01	06:10	05:35	05:26	05:44	06:14	06:45	07:17	07:56 (SE_10) 06:54	07:21
	17:02	17:40 17 07:45 (SE_10)	18:12	19:45	20:16	20:35	20:26	19:49	18:58	18:09 23	08:19 (SE_10) 16:35	16:33
23	07:18	06:44	05:59	06:09	05:34	05:26	05:45	06:15	06:46	07:18	07:55 (SE_10) 06:55	07:22
	17:03	17:41 12 07:43 (SE_10)	18:13	19:46	20:17	20:35	20:25	19:47	18:56	18:07 25	08:20 (SE_10) 16:34	16:33
24	07:18	06:42	05:57	06:07	05:33	05:26	05:45	06:16	06:47	07:20	07:55 (SE_10) 06:56	07:22
	17:04	17:43	18:14	19:48	20:18	20:36	20:24	19:46	18:54	18:06 26	08:21 (SE_10) 16:34	16:34
25	07:17	06:41	05:55	06:06	05:33	05:27	05:46	06:17	06:48	06:21	06:54 (SE_10) 06:57	07:22
	17:05	17:44	18:15	19:49	20:19	20:36	20:24	19:44	18:53	17:05 27	07:21 (SE_10) 16:33	16:34
26	07:16	06:39	05:54	06:04	05:32	05:27	05:47	06:18	06:49	06:22	06:53 (SE_10) 06:59	07:23
	17:07	17:45	18:16	19:50	20:20	20:36	20:23	19:43	18:51	17:03 28	07:21 (SE_10) 16:33	16:35
27	07:15 07:36 (SE_09)	06:38	05:52	06:03	05:31	05:27	05:48	06:19	06:50	06:23	06:53 (SE_10) 07:00	07:23
	17:08 2 07:38 (SE_09)	17:46	18:17	19:51	20:21	20:36	20:22	19:41	18:49	17:02 28	07:21 (SE_10) 16:32	16:36
28	07:15 07:35 (SE_09)	06:36	05:50	06:02	05:31	05:28	05:49	06:20	06:51	06:24	06:53 (SE_10) 07:01	07:24
	17:09 4 07:39 (SE_09)	17:47	18:19	19:52	20:22	20:36	20:21	19:40	18:47	17:01 29	07:22 (SE_10) 16:32	16:36
29	07:14 07:34 (SE_09)		06:49	06:00	05:30	05:28	05:50	06:21	06:52	06:25	06:53 (SE_10) 07:02	07:24
	17:10 6 07:40 (SE_09)		19:20	19:53	20:22	20:36	20:20	19:38	18:46	16:59 29	07:22 (SE_10) 16:31	16:37
30	07:13 07:33 (SE_09)		06:47	05:59	05:30	05:28	05:51	06:22	06:53	06:27	06:53 (SE_10) 07:03	07:24
	17:12 8 07:41 (SE_09)		19:21	19:54	20:23	20:36	20:19	19:36	18:44	16:58 28	07:21 (SE_10) 16:31	16:38
31	07:12 07:32 (SE_09)		06:45		05:29		05:52	06:23		06:28	06:53 (SE_10)	07:24
	17:13 9 07:41 (SE_09)		19:22		20:24		20:18	19:35		16:57 27	07:20 (SE_10)	16:39
Potential sun hours	297	297	369	399	449	453	460	428	375	345	297	287
Total, worst case	29	504								325	213	
Sun reduction	0,43	0,44								0,52	0,47	
Oper. time red.	0,94	0,94								0,94	0,94	
Wind dir. red.	0,61	0,62								0,62	0,62	
Total reduction	0,25	0,26								0,30	0,27	
Total, real	7	129								99	58	

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)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Massimo Lepore / massimo.lepore@tenproject.it
Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R10 - R10

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

	January		February		March	April	May	June	July	August	September	October		November		December
1	07:25		07:11		07:47 (SE_10)	06:35	06:44	05:58	05:28	05:29	05:53	06:24	06:54			06:29		07:22 (SE_10)	07:04
	16:40		17:14	34	08:21 (SE_10)	17:48	19:23	19:55	20:25	20:36	20:17	19:33	18:42			16:55	25	07:47 (SE_10)	16:31
2	07:25		07:10		07:47 (SE_10)	06:33	06:42	05:56	05:28	05:29	05:54	06:25	06:55			06:30		07:21 (SE_10)	07:05
	16:41		17:15	34	08:21 (SE_10)	17:50	19:24	19:56	20:26	20:36	20:16	19:32	18:41			16:54	27	07:48 (SE_10)	16:30
3	07:25		07:09		07:47 (SE_10)	06:32	06:40	05:55	05:28	05:30	05:55	06:26	06:56			06:31		07:20 (SE_10)	07:06
	16:41		17:17	34	08:21 (SE_10)	17:51	19:25	19:57	20:26	20:35	20:14	19:30	18:39			16:53	29	07:49 (SE_10)	16:30
4	07:25		07:08		07:48 (SE_10)	06:30	06:39	05:54	05:27	05:30	05:56	06:27	06:58			06:32		07:19 (SE_10)	07:07
	16:42		17:18	33	08:21 (SE_10)	17:52	19:26	19:58	20:27	20:35	20:13	19:28	18:37			16:52	30	07:49 (SE_10)	16:30
5	07:25		07:07		07:48 (SE_10)	06:29	06:37	05:52	05:27	05:31	05:57	06:28	06:59			06:34		07:19 (SE_10)	07:08
	16:43		17:19	33	08:21 (SE_10)	17:53	19:27	19:59	20:28	20:35	20:12	19:27	18:36			16:51	32	07:51 (SE_10)	16:30
6	07:25		07:06		07:49 (SE_10)	06:27	06:35	05:51	05:26	05:32	05:58	06:29	07:00			06:35		07:18 (SE_10)	07:09
	16:44		17:20	32	08:21 (SE_10)	17:54	19:28	20:00	20:28	20:35	20:11	19:25	18:34			16:49	33	07:51 (SE_10)	16:30
7	07:25		07:05		07:50 (SE_10)	06:25	06:34	05:50	05:26	05:32	05:59	06:30	07:01			06:36		07:18 (SE_10)	07:10
	16:45		17:22	30	08:20 (SE_10)	17:55	19:29	20:01	20:29	20:35	20:10	19:23	18:32			16:48	33	07:51 (SE_10)	16:30
8	07:25		07:04		07:50 (SE_10)	06:24	06:32	05:49	05:26	05:33	06:00	06:31	07:02			06:37		07:18 (SE_10)	07:11
	16:46		17:23	29	08:19 (SE_10)	17:57	19:30	20:02	20:30	20:34	20:08	19:22	18:31			16:47	34	07:52 (SE_10)	16:30
9	07:24		07:02		07:51 (SE_10)	06:22	06:30	05:48	05:26	05:34	06:01	06:32	07:03			06:39		07:18 (SE_10)	07:12
	16:47		17:24	27	08:18 (SE_10)	17:58	19:31	20:03	20:30	20:34	20:07	19:20	18:29			16:46	34	07:52 (SE_10)	16:29
10	07:24		07:01		07:53 (SE_10)	06:20	06:29	05:47	05:26	05:34	06:02	06:33	07:04			06:40		07:17 (SE_10)	07:13
	16:48		17:25	24	08:17 (SE_10)	17:59	19:33	20:04	20:31	20:33	20:06	19:18	18:27			16:45	35	07:52 (SE_10)	16:30
11	07:24		07:00		07:54 (SE_10)	06:19	06:27	05:45	05:25	05:35	06:03	06:34	07:05			06:41		07:15 (SE_09)	07:14
	16:49		17:27	22	08:16 (SE_10)	18:00	19:34	20:06	20:31	20:33	20:05	19:17	18:26			16:44	37	07:52 (SE_10)	16:30
12	07:24		06:59		07:56 (SE_10)	06:17	06:26	05:44	05:25	05:36	06:04	06:35	07:06			06:42		07:14 (SE_09)	07:14
	16:50		17:28	17	08:13 (SE_10)	18:01	19:35	20:07	20:32	20:33	20:03	19:15	18:24			16:43	39	07:53 (SE_10)	16:30
13	07:23	07:45 (SE_09)	06:57		07:59 (SE_10)	06:16	06:24	05:43	05:25	05:36	06:05	06:36	07:07			06:43		07:13 (SE_09)	07:15
	16:51	2 07:46 (SE_09)	17:29	12	08:11 (SE_10)	18:02	19:36	20:08	20:32	20:32	20:02	19:13	18:23			16:42	39	07:52 (SE_10)	16:30
14	07:23	07:45 (SE_09)	06:56			06:14	06:22	05:42	05:25	05:37	06:06	06:37	07:08			06:45		07:12 (SE_09)	07:16
	16:52	8 08:02 (SE_10)	17:30			18:03	19:37	20:09	20:33	20:32	20:01	19:11	18:21			16:41	40	07:52 (SE_10)	16:30
15	07:23	07:44 (SE_09)	06:55		07:14 (SE_14)	06:12	06:21	05:41	05:25	05:38	06:07	06:38	07:09			06:46		07:12 (SE_09)	07:17
	16:54	16 08:05 (SE_10)	17:32	2	07:15 (SE_14)	18:04	19:38	20:10	20:33	20:31	19:59	19:10	18:19			16:40	41	07:53 (SE_10)	16:30
16	07:22	07:44 (SE_09)	06:54		07:13 (SE_14)	06:11	06:19	05:40	05:25	05:39	06:08	06:39	07:10			06:47		07:11 (SE_09)	07:17
	16:55	22 08:08 (SE_10)	17:33	3	07:16 (SE_14)	18:06	19:39	20:11	20:34	20:30	19:58	19:08	18:18			16:39	41	07:52 (SE_10)	16:30
17	07:22	07:43 (SE_09)	06:52		07:12 (SE_14)	06:09	06:18	05:39	05:25	05:39	06:09	06:40	07:12			06:48		07:11 (SE_09)	07:18
	16:56	26 08:09 (SE_10)	17:34	4	07:16 (SE_14)	18:07	19:40	20:12	20:34	20:30	19:56	19:06	18:16			16:39	41	07:52 (SE_10)	16:31
18	07:21	07:43 (SE_09)	06:51		07:10 (SE_14)	06:07	06:16	05:38	05:25	05:40	06:10	06:41	07:13			06:49		07:12 (SE_09)	07:19
	16:57	28 08:11 (SE_10)	17:35	6	07:16 (SE_14)	18:08	19:41	20:12	20:34	20:29	19:55	19:05	18:15			16:38	39	07:51 (SE_10)	16:31
19	07:21	07:42 (SE_09)	06:49		07:09 (SE_14)	06:06	06:15	05:37	05:25	05:41	06:11	06:42	07:14			06:50		07:14 (SE_09)	07:19
	16:58	30 08:12 (SE_10)	17:37	6	07:15 (SE_14)	18:09	19:42	20:13	20:35	20:28	19:53	19:03	18:13			16:37	38	07:52 (SE_10)	16:31
20	07:20	07:41 (SE_09)	06:48		07:07 (SE_14)	06:04	06:13	05:37	05:25	05:42	06:12	06:43	07:15			06:52		07:15 (SE_09)	07:20
	16:59	32 08:13 (SE_10)	17:38	6	07:13 (SE_14)	18:10	19:43	20:14	20:35	20:28	19:52	19:01	18:12			16:36	36	07:51 (SE_10)	16:32
21	07:20	07:41 (SE_09)	06:47		07:08 (SE_14)	06:02	06:12	05:36	05:26	05:43	06:13	06:44	07:16		07:37 (SE_14)	06:53		07:16 (SE_09)	07:21
	17:01	34 08:15 (SE_10)	17:39	3	07:11 (SE_14)	18:11	19:44	20:15	20:35	20:27	19:50	18:59	18:10	6	07:43 (SE_14)	16:36	34	07:50 (SE_10)	16:32
22	07:19	07:40 (SE_09)	06:45			06:00	06:10	05:35	05:26	05:44	06:14	06:45	07:17		07:38 (SE_14)	06:54		07:17 (SE_09)	07:21
	17:02	36 08:16 (SE_10)	17:40			18:12	19:45	20:16	20:35	20:26	19:49	18:58	18:09	6	07:44 (SE_14)	16:35	32	07:49 (SE_10)	16:33
23	07:18	07:39 (SE_09)	06:44			05:59	06:09	05:34	05:26	05:45	06:15	06:46	07:18		07:39 (SE_14)	06:55		07:19 (SE_09)	07:22
	17:03	38 08:17 (SE_10)	17:41			18:13	19:46	20:17	20:35	20:25	19:47	18:56	18:07	6	07:45 (SE_14)	16:34	31	07:50 (SE_10)	16:33
24	07:18	07:38 (SE_09)	06:42			05:57	06:07	05:33	05:26	05:45	06:16	06:47	07:20		07:41 (SE_14)	06:56		07:20 (SE_09)	07:22
	17:04	39 08:17 (SE_10)	17:43			18:14	19:48	20:18	20:36	20:24	19:46	18:54	18:06	5	07:46 (SE_14)	16:34	29	07:49 (SE_10)	16:34
25	07:17	07:38 (SE_09)	06:41			05:55	06:06	05:33	05:27	05:46	06:17	06:48	06:21		06:42 (SE_14)	06:57		07:21 (SE_09)	07:22
	17:05	41 08:19 (SE_10)	17:44			18:15	19:49	20:19	20:36	20:24	19:44	18:53	17:05	4	06:46 (SE_14)	16:33	26	07:47 (SE_10)	16:34
26	07:16	07:38 (SE_09)	06:39			05:54	06:04	05:32	05:27	05:47	06:18	06:49	06:22		06:43 (SE_14)	06:59		07:22 (SE_09)	07:23
	17:07	41 08:19 (SE_10)	17:45			18:16	19:50	20:20	20:36	20:23	19:43	18:51	17:03	3	06:46 (SE_14)	16:33	22	07:46 (SE_10)	16:35
27	07:15	07:39 (SE_09)	06:38			05:52	06:03	05:31	05:27	05:48	06:19	06:50	06:23		06:44 (SE_14)	07:00		07:23 (SE_09)	07:23
	17:08	41 08:20 (SE_10)	17:46			18:17	19:51	20:21	20:36	20:22	19:41	18:49	17:02	2	06:45 (SE_14)	16:32	16	07:44 (SE_10)	16:36
28	07:15	07:40 (SE_09)	06:36			05:50	06:02	05:31	05:28	05:49	06:20	06:51	06:24		07:33 (SE_10)	07:01		07:24 (SE_09)	07:24
	17:09	40 08:20 (SE_10)	17:47			18:19	19:52	20:22	20:36	20:21	19:40	18:47	17:01	3	07:36 (SE_10)	16:32	10	07:42 (SE_10)	16:36
29	07:14	07:41 (SE_09)				06:49	06:00	05:30	05:28	05:50	06:21	06:52	06:25		07:28 (SE_10)	07:02		07:26 (SE_09)	07:24
	17:10	40 08:21 (SE_10)				19:20	19:53	20:22	20:36	20:20	19:38	18:46	16:59	13	07:41 (SE_10)	16:31	2	07:27 (SE_09)	16:37
30	07:13	07:42 (SE_09)				06:47	05:59	05:30	05:28	05:51	06:22	06:53	06:27		07:25 (SE_10)	07:03			07:24
	17:12	39 08:21 (SE_10)				19:21	19:54	20:23	20:36	20:19	19:36	18:44	16:58	18	07:43 (SE_10)	16:31			16:38
31	07:12	07:45 (SE_09)				06:45		05:29		05:52	06:23		06:28		07:23 (SE_10)				07:24
	17:13	36 08:21 (SE_10)				19:22		20:24		20:18	19:35		16:57	22	07:45 (SE_10)				16:39
Potential sun hours	297		297		369	399	449	453	460	428	375	345				297			287
Total, worst case		589		391									88				905		
Sun reduction		0,43		0,44									0,52				0,47		
Oper. time red.		0,94		0,94									0,94				0,94		
Wind dir. red.		0,59		0,59									0,60				0,59		
Total reduction		0,24		0,25									0,30				0,26		
Total, real		141		96									26				236		

