NARBONIS Wind Srl

Parco Eolico Narbonis sito nel Comune di San Gavino Monreale

Analisi degli effetti di shadow - flickering

[Giugno 2022]

Regione Autonoma
della Sardegna

Comune di
San Gavino Monreale

Committente:

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Titolo del Progetto:

Parco Eolico Narbonis sito nel Comune di San Gavino Monreale

Documento:

Analisi degli effetti di shadow - flickering

N° Documento:

IT-VesNar-CLP-ENV-SF-TR-01-Rev.0

A cura di:

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Rev	Data Revisione	Descrizione	Redatto	Controllato	Approvato
0	30/06/2022	Emissione	IAT	GF	GF

Sommario

1 Criteri generali di analisi e valutazione

Il presente elaborato, facente parte integrante dello Studio di impatto ambientale allegato al progetto del parco eolico "Narbonis", proposto dalla Narbonis Wind S.r.l. (società di proprietà di Wind Power Development A/S, controllata da Vestas Wind Systems A/S), in territorio di San Gavino Monreale (VS), esamina compiutamente il potenziale disturbo da ombreggiamento intermittente (*shadow flickering*) sui potenziali ricettori individuati nell'area interessata dal proposto impianto, entro una distanza indicativa di 1000 metri dagli aerogeneratori.
A tal fine, nel seguito, si farà riferimento alla ricognizione sugli edifici esistenti eseguita nell'ambito della definizione del layout di impianto e dell'analisi ambientale, i cui risultati sono riepilogati in opportune "schede fabbricati" all'interno di apposito report allegato al progetto del parco eolico.
Sotto il profilo metodologico, il documento è strutturato in una sezione introduttiva atta a descrivere la natura del fenomeno dell'ombreggiamento intermittente e le ipotesi alla base dei calcoli previsionali, eseguiti a mezzo di specifico software specialistico.

2 Descrizione del fenomeno

Un ostacolo solido opaco posto tra il sole e il terreno genera un'ombra. Generalmente se l'ostacolo è fermo, l'ombra si proietta al suolo seguendo le regole del movimento relativo del sole sull'orizzonte. Le dimensioni dell'ombra proiettata sono funzione inversa dell'angolo che i raggi del sole formano sull'orizzonte per cui si ha la massima dimensione (elongazione sul terreno) dell'ombra all'alba ed al tramonto con il minimo quando il sole raggiunge la massima altezza (mezzogiorno).
Anche gli aerogeneratori durante il giorno proiettano un'ombra che in parte è fissa (torre e navicella) e in parte è mobile (pale del rotore).
Se l'ombra del rotore in movimento si proietta sulle aperture di un fabbricato può venirsi a creare l'effetto di ombra intermittente o *shadow flickering* (sfarfallio dell'ombra); in talune circostanze, tale fenomeno di pulsazioni "luce – ombra" può potenzialmente essere all'origine di un disturbo alle normali attività che possono svolgersi all'interno dell'ambiente abitativo.
Il fenomeno si verifica durante il giorno in presenza di cielo sereno ed in assenza di ostacoli naturali, quali vegetazione, alberi, muri ecc., e con le turbine in movimento.
Per le ragioni anzidette, a distanze turbine-ricettore superiori a circa 300 metri solitamente il fenomeno di *shadow flickering* si manifesta all'alba o al tramonto, allorquando le ombre proiettate sono sufficientemente lunghe. Per le stesse ragioni il tremolio dell'ombra è un fenomeno particolarmente avvertito nelle regioni del nord Europa (Germania, Danimarca, ecc.) piuttosto che alle latitudini del Mediterraneo.
L'intensità del *shadow flickering* è definita come la differenza in luminosità, in un determinato sito, in presenza ed assenza di un'ombra.
Di seguito si riassumono alcuni aspetti caratteristici del fenomeno:

- la pala delle turbine eoliche è stretta in corrispondenza dell'estremità più esterna ed assume progressivamente maggiore larghezza verso la giunzione con il mozzo. Quando una turbina è posizionata sufficientemente vicino ad un ricettore, cosicché la porzione più larga della pala oscura una porzione maggiore del campo visivo (o meglio del disco solare), l'intensità di *shadow flickering* aumenterà. A distanze maggiori l'intensità del fenomeno sarà minore in quanto le pale copriranno una porzione inferiore del disco solare;
- l'intensità del *shadow flickering* è più bassa quando l'ombra che intercetta un ricettore si origina dall'estremità esterna del rotore (minore spessore della pala). L'intensità aumenterà allorché l'ombra si muove lungo lo sviluppo della pala fino ad arrivare ad un massimo in corrispondenza del mozzo; a tal punto l'intensità diminuisce quando l'ombra si sposta verso l'estremità della pala opposta;
- bassi impatti da *shadow flickering* sono generalmente indicativi di grandi distanze tra turbine e ricettore e ombre incidenti originate dalle estremità del rotore;
- situazioni di precaria visibilità determineranno modeste intensità di *S. flickering*;
- a distanze ancora maggiori le ombre proiettate risulteranno "fuori-fuoco". Ciò non è causa di un'intensità inferiore del *shadow flickering* ma contribuisce a rendere meno distinto il fenomeno;
- all'interno di un ambiente ben illuminato le ombre svaniscono. Conseguentemente l'accensione di luci in un ambiente riduce l'incidenza del *shadow flickering*;

- schermare una finestra (con tende o quant'altro) previene il fenomeno;
- schermare un edificio (ad esempio con alberature) può rappresentare una misura di mitigazione per prevenire il fenomeno.

