
PROGETTO PER LA REALIZZAZIONE DI UN IMPIANTO PER LA
PRODUZIONE DI ENERGIA MEDIANTE LO SFRUTTAMENTO DEL VENTO
NEL TERRITORIO COMUNALE DI FOGGIA (FG)
POTENZA NOMINALE 73,2 MW

PROGETTO DEFINITIVO - SIA

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**ES.5 Analisi dell'evoluzione dell'ombra indotta
dagli aereogeneratori - Shadow flickering**

REV. DATA DESCRIZIONE

REV.	DATA	DESCRIZIONE



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1. INTRODUZIONE

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 nel Comune di Foggia ubicato ad est al confine con i comuni di Manfredonia e Carapelle alla località "Tamarici-Melfignana-Mezzanone", costituito da n. 14 aerogeneratori, di cui 10 aventi una potenza unitaria di 6 MW e 4 aventi una potenza unitaria di 4,2 MW, per una potenza complessiva di 76,8 MW. In particolare la posizione degli aerogeneratori è la seguente:

WTG	EST	NORD
WTG01	561614	4581073
WTG02	561009	4581446
WTG03	560531	4581856
WTG04	559824	4581149
WTG05	559051	4580901
WTG06	558845	4581567
WTG07	557554	4582547
WTG08	557520	4583713
WTG09	558084	4584031
WTG10	558090	4584866
WTG11	555737	4583928

Tab. 1 – Coordinate aerogeneratori



Figura 1: Planimetria dell'impianto

Lo Shadow-Flickering è l'espressione comunemente impiegata in ambito specialistico per descrivere l'effetto stroboscopico delle ombre proiettate dalle pale rotanti degli aerogeneratori eolici quando sussistono le condizioni meteorologiche opportune; infatti la possibilità e la durata di tali effetti dipendono da una serie di condizioni ambientali, tra cui : la posizione del sole, l'ora del giorno, il giorno dell'anno, le condizioni atmosferiche ambientali e la posizione della turbina eolica rispetto ad un recettore sensibile. 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 serie di aspetti che caratterizzano le diverse fasi progettuali. Il modulo SHADOW è quello specifico per la valutazione dell'evoluzione dell'ombra e del flickering. In tale report è riportata:

- *La descrizione del caso studio con le posizioni delle turbine e loro caratteristiche tecniche*
- *Una breve descrizione tecnica del fenomeno di shadow flickering*
- *La descrizione dei recettori soggetti al fenomeno per i quali è stata richiesta questa analisi*
- *Sintesi della metodologia di analisi seguita per lo studio*
- *Sintesi dei risultati ottenuti, con allegati grafici ed analitici di dettaglio che descrivono il fenomeno su ognuno dei recettori e da parte di ognuna delle turbine per tutto l'anno solare.*

2. STUDIO DELL'EVOLUZIONE DELL'OMBRA GIORNALIERA 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. Per chi vive in tali zone prossime all'insediamento eolico può essere molto fastidioso il cosiddetto fenomeno del "flicker" che consiste in un effetto di lampeggiamento che si verifica quando le pale del rotore in movimento "tagliano" la luce solare in maniera intermittente. Una progettazione attenta a questa problematica permette di 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 i 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.



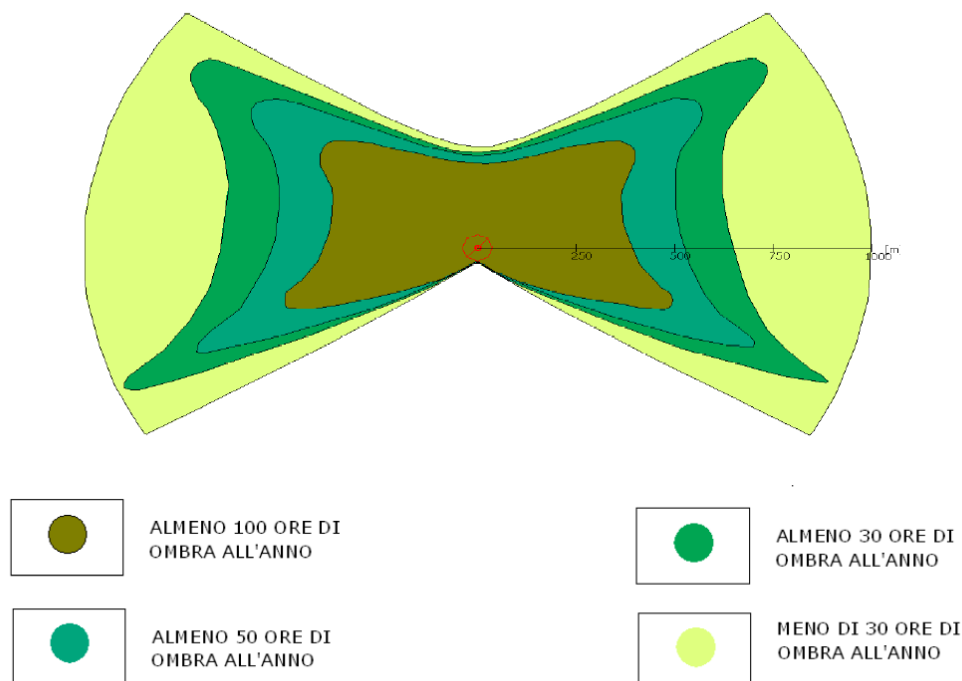


Figura 2: Evoluzione annuale tipo dell'ombra di una pala

Considerati i pochi precedenti esistenti (Germania) e le ipotesi così penalizzanti con cui è stata calcolato tale grafico si è ritenuto opportuno effettuare una sovrapposizione sull'impianto della parte più interna del grafico ovvero dell'area **che supera le 100 ore all'anno di ombra dei punti di installazione, intendendo questo come limite da non superarsi.**

In Italia, così come nella maggior parte dei paesi Europei ed extraeuropei non esiste una normativa specifica in relativa al disturbo generato dal fenomeno di Shadow – Flickering. Esistono delle regolamentazioni locali ma quasi mai comprendono limiti numerici specifici, quanto piuttosto delle raccomandazioni tese a sottolineare che il fenomeno non sia “unreasonable” o “significant”.

3. INDIVIDUAZIONE DEI RECETTORI ED IPOTESI DI CALCOLO

3.1 Individuazione dei ricettori

Il progetto in esame nel comune di Foggia prevede l'installazione di 11 aerogeneratori in località “Tamarici-Melfignana-Mezzanone”.

L'analisi di shadow-flickering di cui al presente studio è stata elaborata per specifici 5 recettori che circondano l'impianto. Si è ritenuto di escludere nel modello di simulazione le strutture che potrebbero essere assimilate a ruderi non abitati e sostanzialmente privi di caratteristiche minime di abitabilità o agibilità.

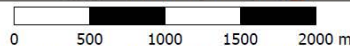
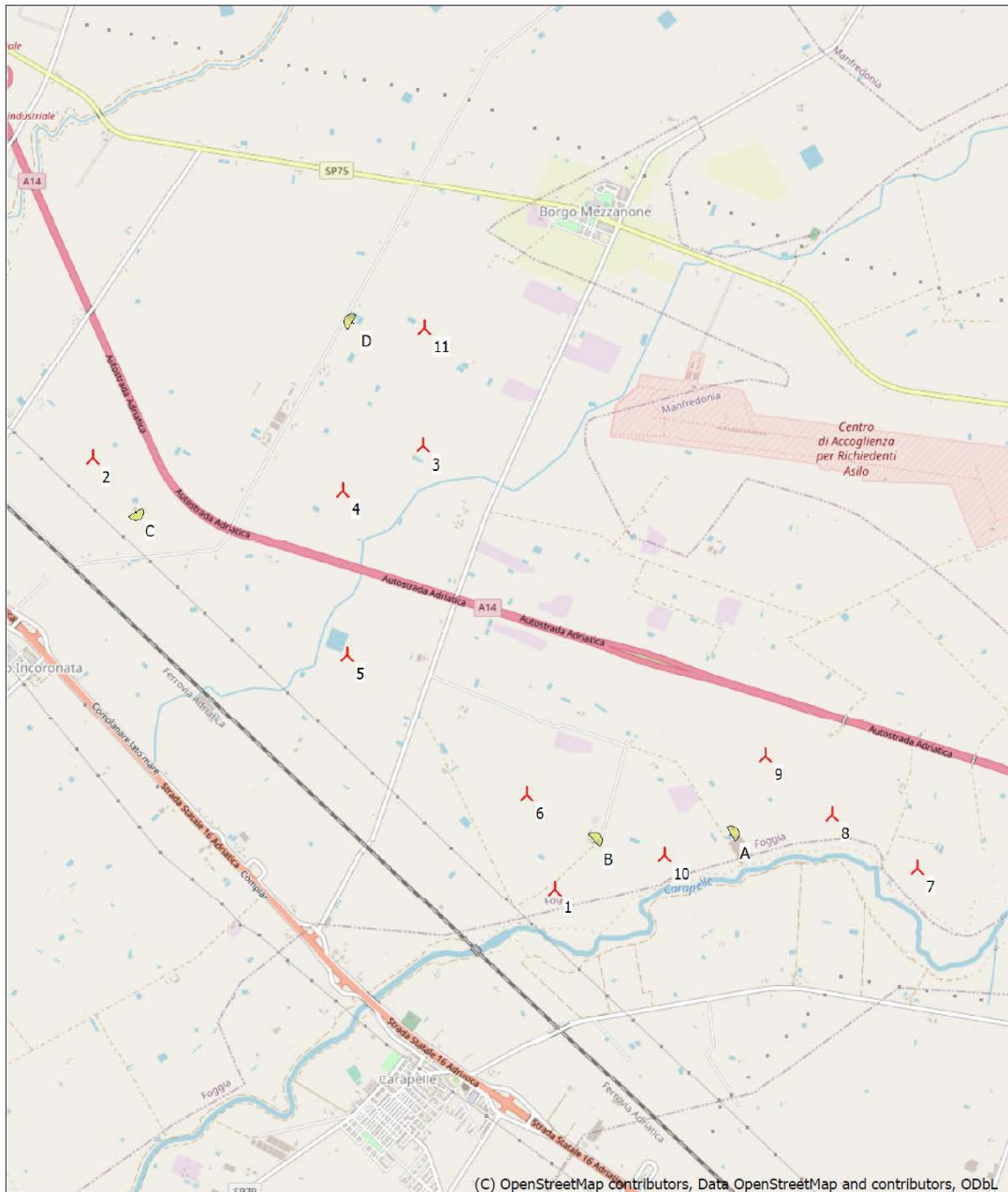


N.	EST	NORD	Z [m]
A	560297	4581306	47.5
B	559317	4581242	52.1
C	556052	4583549	51.3
D	557576	4584908	44

Tab. 2 – Coordinate ricettori

SHADOW - Map

Calculation: ShadowFlickeringFgInc



Map: EMD OpenStreetMap , Print scale 1:40,000, Map center UTM (north)-WGS84 Zone: 33 East: 558,676 North: 4,582,905
 New WTG Shadow receptor
 Flicker map level: Elevation Grid Data Object: ZVI_FoggiaIncoronata_EMDGrid_0.wpg (1)
 windPRO 3.6.361 by EMD International A/S, Tel. +45 69 16 48 50, www.emd-international.com, support@emd.dk 04/05/2023 10:15 / 1 windPRO

Figura 3 -Indicazione dei recettori su igm



Nella tabella a seguire sono riportate le distanze minime intercorrenti tra recettori in oggetto e l'aerogeneratore più prossimo.

Ricettore	Torre più prossima	Distanza mt
A	WTG4	500
B	WTG5	400
C	WTG11	470
D	WTG10	490

Tab. 3 –Distanze delle turbine dai ricettori più prossimi

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 abitazioni ed edifici ritenuti sensibili.

Tale fascia è stata definita in fase di progetto al fine di garantire il rispetto dei limiti in merito non solo all'ombreggiamento ma anche agli impatti acustici, elettromagnetici e in termini di calcolo della gittata.

Lo studio, i cui risultati in dettaglio sono riportati di seguito, è stato condotto con uno specifico software (WindPRO).

Nello studio ci si è posti nella condizione più sfavorevole possibile, in quanto si è considerato che:

- il sole risplende 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 linea che passa per il sole e per l'aerogeneratore (l'aerogeneratore "insegue" il sole);
- l'aerogeneratore è sempre operativo.

Allo stesso tempo, si è trascurata la presenza degli alberi e di altri ostacoli che bordano le strade "intercettando" l'ombra degli aerogeneratori riducendo il fastidio del flickering.

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

3.2 Base dati e parametri di calcolo

In base alla metodologia descritta nei paragrafi precedenti, sono stati utilizzati i seguenti dati di input per impostare il modello di simulazione per la valutazione del fenomeno di Shadow-Flickering degli aerogeneratori di progetto:

- Il DTM o Modello del terreno digitale** per caratterizzare l'orografia è stato estrapolato dal grid disponibile in download dal SIT della Regione Puglia, georeferenziato, sovrapposto, confrontato e adeguato con le curve di livello presenti sulla cartografia ufficiale CTR 1:5.000 con uno step di 5 m. Il modello digitale ottenuto copre un'area sufficiente ad inglobare l'area del parco eolico di progetto e trova un buon riscontro con l'andamento orografico verificato in sito.
- Posizioni geografiche di recettori con dettaglio dimensionale delle aree più esposte.** Sono i ricettori



individuati dallo studio acustico e classificati secondo la loro abitabilità e destinazione d'uso. Per tutti i ricettori si è ritenuto opportuno usare l'ipotesi di cautela della modalità "green house mode". Questa scelta è stata operata poiché in talune circostanze anche lo spazio antistante le strutture può essere considerato o adibito a luogo di riposo e relax. La scelta di una singola finestra o di una facciata in alcune condizioni potrebbe risultare riduttiva allo scopo di una vera valutazione d'impatto.

c) Posizioni geografiche delle turbine eoliche e loro caratteristiche dimensionali

Gli aerogeneratori di progetto con le loro caratteristiche dimensionali e tecnologiche

d) Nessun ostacolo naturale o artificiale è stato modellato.

4. I RISULTATI DEL CALCOLO DELL'EVOLUZIONE DELL'OMBRA

Nella procedura "Worst case" il fenomeno di shadow/flickering viene calcolato non tenendo conto delle condizioni di soleggiamento del sito e del vento, dati che allo stato dell'arte per il sito in questione non sono disponibili. Invece se avessimo di dati di cui sopra potremmo calcolare il fenomeno di shadow/flickering con la metodologia ("real case"), che secondo altri casi simili comporterebbe la riduzione del fenomeno ad 1/3 dei valori, il quale seppur più realistico, è comunque sovrastimato poiché non tiene conto della presenza di nubi e di vegetazione ad alto fusto. Dalle simulazioni effettuate, si evince che gli aerogeneratori di progetto generano maggiormente il fenomeno di shadow/flickering sui recettori "I e J" individuati nell'analisi che, nelle ipotesi di "Worst case", subiscono il fenomeno per un periodo che si avvicina o supera di poco le 100 ore/anno, per tutti gli altri rimanenti recettori considerati invece, l'effetto calcolato è più modesto e/o comunque meno rilevante fino a divenire irrilevante e in alcuni casi nullo.