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)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Massimo Lepore / massimo.lepore@tenproject.it
Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R11 - R11

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

	January	February		March		April		May		June	
1	07:25	07:11		06:35		07:12 (800)	06:44	18:17 (A09)	05:58	18:06 (A09)	05:28
	16:40	17:14		17:48	33	17:20 (A08)	19:23	18:46 (A09)	19:55	39	18:45 (A09)	20:25
2	07:25	07:10		06:33		07:10 (800)	06:42	18:14 (A09)	05:56	18:08 (A09)	05:28
	16:40	17:15		17:50	42	17:23 (A08)	19:24	18:48 (A09)	19:56	35	18:43 (A09)	20:26
3	07:25	07:09		06:32		07:10 (800)	06:40	18:12 (A09)	05:55	18:09 (A09)	05:28
	16:41	17:17		17:51	48	17:26 (A08)	19:25	18:50 (A09)	19:57	32	18:41 (A09)	20:26
4	07:25	07:08		06:30		07:09 (800)	06:39	18:10 (A09)	05:54	18:10 (A09)	05:27
	16:42	17:18		17:52	53	17:27 (A08)	19:26	18:51 (A09)	19:58	30	18:40 (A09)	20:27
5	07:25	07:07		06:28		07:09 (800)	06:37	18:09 (A09)	05:52	18:12 (A09)	05:27
	16:43	17:19		17:53	54	17:28 (A08)	19:27	18:53 (A09)	19:59	26	18:38 (A09)	20:28
6	07:25	07:06		06:27		07:09 (800)	06:35	18:07 (A09)	05:51	18:15 (A09)	05:26
	16:44	17:20		17:54	57	17:29 (A08)	19:28	18:53 (A09)	20:00	21	18:36 (A09)	20:28
7	07:25	07:05		06:25		07:09 (800)	06:34	18:06 (A09)	05:50	18:18 (A09)	05:26
	16:45	17:22		17:55	57	17:29 (A08)	19:29	18:53 (A09)	20:01	15	18:33 (A09)	20:29
8	07:25	07:04		06:24		07:09 (800)	06:32	18:05 (A09)	05:49			05:26
	16:46	17:23		17:57	58	17:30 (A08)	19:30	18:55 (A09)	20:02			20:30
9	07:24	07:02		06:22		07:09 (800)	06:30	18:04 (A09)	05:48			05:26
	16:47	17:24		17:58	58	17:30 (A08)	19:31	18:55 (A09)	20:03			20:30
10	07:24	07:01		06:20		07:10 (800)	06:29	18:03 (A09)	05:46			05:25
	16:48	17:25		17:59	56	17:30 (A08)	19:32	18:55 (A09)	20:04			20:31
11	07:24	07:00		06:19		07:11 (800)	06:27	18:03 (A09)	05:45			05:25
	16:49	17:27		18:00	54	17:30 (A08)	19:34	18:55 (A09)	20:06			20:31
12	07:24	06:59		06:17		07:12 (800)	06:26	18:02 (A09)	05:44			05:25
	16:50	17:28		18:01	51	17:30 (A08)	19:35	18:55 (A09)	20:07			20:32
13	07:23	06:57		06:16		07:13 (800)	06:24	18:02 (A09)	05:43			05:25
	16:51	17:29		18:02	48	17:29 (A08)	19:36	18:56 (A09)	20:08			20:32
14	07:23	06:56		06:14		07:17 (800)	06:22	18:01 (A09)	05:42			05:25
	16:52	17:30		18:03	40	17:29 (A08)	19:37	18:55 (A09)	20:09			20:33
15	07:23	06:55		06:12		16:58 (A08)	06:21	18:01 (A09)	05:41			05:25
	16:53	17:32		18:04	30	17:28 (A08)	19:38	18:56 (A09)	20:10			20:33
16	07:22	06:54		06:11		16:58 (A08)	06:19	18:00 (A09)	05:40			05:25
	16:55	17:33		18:05	28	17:26 (A08)	19:39	18:55 (A09)	20:11			20:34
17	07:22	06:52		06:09		17:00 (A08)	06:18	17:59 (A09)	05:39			05:25
	16:56	17:34		18:07	26	17:26 (A08)	19:40	18:54 (A09)	20:12			20:34
18	07:21	06:51		06:07		17:01 (A08)	06:16	18:00 (A09)	05:38			05:25
	16:57	17:35		18:08	23	17:24 (A08)	19:41	18:55 (A09)	20:12			20:34
19	07:21	06:49		06:06		17:02 (A08)	06:15	17:59 (A09)	05:37			05:25
	16:58	17:36		18:09	19	17:21 (A08)	19:42	18:54 (A09)	20:13			20:35
20	07:20	06:48		06:04		17:03 (A08)	06:13	18:00 (A09)	05:37			05:25
	16:59	17:38		18:10	16	17:19 (A08)	19:43	18:54 (A09)	20:14			20:35
21	07:20	06:47		06:02		17:08 (A08)	06:12	18:01 (A09)	05:36			05:25
	17:00	17:39		18:11	7	17:15 (A08)	19:44	18:54 (A09)	20:15			20:35
22	07:19	06:45		06:00			06:10	18:00 (A09)	05:35			05:26
	17:02	17:40		18:12			19:45	18:53 (A09)	20:16			20:35
23	07:18	06:44		05:59			06:09	18:01 (A09)	05:34			05:26
	17:03	17:41		18:13			19:46	18:52 (A09)	20:17			20:35
24	07:18	06:42	07:23 (800)	05:57			06:07	18:01 (A09)	05:33			05:26
	17:04	17:43	3 07:26 (800)	18:14			19:48	50	18:51 (A09)	20:18		20:36
25	07:17	06:41	07:18 (800)	05:55			06:06		18:02 (A09)	05:33		05:26
	17:05	17:44	13 07:31 (800)	18:15			19:49	49	18:51 (A09)	20:19		20:36
26	07:16	06:39	07:15 (800)	05:54			06:04		18:02 (A09)	05:32		05:27
	17:07	17:45	18 07:33 (800)	18:16			19:50	47	18:49 (A09)	20:20		20:36
27	07:15	06:38	07:14 (800)	05:52			06:03		18:03 (A09)	05:31		05:27
	17:08	17:46	21 07:35 (800)	18:17			19:51	46	18:49 (A09)	20:21		20:36
28	07:15	06:36	07:12 (800)	05:50			06:02		18:04 (A09)	05:31		05:28
	17:09	17:47	24 07:36 (800)	18:19			19:52	44	18:48 (A09)	20:22		20:36
29	07:14			06:49			06:00		18:04 (A09)	05:30		05:28
	17:10			19:20			19:53	42	18:46 (A09)	20:22		20:36
30	07:13			06:47		18:25 (A09)	05:59		18:05 (A09)	05:29		05:28
	17:12			19:21	16	18:41 (A09)	19:54	41	18:46 (A09)	20:23		20:36
31	07:12			06:45		18:20 (A09)				05:29		
	17:13			19:22	24	18:44 (A09)				20:24		
Potential sun hours	297	297		369			399			449		453
Total, worst case			79		898			1450			198	
Sun reduction			0,44		0,44			0,51			0,57	
Oper. time red.			0,94		0,94			0,94			0,94	
Wind dir. red.			0,63		0,68			0,69			0,69	
Total reduction			0,26		0,28			0,33			0,37	
Total, real			21		255			474			73	

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

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

Massimo Lepore / massimo.lepore@tenproject.it
Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R11 - R11

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

	July	August		September		October		November	December
1	05:29	05:53		06:24	18:02 (A09)	06:54	07:51 (800)	06:29	07:04
	20:36	20:17		19:33 52	18:54 (A09)	18:42 50	18:08 (A08)	16:55	16:31
2	05:29	05:54		06:25	18:02 (A09)	06:55	07:50 (800)	06:30	07:05
	20:36	20:15		19:32 52	18:54 (A09)	18:41 53	18:09 (A08)	16:54	16:30
3	05:30	05:55		06:26	18:02 (A09)	06:56	07:49 (800)	06:31	07:06
	20:35	20:14		19:30 51	18:53 (A09)	18:39 55	18:08 (A08)	16:53	16:30
4	05:30	05:56		06:27	18:02 (A09)	06:57	07:47 (800)	06:32	07:07
	20:35	20:13		19:28 50	18:52 (A09)	18:37 58	18:08 (A08)	16:52	16:30
5	05:31	05:57	18:31 (A09)	06:28	18:03 (A09)	06:59	07:46 (800)	06:34	07:08
	20:35	20:12 8	18:39 (A09)	19:27 47	18:50 (A09)	18:36 58	18:07 (A08)	16:50	16:30
6	05:32	05:58	18:27 (A09)	06:29	18:03 (A09)	07:00	07:45 (800)	06:35	07:09
	20:35	20:11 16	18:43 (A09)	19:25 46	18:49 (A09)	18:34 58	18:06 (A08)	16:49	16:30
7	05:32	05:59	18:24 (A09)	06:30	18:04 (A09)	07:01	07:45 (800)	06:36	07:10
	20:35	20:10 22	18:46 (A09)	19:23 44	18:48 (A09)	18:32 57	18:05 (A08)	16:48	16:29
8	05:33	06:00	18:21 (A09)	06:31	18:05 (A09)	07:02	07:44 (800)	06:37	07:11
	20:34	20:08 27	18:48 (A09)	19:22 41	18:46 (A09)	18:31 56	18:04 (A08)	16:47	16:29
9	05:33	06:01	18:19 (A09)	06:32	18:06 (A09)	07:03	07:44 (800)	06:39	07:12
	20:34	20:07 31	18:50 (A09)	19:20 38	18:44 (A09)	18:29 54	18:03 (A08)	16:46	16:29
10	05:34	06:02	18:18 (A09)	06:33	18:08 (A09)	07:04	07:44 (800)	06:40	07:13
	20:33	20:06 33	18:51 (A09)	19:18 34	18:42 (A09)	18:27 50	18:01 (A08)	16:45	16:29
11	05:35	06:03	18:16 (A09)	06:34	18:09 (A09)	07:05	07:44 (800)	06:41	07:14
	20:33	20:05 37	18:53 (A09)	19:16 31	18:40 (A09)	18:26 45	17:58 (A08)	16:44	16:30
12	05:36	06:04	18:15 (A09)	06:35	18:11 (A09)	07:06	07:44 (800)	06:42	07:14
	20:33	20:03 39	18:54 (A09)	19:15 25	18:36 (A09)	18:24 39	17:55 (A08)	16:43	16:30
13	05:36	06:05	18:13 (A09)	06:36	18:14 (A09)	07:07	07:46 (800)	06:43	07:15
	20:32	20:02 42	18:55 (A09)	19:13 18	18:32 (A09)	18:23 24	08:10 (800)	16:42	16:30
14	05:37	06:06	18:12 (A09)	06:37		07:08	07:46 (800)	06:45	07:16
	20:32	20:00 43	18:55 (A09)	19:11		18:21 23	08:09 (800)	16:41	16:30
15	05:38	06:07	18:11 (A09)	06:38		07:09	07:47 (800)	06:46	07:17
	20:31	19:59 45	18:56 (A09)	19:10		18:19 20	08:07 (800)	16:40	16:30
16	05:39	06:08	18:09 (A09)	06:39		07:10	07:49 (800)	06:47	07:17
	20:30	19:58 47	18:56 (A09)	19:08		18:18 16	08:05 (800)	16:39	16:30
17	05:39	06:09	18:08 (A09)	06:40		07:12	07:51 (800)	06:48	07:18
	20:30	19:56 48	18:56 (A09)	19:06		18:16 11	08:02 (800)	16:39	16:31
18	05:40	06:10	18:07 (A09)	06:41		07:13		06:49	07:19
	20:29	19:55 50	18:57 (A09)	19:05		18:15		16:38	16:31
19	05:41	06:11	18:06 (A09)	06:42		07:14		06:50	07:19
	20:28	19:53 51	18:57 (A09)	19:03		18:13		16:37	16:31
20	05:42	06:12	18:06 (A09)	06:43		07:15		06:52	07:20
	20:28	19:52 51	18:57 (A09)	19:01		18:12		16:36	16:32
21	05:43	06:13	18:05 (A09)	06:44		07:16		06:53	07:21
	20:27	19:50 53	18:58 (A09)	18:59		18:10		16:36	16:32
22	05:44	06:14	18:04 (A09)	06:45		07:17		06:54	07:21
	20:26	19:49 54	18:58 (A09)	18:58		18:09		16:35	16:33
23	05:45	06:15	18:04 (A09)	06:46	17:49 (A08)	07:18		06:55	07:22
	20:25	19:47 54	18:58 (A09)	18:56 13	18:02 (A08)	18:07		16:34	16:33
24	05:45	06:16	18:03 (A09)	06:47	17:46 (A08)	07:20		06:56	07:22
	20:24	19:46 55	18:58 (A09)	18:54 18	18:04 (A08)	18:06		16:34	16:34
25	05:46	06:17	18:03 (A09)	06:48	17:44 (A08)	06:21		06:57	07:22
	20:24	19:44 55	18:58 (A09)	18:52 22	18:06 (A08)	17:05		16:33	16:34
26	05:47	06:18	18:02 (A09)	06:49	17:42 (A08)	06:22		06:59	07:23
	20:23	19:43 55	18:57 (A09)	18:51 25	18:07 (A08)	17:03		16:33	16:35
27	05:48	06:19	18:02 (A09)	06:50	17:40 (A08)	06:23		07:00	07:23
	20:22	19:41 55	18:57 (A09)	18:49 27	18:07 (A08)	17:02		16:32	16:36
28	05:49	06:20	18:02 (A09)	06:51	17:39 (A08)	06:24		07:01	07:24
	20:21	19:40 55	18:57 (A09)	18:47 29	18:08 (A08)	17:00		16:32	16:36
29	05:50	06:21	18:02 (A09)	06:52	07:58 (800)	06:25		07:02	07:24
	20:20	19:38 54	18:56 (A09)	18:46 35	18:08 (A08)	16:59		16:31	16:37
30	05:51	06:22	18:02 (A09)	06:53	07:54 (800)	06:27		07:03	07:24
	20:19	19:36 54	18:56 (A09)	18:44 44	18:08 (A08)	16:58		16:31	16:38
31	05:52	06:23	18:01 (A09)			06:28			07:24
	20:18	19:35 54	18:55 (A09)			16:57			16:39
Potential sun hours	460	428		375		345		297	287
Total, worst case		1188		742		727			
Sun reduction		0,68		0,61		0,52			
Oper. time red.		0,94		0,94		0,94			
Wind dir. red.		0,69		0,69		0,67			
Total reduction		0,44		0,40		0,33			
Total, real		526		295		238			

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

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

Massimo Lepore / massimo.lepore@tenproject.it
Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R12 - R12