Con le considerazioni di cui sopra, ovvero prevedendo la riduzione ad 1/3 si avranno valori sicuramente più ridotti per i ricettori con I= 24 ore/anno e J= 39 ore/anno e comunque sono abitati meno di 4 ore giorno e quindi la probabilità di accadimento si riduce quasi al nulla.

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, Marzo, Aprile, Settembre, Novembre e Dicembre nelle prime ore della giornata, oppure al primo pomeriggio. Nella figura che segue è riportato a titolo di esempio il grafico "calendar" di un recettore: 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.

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.

È 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 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 E RACCOMANDAZIONI

In conclusione, si può affermare che i risultati ottenuti della elaborazioni evidenziano, pur considerando le condizioni più sfavorevoli, che le turbine di progetto generano effetti di shadow flickering **i cui impatti risultano essere nulli per molte strutture, e piuttosto modesti (o non particolarmente problematici) per altre.**

In ogni caso è comunque da rimarcare l'effetto di sovrastima dovuto al 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.

6. ELENCO ALLEGATI

1. MAIN RESULT: QUADRO SINTETICO DEI RISULTATI DI CALCOLO;
2. CALENDAR: ANALISI GIORNALIERA DELL'EFFETTO "FLICKERING" RICEVUTO DA OGNI RECETTORE;
3. CALENDAR, GRAPHICAL: GRAFICO DELL'ANALISI GIORNALIERA DELL'EFFETTO "FLICKERING" RICEVUTO DA OGNI RECETTORE;
4. CALENDAR PER WTG: ANALISI GIORNALIERA DELL'EFFETTO "FLICKERING" INDOTTO DA OGNI AEROGENERATORE SUI RECETTORI;
5. CALENDAR PER WTG, GRAPHICAL: GRAFICO DELL'ANALISI GIORNALIERA DELL'EFFETTO "FLICKERING" INDOTTO DA OGNI AEROGENERATORE SUI RECETTORI.



SHADOW - Main Result

Calculation: ShadowFlickeringFgInc
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

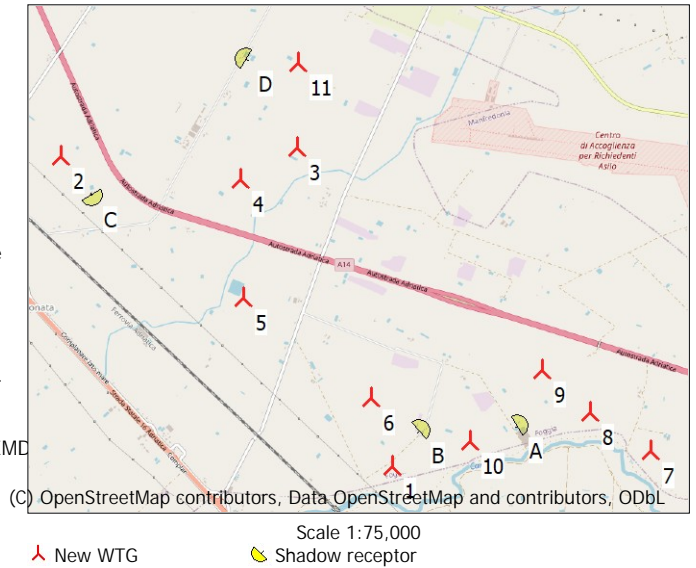
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes
The calculated times are "worst case" given by the following assumptions:
The sun is shining all the day, from sunrise to sunset
The rotor plane is always perpendicular to the line from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

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values.
A WTG will be visible if it is visible from any part of the receiver window.
The ZVI calculation is based on the following assumptions:
Height contours used: Elevation Grid Data Object: ZVI_Foggialncoronata_EMD
Receptor grid resolution: 1.0 m

All coordinates are in
UTM (north)-WGS84 Zone: 33

WTGs

WTG No.	Easting	Northing	Z [m]	Row data/Description	WTG type			Shadow data				
					Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM [RPM]
1	559,051	4,580,901	54.7	VESTAS V172-7.2 7200 172.0 !O! hu...	Yes	VESTAS	V172-7.2-7,200	7,200	172.0	150.0	2,039	12.1
2	555,737	4,583,928	50.9	VESTAS V172-7.2 7200 172.0 !O! hu...	Yes	VESTAS	V172-7.2-7,200	7,200	172.0	150.0	2,039	12.1
3	558,084	4,584,031	45.9	VESTAS V172-7.2 7200 172.0 !O! hu...	Yes	VESTAS	V172-7.2-7,200	7,200	172.0	150.0	2,039	12.1
4	557,520	4,583,713	48.3	VESTAS V172-7.2 7200 172.0 !O! hu...	Yes	VESTAS	V172-7.2-7,200	7,200	172.0	150.0	2,039	12.1
5	557,554	4,582,547	51.0	VESTAS V172-7.2 7200 172.0 !O! hu...	Yes	VESTAS	V172-7.2-7,200	7,200	172.0	150.0	2,039	12.1
6	558,845	4,581,567	49.9	VESTAS V172-7.2 7200 172.0 !O! hu...	Yes	VESTAS	V172-7.2-7,200	7,200	172.0	150.0	2,039	12.1
7	561,614	4,581,073	44.9	VESTAS V172-7.2 7200 172.0 !O! hu...	Yes	VESTAS	V172-7.2-7,200	7,200	172.0	150.0	2,039	12.1
8	561,009	4,581,446	45.8	VESTAS V172-7.2 7200 172.0 !O! hu...	Yes	VESTAS	V172-7.2-7,200	7,200	172.0	150.0	2,039	12.1
9	560,531	4,581,856	47.7	VESTAS V172-7.2 7200 172.0 !O! hu...	Yes	VESTAS	V172-7.2-7,200	7,200	172.0	150.0	2,039	12.1
10	559,824	4,581,149	48.7	VESTAS V172-7.2 7200 172.0 !O! hu...	Yes	VESTAS	V172-7.2-7,200	7,200	172.0	150.0	2,039	12.1
11	558,090	4,584,866	44.5	VESTAS V172-7.2 7200 172.0 !O! hu...	Yes	VESTAS	V172-7.2-7,200	7,200	172.0	150.0	2,039	12.1



Shadow receptor-Input

No.	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Degrees from south cw	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
	[m]	[m]	[m]	[m]	[m]	[m]	[°]	[°]		[m]
A	560,297	4,581,306	47.5	1.0	1.0	1.0	60.0	90.0	Fixed direction	2.0
B	559,317	4,581,242	52.1	1.0	1.0	1.0	50.0	90.0	Fixed direction	2.0
C	556,052	4,583,549	51.3	1.0	1.0	1.0	150.0	90.0	Fixed direction	2.0
D	557,576	4,584,908	45.6	1.0	1.0	1.0	-60.0	90.0	Fixed direction	2.0

Calculation Results

Shadow receptor

No.	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
A	118:48	143	1:16
B	172:48	128	1:32
C	0:00	0	0:00
D	95:26	101	1:13

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

No.	Name	Worst case [h/year]
1	VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (1)	188:50
2	VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (2)	0:00

To be continued on next page...

Project:
ZVI_Foggialncoronata

Licensed user:
Iron solar s.r.l.
via Lanzone, 31
IT-20122 Milano
+393487125089
Fabio Paccapelo / francesca.saccarola@hopegroup.it
Calculated:
04/05/2023 09:44/3.6.361

SHADOW - Main Result

Calculation: ShadowFlickeringFgInc

...continued from previous page

No.	Name	Worst case [h/year]
3	VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (3)	0:00
4	VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (4)	0:00
5	VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (5)	0:00
6	VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (6)	13:37
7	VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (7)	0:00
8	VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (8)	0:00
9	VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (9)	0:00
10	VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (10)	95:05
11	VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (11)	95:26

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

SHADOW - Calendar

Calculation: ShadowFlickeringFgInc Shadow receptor: A - Shadow Receptor: 1.0 × 1.0 Azimuth: 60.0° Slope: 90.0° (1)
Assumptions for shadow calculations

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

- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

	January	February	March	April	May	June
1	07:24 16:38	07:10 17:13	06:34 17:47	16:02 (10) 17:17 (1)	06:43 19:22	17:00 (10) 19:54
2	07:24 16:39	07:09 17:14	06:32 17:48	16:01 (10) 17:16 (1)	06:41 19:23	17:01 (10) 19:55
3	07:24 16:40	07:08 17:15	06:31 17:50	16:00 (10) 17:16 (1)	06:39 19:24	17:03 (10) 19:56
4	07:24 16:41	07:07 17:17	06:29 17:51	15:59 (10) 17:15 (1)	06:37 19:25	17:05 (10) 19:57
5	07:24 16:42	07:06 17:18	06:27 17:52	15:57 (10) 17:13 (1)	06:36 19:26	17:07 (10) 19:58
6	07:24 16:43	07:05 17:19	06:26 17:53	15:57 (10) 17:12 (1)	06:34 19:27	17:10 (10) 19:59
7	07:24 16:44	07:04 17:20	06:24 17:54	15:56 (10) 17:09 (1)	06:33 19:28	17:12 (10) 20:01
8	07:24 16:45	07:03 17:22	06:23 17:55	15:56 (10) 17:08 (1)	06:31 19:29	17:16 (10) 20:02
9	07:24 16:46	07:01 17:23	06:21 17:57	15:55 (10) 17:07 (1)	06:29 19:30	17:34 (10) 20:03
10	07:23 16:47	07:00 17:24	06:19 17:58	15:54 (10) 17:07 (1)	06:28 19:32	20:04 20:04
11	07:23 16:48	06:59 17:25	06:18 17:59	15:54 (10) 17:08 (1)	06:26 19:33	20:05 20:05
12	07:23 16:49	06:58 17:27	06:16 18:00	15:53 (10) 17:08 (1)	06:24 19:34	19:04 (6) 20:06
13	07:23 16:50	06:57 17:28	06:14 18:01	15:53 (10) 17:07 (1)	06:23 19:35	19:00 (6) 20:07
14	07:22 16:51	06:55 17:29	06:13 18:02	15:53 (10) 17:08 (1)	06:21 19:36	18:59 (6) 20:08
15	07:22 16:52	06:54 17:30	06:11 18:03	15:52 (10) 17:07 (1)	06:20 19:37	18:57 (6) 20:09
16	07:22 16:53	06:53 17:32	06:09 18:04	15:52 (10) 17:07 (1)	06:18 19:38	18:56 (6) 20:10
17	07:21 16:54	06:51 17:33	16:59 (1) 18:05	06:08 17:07 (1)	06:17 19:39	18:54 (6) 20:11
18	07:21 16:56	06:50 17:34	16:55 (1) 17:11 (1)	06:06 18:07	06:15 19:40	18:54 (6) 20:12
19	07:20 16:57	06:49 17:35	16:54 (1) 17:13 (1)	06:04 18:08	06:13 19:41	18:53 (6) 20:13
20	07:19 16:58	06:47 17:36	16:23 (10) 17:14 (1)	06:03 18:09	06:12 19:42	18:53 (6) 20:14
21	07:19 16:59	06:46 17:38	16:19 (10) 17:16 (1)	06:01 18:10	06:10 19:43	18:52 (6) 20:15
22	07:18 17:00	06:44 17:39	16:16 (10) 17:17 (1)	05:59 18:11	06:09 19:44	18:52 (6) 20:15
23	07:18 17:02	06:43 17:40	16:13 (10) 17:17 (1)	05:58 18:12	06:07 19:46	18:52 (6) 20:16
24	07:17 17:03	06:41 17:41	16:11 (10) 17:18 (1)	05:56 18:13	06:06 19:47	18:52 (6) 20:17
25	07:16 17:04	06:40 17:43	16:09 (10) 17:18 (1)	05:54 18:14	06:05 19:48	18:53 (6) 20:18
26	07:15 17:05	06:38 17:44	16:07 (10) 17:18 (1)	05:53 18:15	06:03 19:49	18:53 (6) 20:19
27	07:15 17:06	06:37 17:45	16:05 (10) 17:18 (1)	05:51 18:16	06:02 19:50	18:54 (6) 20:20
28	07:14 17:08	06:35 17:46	16:03 (10) 17:17 (1)	05:49 18:17	06:00 19:51	18:55 (6) 20:21
29	07:13 17:09		06:48 19:19	16:57 (10) 17:57 (1)	05:59 19:52	18:56 (6) 20:22
30	07:12 17:10		06:46 19:20	16:58 (10) 17:56 (10)	05:58 19:53	18:58 (6) 20:22
31	07:11 17:11		06:44 19:21	16:59 (10) 17:55 (10)		05:28 20:23
Potential sun hours	296	297	369	399	449	453
Total, worst case		620	2205	709	7	

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)
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SHADOW - Calendar

Calculation: ShadowFlickeringFgInc Shadow receptor: A - Shadow Receptor: 1.0 × 1.0 Azimuth: 60.0° Slope: 90.0° (1)
Assumptions for shadow calculations

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

- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

	July	August	September	October	November	December						
1	05:27	05:52	06:23	06:53	16:32 (10)	06:28	07:03					
	20:35	20:16	19:32	18:41	74	17:46 (10)	16:54	16:29				
2	05:28	05:53	06:24	06:54	16:33 (10)	06:29	07:04					
	20:35	20:15	19:31	18:39	74	17:47 (10)	16:53	16:29				
3	05:28	05:54	06:25	06:55	16:32 (10)	06:30	07:05					
	20:35	20:14	19:29	18:38	74	17:46 (10)	16:52	16:29				
4	05:29	05:55	06:26	17:14 (10)	06:56	16:32 (10)	06:32	07:06				
	20:35	20:12	19:27	18	17:32 (10)	18:36	73	17:45 (10)	16:50	16:29		
5	05:30	05:56	06:27	17:09 (10)	06:58	16:32 (10)	06:33	07:07				
	20:34	20:11	19:26	27	17:36 (10)	18:34	72	17:44 (10)	16:49	16:28		
6	05:30	05:57	06:28	17:06 (10)	06:59	16:32 (10)	06:34	07:08				
	20:34	20:10	19:24	32	17:38 (10)	18:33	73	17:45 (1)	16:48	16:28		
7	05:31	05:58	06:29	17:03 (10)	07:00	16:32 (10)	06:35	07:09				
	20:34	20:09	19:22	37	17:40 (10)	18:31	75	17:47 (1)	16:47	16:28		
8	05:31	05:59	06:30	17:00 (10)	07:01	16:33 (10)	06:36	07:10				
	20:33	20:08	19:21	42	17:42 (10)	18:29	75	17:48 (1)	16:46	16:28		
9	05:32	06:00	06:31	16:57 (10)	07:02	16:33 (10)	06:38	07:11				
	20:33	20:06	19:19	46	17:43 (10)	18:28	76	17:49 (1)	16:45	16:28		
10	05:33	06:01	06:32	16:55 (10)	07:03	16:33 (10)	06:39	07:12				
	20:33	20:05	19:17	49	17:44 (10)	18:26	76	17:49 (1)	16:44	16:28		
11	05:33	06:02	06:33	16:53 (10)	07:04	16:34 (10)	06:40	07:13				
	20:32	20:04	19:15	52	17:45 (10)	18:25	76	17:50 (1)	16:43	16:28		
12	05:34	06:03	19:08 (6)	06:34	16:51 (10)	07:05	16:34 (10)	06:41	07:14			
	20:32	20:02	9	19:17 (6)	19:14	55	17:46 (10)	18:23	76	17:50 (1)	16:42	16:28
13	05:35	06:04	19:05 (6)	06:35	16:49 (10)	07:06	16:36 (10)	06:42	07:14			
	20:31	20:01	14	19:19 (6)	19:12	58	17:47 (10)	18:21	75	17:51 (1)	16:41	16:28
14	05:36	06:05	19:03 (6)	06:36	16:47 (10)	07:07	16:37 (10)	06:44	07:15			
	20:31	20:00	18	19:21 (6)	19:10	60	17:47 (10)	18:20	74	17:51 (1)	16:40	16:29
15	05:36	06:06	19:02 (6)	06:37	16:46 (10)	07:08	16:38 (10)	06:45	07:16			
	20:30	19:58	20	19:22 (6)	19:09	62	17:48 (10)	18:18	72	17:50 (1)	16:39	16:29
16	05:37	06:07	19:01 (6)	06:38	16:44 (10)	07:09	16:39 (10)	06:46	07:17			
	20:30	19:57	22	19:23 (6)	19:07	64	17:48 (10)	18:17	71	17:50 (1)	16:38	16:29
17	05:38	06:08	19:00 (6)	06:39	16:43 (10)	07:11	16:41 (10)	06:47	07:17			
	20:29	19:55	24	19:24 (6)	19:05	66	17:49 (10)	18:15	68	17:49 (1)	16:37	16:29
18	05:39	06:09	18:59 (6)	06:40	16:42 (10)	07:12	16:42 (10)	06:48	07:18			
	20:28	19:54	25	19:24 (6)	19:03	67	17:49 (10)	18:14	66	17:48 (1)	16:36	16:30
19	05:40	06:10	18:58 (6)	06:41	16:41 (10)	07:13	16:45 (10)	06:50	07:19			
	20:28	19:52	26	19:24 (6)	19:02	68	17:49 (10)	18:12	63	17:48 (1)	16:36	16:30
20	05:41	06:11	18:58 (6)	06:42	16:39 (10)	07:14	16:48 (10)	06:51	07:19			
	20:27	19:51	26	19:24 (6)	19:00	70	17:49 (10)	18:11	59	17:47 (1)	16:35	16:30
21	05:41	06:12	18:57 (6)	06:43	16:38 (10)	07:15	16:51 (10)	06:52	07:20			
	20:26	19:50	27	19:24 (6)	18:58	71	17:49 (10)	18:09	50	17:46 (1)	16:34	16:31
22	05:42	06:13	18:57 (6)	06:44	16:37 (10)	07:16	16:55 (10)	06:53	07:20			
	20:25	19:48	27	19:24 (6)	18:57	72	17:49 (10)	18:08	38	17:44 (1)	16:34	16:31
23	05:43	06:14	18:57 (6)	06:45	16:36 (10)	07:17	17:24 (1)	06:54	07:21			
	20:24	19:46	27	19:24 (6)	18:55	73	17:49 (10)	18:06	18	17:42 (1)	16:33	16:32
24	05:44	06:15	18:57 (6)	06:46	16:36 (10)	07:19	17:27 (1)	06:56	07:21			
	20:24	19:45	25	19:22 (6)	18:53	73	17:49 (10)	18:05	14	17:41 (1)	16:32	16:32
25	05:45	06:16	18:57 (6)	06:47	16:35 (10)	06:20	16:30 (1)	06:57	07:22			
	20:23	19:43	24	19:21 (6)	18:51	74	17:49 (10)	17:03	7	16:37 (1)	16:32	16:33
26	05:46	06:17	18:57 (6)	06:48	16:34 (10)	06:21	16:34 (10)	06:58	07:22			
	20:22	19:42	22	19:19 (6)	18:50	75	17:49 (10)	17:02	16:31	16:34		
27	05:47	06:18	18:58 (6)	06:49	16:34 (10)	06:22	16:34 (10)	06:59	07:22			
	20:21	19:40	20	19:18 (6)	18:48	74	17:48 (10)	17:01	16:31	16:34		
28	05:48	06:19	18:59 (6)	06:50	16:33 (10)	06:23	16:33 (10)	07:00	07:23			
	20:20	19:39	17	19:16 (6)	18:46	75	17:48 (10)	16:59	16:30	16:35		
29	05:49	06:20	19:00 (6)	06:51	16:33 (10)	06:24	16:33 (10)	07:01	07:23			
	20:19	19:37	15	19:15 (6)	18:45	75	17:48 (10)	16:58	16:30	16:36		
30	05:50	06:21	19:01 (6)	06:52	16:32 (10)	06:26	16:32 (10)	07:02	07:23			
	20:18	19:35	12	19:13 (6)	18:43	75	17:47 (10)	16:57	16:30	16:36		
31	05:51	06:22	19:04 (6)	06:53	16:31 (10)	06:27	16:31 (10)	07:03	07:24			
	20:17	19:34	8	19:12 (6)	18:42	76	17:46 (10)	16:56	16:37			
Potential sun hours	460	429		375		345		297	287			
Total, worst case		408		1610		1569						

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)
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SHADOW - Calendar

Calculation: ShadowFlickeringFgInc Shadow receptor: B - Shadow Receptor: 1.0 × 1.0 Azimuth: 50.0° Slope: 90.0° (2)
 Assumptions for shadow calculations

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

- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:24 16:38	13:50 (1) 07:10 15:18 (1) 17:13	14:01 (1) 06:34 15:28 (1) 17:47	06:43 19:22	05:56 19:22	05:27 19:24	05:27 20:24	05:52 20:35	06:23 20:16	06:53 19:32	06:28 16:54	13:39 (1) 07:03 14:55 (1) 16:29	13:34 (1) 15:05 (1)
2	07:24 16:39	13:50 (1) 07:09 15:19 (1) 17:14	14:02 (1) 06:32 15:28 (1) 17:48	06:41 19:23	05:55 19:25	05:27 20:25	05:28 20:35	05:53 20:15	06:24 19:31	06:54 18:40	06:29 16:53	13:38 (1) 07:04 14:55 (1) 16:29	13:35 (1) 15:05 (1)
3	07:24 16:40	13:50 (1) 07:08 15:19 (1) 17:15	14:03 (1) 06:31 15:28 (1) 17:50	06:39 19:24	05:54 19:26	05:26 20:26	05:28 20:35	05:54 20:14	06:25 19:29	06:55 18:38	06:30 16:52	13:37 (1) 07:05 14:55 (1) 16:29	13:35 (1) 15:06 (1)
4	07:24 16:41	13:50 (1) 07:07 15:19 (1) 17:17	14:04 (1) 06:29 15:27 (1) 17:51	06:38 19:25	05:52 19:25	05:26 20:26	05:29 20:35	05:55 20:12	06:26 19:27	06:57 18:36	06:32 16:50	13:37 (1) 07:06 14:57 (1) 16:29	13:36 (1) 15:06 (1)
5	07:24 16:42	13:50 (1) 07:06 15:20 (1) 17:18	14:05 (1) 06:28 15:27 (1) 17:52	06:36 19:26	05:51 19:26	05:25 20:27	05:30 20:34	05:56 20:11	06:27 19:26	06:58 18:35	06:33 16:49	13:35 (1) 07:07 14:57 (1) 16:28	13:36 (1) 15:06 (1)
6	07:24 16:43	13:51 (1) 07:05 15:20 (1) 17:19	14:06 (1) 06:26 15:27 (1) 17:53	06:34 19:27	05:50 19:27	05:25 20:28	05:30 20:34	05:57 20:10	06:28 19:24	06:59 18:33	06:34 16:48	13:34 (1) 07:08 14:57 (1) 16:28	13:37 (1) 15:06 (1)
7	07:24 16:44	13:51 (1) 07:04 15:21 (1) 17:20	14:07 (1) 06:24 15:27 (1) 17:54	06:33 19:28	05:49 20:01	05:25 20:28	05:31 20:34	05:58 20:09	06:29 19:22	07:00 18:31	06:35 16:47	13:33 (1) 07:09 14:58 (1) 16:28	13:37 (1) 15:07 (1)
8	07:24 16:45	13:52 (1) 07:03 15:22 (1) 17:22	14:08 (1) 06:23 15:27 (1) 17:55	06:31 19:29	05:48 20:02	05:25 20:29	05:31 20:33	05:59 20:08	06:30 19:21	07:01 18:30	06:36 16:46	13:34 (1) 07:10 14:59 (1) 16:28	13:38 (1) 15:07 (1)
9	07:24 16:46	13:52 (1) 07:02 15:23 (1) 17:23	14:08 (1) 06:21 15:25 (1) 17:57	06:29 19:30	05:46 20:03	05:24 20:29	05:32 20:33	06:00 20:06	06:31 19:19	07:02 18:28	06:38 16:45	13:33 (1) 07:11 14:59 (1) 16:28	13:38 (1) 15:08 (1)
10	07:24 16:47	13:52 (1) 07:00 15:22 (1) 17:24	14:10 (1) 06:19 15:25 (1) 17:58	06:28 19:32	05:45 20:04	05:24 20:30	05:33 20:33	06:01 20:05	06:32 19:17	07:03 18:26	06:39 16:44	13:32 (1) 07:12 14:59 (1) 16:28	13:39 (1) 15:08 (1)
11	07:23 16:48	13:52 (1) 06:59 15:23 (1) 17:25	14:12 (1) 06:18 15:24 (1) 17:59	06:26 19:33	05:44 20:05	05:24 20:31	05:33 20:32	06:02 20:04	06:33 19:16	07:04 18:25	06:40 16:43	13:32 (1) 07:13 15:00 (1) 16:28	13:40 (1) 15:08 (1)
12	07:23 16:49	13:53 (1) 06:58 15:24 (1) 17:27	14:13 (1) 06:16 15:24 (1) 18:00	06:24 19:34	05:43 20:06	05:24 20:31	05:34 20:32	06:03 20:02	06:34 19:14	07:05 18:23	06:41 16:42	13:32 (1) 07:14 15:00 (1) 16:28	13:40 (1) 15:09 (1)
13	07:23 16:50	13:53 (1) 06:57 15:24 (1) 17:28	14:14 (1) 06:15 15:22 (1) 18:01	06:23 19:35	05:42 20:07	05:24 20:32	05:35 20:31	06:04 20:01	06:35 19:12	07:06 18:21	06:43 16:41	13:31 (1) 07:14 15:00 (1) 16:28	13:40 (1) 15:09 (1)
14	07:22 16:51	13:53 (1) 06:55 15:25 (1) 17:29	14:16 (1) 06:13 15:21 (1) 18:02	06:21 19:36	05:41 20:08	05:24 20:32	05:36 20:31	06:05 20:00	06:36 19:10	07:07 18:20	06:44 16:40	13:32 (1) 07:15 15:01 (1) 16:29	13:41 (1) 15:09 (1)
15	07:22 16:52	13:53 (1) 06:54 15:25 (1) 17:30	14:18 (1) 06:11 15:20 (1) 18:03	06:20 19:37	05:40 20:09	05:24 20:32	05:36 20:30	06:06 19:58	06:37 19:09	07:08 18:18	06:45 16:39	13:31 (1) 07:16 15:01 (1) 16:28	13:42 (1) 15:10 (1)
16	07:22 16:53	13:54 (1) 06:53 15:26 (1) 17:32	14:19 (1) 06:10 15:18 (1) 18:04	06:18 19:38	05:39 20:10	05:24 20:33	05:37 20:30	06:07 19:57	06:38 19:07	07:10 18:17	06:46 16:38	13:31 (1) 07:17 15:01 (1) 16:29	13:42 (1) 15:09 (1)
17	07:21 16:54	13:54 (1) 06:51 15:26 (1) 17:33	14:22 (1) 06:08 15:17 (1) 18:06	06:17 19:39	05:38 20:11	05:24 20:33	05:38 20:29	06:08 19:55	06:39 19:05	07:11 18:15	06:47 16:37	13:31 (1) 07:17 15:01 (1) 16:29	13:43 (1) 15:10 (1)
18	07:21 16:56	13:55 (1) 06:50 15:27 (1) 17:34	14:23 (1) 06:06 15:15 (1) 18:07	06:15 19:40	05:37 20:12	05:24 20:34	05:39 20:28	06:09 19:54	06:40 19:04	07:12 18:14	06:49 16:36	13:31 (1) 07:18 15:02 (1) 16:30	13:43 (1) 15:11 (1)
19	07:20 16:57	13:55 (1) 06:49 15:27 (1) 17:35	14:26 (1) 06:04 15:13 (1) 18:08	06:13 19:41	05:36 20:13	05:24 20:34	05:40 20:28	06:10 19:53	06:41 19:02	07:13 18:12	06:50 16:36	15:11 (1) 06:50 15:03 (1) 16:30	13:43 (1) 15:11 (1)
20	07:20 16:58	13:56 (1) 06:47 15:28 (1) 17:37	14:30 (1) 06:03 15:11 (1) 18:09	06:12 19:42	05:35 20:14	05:24 20:34	05:41 20:27	06:11 19:51	06:42 19:00	07:14 18:11	06:51 16:35	15:06 (1) 06:51 15:03 (1) 16:30	13:44 (1) 15:12 (1)
21	07:19 16:59	13:56 (1) 06:46 15:28 (1) 17:38	14:32 (1) 06:01 15:08 (1) 18:10	06:10 19:43	05:34 20:15	05:24 20:34	05:41 20:26	06:12 19:50	06:43 18:58	07:15 18:09	06:52 16:34	15:02 (1) 06:52 15:04 (1) 16:34	13:44 (1) 15:12 (1)
22	07:18 17:00	13:56 (1) 06:44 15:28 (1) 17:39	14:37 (1) 05:59 15:05 (1) 18:11	06:09 19:44	05:34 20:16	05:24 20:34	05:42 20:25	06:13 19:48	06:44 18:57	07:16 18:08	06:53 16:34	14:58 (1) 06:53 15:04 (1) 16:34	13:45 (1) 15:13 (1)
23	07:18 17:02	13:56 (1) 06:43 15:28 (1) 17:40	14:42 (1) 05:58 14:59 (1) 18:12	06:08 19:46	05:33 20:16	05:25 20:35	05:43 20:25	06:14 19:47	06:45 18:55	07:17 18:06	06:54 16:33	14:55 (1) 06:54 15:04 (1) 16:33	13:45 (1) 15:13 (1)
24	07:17 17:03	13:57 (1) 06:41 15:28 (1) 17:41	14:42 (1) 05:56 15:17 (1) 18:13	06:06 19:47	05:32 20:17	05:25 20:35	05:44 20:24	06:15 19:45	06:46 18:53	07:19 18:05	06:56 16:32	14:53 (1) 06:56 15:04 (1) 16:32	13:46 (1) 15:14 (1)
25	07:16 17:04	13:58 (1) 06:40 15:28 (1) 17:43	14:42 (1) 05:54 15:18 (1) 18:14	06:05 19:48	05:31 20:18	05:25 20:35	05:45 20:23	06:16 19:43	06:47 18:51	07:20 17:03	06:57 16:32	15:01 (1) 06:57 15:04 (1) 16:33	13:46 (1) 15:14 (1)
26	07:15 17:05	13:58 (1) 06:38 15:28 (1) 17:44	14:42 (1) 05:52 15:18 (1) 18:15	06:04 19:49	05:30 20:19	05:25 20:35	05:46 20:22	06:17 19:42	06:48 18:50	07:21 17:02	06:58 16:31	15:02 (1) 06:58 15:04 (1) 16:34	13:46 (1) 15:14 (1)
27	07:15 17:07	13:58 (1) 06:37 15:28 (1) 17:45	14:42 (1) 05:51 15:18 (1) 18:16	06:03 19:50	05:29 20:20	05:26 20:35	05:47 20:21	06:18 19:40	06:49 18:48	07:22 17:01	06:59 16:30	15:03 (1) 06:59 15:05 (1) 16:34	13:47 (1) 15:15 (1)
28	07:14 17:08	13:59 (1) 06:35 15:28 (1) 17:46	14:42 (1) 05:50 15:18 (1) 18:17	06:02 19:51	05:28 20:21	05:26 20:35	05:48 20:20	06:19 19:39	06:50 18:46	07:23 17:00	07:00 16:30	15:04 (1) 07:00 15:05 (1) 16:35	13:48 (1) 15:16 (1)
29	07:13 17:09	13:59 (1) 06:34 15:28 (1) 17:47	14:42 (1) 05:49 15:19 (1) 18:18	06:01 19:52	05:27 20:22	05:25 20:35	05:49 20:19	06:20 19:37	06:51 18:45	07:24 17:00	07:01 16:30	15:04 (1) 07:01 15:05 (1) 16:36	13:48 (1) 15:16 (1)
30	07:12 17:10	14:00 (1) 06:33 15:28 (1) 17:48	14:42 (1) 05:48 15:20 (1) 18:19	06:00 19:53	05:26 20:22	05:24 20:35	05:50 20:18	06:21 19:36	06:52 18:43	07:25 17:00	07:02 16:30	15:04 (1) 07:02 15:05 (1) 16:37	13:48 (1) 15:16 (1)
31	07:11 17:12	14:00 (1) 06:32 15:28 (1) 17:49	14:42 (1) 05:47 15:21 (1) 18:20	06:00 19:54	05:26 20:23	05:24 20:35	05:51 20:17	06:22 19:34	06:53 18:44	07:26 17:00	07:03 16:30	15:04 (1) 07:03 15:05 (1) 16:38	13:48 (1) 15:17 (1)
Potential sun hours	296	297	369	399	449	453	460	429	375	345	297	287	
Total, worst case	2803	1489							694	2635		2747	