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:25	07:11	06:35	06:44	05:58	05:28	05:50 (800)	05:29	05:52 (800)	05:53	06:24	06:54	06:29	07:04
	16:40	17:14	17:48	19:23	19:55	20:25 7	05:57 (800)	20:36 12	06:04 (800)	20:17	19:33	18:42	16:55	16:31
2	07:25	07:10	06:33	06:42	05:56	05:28	05:50 (800)	05:29	05:52 (800)	05:54	06:25	06:55	06:30	07:05
	16:40	17:15	17:50	19:24	19:56	20:26 8	05:58 (800)	20:36 11	06:03 (800)	20:16	19:32	18:41	16:54	16:30
3	07:25	07:09	06:32	06:40	05:55	05:28	05:49 (800)	05:30	05:53 (800)	05:55	06:26	06:56	06:31	07:06
	16:41	17:17	17:51	19:25	19:57	20:26 9	05:58 (800)	20:35 11	06:04 (800)	20:14	19:30	18:39	16:53	16:30
4	07:25	07:08	06:30	06:39	05:54	05:27	05:49 (800)	05:30	05:53 (800)	05:56	06:27	06:58	06:32	07:07
	16:42	17:18	17:52	19:26	19:58	20:27 9	05:58 (800)	20:35 11	06:04 (800)	20:13	19:28	18:37	16:52	16:30
5	07:25	07:07	06:29	06:37	05:52	05:27	05:49 (800)	05:31	05:54 (800)	05:57	06:28	06:59	06:34	07:08
	16:43	17:19	17:53	19:27	19:59	20:28 10	05:59 (800)	20:35 11	06:05 (800)	20:12	19:27	18:36	16:50	16:30
6	07:25	07:06	06:27	06:35	05:51	05:26	05:48 (800)	05:32	05:54 (800)	05:58	06:29	07:00	06:35	07:09
	16:44	17:20	17:54	19:28	20:00	20:28 10	05:58 (800)	20:35 10	06:04 (800)	20:11	19:25	18:34	16:49	16:30
7	07:25	07:05	06:25	06:34	05:50	05:26	05:48 (800)	05:32	05:55 (800)	05:59	06:30	07:01	06:36	07:10
	16:45	17:22	17:55	19:29	20:01	20:29 10	05:58 (800)	20:35 10	06:05 (800)	20:10	19:23	18:32	16:48	16:30
8	07:25	07:04	06:24	06:32	05:49	05:26	05:48 (800)	05:33	05:56 (800)	06:00	06:31	07:02	06:37	07:11
	16:46	17:23	17:57	19:30	20:02	20:30 11	05:59 (800)	20:34 9	06:05 (800)	20:08	19:22	18:31	16:47	16:29
9	07:24	07:02	06:22	06:30	05:48	05:26	05:48 (800)	05:33	05:56 (800)	06:01	06:32	07:03	06:39	07:12
	16:47	17:24	17:58	19:31	20:03	20:30 11	05:59 (800)	20:34 9	06:05 (800)	20:07	19:20	18:29	16:46	16:29
10	07:24	07:01	06:20	06:29	05:47	05:25	05:48 (800)	05:34	05:57 (800)	06:02	06:33	07:04	06:40	07:13
	16:48	17:25	17:59	19:33	20:04	20:31 11	05:59 (800)	20:33 8	06:05 (800)	20:06	19:18	18:27	16:45	16:29
11	07:24	07:00	06:19	06:27	05:45	05:25	05:47 (800)	05:35	05:58 (800)	06:03	06:34	07:05	06:41	07:14
	16:49	17:27	18:00	19:34	20:06	20:31 11	05:58 (800)	20:33 8	06:06 (800)	20:05	19:17	18:26	16:44	16:30
12	07:24	06:59	06:17	06:26	05:44	05:25	05:47 (800)	05:36	05:58 (800)	06:04	06:35	07:06	06:42	07:14
	16:50	17:28	18:01	19:35	20:07	20:32 12	05:59 (800)	20:33 7	06:05 (800)	20:03	19:15	18:24	16:43	16:30
13	07:23	06:57	06:16	06:24	05:43	05:25	05:47 (800)	05:36	05:59 (800)	06:05	06:36	07:07	06:43	07:15
	16:51	17:29	18:02	19:36	20:08	20:32 12	05:59 (800)	20:32 6	06:05 (800)	20:02	19:13	18:23	16:42	16:30
14	07:23	06:56	06:14	06:22	05:42	05:25	05:47 (800)	05:37	06:00 (800)	06:06	06:37	07:08	06:45	07:16
	16:52	17:30	18:03	19:37	20:09	20:33 12	05:59 (800)	20:32 5	06:05 (800)	20:01	19:11	18:21	16:41	16:30
15	07:23	06:55	06:12	06:21	05:41	05:25	05:47 (800)	05:38	06:00 (800)	06:07	06:38	07:09	06:46	07:17
	16:54	17:32	18:04	19:38	20:10	20:33 12	05:59 (800)	20:31 4	06:04 (800)	19:59	19:10	18:19	16:40	16:30
16	07:22	06:54	06:11	06:19	05:40	05:25	05:47 (800)	05:39	06:01 (800)	06:08	06:39	07:10	06:47	07:17
	16:55	17:33	18:05	19:39	20:11	20:34 12	05:59 (800)	20:30 3	06:04 (800)	19:58	19:08	18:18	16:39	16:30
17	07:22	06:52	06:09	06:18	05:39	05:25	05:47 (800)	05:39	06:02 (800)	06:09	06:40	07:12	06:48	07:18
	16:56	17:34	18:07	19:40	20:12	20:34 12	05:59 (800)	20:30 2	06:03 (800)	19:56	19:06	18:16	16:39	16:31
18	07:21	06:51	06:07	06:16	05:38	05:25	05:48 (800)	05:40		06:10	06:41	07:13	06:49	07:19
	16:57	17:35	18:08	19:41	20:13	20:34 12	06:00 (800)	20:29		19:55	19:05	18:15	16:38	16:31
19	07:21	06:49	06:06	06:15	05:37	05:25	05:48 (800)	05:41		06:11	06:42	07:14	06:50	07:19
	16:58	17:37	18:09	19:42	20:13	20:35 12	06:00 (800)	20:28		19:53	19:03	18:13	16:37	16:31
20	07:20	06:48	06:04	06:13	05:37	05:25	05:48 (800)	05:42		06:12	06:43	07:15	06:52	07:20
	16:59	17:38	18:10	19:43	20:14	20:35 12	06:00 (800)	20:28		19:52	19:01	18:12	16:36	16:32
21	07:20	06:47	06:02	06:12	05:36	05:26	05:48 (800)	05:43		06:13	06:44	07:16	06:53	07:21
	17:00	17:39	18:11	19:44	20:15	20:35 12	06:00 (800)	20:27		19:50	18:59	18:10	16:36	16:32
22	07:19	06:45	06:00	06:10	05:35	05:26	05:48 (800)	05:44		06:14	06:45	07:17	06:54	07:21
	17:02	17:40	18:12	19:45	20:16	20:35 12	06:00 (800)	20:26		19:49	18:58	18:09	16:35	16:33
23	07:18	06:44	05:59	06:09	05:34	05:26	05:49 (800)	05:45		06:15	06:46	07:18	06:55	07:22
	17:03	17:41	18:13	19:46	20:17	20:35 12	06:01 (800)	20:25		19:47	18:56	18:07	16:34	16:33
24	07:18	06:42	05:57	06:07	05:33	05:26	05:49 (800)	05:45		06:16	06:47	07:20	06:56	07:22
	17:04	17:43	18:14	19:48	20:18	20:36 12	06:01 (800)	20:24		19:46	18:54	18:06	16:34	16:34
25	07:17	06:41	05:55	06:06	05:33	05:26	05:49 (800)	05:46		06:17	06:48	06:21	06:57	07:22
	17:05	17:44	18:15	19:49	20:19	20:36 12	06:01 (800)	20:24		19:44	18:53	17:05	16:33	16:34
26	07:16	06:39	05:54	06:04	05:32	05:27	05:49 (800)	05:47		06:18	06:49	06:22	06:59	07:23
	17:07	17:45	18:16	19:50	20:20	20:36 12	06:01 (800)	20:23		19:43	18:51	17:03	16:33	16:35
27	07:15	06:38	05:52	06:03	05:31	05:52 (800) 05:27	05:50 (800)	05:48		06:19	06:50	06:23	07:00	07:23
	17:08	17:46	18:17	19:51	20:21 2	05:54 (800) 20:36 12	06:02 (800)	20:22		19:41	18:49	17:02	16:32	16:36
28	07:15	06:36	05:50	06:02	05:31	05:52 (800) 05:28	05:50 (800)	05:49		06:20	06:51	06:24	07:01	07:24
	17:09	17:47	18:19	19:52	20:22 3	05:55 (800) 20:36 12	06:02 (800)	20:21		19:40	18:47	17:00	16:32	16:36
29	07:14		06:49	06:00	05:30	05:51 (800) 05:28	05:51 (800)	05:50		06:21	06:52	06:25	07:02	07:24
	17:10		19:20	19:53	20:22 4	05:55 (800) 20:36 12	06:03 (800)	20:20		19:38	18:46	16:59	16:31	16:37
30	07:13		06:47	05:59	05:29	05:51 (800) 05:28	05:51 (800)	05:51		06:22	06:53	06:27	07:03	07:24
	17:12		19:21	19:54	20:23 5	05:56 (800) 20:36 12	06:03 (800)	20:19		19:36	18:44	16:58	16:31	16:38
31	07:12		06:45		05:29	05:50 (800)		05:52		06:23		06:28		07:24
	17:13		19:22		20:24 6	05:56 (800)		20:18		19:35		16:57		16:39
Potential sun hours	297	297	369	399	449	453		460		428	375	345	297	287
Total, worst case					20	335		137						
Sun reduction					0,57	0,62		0,69						
Oper. time red.					0,94	0,94		0,94						
Wind dir. red.					0,72	0,72		0,72						
Total reduction					0,39	0,42		0,46						
Total, real					8	140		64						

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)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Massimo Lepore / massimo.lepore@tenproject.it
Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R13 - R13

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:25	07:11	06:35	06:44	05:58	05:28	05:29	05:53	06:24	06:54	06:29	07:04
	16:40	17:14	17:48	19:23	19:55	20:25	20:36	20:17	19:33	18:42	16:55	16:31
2	07:25	07:10	06:33	06:42	05:56	05:28	05:29	05:54	06:25	06:55	06:30	07:05
	16:40	17:15	17:50	19:24	19:56	20:26	20:36	20:15	19:32	18:41	16:54	16:30
3	07:25	07:09	06:32	06:40	05:55	05:28	05:30	05:55	06:26	06:56	06:31	07:06
	16:41	17:17	17:51	19:25	19:57	20:26	20:35	20:14	19:30	18:39	16:53	16:30
4	07:25	07:08	06:30	06:39	05:54	05:27	05:30	05:56	06:27	06:58	06:32	07:07
	16:42	17:18	17:52	19:26	19:58	20:27	20:35	20:13	19:28	18:37	16:52	16:30
5	07:25	07:07	06:29	06:37	05:52	05:27	05:31	05:57	06:28	06:59	06:34	07:08
	16:43	17:19	17:53	19:27	19:59	20:28	20:35	20:12	19:27	18:36	16:50	16:30
6	07:25	07:06	06:27	06:35	05:51	05:26	05:32	05:58	06:29	07:00	06:35	07:09
	16:44	17:20	17:54	19:28	20:00	20:28	20:35	20:11	19:25	18:34	16:49	16:30
7	07:25	07:05	06:25	06:34	05:50	05:26	05:32	05:59	06:30	07:01	06:36	07:10
	16:45	17:22	17:55	19:29	20:01	20:29	20:35	20:10	19:23	18:32	16:48	16:30
8	07:25	07:04	06:24	06:32	05:49	05:26	05:33	06:00	06:31	07:02	06:37	07:11
	16:46	17:23	17:57	19:30	20:02	20:30	20:34	20:08	19:22	18:31	16:47	16:29
9	07:24	07:02	06:22	06:30	05:48	05:26	05:33	06:01	06:32	07:03	06:39	07:12
	16:47	17:24	17:58	19:31	20:03	20:30	20:34	20:07	19:20	18:29	16:46	16:29
10	07:24	07:01	06:20	06:29	05:47	05:25	05:34	06:02	06:33	07:04	06:40	07:13
	16:48	17:25	17:59	19:33	20:04	20:31	20:33	20:06	19:18	18:27	16:45	16:29
11	07:24	07:00	06:19	06:27	05:45	05:25	05:35	06:03	06:34	07:05	06:41	07:14
	16:49	17:27	18:00	19:34	20:06	20:31	20:33	20:05	19:17	18:26	16:44	16:30
12	07:24	06:59	06:17	06:26	05:44	05:25	05:36	06:04	06:35	07:06	06:42	07:14
	16:50	17:28	18:01	19:35	20:07	20:32	20:33	20:03	19:15	18:24	16:43	16:30
13	07:23	06:57	06:16	06:24	05:43	05:25	05:36	06:05	06:36	07:07	06:43	07:15
	16:51	17:29	18:02	19:36	20:08	20:32	20:32	20:02	19:13	18:23	16:42	16:30
14	07:23	06:56	06:14	06:22	05:42	05:25	05:37	06:06	06:37	07:08	06:45	07:16
	16:52	17:30	18:03	19:37	20:09	20:33	20:32	20:00	19:11	18:21	16:41	16:30
15	07:23	06:55	06:12	06:21	05:41	05:25	05:38	06:07	06:38	07:09	06:46	07:17
	16:54	17:32	18:04	19:38	20:10	20:33	20:31	19:59	19:10	18:19	16:40	16:30
16	07:22	06:54	06:11	06:19	05:40	05:25	05:39	06:08	06:39	07:10	06:47	07:17
	16:55	17:33	18:05	19:39	20:11	20:34	20:30	19:58	19:08	18:18	16:39	16:30
17	07:22	06:52	06:09	06:18	05:39	05:25	05:39	06:09	06:40	07:12	06:48	07:18
	16:56	17:34	18:07	19:40	20:12	20:34	20:30	19:56	19:06	18:16	16:39	16:31
18	07:21	06:51	06:07	06:16	05:38	05:25	05:40	06:10	06:41	07:13	06:49	07:19
	16:57	17:35	18:08	19:41	20:12	20:34	20:29	19:55	19:05	18:15	16:38	16:31
19	07:21	06:49	06:06	06:15	05:37	05:25	05:41	06:11	06:42	07:14	06:50	07:19
	16:58	17:37	18:09	19:42	20:13	20:35	20:28	19:53	19:03	18:13	16:37	16:31
20	07:20	06:48	06:04	06:13	05:37	05:25	05:42	06:12	06:43	07:15	06:52	07:20
	16:59	17:38	18:10	19:43	20:14	20:35	20:28	19:52	19:01	18:12	16:36	16:32
21	07:20	06:47	06:02	06:12	05:36	05:26	05:43	06:13	06:44	07:16	06:53	07:21
	17:01	17:39	18:11	19:44	20:15	20:35	20:27	19:50	18:59	18:10	16:36	16:32
22	07:19	06:45	06:00	06:10	05:35	05:26	05:44	06:14	06:45	07:17	06:54	07:21
	17:02	17:40	18:12	19:45	20:16	20:35	20:26	19:49	18:58	18:09	16:35	16:33
23	07:18	06:44	05:59	06:09	05:34	05:26	05:45	06:15	06:46	07:18	06:55	07:22
	17:03	17:41	18:13	19:46	20:17	20:35	20:25	19:47	18:56	18:07	16:34	16:33
24	07:18	06:42	05:57	06:07	05:33	05:26	05:45	06:16	06:47	07:20	06:56	07:22
	17:04	17:43	18:14	19:48	20:18	20:36	20:24	19:46	18:54	18:06	16:34	16:34
25	07:17	06:41	05:55	06:06	05:33	05:27	05:46	06:17	06:48	06:21	06:57	07:22
	17:05	17:44	18:15	19:49	20:19	20:36	20:24	19:44	18:53	17:05	16:33	16:34
26	07:16	06:39	05:54	06:04	05:32	05:27	05:47	06:18	06:49	06:22	06:59	07:23
	17:07	17:45	18:16	19:50	20:20	20:36	20:23	19:43	18:51	17:03	16:33	16:35
27	07:15	06:38	05:52	06:03	05:31	05:27	05:48	06:19	06:50	06:23	07:00	07:23
	17:08	17:46	18:17	19:51	20:21	20:36	20:22	19:41	18:49	17:02	16:32	16:36
28	07:15	06:36	05:50	06:02	05:31	05:28	05:49	06:20	06:51	06:24	07:01	07:24
	17:09	17:47	18:19	19:52	20:22	20:36	20:21	19:40	18:47	17:01	16:32	16:36
29	07:14		06:49	06:00	05:30	05:28	05:50	06:21	06:52	06:25	07:02	07:24
	17:10		19:20	19:53	20:22	20:36	20:20	19:38	18:46	16:59	16:31	16:37
30	07:13		06:47	05:59	05:29	05:28	05:51	06:22	06:53	06:27	07:03	07:24
	17:12		19:21	19:54	20:23	20:36	20:19	19:36	18:44	16:58	16:31	16:38
31	07:12		06:45		05:29		05:52	06:23		06:28		07:24
	17:13		19:22		20:24		20:18	19:35		16:57		16:39
Potential sun hours	297	297	369	399	449	453	460	428	375	345	297	287
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Massimo Lepore / massimo.lepore@tenproject.it

Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R14 - R14

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

	January			February	March	April	May	June	July	August	September	October	November			December		
1	07:25		07:47 (SE_10)	07:11	06:35	06:44	05:58	05:28	05:29	05:53	06:24	06:54	06:29			07:04		07:28 (SE_09)
	16:40	11	07:58 (SE_10)	17:14	17:48	19:23	19:55	20:25	20:36	20:17	19:33	18:42	16:55			16:31	20	07:48 (SE_10)
2	07:25		07:47 (SE_10)	07:10	06:33	06:42	05:56	05:28	05:29	05:54	06:25	06:55	06:30			07:05		07:29 (SE_09)
	16:41	11	07:58 (SE_10)	17:15	17:50	19:24	19:56	20:26	20:36	20:16	19:32	18:41	16:54			16:30	19	07:48 (SE_10)
3	07:25		07:47 (SE_10)	07:09	06:32	06:40	05:55	05:28	05:30	05:55	06:26	06:56	06:31			07:06		07:30 (SE_09)
	16:41	12	07:59 (SE_10)	17:17	17:51	19:25	19:57	20:26	20:36	20:14	19:30	18:39	16:53			16:30	18	07:48 (SE_10)
4	07:25		07:47 (SE_10)	07:08	06:30	06:39	05:54	05:27	05:30	05:56	06:27	06:58	06:33			07:07		07:31 (SE_09)
	16:42	13	08:00 (SE_10)	17:18	17:52	19:26	19:58	20:27	20:35	20:13	19:28	18:37	16:52			16:30	17	07:48 (SE_10)
5	07:25		07:47 (SE_10)	07:07	06:29	06:37	05:52	05:27	05:31	05:57	06:28	06:59	06:34			07:08		07:32 (SE_09)
	16:43	14	08:01 (SE_10)	17:19	17:53	19:27	19:59	20:28	20:35	20:12	19:27	18:36	16:51			16:30	16	07:48 (SE_10)
6	07:25		07:47 (SE_10)	07:06	06:27	06:35	05:51	05:27	05:32	05:58	06:29	07:00	06:35			07:09		07:33 (SE_10)
	16:44	15	08:02 (SE_10)	17:20	17:54	19:28	20:00	20:28	20:35	20:11	19:25	18:34	16:49			16:30	15	07:48 (SE_10)
7	07:25		07:47 (SE_09)	07:05	06:25	06:34	05:50	05:26	05:32	05:59	06:30	07:01	06:36			07:10		07:34 (SE_10)
	16:45	16	08:03 (SE_10)	17:22	17:55	19:29	20:01	20:29	20:35	20:10	19:23	18:32	16:48			16:30	14	07:48 (SE_10)
8	07:25		07:47 (SE_09)	07:04	06:24	06:32	05:49	05:26	05:33	06:00	06:31	07:02	06:37			07:11		07:35 (SE_10)
	16:46	17	08:04 (SE_10)	17:23	17:57	19:30	20:02	20:30	20:34	20:08	19:22	18:31	16:47			16:30	13	07:48 (SE_10)
9	07:24		07:46 (SE_09)	07:02	06:22	06:31	05:48	05:26	05:34	06:01	06:32	07:03	06:39			07:12		07:36 (SE_10)
	16:47	18	08:04 (SE_10)	17:24	17:58	19:31	20:03	20:30	20:34	20:07	19:20	18:29	16:46			16:30	12	07:48 (SE_10)
10	07:24		07:46 (SE_09)	07:01	06:20	06:29	05:47	05:26	05:34	06:02	06:33	07:04	06:40			07:13		07:37 (SE_10)
	16:48	19	08:05 (SE_10)	17:25	17:59	19:33	20:05	20:31	20:33	20:06	19:18	18:27	16:45			16:30	12	07:49 (SE_10)
11	07:24		07:46 (SE_09)	07:00	06:19	06:27	05:45	05:25	05:35	06:03	06:34	07:05	06:41			07:14		07:37 (SE_10)
	16:49	20	08:06 (SE_10)	17:27	18:00	19:34	20:06	20:31	20:33	20:05	19:17	18:26	16:44			16:30	11	07:48 (SE_10)
12	07:24		07:45 (SE_09)	06:59	06:17	06:26	05:44	05:25	05:36	06:04	06:35	07:06	06:42			07:14		07:38 (SE_10)
	16:50	20	08:05 (SE_10)	17:28	18:01	19:35	20:07	20:32	20:33	20:03	19:15	18:24	16:43			16:30	10	07:48 (SE_10)
13	07:23		07:45 (SE_09)	06:58	06:16	06:24	05:43	05:25	05:36	06:05	06:36	07:07	06:43			07:15		07:39 (SE_10)
	16:51	21	08:06 (SE_10)	17:29	18:02	19:36	20:08	20:32	20:32	20:02	19:13	18:23	16:42			16:30	9	07:48 (SE_10)
14	07:23		07:45 (SE_09)	06:56	06:14	06:22	05:42	05:25	05:37	06:06	06:37	07:08	06:45			07:16		07:40 (SE_10)
	16:52	22	08:07 (SE_10)	17:30	18:03	19:37	20:09	20:33	20:32	20:01	19:11	18:21	16:41			16:30	8	07:48 (SE_10)
15	07:23		07:44 (SE_09)	06:55	06:12	06:21	05:41	05:25	05:38	06:07	06:38	07:09	06:46			07:17		07:40 (SE_10)
	16:54	23	08:07 (SE_10)	17:32	18:04	19:38	20:10	20:33	20:31	19:59	19:10	18:19	16:40			16:30	8	07:48 (SE_10)
16	07:22		07:44 (SE_09)	06:54	06:11	06:19	05:40	05:25	05:39	06:08	06:39	07:10	06:47		07:31 (SE_10)	07:17		07:41 (SE_10)
	16:55	24	08:08 (SE_10)	17:33	18:06	19:39	20:11	20:34	20:30	19:58	19:08	18:18	16:39	4	07:35 (SE_10)	16:30	7	07:48 (SE_10)
17	07:22		07:43 (SE_09)	06:52	06:09	06:18	05:39	05:25	05:39	06:09	06:40	07:12	06:48		07:28 (SE_10)	07:18		07:42 (SE_10)
	16:56	25	08:08 (SE_10)	17:34	18:07	19:40	20:12	20:34	20:30	19:56	19:06	18:16	16:39	10	07:38 (SE_10)	16:31	7	07:49 (SE_10)
18	07:21		07:43 (SE_09)	06:51	06:07	06:16	05:38	05:25	05:40	06:10	06:41	07:13	06:49		07:27 (SE_10)	07:19		07:42 (SE_10)
	16:57	25	08:08 (SE_10)	17:35	18:08	19:41	20:13	20:34	20:29	19:55	19:05	18:15	16:38	12	07:39 (SE_10)	16:31	6	07:48 (SE_10)
19	07:21		07:42 (SE_09)	06:50	06:06	06:15	05:37	05:25	05:41	06:11	06:42	07:14	06:51		07:26 (SE_10)	07:19		07:43 (SE_10)
	16:58	26	08:08 (SE_10)	17:37	18:09	19:42	20:13	20:35	20:28	19:53	19:03	18:13	16:37	15	07:41 (SE_10)	16:31	6	07:49 (SE_10)
20	07:20		07:43 (SE_09)	06:48	06:04	06:13	05:37	05:25	05:42	06:12	06:43	07:15	06:52		07:26 (SE_10)	07:20		07:44 (SE_10)
	16:59	25	08:08 (SE_10)	17:38	18:10	19:43	20:14	20:35	20:28	19:52	19:01	18:12	16:36	16	07:42 (SE_10)	16:32	6	07:50 (SE_10)
21	07:20		07:46 (SE_09)	06:47	06:02	06:12	05:36	05:26	05:43	06:13	06:44	07:16	06:53		07:21 (SE_09)	07:21		07:44 (SE_10)
	17:01	22	08:08 (SE_10)	17:39	18:11	19:44	20:15	20:35	20:27	19:50	18:59	18:10	16:36	22	07:43 (SE_10)	16:32	5	07:49 (SE_10)
22	07:19		07:51 (SE_10)	06:45	06:01	06:10	05:35	05:26	05:44	06:14	06:45	07:17	06:54		07:19 (SE_09)	07:21		07:45 (SE_10)
	17:02	16	08:07 (SE_10)	17:40	18:12	19:45	20:16	20:35	20:26	19:49	18:58	18:09	16:35	25	07:44 (SE_10)	16:33	5	07:50 (SE_10)
23	07:18		07:51 (SE_10)	06:44	05:59	06:09	05:34	05:26	05:45	06:15	06:46	07:18	06:55		07:19 (SE_09)	07:22		07:45 (SE_10)
	17:03	15	08:06 (SE_10)	17:41	18:13	19:46	20:17	20:36	20:25	19:47	18:56	18:07	16:34	26	07:45 (SE_10)	16:33	5	07:50 (SE_10)
24	07:18		07:53 (SE_10)	06:42	05:57	06:07	05:33	05:26	05:45	06:16	06:47	07:20	06:56		07:20 (SE_09)	07:22		07:45 (SE_10)
	17:04	12	08:05 (SE_10)	17:43	18:14	19:48	20:18	20:36	20:24	19:46	18:54	18:06	16:34	25	07:45 (SE_10)	16:34	6	07:51 (SE_10)
25	07:17		07:55 (SE_10)	06:41	05:55	06:06	05:33	05:27	05:46	06:17	06:48	06:21	06:57		07:21 (SE_09)	07:23		07:46 (SE_10)
	17:05	10	08:05 (SE_10)	17:44	18:15	19:49	20:19	20:36	20:24	19:44	18:53	17:05	16:33	25	07:46 (SE_10)	16:34	6	07:52 (SE_10)
26	07:16		07:58 (SE_10)	06:39	05:54	06:04	05:32	05:27	05:47	06:18	06:49	06:22	06:59		07:22 (SE_09)	07:23		07:46 (SE_10)
	17:07	4	08:02 (SE_10)	17:45	18:16	19:50	20:20	20:36	20:23	19:43	18:51	17:03	16:33	24	07:46 (SE_10)	16:35	6	07:52 (SE_10)
27	07:15			06:38	05:52	06:03	05:31	05:27	05:48	06:19	06:50	06:23	07:00		07:23 (SE_09)	07:23		07:46 (SE_10)
	17:08			17:46	18:17	19:51	20:21	20:36	20:22	19:41	18:49	17:02	16:32	23	07:46 (SE_10)	16:36	7	07:53 (SE_10)
28	07:15			06:36	05:50	06:02	05:31	05:28	05:49	06:20	06:51	06:24	07:01		07:24 (SE_09)	07:24		07:47 (SE_10)
	17:09			17:47	18:19	19:52	20:22	20:36	20:21	19:40	18:47	17:01	16:32	22	07:46 (SE_10)	16:36	8	07:55 (SE_10)
29	07:14				06:49	06:00	05:30	05:28	05:50	06:21	06:52	06:25	07:02		07:26 (SE_09)	07:24		07:47 (SE_10)
	17:10				19:20	19:53	20:22	20:36	20:20	19:38	18:46	16:59	16:31	21	07:47 (SE_10)	16:37	8	07:55 (SE_10)
30	07:13				06:47	05:59	05:30	05:28	05:51	06:22	06:53	06:27	07:03		07:27 (SE_09)	07:24		07:47 (SE_10)
	17:12				19:21	19:54	20:23	20:36	20:19	19:36	18:44	16:58	16:31	21	07:48 (SE_10)	16:38	9	07:56 (SE_10)
31	07:12				06:45		05:29		05:52	06:23		06:28				07:24		07:47 (SE_10)
	17:13				19:22		20:24		20:18	19:35		16:57				16:39	10	07:57 (SE_10)
Potential sun hours	297			297	369	399	449	453	460	428	375	345	297			287		
Total, worst case		456												291			309	
Sun reduction		0,43												0,47			0,41	
Oper. time red.		0,94												0,94			0,94	
Wind dir. red.		0,58												0,58			0,58	
Total reduction		0,24												0,26			0,23	
Total, real		107												75			70	