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)
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SHADOW - Calendar

Calculation: ShadowFlickeringFgInc Shadow receptor: C - Shadow Receptor: 1.0 × 1.0 Azimuth: 150.0° Slope: 90.0° (3)
Assumptions for shadow calculations

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

- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:24 16:38	07:10 17:13	06:34 17:47	06:43 19:22	05:56 19:54	05:27 20:24	05:28 20:35	05:52 20:16	06:23 19:32	06:54 18:41	06:28 16:54	07:04 16:29
2	07:24 16:39	07:09 17:14	06:32 17:49	06:41 19:23	05:55 19:55	05:27 20:25	05:28 20:35	05:53 20:15	06:24 19:31	06:55 18:40	06:29 16:53	07:05 16:29
3	07:24 16:40	07:08 17:15	06:31 17:50	06:39 19:24	05:54 19:57	05:26 20:26	05:29 20:35	05:54 20:14	06:25 19:29	06:56 18:38	06:31 16:52	07:06 16:29
4	07:24 16:41	07:07 17:17	06:29 17:51	06:38 19:25	05:53 19:58	05:26 20:26	05:29 20:35	05:55 20:13	06:26 19:27	06:57 18:36	06:32 16:51	07:07 16:29
5	07:24 16:42	07:06 17:18	06:28 17:52	06:36 19:26	05:51 19:59	05:25 20:27	05:30 20:35	05:56 20:11	06:27 19:26	06:58 18:35	06:33 16:49	07:08 16:28
6	07:24 16:43	07:05 17:19	06:26 17:53	06:34 19:27	05:50 20:00	05:25 20:28	05:30 20:34	05:57 20:10	06:28 19:24	06:59 18:33	06:34 16:48	07:09 16:28
7	07:24 16:44	07:04 17:20	06:25 17:54	06:33 19:29	05:49 20:01	05:25 20:28	05:31 20:34	05:58 20:09	06:29 19:22	07:00 18:31	06:35 16:47	07:10 16:28
8	07:24 16:45	07:03 17:22	06:23 17:56	06:31 19:30	05:48 20:02	05:25 20:29	05:32 20:34	05:59 20:08	06:30 19:21	07:01 18:30	06:37 16:46	07:10 16:28
9	07:24 16:46	07:02 17:23	06:21 17:57	06:29 19:31	05:46 20:03	05:24 20:30	05:32 20:33	06:00 20:07	06:31 19:19	07:02 18:28	06:38 16:45	07:11 16:28
10	07:24 16:47	07:01 17:24	06:20 17:58	06:28 19:32	05:45 20:04	05:24 20:30	05:33 20:33	06:01 20:05	06:32 19:17	07:03 18:26	06:39 16:44	07:12 16:28
11	07:24 16:48	06:59 17:26	06:18 17:59	06:26 19:33	05:44 20:05	05:24 20:31	05:34 20:33	06:02 20:04	06:33 19:16	07:04 18:25	06:40 16:43	07:13 16:28
12	07:23 16:49	06:58 17:27	06:16 18:00	06:25 19:34	05:43 20:06	05:24 20:31	05:34 20:32	06:03 20:03	06:34 19:14	07:05 18:23	06:42 16:42	07:14 16:28
13	07:23 16:50	06:57 17:28	06:15 18:01	06:23 19:35	05:42 20:07	05:24 20:32	05:35 20:32	06:04 20:01	06:35 19:12	07:06 18:22	06:43 16:41	07:15 16:28
14	07:23 16:51	06:56 17:29	06:13 18:02	06:21 19:36	05:41 20:08	05:24 20:32	05:36 20:31	06:05 20:00	06:36 19:11	07:07 18:20	06:44 16:40	07:15 16:29
15	07:22 16:52	06:54 17:31	06:11 18:03	06:20 19:37	05:40 20:09	05:24 20:33	05:37 20:30	06:06 19:58	06:37 19:09	07:09 18:18	06:45 16:39	07:16 16:29
16	07:22 16:53	06:53 17:32	06:10 18:05	06:18 19:38	05:39 20:10	05:24 20:33	05:37 20:30	06:07 19:57	06:38 19:07	07:10 18:17	06:46 16:38	07:17 16:29
17	07:21 16:55	06:52 17:33	06:08 18:06	06:17 19:39	05:38 20:11	05:24 20:33	05:38 20:29	06:08 19:56	06:39 19:05	07:11 18:15	06:48 16:37	07:18 16:29
18	07:21 16:56	06:50 17:34	06:06 18:07	06:15 19:40	05:37 20:12	05:24 20:34	05:39 20:29	06:09 19:54	06:40 19:04	07:12 18:14	06:49 16:37	07:18 16:30
19	07:20 16:57	06:49 17:35	06:05 18:08	06:14 19:41	05:36 20:13	05:24 20:34	05:40 20:28	06:10 19:53	06:41 19:02	07:13 18:12	06:50 16:36	07:19 16:30
20	07:20 16:58	06:47 17:37	06:03 18:09	06:12 19:43	05:35 20:14	05:24 20:34	05:41 20:27	06:11 19:51	06:42 19:00	07:14 18:11	06:51 16:35	07:20 16:31
21	07:19 16:59	06:46 17:38	06:01 18:10	06:11 19:44	05:34 20:15	05:24 20:35	05:42 20:26	06:12 19:50	06:43 18:59	07:15 18:09	06:52 16:34	07:20 16:31
22	07:19 17:00	06:45 17:39	06:00 18:11	06:09 19:45	05:34 20:16	05:24 20:35	05:42 20:26	06:13 19:48	06:44 18:57	07:16 18:08	06:53 16:34	07:21 16:31
23	07:18 17:02	06:43 17:40	05:58 18:12	06:08 19:46	05:33 20:17	05:25 20:35	05:43 20:25	06:14 19:47	06:45 18:55	07:18 18:06	06:55 16:33	07:21 16:32
24	07:17 17:03	06:42 17:42	05:56 18:13	06:06 19:47	05:32 20:18	05:25 20:35	05:44 20:24	06:15 19:45	06:46 18:53	07:19 18:05	06:56 16:33	07:22 16:33
25	07:16 17:04	06:40 17:43	05:55 18:14	06:05 19:48	05:31 20:18	05:25 20:35	05:45 20:23	06:16 19:44	06:47 18:52	07:20 17:04	06:57 16:32	07:22 16:33
26	07:16 17:05	06:39 17:44	05:53 18:16	06:03 19:49	05:31 20:19	05:25 20:35	05:46 20:22	06:17 19:42	06:48 18:50	07:21 17:02	06:58 16:31	07:22 16:34
27	07:15 17:07	06:37 17:45	05:51 18:17	06:02 19:50	05:30 20:20	05:26 20:35	05:47 20:21	06:18 19:40	06:49 18:48	07:22 17:01	06:59 16:31	07:23 16:34
28	07:14 17:08	06:36 17:46	05:49 18:18	06:00 19:51	05:29 20:21	05:26 20:35	05:48 20:20	06:19 19:39	06:50 18:46	07:23 16:59	07:00 16:31	07:23 16:35
29	07:13 17:09		06:48 19:19	05:59 19:52	05:29 20:22	05:27 20:35	05:49 20:19	06:20 19:37	06:51 18:45	07:24 16:58	07:01 16:30	07:23 16:36
30	07:12 17:10		06:46 19:20	05:58 19:53	05:28 20:23	05:27 20:35	05:50 20:18	06:21 19:36	06:52 18:43	07:25 16:57	07:02 16:30	07:24 16:37
31	07:11 17:12		06:44 19:21		05:28 20:23		05:51 20:17	06:22 19:34		06:27 16:55		07:24 16:37
Potential sun hours Total, worst case	296	297	369	399	449	453	460	429	375	345	297	287

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)
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SHADOW - Calendar

Calculation: ShadowFlickeringFgInc Shadow receptor: D - Shadow Receptor: 1.0 × 1.0 Azimuth: -60.0° Slope: 90.0° (4)
Assumptions for shadow calculations

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

- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

	January	February	March		April		May		June		
1	07:24	07:10	06:34		06:43		07:26 (11)	05:56	07:39 (11)	05:27	
	16:38	17:13	17:47		19:22	72	08:38 (11)	19:54	27	08:06 (11)	20:24
2	07:24	07:09	06:32		06:41		07:26 (11)	05:55		07:41 (11)	05:27
	16:39	17:14	17:49		19:23	72	08:38 (11)	19:55	21	08:02 (11)	20:25
3	07:24	07:08	06:31		06:39		07:25 (11)	05:54		07:46 (11)	05:26
	16:40	17:15	17:50		19:24	73	08:38 (11)	19:56	11	07:57 (11)	20:26
4	07:24	07:07	06:29		06:38		07:25 (11)	05:52			05:26
	16:41	17:17	17:51		19:25	72	08:37 (11)	19:58			20:26
5	07:24	07:06	06:28		06:36		07:25 (11)	05:51			05:25
	16:42	17:18	17:52		19:26	73	08:38 (11)	19:59			20:27
6	07:24	07:05	06:26		06:34		07:24 (11)	05:50			05:25
	16:43	17:19	17:53		19:27	73	08:37 (11)	20:00			20:28
7	07:24	07:04	06:24		06:33		07:23 (11)	05:49			05:25
	16:44	17:20	17:54		19:28	73	08:36 (11)	20:01			20:28
8	07:24	07:03	06:23		06:31		07:24 (11)	05:48			05:24
	16:45	17:22	17:55		19:30	72	08:36 (11)	20:02			20:29
9	07:24	07:02	06:21		06:29		07:23 (11)	05:46			05:24
	16:46	17:23	17:57		19:31	73	08:36 (11)	20:03			20:30
10	07:24	07:00	06:20		06:28		07:23 (11)	05:45			05:24
	16:47	17:24	17:58		19:32	72	08:35 (11)	20:04			20:30
11	07:23	06:59	06:18		06:26		07:23 (11)	05:44			05:24
	16:48	17:25	17:59		19:33	71	08:34 (11)	20:05			20:31
12	07:23	06:58	06:16		06:25		07:23 (11)	05:43			05:24
	16:49	17:27	18:00		19:34	70	08:33 (11)	20:06			20:31
13	07:23	06:57	06:15		06:23		07:23 (11)	05:42			05:24
	16:50	17:28	18:01		19:35	70	08:33 (11)	20:07			20:32
14	07:23	06:55	06:13		06:21		07:23 (11)	05:41			05:24
	16:51	17:29	18:02		19:36	69	08:32 (11)	20:08			20:32
15	07:22	06:54	06:11		06:20		07:23 (11)	05:40			05:24
	16:52	17:30	18:03	20	07:18 (11)	19:37	08:30 (11)	20:09			20:33
16	07:22	06:53	06:10		06:53 (11)	06:18	07:23 (11)	05:39			05:24
	16:53	17:32	18:04	29	07:22 (11)	19:38	08:30 (11)	20:10			20:33
17	07:21	06:51	06:08		06:50 (11)	06:17	07:23 (11)	05:38			05:24
	16:54	17:33	18:06	36	07:26 (11)	19:39	08:29 (11)	20:11			20:33
18	07:21	06:50	06:06		06:47 (11)	06:15	07:24 (11)	05:37			05:24
	16:56	17:34	18:07	41	07:28 (11)	19:40	08:28 (11)	20:12			20:34
19	07:20	06:49	06:05		06:44 (11)	06:14	07:24 (11)	05:36			05:24
	16:57	17:35	18:08	45	07:29 (11)	19:41	08:26 (11)	20:13			20:34
20	07:20	06:47	06:03		06:42 (11)	06:12	07:25 (11)	05:35			05:24
	16:58	17:37	18:09	50	07:32 (11)	19:42	08:26 (11)	20:14			20:34
21	07:19	06:46	06:01		06:40 (11)	06:11	07:25 (11)	05:34			05:24
	16:59	17:38	18:10	53	07:33 (11)	19:44	08:24 (11)	20:15			20:35
22	07:18	06:44	06:00		06:38 (11)	06:09	07:26 (11)	05:34			05:24
	17:00	17:39	18:11	56	07:34 (11)	19:45	08:23 (11)	20:16			20:35
23	07:18	06:43	05:58		06:36 (11)	06:08	07:28 (11)	05:33			05:24
	17:02	17:40	18:12	58	07:34 (11)	19:46	08:22 (11)	20:17			20:35
24	07:17	06:42	05:56		06:35 (11)	06:06	07:28 (11)	05:32			05:25
	17:03	17:41	18:13	61	07:36 (11)	19:47	08:20 (11)	20:18			20:35
25	07:16	06:40	05:54		06:34 (11)	06:05	07:29 (11)	05:31			05:25
	17:04	17:43	18:14	62	07:36 (11)	19:48	08:19 (11)	20:18			20:35
26	07:16	06:39	05:53		06:32 (11)	06:03	07:30 (11)	05:31			05:25
	17:05	17:44	18:15	64	07:36 (11)	19:49	08:17 (11)	20:19			20:35
27	07:15	06:37	05:51		06:31 (11)	06:02	07:31 (11)	05:30			05:26
	17:07	17:45	18:17	67	07:38 (11)	19:50	08:15 (11)	20:20			20:35
28	07:14	06:35	05:49		06:30 (11)	06:00	07:33 (11)	05:29			05:26
	17:08	17:46	18:18	68	07:38 (11)	19:51	08:13 (11)	20:21			20:35
29	07:13		06:48		07:29 (11)	05:59	07:34 (11)	05:29			05:27
	17:09		19:19	69	08:38 (11)	19:52	08:11 (11)	20:22			20:35
30	07:12		06:46		07:29 (11)	05:58	07:36 (11)	05:28			05:27
	17:10		19:20	69	08:38 (11)	19:53	08:09 (11)	20:23			20:35
31	07:11		06:44		07:27 (11)			05:28			
	17:12		19:21	71	08:38 (11)			20:23			
Potential sun hours	296	297	369		399		449			453	
Total, worst case				919		1865		59			

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)
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SHADOW - Calendar

Calculation: ShadowFlickeringFgInc Shadow receptor: D - Shadow Receptor: 1.0 × 1.0 Azimuth: -60.0° Slope: 90.0° (4)
Assumptions for shadow calculations

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

- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

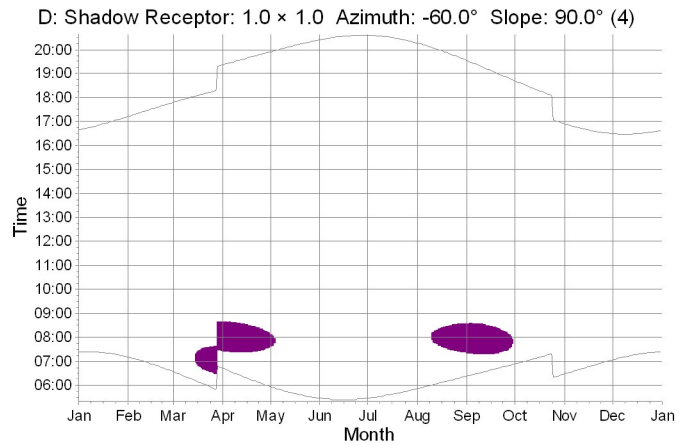
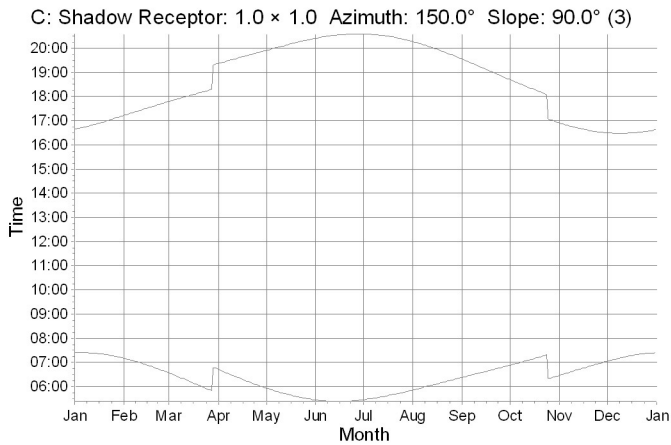
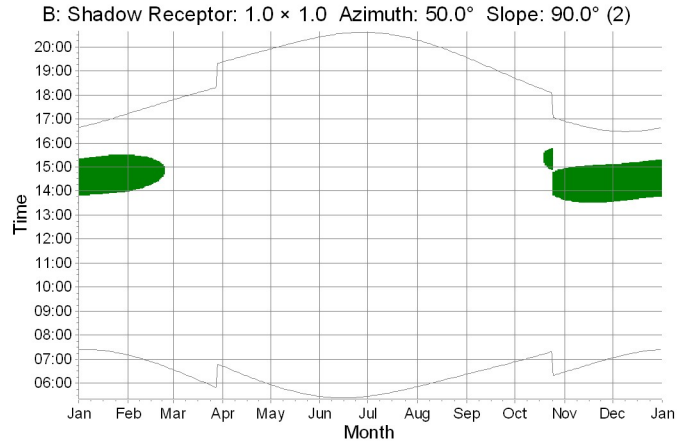
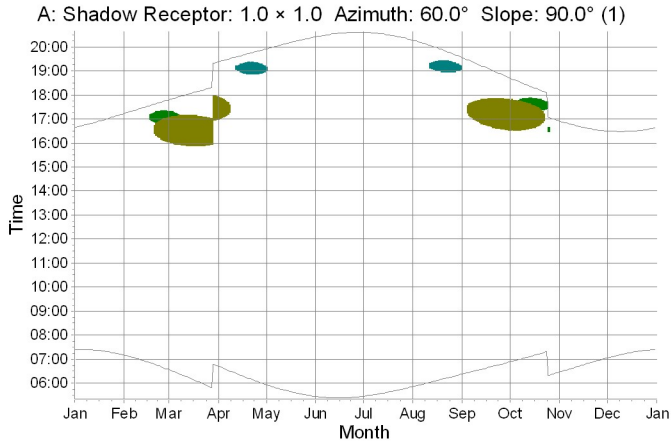
	July	August	September	October	November	December	
1	05:27 20:35	05:52 20:16	06:23 19:32	07:22 (11) 08:33 (11)	06:53 18:41	06:28 16:54	07:03 16:29
2	05:28 20:35	05:53 20:15	06:24 19:31	07:22 (11) 08:33 (11)	06:54 18:40	06:29 16:53	07:05 16:29
3	05:28 20:35	05:54 20:14	06:25 19:29	07:21 (11) 08:34 (11)	06:56 18:38	06:31 16:52	07:06 16:29
4	05:29 20:35	05:55 20:13	06:26 19:27	07:21 (11) 08:33 (11)	06:57 18:36	06:32 16:50	07:07 16:29
5	05:30 20:35	05:56 20:11	06:27 19:26	07:20 (11) 08:33 (11)	06:58 18:35	06:33 16:49	07:08 16:28
6	05:30 20:34	05:57 20:10	06:28 19:24	07:20 (11) 08:33 (11)	06:59 18:33	06:34 16:48	07:09 16:28
7	05:31 20:34	05:58 20:09	06:29 19:22	07:20 (11) 08:33 (11)	07:00 18:31	06:35 16:47	07:09 16:28
8	05:31 20:34	05:59 20:08	06:30 19:21	07:20 (11) 08:33 (11)	07:01 18:30	06:37 16:46	07:10 16:28
9	05:32 20:33	06:00 20:06	06:31 19:19	07:20 (11) 08:32 (11)	07:02 18:28	06:38 16:45	07:11 16:28
10	05:33 20:33	06:01 20:05	07:54 (11) 06:32 19:17	07:19 (11) 08:32 (11)	07:03 18:26	06:39 16:44	07:12 16:28
11	05:33 20:32	06:02 20:04	07:49 (11) 06:33 19:16	07:19 (11) 08:31 (11)	07:04 18:25	06:40 16:43	07:13 16:28
12	05:34 20:32	06:03 20:03	07:46 (11) 06:34 19:14	07:20 (11) 08:30 (11)	07:05 18:23	06:41 16:42	07:14 16:28
13	05:35 20:32	06:04 20:01	07:44 (11) 06:35 19:12	07:19 (11) 08:29 (11)	07:06 18:22	06:43 16:41	07:15 16:28
14	05:36 20:31	06:05 20:00	07:41 (11) 06:36 19:10	07:19 (11) 08:28 (11)	07:07 18:20	06:44 16:40	07:15 16:29
15	05:36 20:30	06:06 19:58	07:40 (11) 06:37 19:09	07:19 (11) 08:27 (11)	07:09 18:18	06:45 16:39	07:16 16:29
16	05:37 20:30	06:07 19:57	07:38 (11) 06:38 19:07	07:20 (11) 08:26 (11)	07:10 18:17	06:46 16:38	07:17 16:29
17	05:38 20:29	06:08 19:56	07:36 (11) 06:39 19:05	07:20 (11) 08:25 (11)	07:11 18:15	06:47 16:37	07:18 16:29
18	05:39 20:28	06:09 19:54	07:35 (11) 06:40 19:04	07:21 (11) 08:24 (11)	07:12 18:14	06:49 16:36	07:18 16:30
19	05:40 20:28	06:10 19:53	07:33 (11) 06:41 19:02	07:21 (11) 08:22 (11)	07:13 18:12	06:50 16:36	07:19 16:30
20	05:41 20:27	06:11 19:51	07:32 (11) 06:42 19:00	07:22 (11) 08:21 (11)	07:14 18:11	06:51 16:35	07:19 16:30
21	05:41 20:26	06:12 19:50	07:31 (11) 06:43 18:58	07:23 (11) 08:19 (11)	07:15 18:09	06:52 16:34	07:20 16:31
22	05:42 20:26	06:13 19:48	07:30 (11) 06:44 18:57	07:24 (11) 08:18 (11)	07:16 18:08	06:53 16:34	07:21 16:31
23	05:43 20:25	06:14 19:47	07:29 (11) 06:45 18:55	07:25 (11) 08:16 (11)	07:18 18:06	06:55 16:33	07:21 16:32
24	05:44 20:24	06:15 19:45	07:28 (11) 06:46 18:53	07:27 (11) 08:13 (11)	07:19 18:05	06:56 16:32	07:22 16:32
25	05:45 20:23	06:16 19:44	07:27 (11) 06:47 18:52	07:28 (11) 08:11 (11)	06:20 17:03	06:57 16:32	07:22 16:33
26	05:46 20:22	06:17 19:42	07:26 (11) 06:48 18:50	07:30 (11) 08:08 (11)	06:21 17:02	06:58 16:31	07:22 16:34
27	05:47 20:21	06:18 19:40	07:25 (11) 06:49 18:48	07:33 (11) 08:05 (11)	06:22 17:01	06:59 16:31	07:23 16:34
28	05:48 20:20	06:19 19:39	07:24 (11) 06:50 18:46	07:37 (11) 08:00 (11)	06:23 16:59	07:00 16:30	07:23 16:35
29	05:49 20:19	06:20 19:37	07:24 (11) 06:51 18:45	07:44 (11) 07:55 (11)	06:25 16:58	07:01 16:30	07:23 16:36
30	05:50 20:18	06:21 19:36	07:23 (11) 06:52 18:43		06:26 16:57	07:02 16:30	07:24 16:36
31	05:51 20:17	06:22 19:34	07:23 (11) 08:33 (11)		06:27 16:55		07:24 16:37
Potential sun hours	460	429	375	345	297	287	
Total, worst case		1142	1741				

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)
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SHADOW - Calendar, graphical

Calculation: ShadowFlickeringFgInc



WTGs

- 1: VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (1)
- 6: VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (6)

- 10: VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (10)
- 11: VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (11)

SHADOW - Calendar per WTG

Calculation: ShadowFlickeringFgInc WTG: 1 - VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (1)
Assumptions for shadow calculations

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

- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

	January	February	March	April	May	June
1	07:24 13:50-15:18/88 16:38	07:10 14:01-15:28/87 17:13	06:34 16:48-17:17/29 17:47	06:43 19:22	05:56 19:54	05:27 20:24
2	07:24 13:50-15:19/89 16:39	07:09 14:02-15:28/86 17:14	06:32 16:48-17:16/28 17:48	06:41 19:23	05:55 19:55	05:27 20:25
3	07:24 13:50-15:19/89 16:40	07:08 14:03-15:28/85 17:15	06:31 16:49-17:16/27 17:50	06:39 19:24	05:54 19:56	05:26 20:26
4	07:24 13:50-15:19/89 16:41	07:07 14:04-15:28/84 17:17	06:29 16:49-17:15/26 17:51	06:38 19:25	05:52 19:57	05:26 20:26
5	07:24 13:50-15:20/90 16:42	07:06 14:05-15:27/82 17:18	06:28 16:50-17:13/23 17:52	06:36 19:26	05:51 19:58	05:25 20:27
6	07:24 13:51-15:20/89 16:43	07:05 14:06-15:27/81 17:19	06:26 16:51-17:12/21 17:53	06:34 19:27	05:50 20:00	05:25 20:28
7	07:24 13:51-15:21/90 16:44	07:04 14:07-15:27/80 17:20	06:24 16:53-17:09/16 17:54	06:33 19:28	05:49 20:01	05:25 20:28
8	07:24 13:52-15:22/90 16:45	07:03 14:08-15:27/79 17:22	06:23 16:56-17:07/11 17:55	06:31 19:29	05:48 20:02	05:25 20:29
9	07:24 13:52-15:23/91 16:46	07:02 14:08-15:25/77 17:23	06:21 17:57	06:29 19:31	05:46 20:03	05:24 20:29
10	07:24 13:52-15:22/90 16:47	07:00 14:10-15:25/75 17:24	06:19 17:58	06:28 19:32	05:45 20:04	05:24 20:30
11	07:23 13:52-15:23/91 16:48	06:59 14:12-15:24/72 17:25	06:18 17:59	06:26 19:33	05:44 20:05	05:24 20:31
12	07:23 13:53-15:24/91 16:49	06:58 14:13-15:24/71 17:27	06:16 18:00	06:24 19:34	05:43 20:06	05:24 20:31
13	07:23 13:53-15:24/91 16:50	06:57 14:14-15:22/68 17:28	06:15 18:01	06:23 19:35	05:42 20:07	05:24 20:32
14	07:22 13:53-15:25/92 16:51	06:55 14:16-15:21/65 17:29	06:13 18:02	06:21 19:36	05:41 20:08	05:24 20:32
15	07:22 13:53-15:25/92 16:52	06:54 14:18-15:20/62 17:30	06:11 18:03	06:20 19:37	05:40 20:09	05:24 20:32
16	07:22 13:54-15:26/92 16:53	06:53 14:19-15:18/59 17:32	06:10 18:04	06:18 19:38	05:39 20:10	05:24 20:33
17	07:21 13:54-15:26/92 16:54	06:51 14:22-15:17/55 17:33	06:08 18:06	06:17 19:39	05:38 20:11	05:24 20:33
18	07:21 13:55-15:27/92 16:56	06:50 14:23-15:15/52 17:34	06:06 18:07	06:15 19:40	05:37 20:12	05:24 20:34
19	07:20 13:55-15:27/92 16:57	06:49 14:26-15:13/47 17:35	06:05 18:08	06:14 19:41	05:36 20:13	05:24 20:34
20	07:20 13:56-15:28/92 16:58	06:47 14:30-15:11/41 17:37	06:03 18:09	06:12 19:42	05:35 20:14	05:24 20:34
21	07:19 13:56-15:28/92 16:59	06:46 14:32-15:08/36 17:38	06:01 18:10	06:10 19:43	05:34 20:15	05:24 20:34
22	07:18 13:56-15:28/92 17:00	06:44 14:37-15:05/28 17:39	05:59 18:11	06:09 19:45	05:34 20:16	05:24 20:35
23	07:18 13:56-15:28/92 17:02	06:43 14:42-14:59/17 17:40	05:58 18:12	06:08 19:46	05:33 20:16	05:25 20:35
24	07:17 13:57-15:28/91 17:03	06:41 16:49-17:18/29 17:41	05:56 18:13	06:06 19:47	05:32 20:17	05:25 20:35
25	07:16 13:58-15:28/90 17:04	06:40 16:48-17:18/30 17:43	05:54 18:14	06:05 19:48	05:31 20:18	05:25 20:35
26	07:15 13:58-15:28/90 17:05	06:38 16:48-17:18/30 17:44	05:53 18:15	06:03 19:49	05:31 20:19	05:25 20:35
27	07:15 13:58-15:28/90 17:07	06:37 16:47-17:18/31 17:45	05:51 18:16	06:02 19:50	05:30 20:20	05:26 20:35
28	07:14 13:59-15:28/89 17:08	06:35 16:47-17:17/30 17:46	05:49 18:18	06:00 19:51	05:29 20:21	05:26 20:35
29	07:13 13:59-15:28/89 17:09		06:48 19:19	05:59 19:52	05:29 20:22	05:27 20:35
30	07:12 14:00-15:28/88 17:10		06:46 19:20	05:58 19:53	05:28 20:22	05:27 20:35
31	07:11 14:00-15:28/88 17:12		06:44 19:21		05:28 20:23	
Potential sun hours	296	297	369	399	449	453
Sum of minutes with flicker	2803	1786	181	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: ShadowFlickeringFgInc WTG: 1 - VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (1)