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)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Massimo Lepore / massimo.lepore@tenproject.it

Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R15 - R15

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

	January		February		March		April		May		June	
1	07:25		14:02 (E04)	07:11		14:30 (E04)	06:35		06:44		05:58	18:36 (E01)	05:29
	16:40	54	14:56 (E04)	17:14	52	16:18 (E03)	17:49		19:23		19:55	31	19:07 (E01)	20:25
2	07:25		14:02 (E04)	07:10		14:33 (E04)	06:33		06:42		05:56		18:36 (E01)	05:28
	16:41	54	14:56 (E04)	17:15	47	16:19 (E03)	17:50		19:24		19:56	31	19:07 (E01)	20:26
3	07:25		14:02 (E04)	07:09		14:39 (E04)	06:32		06:40		05:55		18:36 (E01)	05:28
	16:41	55	14:57 (E04)	17:17	37	16:19 (E03)	17:51		19:25		19:57	32	19:08 (E01)	20:26
4	07:25		14:03 (E04)	07:08		15:48 (E03)	06:30		06:39		05:54		18:34 (E01)	05:27
	16:42	54	14:57 (E04)	17:18	32	16:20 (E03)	17:52		19:26		19:58	33	19:07 (E01)	20:27
5	07:25		14:03 (E04)	07:07		15:48 (E03)	06:29		06:37		05:53		18:34 (E01)	05:27
	16:43	55	14:58 (E04)	17:19	33	16:21 (E03)	17:53		19:27		19:59	34	19:08 (E01)	20:28
6	07:25		14:04 (E04)	07:06		15:48 (E03)	06:27		06:35		05:51		18:34 (E01)	05:27
	16:44	54	14:58 (E04)	17:21	33	16:21 (E03)	17:54		19:28		20:00	34	19:08 (E01)	20:28
7	07:25		14:05 (E04)	07:05		15:49 (E03)	06:25		06:34		05:50		18:34 (E01)	05:26
	16:45	54	14:59 (E04)	17:22	32	16:21 (E03)	17:55		19:29		20:01	34	19:08 (E01)	20:29
8	07:25		14:05 (E04)	07:04		15:48 (E03)	06:24		06:32		05:49		18:35 (E01)	05:26
	16:46	55	15:00 (E04)	17:23	33	16:21 (E03)	17:57		19:30		20:02	33	19:08 (E01)	20:30
9	07:25		14:05 (E04)	07:02		15:48 (E03)	06:22		06:31		05:48		18:35 (E01)	05:26
	16:47	54	14:59 (E04)	17:24	33	16:21 (E03)	17:58		19:32		20:04	33	19:08 (E01)	20:30
10	07:24		14:06 (E04)	07:01		15:49 (E03)	06:21		06:29		05:47		18:35 (E01)	05:26
	16:48	54	15:00 (E04)	17:26	32	16:21 (E03)	17:59		19:33		20:05	33	19:08 (E01)	20:31
11	07:24		14:07 (E04)	07:00		15:50 (E03)	06:19	17:07 (E02)	06:27		05:46		18:35 (E01)	05:25
	16:49	53	15:00 (E04)	17:27	31	16:21 (E03)	18:00	4 17:11 (E02)	19:34		20:06	32	19:07 (E01)	20:31
12	07:24		14:07 (E04)	06:59		15:49 (E03)	06:17	17:02 (E02)	06:26		05:44		18:35 (E01)	05:25
	16:50	53	15:00 (E04)	17:28	31	16:20 (E03)	18:01	13 17:15 (E02)	19:35		20:07	31	19:06 (E01)	20:32
13	07:24		14:07 (E04)	06:58		15:51 (E03)	06:16	16:59 (E02)	06:24		05:43		18:35 (E01)	05:25
	16:51	54	15:01 (E04)	17:29	28	16:19 (E03)	18:02	18 17:17 (E02)	19:36		20:08	31	19:06 (E01)	20:32
14	07:23		14:08 (E04)	06:56		15:52 (E03)	06:14	16:58 (E02)	06:23		05:42		18:37 (E01)	05:25
	16:53	53	15:01 (E04)	17:31	27	16:19 (E03)	18:03	21 17:19 (E02)	19:37		20:09	29	19:06 (E01)	20:33
15	07:23		14:09 (E04)	06:55		15:52 (E03)	06:12	16:56 (E02)	06:21		05:41		18:37 (E01)	05:25
	16:54	52	15:01 (E04)	17:32	25	16:17 (E03)	18:04	24 17:20 (E02)	19:38		20:10	28	19:05 (E01)	20:33
16	07:22		14:10 (E04)	06:54		15:54 (E03)	06:11	16:55 (E02)	06:19		05:40		18:38 (E01)	05:25
	16:55	52	15:02 (E04)	17:33	22	16:16 (E03)	18:06	25 17:20 (E02)	19:39		20:11	27	19:05 (E01)	20:34
17	07:22		14:10 (E04)	06:52		15:56 (E03)	06:09	16:55 (E02)	06:18		05:39		18:38 (E01)	05:25
	16:56	51	15:01 (E04)	17:34	19	16:15 (E03)	18:07	26 17:21 (E02)	19:40		20:12	26	19:04 (E01)	20:34
18	07:21		14:11 (E04)	06:51		15:58 (E03)	06:07	16:54 (E02)	06:16		05:38		18:39 (E01)	05:25
	16:57	51	15:02 (E04)	17:35	14	16:12 (E03)	18:08	27 17:21 (E02)	19:41		20:13	24	19:03 (E01)	20:34
19	07:21		14:11 (E04)	06:50		16:03 (E03)	06:06	16:53 (E02)	06:15		05:38		18:40 (E01)	05:25
	16:58	51	15:02 (E04)	17:37	5	16:08 (E03)	18:09	28 17:21 (E02)	19:42		20:14	22	19:02 (E01)	20:35
20	07:20		14:12 (E04)	06:48			06:04	16:53 (E02)	06:13		05:37		18:41 (E01)	05:25
	16:59	49	15:01 (E04)	17:38			18:10	28 17:21 (E02)	19:43		20:15	20	19:01 (E01)	20:35
21	07:20		14:13 (E04)	06:47			06:02	16:53 (E02)	06:12		05:36		18:43 (E01)	05:26
	17:01	49	15:02 (E04)	17:39			18:11	27 17:20 (E02)	19:44		20:15	17	19:00 (E01)	20:35
22	07:19		14:14 (E04)	06:45			06:01	16:53 (E02)	06:10		05:35		18:44 (E01)	05:26
	17:02	47	15:01 (E04)	17:40			18:12	26 17:19 (E02)	19:45		20:16	15	18:59 (E01)	20:35
23	07:19		14:15 (E04)	06:44			05:59	16:52 (E02)	06:09		05:34		18:46 (E01)	05:26
	17:03	46	15:01 (E04)	17:41			18:13	26 17:18 (E02)	19:47		20:17	10	18:56 (E01)	20:36
24	07:18		14:16 (E04)	06:42			05:57	16:54 (E02)	06:07	18:48 (E01)	05:33		18:50 (E01)	05:26
	17:04	44	15:00 (E04)	17:43			18:14	24 17:18 (E02)	19:48	8 18:56 (E01)	20:18	2	18:52 (E01)	20:36
25	07:17		14:18 (E04)	06:41			05:56	16:54 (E02)	06:06	18:45 (E01)	05:33			05:27
	17:05	52	16:07 (E03)	17:44			18:15	22 17:16 (E02)	19:49	15 19:00 (E01)	20:19			20:36
26	07:16		14:19 (E04)	06:39			05:54	16:55 (E02)	06:05	18:43 (E01)	05:32			05:27
	17:07	56	16:10 (E03)	17:45			18:16	19 17:14 (E02)	19:50	19 19:02 (E01)	20:20			20:36
27	07:16		14:20 (E04)	06:38			05:52	16:57 (E02)	06:03	18:40 (E01)	05:31			05:27
	17:08	58	16:12 (E03)	17:46			18:18	16 17:13 (E02)	19:51	23 19:03 (E01)	20:21			20:36
28	07:15		14:21 (E04)	06:36			05:50	16:59 (E02)	06:02	18:39 (E01)	05:31			05:28
	17:09	58	16:13 (E03)	17:47			18:19	11 17:10 (E02)	19:52	26 19:05 (E01)	20:22			20:36
29	07:14		14:23 (E04)				06:49		06:00	18:38 (E01)	05:30			05:28
	17:10	58	16:15 (E03)				19:20		19:53	28 19:06 (E01)	20:22			20:36
30	07:13		14:25 (E04)				06:47		05:59	18:37 (E01)	05:30			05:29
	17:12	57	16:16 (E03)				19:21		19:54	29 19:06 (E01)	20:23			20:36
31	07:12		14:27 (E04)				06:45				05:29			
	17:13	55	16:17 (E03)				19:22				20:24			
Potential sun hours	297			297			369		399		449			453
Total, worst case		1642			566			385		148		642		
Sun reduction		0,43			0,44			0,44		0,51		0,57		
Oper. time red.		0,94			0,94			0,94		0,94		0,94		
Wind dir. red.		0,69			0,71			0,70		0,65		0,65		
Total reduction		0,28			0,30			0,30		0,31		0,35		
Total, real		460			167			114		46		225		

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

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

Massimo Lepore / massimo.lepore@tenproject.it
Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar

Calculation: GE.BOV01 SH/FL 2018_10 **Shadow receptor:** R15 - R15

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,12	4,66	5,30	6,72	8,25	9,35	10,16	9,45	7,64	5,82	4,65	3,82

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
515	212	303	180	173	239	299	759	2.233	1.254	1.025	1.075	8.266