Assumptions for shadow calculations

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

- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

	July	August	September	October	November	December
1	05:27 20:35	05:52 20:16	06:23 19:32	06:53 18:41	06:28 13:39-14:55/76 16:54	07:03 13:34-15:05/91 16:29
2	05:28 20:35	05:53 20:15	06:24 19:31	06:54 18:40	06:29 13:38-14:55/77 16:53	07:04 13:35-15:05/90 16:29
3	05:28 20:35	05:54 20:14	06:25 19:29	06:55 18:38	06:30 13:37-14:55/78 16:52	07:05 13:35-15:06/91 16:29
4	05:29 20:35	05:55 20:12	06:26 19:27	06:57 18:36	06:32 13:37-14:57/80 16:50	07:06 13:36-15:06/90 16:29
5	05:30 20:34	05:56 20:11	06:27 19:26	06:58 17:36-17:40/4 18:35	06:33 13:35-14:57/82 16:49	07:07 13:36-15:06/90 16:28
6	05:30 20:34	05:57 20:10	06:28 19:24	06:59 17:31-17:45/14 18:33	06:34 13:34-14:57/83 16:48	07:08 13:37-15:06/89 16:28
7	05:31 20:34	05:58 20:09	06:29 19:22	07:00 17:28-17:47/19 18:31	06:35 13:33-14:58/85 16:47	07:09 13:37-15:07/90 16:28
8	05:31 20:33	05:59 20:08	06:30 19:21	07:01 17:26-17:48/22 18:30	06:36 13:34-14:59/85 16:46	07:10 13:38-15:07/89 16:28
9	05:32 20:33	06:00 20:06	06:31 19:19	07:02 17:24-17:49/25 18:28	06:38 13:33-14:59/86 16:45	07:11 13:38-15:08/90 16:28
10	05:33 20:33	06:01 20:05	06:32 19:17	07:03 17:23-17:49/26 18:26	06:39 13:32-14:59/87 16:44	07:12 13:39-15:08/89 16:28
11	05:33 20:32	06:02 20:04	06:33 19:16	07:04 17:22-17:50/28 18:25	06:40 13:32-15:00/88 16:43	07:13 13:40-15:08/88 16:28
12	05:34 20:32	06:03 20:02	06:34 19:14	07:05 17:21-17:50/29 18:23	06:41 13:32-15:00/88 16:42	07:14 13:40-15:09/89 16:28
13	05:35 20:31	06:04 20:01	06:35 19:12	07:06 17:21-17:51/30 18:21	06:43 13:31-15:00/89 16:41	07:14 13:40-15:09/89 16:28
14	05:36 20:31	06:05 20:00	06:36 19:10	07:07 17:20-17:51/31 18:20	06:44 13:32-15:01/89 16:40	07:15 13:41-15:09/88 16:29
15	05:36 20:30	06:06 19:58	06:37 19:09	07:08 17:20-17:50/30 18:18	06:45 13:31-15:01/90 16:39	07:16 13:42-15:10/88 16:29
16	05:37 20:30	06:07 19:57	06:38 19:07	07:10 17:20-17:50/30 18:17	06:46 13:31-15:01/90 16:38	07:17 13:42-15:09/87 16:29
17	05:38 20:29	06:08 19:55	06:39 19:05	07:11 17:19-17:49/30 18:15	06:47 13:31-15:01/90 16:37	07:17 13:43-15:10/87 16:29
18	05:39 20:28	06:09 19:54	06:40 19:04	07:12 17:19-17:48/29 18:14	06:49 13:31-15:02/91 16:37	07:18 13:43-15:11/88 16:30
19	05:40 20:28	06:10 19:53	06:41 19:02	07:13 15:11-15:33/22 18:12 17:21-17:48/27	06:50 13:31-15:03/92 16:36	07:19 13:43-15:11/88 16:30
20	05:41 20:27	06:11 19:51	06:42 19:00	07:14 15:06-15:37/31 18:11 17:21-17:47/26	06:51 13:31-15:03/92 16:35	07:19 13:44-15:12/88 16:30
21	05:41 20:26	06:12 19:50	06:43 18:58	07:15 15:02-15:40/38 18:09 17:22-17:46/24	06:52 13:31-15:03/92 16:34	07:20 13:44-15:12/88 16:31
22	05:42 20:25	06:13 19:48	06:44 18:57	07:16 14:58-15:42/44 18:08 17:23-17:44/21	06:53 13:32-15:04/92 16:34	07:20 13:45-15:13/88 16:31
23	05:43 20:25	06:14 19:47	06:45 18:55	07:17 14:55-15:44/49 18:06 17:24-17:42/18	06:54 13:32-15:04/92 16:33	07:21 13:45-15:13/88 16:32
24	05:44 20:24	06:15 19:45	06:46 18:53	07:19 14:53-15:46/53 18:05 17:27-17:41/14	06:56 13:32-15:04/92 16:32	07:21 13:46-15:14/88 16:32
25	05:45 20:23	06:16 19:43	06:47 18:51	06:20 13:51-14:47/56 17:03 16:30-16:37/7	06:57 13:32-15:04/92 16:32	07:22 13:46-15:14/88 16:33
26	05:46 20:22	06:17 19:42	06:48 18:50	06:21 13:48-14:48/60 17:02	06:58 13:32-15:04/92 16:31	07:22 13:46-15:14/88 16:34
27	05:47 20:21	06:18 19:40	06:49 18:48	06:22 13:46-14:49/63 17:01	06:59 13:33-15:05/92 16:31	07:23 13:48-15:15/87 16:34
28	05:48 20:20	06:19 19:39	06:50 18:46	06:23 13:45-14:51/66 16:59	07:00 13:34-15:05/91 16:30	07:23 13:48-15:16/88 16:35
29	05:49 20:19	06:20 19:37	06:51 18:45	06:24 13:43-14:52/69 16:58	07:01 13:34-15:05/91 16:30	07:23 13:48-15:16/88 16:36
30	05:50 20:18	06:21 19:36	06:52 18:43	06:26 13:42-14:52/70 16:57	07:02 13:34-15:05/91 16:30	07:23 13:48-15:16/88 16:36
31	05:51 20:17	06:22 19:34		06:27 13:40-14:53/73 16:55		07:24 13:48-15:17/89 16:37
Potential sun hours	460	429	375	345	297	287
Sum of minutes with flicker	0	0	0	1178	2635	2747

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: ShadowFlickeringFgInc WTG: 2 - VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (2)

Assumptions for shadow calculations

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

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

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

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:24 16:38	07:10 17:13	06:34 17:47	06:43 19:22	05:56 19:54	05:27 20:24	05:28 20:35	05:52 20:16	06:23 19:32	06:54 18:41	06:28 16:54	07:04 16:29
2	07:24 16:39	07:09 17:14	06:32 17:49	06:41 19:23	05:55 19:55	05:27 20:25	05:28 20:35	05:53 20:15	06:24 19:31	06:55 18:40	06:29 16:53	07:05 16:29
3	07:24 16:40	07:08 17:15	06:31 17:50	06:39 19:24	05:54 19:57	05:26 20:26	05:29 20:35	05:54 20:14	06:25 19:29	06:56 18:38	06:31 16:52	07:06 16:29
4	07:24 16:41	07:07 17:17	06:29 17:51	06:38 19:25	05:53 19:58	05:26 20:27	05:29 20:35	05:55 20:13	06:26 19:28	06:57 18:36	06:32 16:51	07:07 16:29
5	07:24 16:42	07:06 17:18	06:28 17:52	06:36 19:26	05:51 19:59	05:25 20:27	05:30 20:35	05:56 20:11	06:27 19:26	06:58 18:35	06:33 16:49	07:08 16:28
6	07:24 16:43	07:05 17:19	06:26 17:53	06:34 19:27	05:50 20:00	05:25 20:28	05:30 20:34	05:57 20:10	06:28 19:24	06:59 18:33	06:34 16:48	07:09 16:28
7	07:24 16:44	07:04 17:21	06:25 17:54	06:33 19:29	05:49 20:01	05:25 20:29	05:31 20:34	05:58 20:09	06:29 19:22	07:00 18:31	06:35 16:47	07:10 16:28
8	07:24 16:45	07:03 17:22	06:23 17:56	06:31 19:30	05:48 20:02	05:25 20:29	05:32 20:34	05:59 20:08	06:30 19:21	07:01 18:30	06:37 16:46	07:10 16:28
9	07:24 16:46	07:02 17:23	06:21 17:57	06:29 19:31	05:46 20:03	05:24 20:30	05:32 20:33	06:00 20:07	06:31 19:19	07:02 18:28	06:38 16:45	07:11 16:28
10	07:24 16:47	07:01 17:24	06:20 17:58	06:28 19:32	05:45 20:04	05:24 20:30	05:33 20:33	06:01 20:05	06:32 19:17	07:03 18:26	06:39 16:44	07:12 16:28
11	07:24 16:48	06:59 17:26	06:18 17:59	06:26 19:33	05:44 20:05	05:24 20:31	05:34 20:33	06:02 20:04	06:33 19:16	07:04 18:25	06:40 16:43	07:13 16:28
12	07:23 16:49	06:58 17:27	06:16 18:00	06:25 19:34	05:43 20:06	05:24 20:31	05:34 20:32	06:03 20:03	06:34 19:14	07:05 18:23	06:42 16:42	07:14 16:28
13	07:23 16:50	06:57 17:28	06:15 18:01	06:23 19:35	05:42 20:07	05:24 20:32	05:35 20:32	06:04 20:01	06:35 19:12	07:06 18:22	06:43 16:41	07:15 16:28
14	07:23 16:51	06:56 17:29	06:13 18:02	06:21 19:36	05:41 20:08	05:24 20:32	05:36 20:31	06:05 20:00	06:36 19:11	07:07 18:20	06:44 16:40	07:16 16:29
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31	07:11 17:12		06:44 19:21		05:28 20:24		05:51 20:17	06:22 19:34		06:27 16:55		07:24 16:37
Potential sun hours	296	297	369	399	449	453	460	429	375	345	297	287
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: ShadowFlickeringFgInc WTG: 3 - VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (3)

Assumptions for shadow calculations

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

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

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

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:24 16:38	07:10 17:13	06:34 17:47	06:43 19:22	05:56 19:54	05:27 20:24	05:27 20:35	05:52 20:16	06:23 19:32	06:53 18:41	06:28 16:54	07:03 16:29
2	07:24 16:39	07:09 17:14	06:32 17:49	06:41 19:23	05:55 19:55	05:27 20:25	05:28 20:35	05:53 20:15	06:24 19:31	06:54 18:40	06:29 16:53	07:04 16:29
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Potential sun hours	296	297	369	399	449	453	460	429	375	345	297	287
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: ShadowFlickeringFgInc WTG: 4 - VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (4)
Assumptions for shadow calculations

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

- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:24 16:38	07:10 17:13	06:34 17:47	06:43 19:22	05:56 19:54	05:27 20:24	05:27 20:35	05:52 20:16	06:23 19:32	06:53 18:41	06:28 16:54	07:03 16:29
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Potential sun hours	296	297	369	399	449	453	460	429	375	345	297	287
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: ShadowFlickeringFgInc WTG: 5 - VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (5)

Assumptions for shadow calculations

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

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

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

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
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4	07:24 16:41	07:07 17:17	06:29 17:51	06:38 19:25	05:52 19:57	05:26 20:26	05:29 20:35	05:55 20:13	06:26 19:27	06:57 18:36	06:32 16:50	07:07 16:29
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31	07:11 17:12		06:44 19:21		05:28 20:23		05:51 20:17	06:22 19:34		06:27 16:55		07:24 16:37
Potential sun hours	296	297	369	399	449	453	460	429	375	345	297	287
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

Project:

ZVI_Foggialncoronata

Licensed user:

Iron solar s.r.l.

via Lanzone, 31

IT-20122 Milano

+393487125089

Fabio Paccapelo / francesca.saccarola@hopegroup.it

Calculated:

04/05/2023 09:44/3.6.361

SHADOW - Calendar per WTG

Calculation: ShadowFlickeringFgInc WTG: 6 - VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (6)

Assumptions for shadow calculations

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

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

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

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:24 16:38	07:10 17:13	06:34 17:47	06:43 19:22	05:56 19:54	19:01-19:08/7 20:24	05:27 20:25	05:27 20:16	05:52 20:11	06:23 19:32	06:53 18:41	06:28 16:54	07:03 16:29
2	07:24 16:39	07:09 17:14	06:32 17:48	06:41 19:23	05:55 19:55	05:27 20:25	05:28 20:15	05:53 20:15	06:24 19:31	06:54 18:40	06:30 16:53	07:04 16:29	07:04 16:29
3	07:24 16:40	07:08 17:15	06:31 17:50	06:39 19:24	05:54 19:56	05:26 20:26	05:28 20:35	05:54 20:14	06:25 19:29	06:55 18:38	06:30 16:52	07:05 16:29	07:05 16:29
4	07:24 16:41	07:07 17:17	06:29 17:51	06:38 19:25	05:52 19:57	05:26 20:26	05:29 20:35	05:55 20:12	06:26 19:27	06:57 18:36	06:32 16:50	07:06 16:29	07:06 16:29
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8	07:24 16:45	07:03 17:22	06:23 17:55	06:31 19:29	05:48 20:02	05:25 20:29	05:31 20:34	05:59 20:08	06:30 19:21	07:01 18:30	06:37 16:46	07:10 16:28	07:10 16:28
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11	07:23 16:48	06:59 17:25	06:18 17:59	06:26 19:33	05:44 20:05	05:24 20:31	05:33 20:32	06:02 20:04	06:33 19:16	07:04 18:25	06:40 16:43	07:13 16:28	07:13 16:28
12	07:23 16:49	06:58 17:27	06:16 18:00	06:24 19:34	05:43 20:06	05:24 20:31	05:34 20:32	06:03 20:02	19:08-19:17/9 19:14	06:34 18:23	07:05 16:42	07:14 16:28	07:14 16:28
13	07:23 16:50	06:57 17:28	06:15 18:01	06:23 19:35	05:42 20:07	05:24 20:32	05:35 20:31	06:04 20:01	19:05-19:19/14 19:12	06:35 18:21	07:06 16:41	07:15 16:28	07:15 16:28
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15	07:22 16:52	06:54 17:30	06:11 18:03	06:20 19:37	05:40 20:09	05:24 20:33	05:36 20:30	06:06 19:58	19:02-19:22/20 19:09	06:37 18:18	07:08 16:39	07:16 16:29	07:16 16:29
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17	07:21 16:54	06:51 17:33	06:08 18:06	06:17 19:39	05:38 20:11	05:24 20:33	05:38 20:29	06:08 19:55	19:00-19:24/24 19:05	06:39 18:15	07:11 16:37	07:17 16:29	07:17 16:29
18	07:21 16:56	06:50 17:34	06:06 18:07	06:15 19:40	05:37 20:12	05:24 20:34	05:39 20:28	06:09 19:54	18:59-19:24/25 19:04	06:40 18:14	07:12 16:37	07:18 16:30	07:18 16:30
19	07:20 16:57	06:49 17:35	06:05 18:08	06:14 19:41	05:36 20:13	05:24 20:34	05:40 20:28	06:10 19:53	18:58-19:24/26 19:02	06:41 18:12	07:13 16:36	07:19 16:30	07:19 16:30
20	07:20 16:58	06:47 17:37	06:03 18:09	06:12 19:42	05:35 20:14	05:24 20:34	05:41 20:27	06:11 19:51	18:58-19:24/26 19:00	06:42 18:11	07:14 16:35	07:19 16:30	07:19 16:30
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Potential sun hours	296	297	369	399	449	453	460	429	408	375	345	297	287
Sum of minutes with flicker	0	0	0	402	7	0	0	408	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

Project:

ZVI_Foggialncoronata

Licensed user:

Iron solar s.r.l.

via Lanzone, 31

IT-20122 Milano

+393487125089

Fabio Paccapelo / francesca.saccarola@hopegroup.it

Calculated:

04/05/2023 09:44/3.6.361

SHADOW - Calendar per WTG

Calculation: ShadowFlickeringFgInc WTG: 7 - VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (7)

Assumptions for shadow calculations

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

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

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

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:24 16:38	07:10 17:13	06:34 17:47	06:42 19:22	05:56 19:54	05:27 20:24	05:27 20:35	05:52 20:16	06:23 19:32	06:53 18:41	06:28 16:54	07:03 16:29
2	07:24 16:39	07:09 17:14	06:32 17:48	06:41 19:23	05:55 19:55	05:26 20:25	05:28 20:35	05:53 20:15	06:24 19:31	06:54 18:39	06:29 16:53	07:04 16:29
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13	07:23 16:50	06:57 17:28	06:14 18:01	06:23 19:35	05:42 20:07	05:24 20:31	05:35 20:31	06:04 20:01	06:35 19:12	07:06 18:21	06:42 16:41	07:14 16:28
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19	07:20 16:57	06:48 17:35	06:04 18:08	06:13 19:41	05:36 20:13	05:24 20:34	05:40 20:28	06:10 19:52	06:41 19:02	07:13 18:12	06:50 16:36	07:19 16:30
20	07:19 16:58	06:47 17:36	06:03 18:09	06:12 19:42	05:35 20:14	05:24 20:34	05:40 20:27	06:11 19:51	06:42 19:00	07:14 18:11	06:51 16:35	07:19 16:30
21	07:19 16:59	06:46 17:38	06:01 18:10	06:10 19:43	05:34 20:14	05:24 20:34	05:41 20:26	06:12 19:49	06:43 18:58	07:15 18:09	06:52 16:34	07:20 16:31
22	07:18 17:00	06:44 17:39	05:59 18:11	06:09 19:44	05:33 20:15	05:24 20:35	05:42 20:25	06:13 19:48	06:44 18:57	07:16 18:08	06:53 16:34	07:20 16:31
23	07:18 17:01	06:43 17:40	05:58 18:12	06:07 19:45	05:33 20:16	05:24 20:35	05:43 20:24	06:14 19:46	06:45 18:55	07:17 18:06	06:54 16:33	07:21 16:32
24	07:17 17:03	06:41 17:41	05:56 18:13	06:06 19:47	05:32 20:17	05:25 20:35	05:44 20:24	06:15 19:45	06:46 18:53	07:19 18:05	06:55 16:32	07:21 16:32
25	07:16 17:04	06:40 17:42	05:54 18:14	06:04 19:48	05:31 20:18	05:25 20:35	05:45 20:23	06:16 19:43	06:47 18:51	07:20 17:03	06:57 16:32	07:22 16:33
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31	07:11 17:11		06:44 19:21		05:27 20:23		05:51 20:17	06:22 19:34		06:27 16:55		07:23 16:37
Potential sun hours	296	297	369	399	449	453	460	429	375	345	297	287
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: ShadowFlickeringFgInc WTG: 8 - VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (8)

Assumptions for shadow calculations

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

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

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

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:24 16:38	07:10 17:13	06:34 17:47	06:42 19:22	05:56 19:54	05:27 20:24	05:27 20:35	05:52 20:16	06:23 19:32	06:53 18:41	06:28 16:54	07:03 16:29
2	07:24 16:39	07:09 17:14	06:32 17:48	06:41 19:23	05:55 19:55	05:27 20:25	05:28 20:35	05:53 20:15	06:24 19:31	06:54 18:39	06:29 16:53	07:04 16:29
3	07:24 16:40	07:08 17:15	06:31 17:50	06:39 19:24	05:54 19:56	05:26 20:25	05:28 20:35	05:54 20:14	06:25 19:29	06:55 18:38	06:30 16:52	07:05 16:29
4	07:24 16:41	07:07 17:17	06:29 17:51	06:37 19:25	05:52 19:57	05:26 20:26	05:29 20:35	05:55 20:12	06:26 19:27	06:56 18:36	06:32 16:50	07:06 16:28
5	07:24 16:42	07:06 17:18	06:27 17:52	06:36 19:26	05:51 19:58	05:25 20:27	05:29 20:34	05:55 20:11	06:27 19:26	06:57 18:34	06:33 16:49	07:07 16:28
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31	07:11 17:11		06:44 19:21		05:27 20:23		05:51 20:17	06:22 19:34		06:27 16:55		07:24 16:37
Potential sun hours	296	297	369	399	449	453	460	429	375	345	297	287
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

Project:

ZVI_Foggialncoronata

Licensed user:

Iron solar s.r.l.

via Lanzone, 31

IT-20122 Milano

+393487125089

Fabio Paccapelo / francesca.saccarola@hopegroup.it

Calculated:

04/05/2023 09:44/3.6.361

SHADOW - Calendar per WTG

Calculation: ShadowFlickeringFgInc WTG: 9 - VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (9)

Assumptions for shadow calculations

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

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

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

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:24 16:38	07:10 17:13	06:34 17:47	06:42 19:22	05:56 19:54	05:27 20:24	05:27 20:35	05:52 20:16	06:23 19:32	06:53 18:41	06:28 16:54	07:03 16:29
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23	07:18 17:02	06:43 17:40	05:58 18:12	06:07 19:46	05:33 20:16	05:24 20:35	05:43 20:24	06:14 19:46	06:45 18:55	07:17 18:06	06:54 16:33	07:21 16:32
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Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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-Last time (hh:mm) with flicker/Minutes with flicker
Sun set (hh:mm) First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

SHADOW - Calendar per WTG

Calculation: ShadowFlickeringFgInc WTG: 10 - VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (10)

Assumptions for shadow calculations

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

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

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The WTG is always operating

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2	07:24 16:39	07:09 17:14	06:32 17:48	06:41 19:23	05:55 19:55	05:27 20:25	05:28 20:35	05:53 20:15	06:24 19:31	06:54 18:40	16:33-17:47/74	06:29 16:53
3	07:24 16:40	07:08 17:15	06:31 17:50	06:39 19:24	05:54 19:56	05:26 20:26	05:28 20:35	05:54 20:14	06:25 19:29	06:55 18:38	16:32-17:46/74	06:30 16:52
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7	07:24 16:44	07:04 17:20	06:24 17:54	06:33 19:28	05:49 20:01	05:25 20:28	05:31 20:34	05:58 20:09	06:29 19:22	07:00 18:31	17:03-17:40/37	06:35 16:47
8	07:24 16:45	07:03 17:22	06:23 17:55	06:31 19:29	05:47 20:02	05:24 20:29	05:31 20:33	05:59 20:08	06:30 19:21	07:00 18:30	17:00-17:42/42	06:36 16:46
9	07:24 16:46	07:02 17:23	06:21 17:57	06:29 19:30	05:46 20:03	05:24 20:29	05:32 20:33	06:00 20:06	06:31 19:19	07:02 18:28	16:57-17:43/46	06:38 16:45
10	07:23 16:47	07:00 17:24	06:19 17:58	06:28 19:32	05:45 20:04	05:24 20:30	05:33 20:33	06:01 20:05	06:32 19:17	07:03 18:26	16:55-17:44/49	06:39 16:44
11	07:23 16:48	06:59 17:25	06:18 17:59	06:26 19:33	05:44 20:05	05:24 20:31	05:33 20:32	06:02 20:04	06:33 19:16	07:04 18:25	16:53-17:45/52	06:40 16:43
12	07:23 16:49	06:58 17:27	06:16 18:00	06:24 19:34	05:43 20:06	05:24 20:31	05:34 20:32	06:03 20:02	06:34 19:14	07:05 18:23	16:51-17:46/55	06:41 16:42
13	07:23 16:50	06:57 17:28	06:14 18:01	06:23 19:35	05:42 20:07	05:24 20:32	05:35 20:31	06:04 20:01	06:35 19:12	07:06 18:21	16:49-17:47/58	06:42 16:41
14	07:22 16:51	06:55 17:29	06:13 18:02	06:21 19:36	05:41 20:08	05:24 20:32	05:36 20:31	06:05 20:00	06:36 19:10	07:07 18:20	16:47-17:47/60	06:44 16:40
15	07:22 16:52	06:54 17:30	06:11 18:03	06:20 19:37	05:40 20:09	05:24 20:32	05:36 20:30	06:06 19:58	06:37 19:09	07:08 18:18	16:46-17:48/62	06:45 16:39
16	07:22 16:53	06:53 17:32	06:10 18:04	06:18 19:38	05:39 20:10	05:24 20:33	05:37 20:30	06:07 19:57	06:38 19:07	07:09 18:17	16:44-17:48/64	06:46 16:38
17	07:21 16:54	06:51 17:33	06:08 18:05	06:17 19:39	05:38 20:11	05:24 20:33	05:38 20:29	06:08 19:55	06:39 19:05	07:11 18:15	16:43-17:49/66	06:47 16:37
18	07:21 16:55	06:50 17:34	06:06 18:07	06:15 19:40	05:37 20:12	05:24 20:34	05:39 20:28	06:09 19:54	06:40 19:03	07:12 18:14	16:42-17:49/67	06:48 16:36
19	07:20 16:57	06:49 17:35	06:04 18:08	06:13 19:41	05:36 20:13	05:24 20:34	05:40 20:28	06:10 19:52	06:41 19:02	07:13 18:12	16:41-17:49/68	06:50 16:36
20	07:20 16:58	06:47 17:37	06:03 18:09	06:12 19:42	05:35 20:14	05:24 20:34	05:41 20:27	06:11 19:51	06:42 19:00	07:14 18:11	16:39-17:49/70	06:51 16:35
21	07:19 16:59	06:46 17:38	06:01 18:10	06:10 19:43	05:34 20:15	05:24 20:34	05:41 20:26	06:12 19:50	06:43 18:58	07:15 18:09	16:38-17:49/71	06:52 16:34
22	07:18 17:00	06:44 17:39	05:59 18:11	06:09 19:44	05:34 20:16	05:24 20:35	05:42 20:25	06:13 19:48	06:44 18:57	07:16 18:08	16:37-17:49/72	06:53 16:31
23	07:18 17:02	06:43 17:40	05:58 18:12	06:07 19:46	05:33 20:16	05:25 20:35	05:43 20:24	06:14 19:46	06:45 18:55	07:17 18:06	16:36-17:49/73	06:54 16:32
24	07:17 17:03	06:41 17:41	05:56 18:13	06:06 19:47	05:32 20:17	05:25 20:35	05:44 20:24	06:15 19:45	06:46 18:53	07:19 18:05	16:36-17:49/73	06:56 16:32
25	07:16 17:04	06:40 17:43	05:54 18:14	06:05 19:48	05:31 20:18	05:25 20:35	05:45 20:23	06:16 19:43	06:47 18:51	07:20 17:03	16:35-17:49/74	06:57 16:32
26	07:15 17:05	06:38 17:44	05:53 18:15	06:03 19:49	05:30 20:19	05:25 20:35	05:46 20:22	06:17 19:42	06:48 18:50	07:21 17:02	16:34-17:49/75	06:58 16:31
27	07:15 17:06	06:37 17:45	05:51 18:16	06:02 19:50	05:30 20:20	05:26 20:35	05:47 20:21	06:18 19:40	06:49 18:48	07:22 17:01	16:34-17:48/74	06:59 16:34
28	07:14 17:08	06:35 17:46	05:49 18:18	06:00 19:51	05:29 20:21	05:26 20:35	05:48 20:20	06:19 19:39	06:50 18:46	07:23 16:59	16:33-17:48/75	07:00 16:35
29	07:13 17:09	06:34 17:46	05:48 18:19	05:59 19:52	05:29 20:22	05:27 20:35	05:49 20:19	06:20 19:37	06:51 18:45	07:24 16:58	16:33-17:48/75	07:01 16:36
30	07:12 17:10	06:33 17:45	05:46 18:20	05:58 19:53	05:28 20:22	05:27 20:35	05:50 20:18	06:21 19:35	06:52 18:43	07:25 16:57	16:32-17:47/75	07:02 16:36
31	07:11 17:12	06:32 17:44	05:44 18:21	05:56 19:54	05:28 20:23	05:25 20:35	05:51 20:17	06:22 19:34	06:53 18:42	07:26 16:55	16:31-17:47/75	07:24 16:37
Potential sun hours	296	297	369	399	449	453	460	429	375	1610	1265	287
Sum of minutes with flicker	0	382	2141	307	0	0	0	0	0	1610	1265	0