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

July			August			September			October			November			December		
1	05:29			05:53		18:45 (E01)	06:24			06:54		17:41 (E02)	06:29		15:19 (E03)	07:04		13:49 (E04)
	20:36			20:17	32	19:17 (E01)	19:33			18:42	15	17:56 (E02)	16:55	32	15:51 (E03)	16:31	53	14:42 (E04)
2	05:29			05:54		18:45 (E01)	06:25			06:56		17:43 (E02)	06:30		15:18 (E03)	07:05		13:49 (E04)
	20:36			20:16	32	19:17 (E01)	19:32			18:41	10	17:53 (E02)	16:54	33	15:51 (E03)	16:31	54	14:43 (E04)
3	05:30			05:55		18:45 (E01)	06:26			06:57			06:31		15:18 (E03)	07:06		13:49 (E04)
	20:36			20:14	32	19:17 (E01)	19:30			18:39			16:53	32	15:50 (E03)	16:30	54	14:43 (E04)
4	05:31			05:56		18:44 (E01)	06:27			06:58			06:33		15:17 (E03)	07:07		13:49 (E04)
	20:35			20:13	33	19:17 (E01)	19:28			18:37			16:52	33	15:50 (E03)	16:30	55	14:44 (E04)
5	05:31			05:57		18:44 (E01)	06:28			06:59			06:34		15:18 (E03)	07:08		13:50 (E04)
	20:35			20:12	34	19:18 (E01)	19:27			18:36			16:51	33	15:51 (E03)	16:30	54	14:44 (E04)
6	05:32			05:58		18:44 (E01)	06:29			07:00			06:35		15:18 (E03)	07:09		13:50 (E04)
	20:35			20:11	33	19:17 (E01)	19:25			18:34			16:49	32	15:50 (E03)	16:30	54	14:44 (E04)
7	05:32			05:59		18:44 (E01)	06:30			07:01			06:36		15:18 (E03)	07:10		13:50 (E04)
	20:35			20:10	33	19:17 (E01)	19:23			18:32			16:48	32	15:50 (E03)	16:30	55	14:45 (E04)
8	05:33			06:00		18:44 (E01)	06:31			07:02			06:37		14:09 (E04)	07:11		13:51 (E04)
	20:34			20:08	33	19:17 (E01)	19:22			18:31			16:47	39	15:50 (E03)	16:30	54	14:45 (E04)
9	05:34			06:01		18:44 (E01)	06:32			07:03			06:39		14:03 (E04)	07:12		13:51 (E04)
	20:34			20:07	33	19:17 (E01)	19:20			18:29			16:46	47	15:49 (E03)	16:30	55	14:46 (E04)
10	05:34			06:02		18:44 (E01)	06:33			07:04			06:40		14:00 (E04)	07:13		13:52 (E04)
	20:34			20:06	32	19:16 (E01)	19:18			18:28			16:45	53	15:49 (E03)	16:30	54	14:46 (E04)
11	05:35			06:03		18:45 (E01)	06:34			07:05			06:41		13:59 (E04)	07:14		13:52 (E04)
	20:33			20:05	31	19:16 (E01)	19:17			18:26			16:44	55	15:49 (E03)	16:30	54	14:46 (E04)
12	05:36			06:04		18:45 (E01)	06:35			07:06			06:42		13:57 (E04)	07:14		13:52 (E04)
	20:33			20:03	30	19:15 (E01)	19:15			18:24			16:43	57	15:48 (E03)	16:30	55	14:47 (E04)
13	05:36			06:05		18:46 (E01)	06:36			07:07			06:43		13:55 (E04)	07:15		13:53 (E04)
	20:32			20:02	28	19:14 (E01)	19:13			18:23			16:42	58	15:47 (E03)	16:30	54	14:47 (E04)
14	05:37			06:06		18:46 (E01)	06:37			07:08			06:45		13:53 (E04)	07:16		13:54 (E04)
	20:32			20:01	27	19:13 (E01)	19:11			18:21			16:41	58	15:45 (E03)	16:30	54	14:48 (E04)
15	05:38			06:07		18:47 (E01)	06:38		17:50 (E02)	07:09			06:46		13:53 (E04)	07:17		10:56 (E05)
	20:31			19:59	25	19:12 (E01)	19:10	9	17:59 (E02)	18:20			16:40	58	15:45 (E03)	16:30	63	14:49 (E04)
16	05:39			06:08		18:48 (E01)	06:39		17:47 (E02)	07:11			06:47		13:52 (E04)	07:18		10:54 (E05)
	20:30			19:58	22	19:10 (E01)	19:08	15	18:02 (E02)	18:18			16:40	56	15:43 (E03)	16:31	66	14:48 (E04)
17	05:40			06:09		18:50 (E01)	06:40		17:44 (E02)	07:12			06:48		13:51 (E04)	07:18		10:54 (E05)
	20:30			19:56	19	19:09 (E01)	19:06	18	18:02 (E02)	18:16			16:39	52	15:40 (E03)	16:31	68	14:49 (E04)
18	05:40			06:10		18:52 (E01)	06:41		17:42 (E02)	07:13			06:49		13:50 (E04)	07:19		10:54 (E05)
	20:29			19:55	14	19:06 (E01)	19:05	21	18:03 (E02)	18:15			16:38	44	14:34 (E04)	16:31	70	14:50 (E04)
19	05:41			06:11		18:56 (E01)	06:42		17:40 (E02)	07:14			06:51		13:50 (E04)	07:20		10:53 (E05)
	20:28			19:53	6	19:02 (E01)	19:03	24	18:04 (E02)	18:13			16:37	46	14:36 (E04)	16:32	71	14:50 (E04)
20	05:42		18:58 (E01)	06:12			06:43		17:39 (E02)	07:15			06:52		13:49 (E04)	07:20		10:54 (E05)
	20:28	7	19:05 (E01)	19:52			19:01	26	18:05 (E02)	18:12			16:36	47	14:36 (E04)	16:32	72	14:51 (E04)
21	05:43		18:55 (E01)	06:13			06:44		17:38 (E02)	07:16			06:53		13:48 (E04)	07:21		10:53 (E05)
	20:27	12	19:07 (E01)	19:51			18:59	27	18:05 (E02)	18:10			16:36	49	14:37 (E04)	16:32	73	14:51 (E04)
22	05:44		18:53 (E01)	06:14			06:45		17:37 (E02)	07:17			06:54		13:48 (E04)	07:21		10:54 (E05)
	20:26	16	19:09 (E01)	19:49			18:58	28	18:05 (E02)	18:09			16:35	49	14:37 (E04)	16:33	73	14:52 (E04)
23	05:45		18:52 (E01)	06:15			06:46		17:37 (E02)	07:18		16:30 (E03)	06:55		13:49 (E04)	07:22		10:55 (E05)
	20:25	18	19:10 (E01)	19:48			18:56	28	18:05 (E02)	18:08	10	16:40 (E03)	16:34	50	14:39 (E04)	16:33	72	14:52 (E04)
24	05:46		18:51 (E01)	06:16			06:47		17:36 (E02)	07:20		16:28 (E03)	06:56		13:48 (E04)	07:22		10:55 (E05)
	20:24	21	19:12 (E01)	19:46			18:54	28	18:04 (E02)	18:06	15	16:43 (E03)	16:34	51	14:39 (E04)	16:34	71	14:52 (E04)
25	05:46		18:50 (E01)	06:17			06:48		17:36 (E02)	06:21		15:25 (E03)	06:58		13:48 (E04)	07:23		10:56 (E05)
	20:24	23	19:13 (E01)	19:44			18:53	28	18:04 (E02)	17:05	20	15:45 (E03)	16:33	51	14:39 (E04)	16:35	71	14:53 (E04)
26	05:47		18:49 (E01)	06:18			06:49		17:36 (E02)	06:22		15:23 (E03)	06:59		13:48 (E04)	07:23		10:57 (E05)
	20:23	25	19:14 (E01)	19:43			18:51	27	18:03 (E02)	17:03	23	15:46 (E03)	16:33	52	14:40 (E04)	16:35	69	14:53 (E04)
27	05:48		18:49 (E01)	06:19			06:50		17:36 (E02)	06:23		15:22 (E03)	07:00		13:48 (E04)	07:23		10:58 (E05)
	20:22	26	19:15 (E01)	19:41			18:49	26	18:02 (E02)	17:02	25	15:47 (E03)	16:32	52	14:40 (E04)	16:36	67	14:53 (E04)
28	05:49		18:48 (E01)	06:20			06:51		17:36 (E02)	06:24		15:21 (E03)	07:01		13:49 (E04)	07:24		11:01 (E05)
	20:21	28	19:16 (E01)	19:40			18:48	25	18:01 (E02)	17:01	28	15:49 (E03)	16:32	52	14:41 (E04)	16:36	64	14:54 (E04)
29	05:50		18:48 (E01)	06:21			06:52		17:38 (E02)	06:25		15:20 (E03)	07:02		13:49 (E04)	07:24		11:05 (E05)
	20:20	28	19:16 (E01)	19:38			18:46	22	18:00 (E02)	16:59	29	15:49 (E03)	16:32	53	14:42 (E04)	16:37	58	14:55 (E04)
30	05:51		18:46 (E01)	06:22			06:53		17:39 (E02)	06:27		15:19 (E03)	07:03		13:49 (E04)	07:24		14:01 (E04)
	20:19	30	19:16 (E01)	19:37			18:44	19	17:58 (E02)	16:58	31	15:50 (E03)	16:31	53	14:42 (E04)	16:38	54	14:55 (E04)
31	05:52		18:46 (E01)	06:23						06:28		15:18 (E03)				07:24		14:01 (E04)
	20:18	30	19:16 (E01)	19:35						16:57	32	15:50 (E03)				16:39	54	14:55 (E04)
Potential sun hours	460			428			375			345			297			287		
Total, worst case	264			529			371			238			1409			1895		
Sun reduction	0,69			0,68			0,61			0,52			0,47			0,41		
Oper. time red.	0,94			0,94			0,94			0,94			0,94			0,94		
Wind dir. red.	0,65			0,65			0,70			0,71			0,69			0,67		
Total reduction	0,42			0,42			0,41			0,35			0,31			0,26		
Total, real	111			223			151			84			434			498		

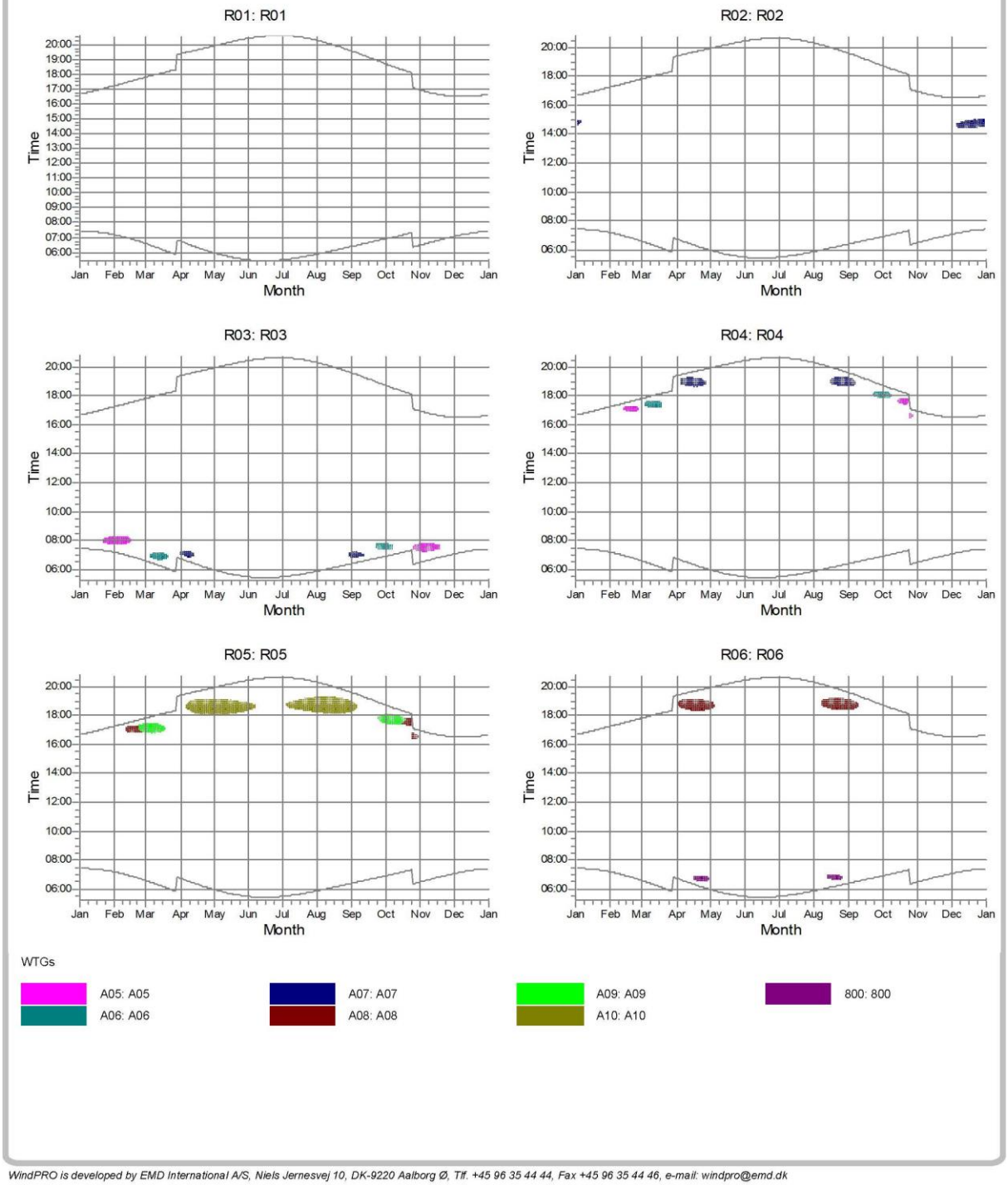
Table layout: For each day in each month the following matrix apply

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

ALLEGATO 3: CALENDAR: ANALISI GRAFICA DELL'EFFETTO "FLICKERING" SUI RECETTORI ANALIZZATI

Massimo Lepore / massimo.lepore@tenproject.it
Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar, graphical
Calculation: GE.BOV01 SH/FL 2018_10

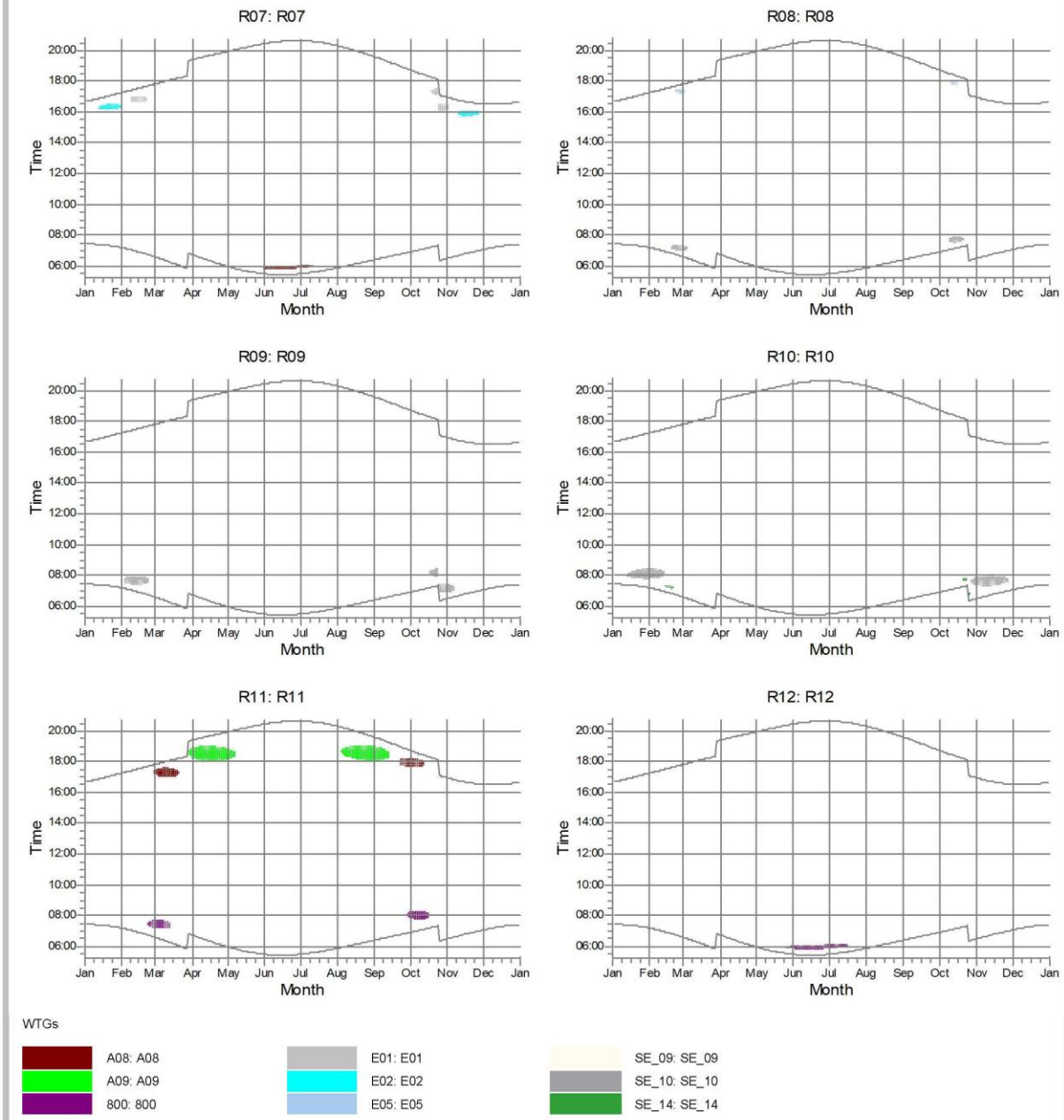


WindPRO is developed by EMD International A/S, Niels Jernesvej 10, DK-9220 Aalborg Ø, Tlf. +45 96 35 44 44, Fax +45 96 35 44 46, e-mail: windpro@emd.dk

Massimo Lepore / massimo.lepore@tenproject.it
Calculated:
23/10/2018 16:04/2.7.490

SHADOW - Calendar, graphical

Calculation: GE.BOV01 SH/FL 2018_10

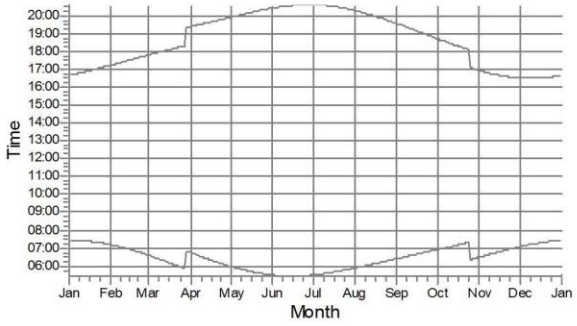


Massimo Lepore / massimo.lepore@tenproject.it
Calculated:
23/10/2018 16:04/2.7.490

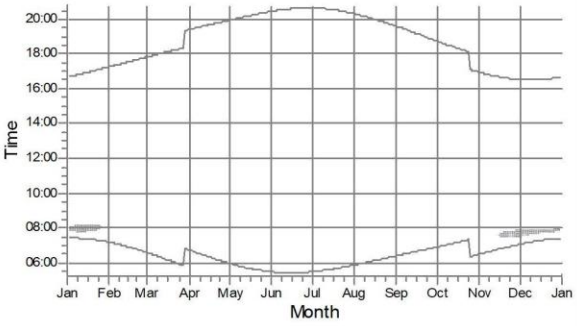
SHADOW - Calendar, graphical

Calculation: GE.BOV01 SH/FL 2018_10

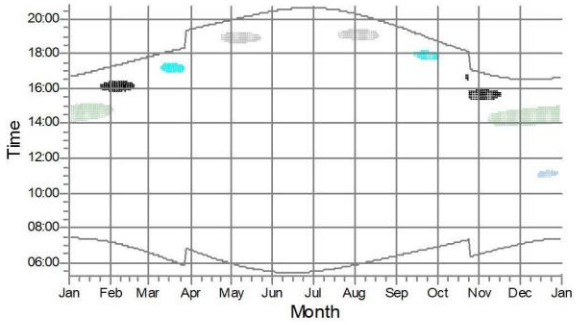
R13: R13



R14: R14



R15: R15

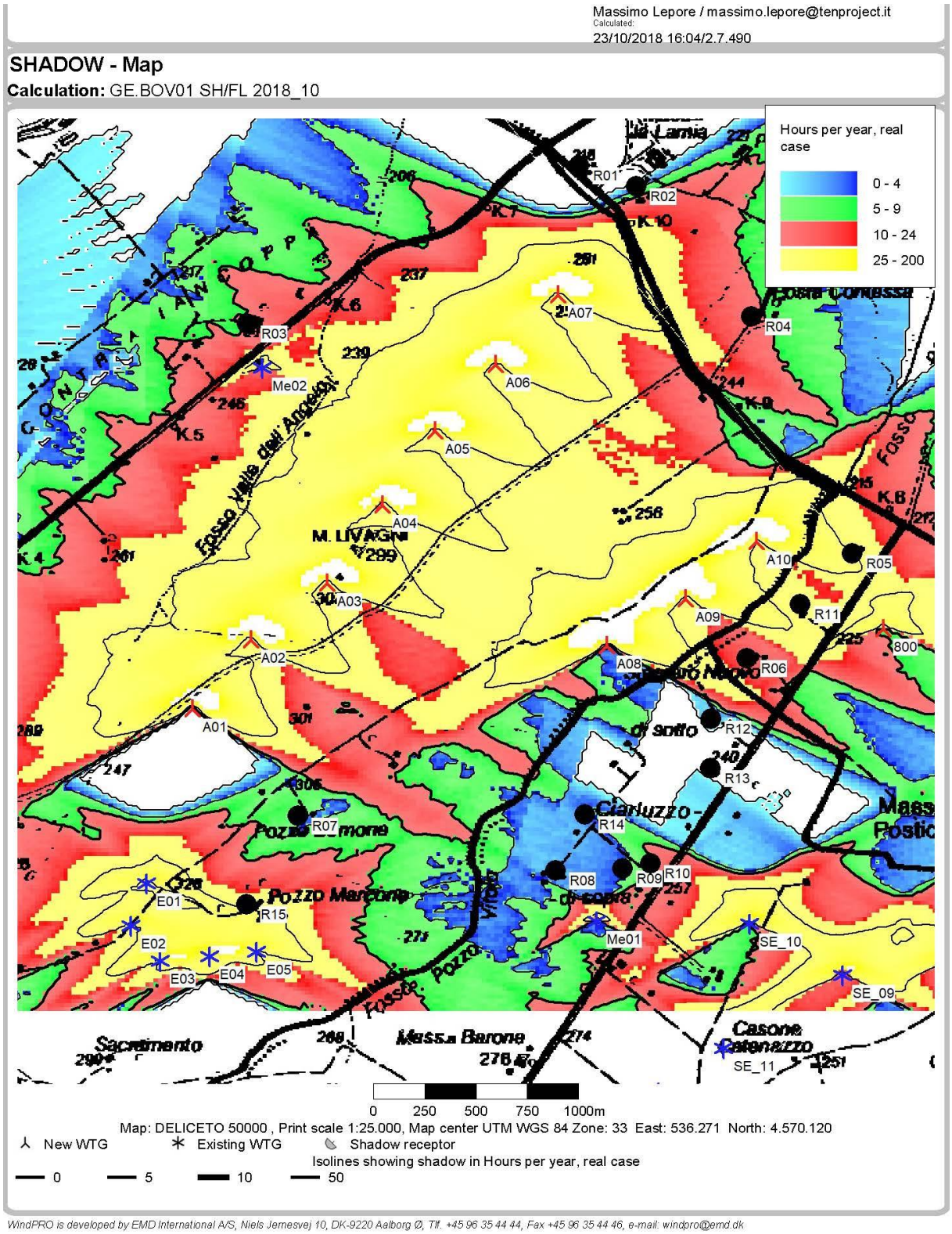


WTGs

E01: E01
E02: E02
E03: E03
E04: E04
E05: E05
SE_09: SE_09
SE_10: SE_10

ALLEGATO 4: "SHADOW MAP"

MAPPA CHE RAPPRESENTA LE ORE DI OMBREGGIAMENTO ("REAL CASE") PER LE AREE LIMITROFE ALLE TURBINE DI PROGETTO (ed esistenti).



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