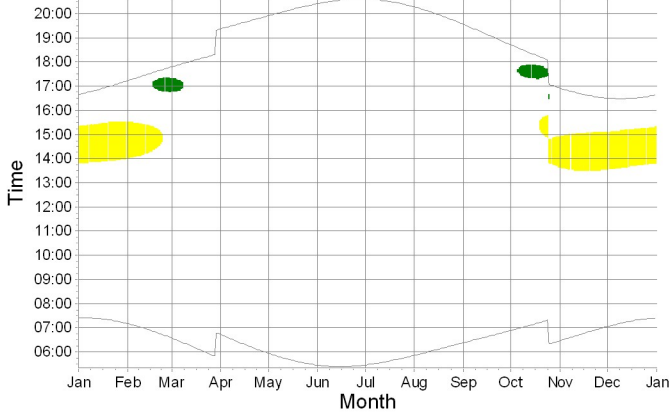
Table layout: For each day in each month the following matrix apply

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

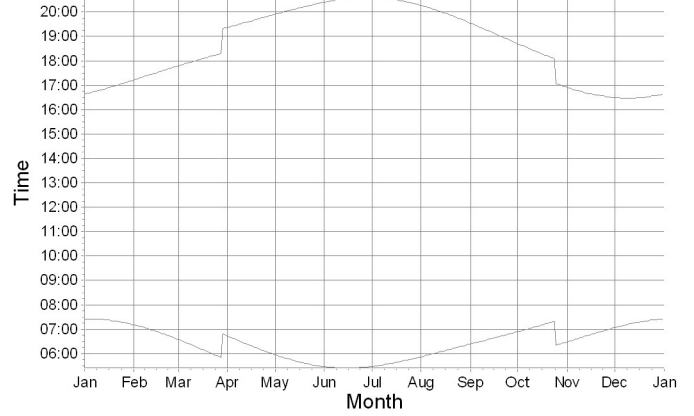
SHADOW - Calendar per WTG, graphical

Calculation: ShadowFlickeringFgInc

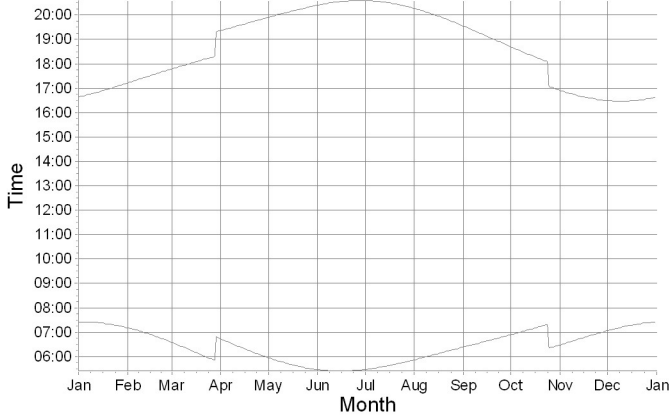
1: VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (1)



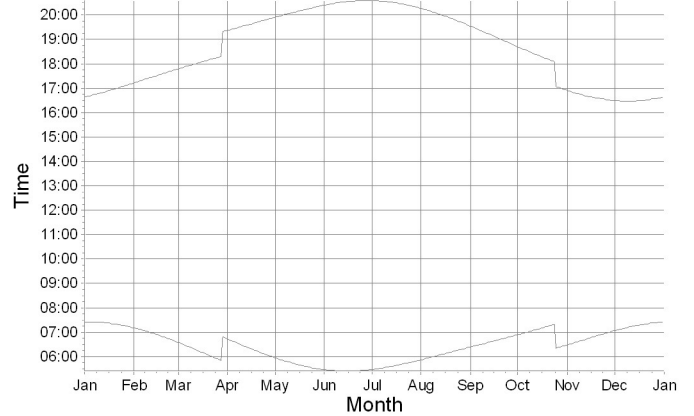
2: VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (2)



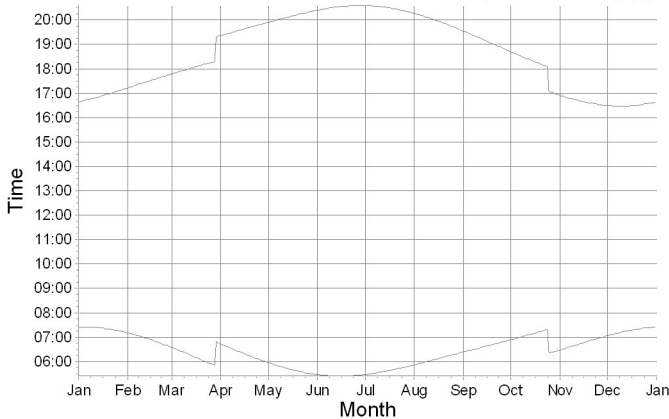
3: VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (3)



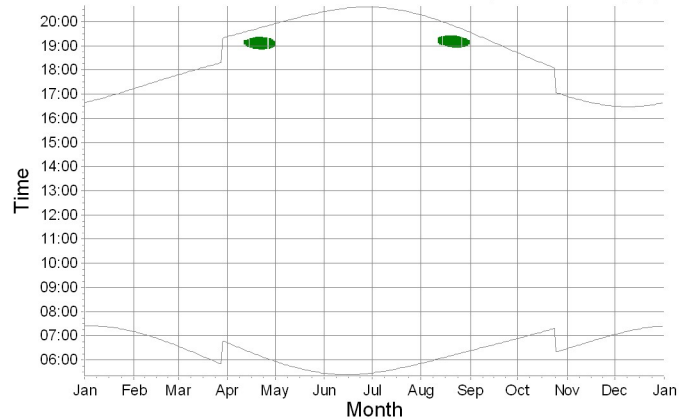
4: VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (4)



5: VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (5)



6: VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (6)



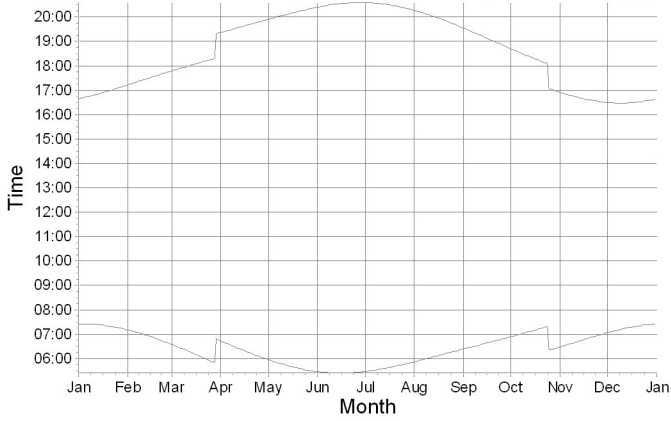
Shadow receptors

- A: Shadow Receptor: 1.0 × 1.0 Azimuth: 60.0° Slope: 90.0° (1)
- B: Shadow Receptor: 1.0 × 1.0 Azimuth: 50.0° Slope: 90.0° (2)

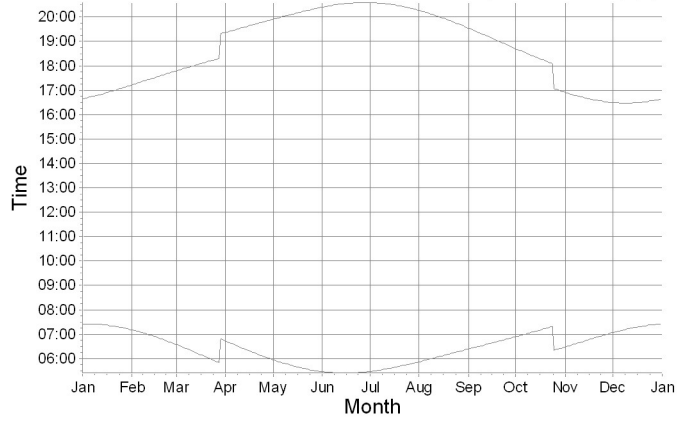
SHADOW - Calendar per WTG, graphical

Calculation: ShadowFlickeringFgInc

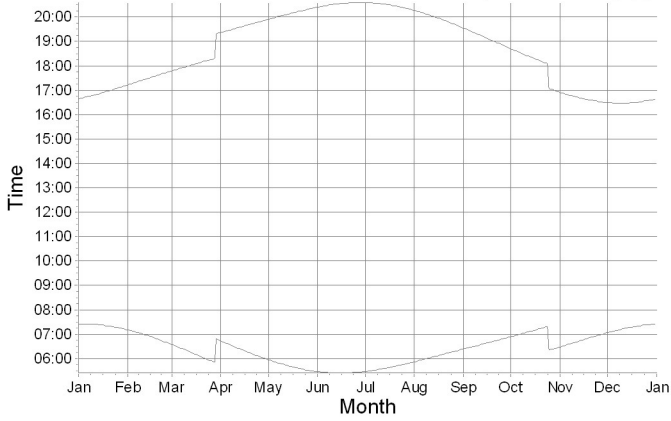
7: VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (7)



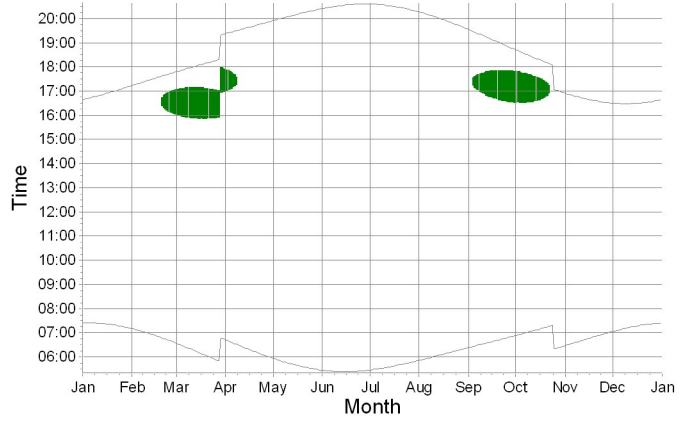
8: VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (8)



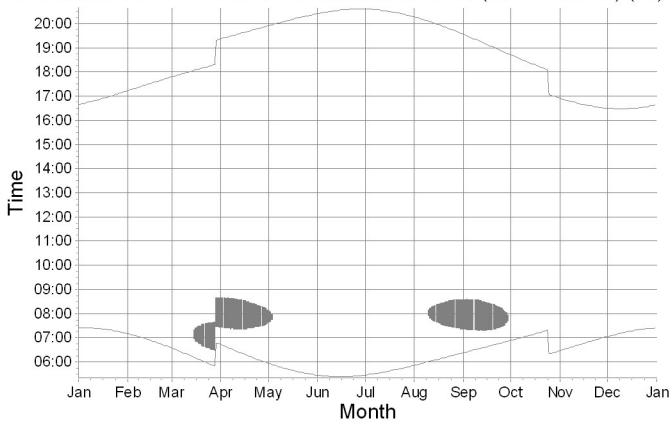
9: VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (9)



10: VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (10)



11: VESTAS V172-7.2 7200 172.0 !O! hub: 150.0 m (TOT: 236.0 m) (11)



Shadow receptors



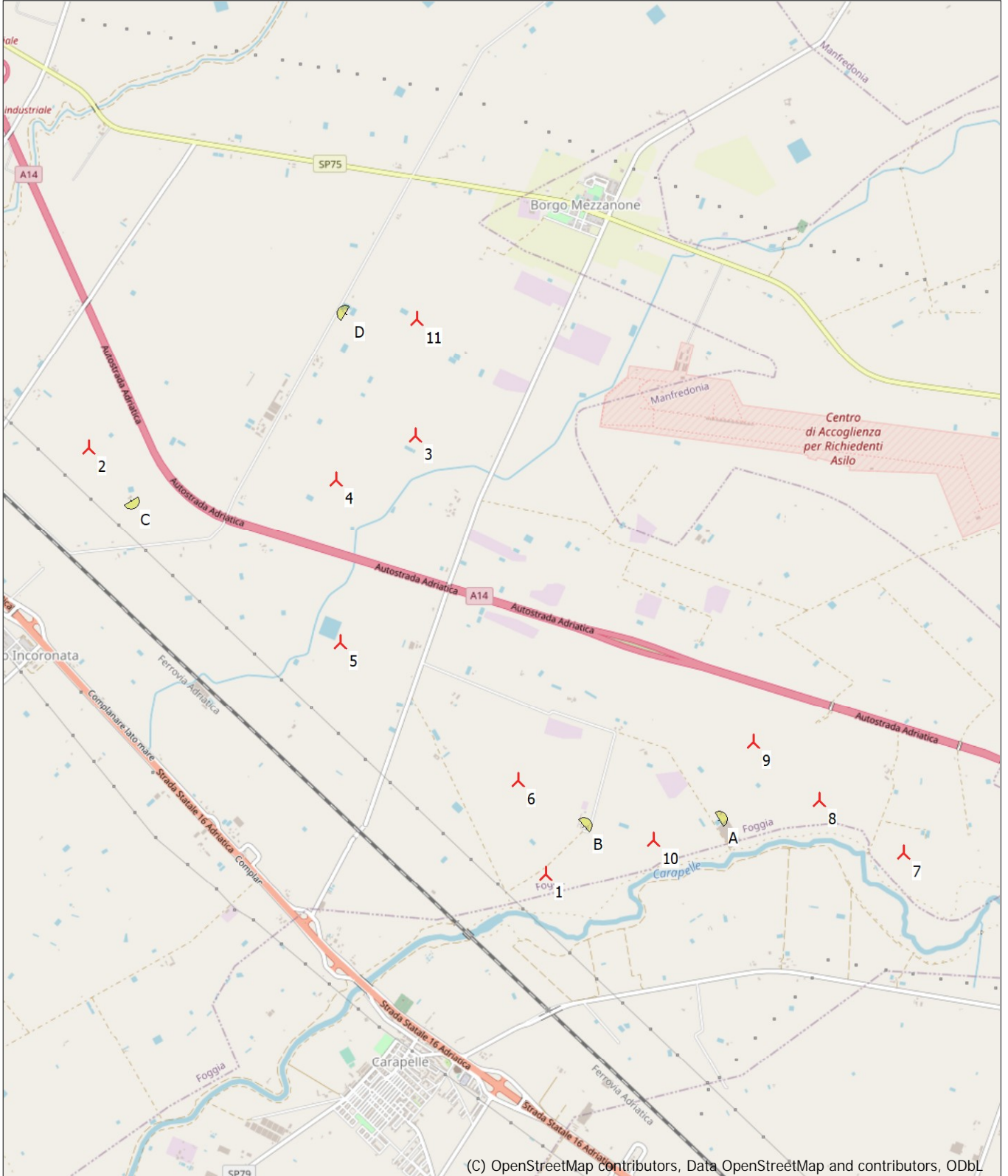
A: Shadow Receptor: 1.0 × 1.0 Azimuth: 60.0° Slope: 90.0° (1)



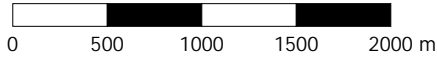
D: Shadow Receptor: 1.0 × 1.0 Azimuth: -60.0° Slope: 90.0° (4)

SHADOW - Map

Calculation: ShadowFlickeringFgInc



(C) OpenStreetMap contributors, Data OpenStreetMap and contributors, ODbL



Map: EMD OpenStreetMap , Print scale 1:40,000, Map center UTM (north)-WGS84 Zone: 33 East: 558,676 North: 4,582,905

New WTG Shadow receptor

Flicker map level: Elevation Grid Data Object: ZVI_Foggialncoronata_EMDGrid_0.wpg (1)