La frequenza di pulsazione del tremolio dell'ombra è proporzionale alla velocità di rotazione del rotore. La tipica frequenza di passo fra le pale del rotore (tripala) è compresa tra 0.6 ed 1 Hz (velocità con cui le pale passano attraverso una posizione specifica).
Nel caso specifico, considerando un rotore del diametro indicativo di 162 metri con una velocità massima nominale di rotazione di circa 12.5 RPM si avrà una frequenza di passo pari a circa 0,6 Hz. Tali frequenze di oscillazione luminosa sono prive di rischi significativi per la salute.
Ricerche finalizzate alla definizione di relazioni cause-effetto tra fenomeni stroboscopici ed attacchi epilettici (Graham e Pamela Harding della *Aston University* e Arnold Wilkins della *University of Essex*) attestano che, al fine di escludere rischi sulla salute, le turbine eoliche dovrebbero ruotare a velocità superiori a 60 RPM (velocità di passo 5 volte superiori a quella degli aerogeneratori in progetto, superiori a 3 Hz). Peraltro, non può disconoscersi come il fenomeno del *shadow flickering* possa talvolta costituire, in particolari situazioni, un disturbo per i ricettori più esposti.
Per analizzare i risultati e quindi definire l'effettiva portata del disturbo, è dunque fondamentale conoscere l'esatta destinazione del fabbricato ricettore. Nel seguito saranno considerati potenziali ricettori i soli edifici che, sulla base delle informazioni disponibili e delle verifiche condotte in sito, potrebbero prudenzialmente ricondursi alla fattispecie di "ambienti abitativi".

3 Individuazione dei ricettori

Per le finalità del presente studio, con l'intento di meglio inquadrare i criteri di individuazione dei potenziali edifici sensibili (o ricettori) del proposto impianto eolico, si ritiene opportuno richiamare i contenuti della D.G.R. RAS 59/90 del 2020 e s.m.i. (*Individuazione delle aree non idonee all'installazione di impianti energetici alimentati da fonti energetiche rinnovabili*) e segnatamente al punto 4.3.3 "*Distanze di rispetto dagli insediamenti rurali*".
"*Al fine di limitare gli impatti visivi, acustici e di ombreggiamento, ogni singolo aerogeneratore dovrà rispettare una distanza pari a:*

- *300 metri da corpi aziendali ad utilizzazione agro-pastorale in cui sia accertata la presenza continuativa di personale in orario diurno (h. 6.00 – 22.00);*
- *500 metri da corpi aziendali ad utilizzazione agro-pastorale in cui sia accertata la presenza continuativa di personale in orario notturno (h. 22.00 – 6.00), o case rurali ad utilizzazione residenziale di carattere stagionale;*
- *700 metri da nuclei e case sparse nell'agro, destinati ad uso residenziale, così come definiti all'art. 82 delle NTA del PPR.*"

Secondo tale impostazione, pertanto, possono individuarsi le seguenti categorie di edifici:

Cat.1 – Case rurali ad utilizzazione residenziale (Categoria catastale A);

Cat. 2a – corpi aziendali ad utilizzazione agro-pastorale in cui sia accertata la presenza continuativa di personale in orario notturno;

Cat. 2b – corpi aziendali ad utilizzazione agro-pastorale in cui sia accertata la presenza continuativa di personale in orario diurno;

Cat. 3 – fabbricati ad utilizzazione agro-pastorale con presenza discontinua di personale;

Cat. 4 – fabbricati di supporto alle attività agricole (ricoveri, depositi, stalle);

Cat. 5 – ruderi/fabbricati in abbandono;

Cat. 6 – impianti minieolici esistenti.

Muovendo da tale classificazione, al fine di procedere all'individuazione di potenziali ricettori nelle aree più direttamente interessate dalle installazioni eoliche, ricomprese entro una distanza massima di 1000m[1] dalle postazioni di macchina, si è proceduto ad una individuazione complessiva dei fabbricati con l'ausilio della cartografia ufficiale di riferimento (Carta Tecnica Regionale in scala 1:10.000). Successivamente è stata verificata l'effettiva esistenza e consistenza dall'esame di foto aeree e satellitari nonché attraverso specifici sopralluoghi e riscontri sul campo. In tal modo sono state acquisite le necessarie informazioni preliminari sulle caratteristiche tipologico-costruttive e le condizioni di utilizzo degli edifici. A valle di tali riscontri, è stata inoltre accertata la categoria catastale di appartenenza degli edifici, laddove disponibile.
L'Elaborato IT-VesNa-CLP-CW-CD-TR-003-Rev.0 (*Censimento recettori*) riporta l'individuazione dei fabbricati in accordo con la metodologia precedentemente indicata.
Il censimento ha condotto ad individuare n. 45 edifici, o complessi di fabbricati agricoli. Tra questi, all'interno di una distanza di 1000m dagli aerogeneratori, sono stati individuati n. 3 edifici riconducibili alla Cat. 1 (*Case rurali ad utilizzazione residenziale - Categoria catastale A)* e, n. 3 edifici che, sebbene non accatastati come abitazioni, si è ritenuto potessero essere ricondotti ad ambienti abitativi in ragione della tipologia costruttiva o di informazioni dirette acquisite sul territorio. A questo riguardo, a titolo esemplificativo, il fabbricato con identificativo R5 - in corso di costruzione ma con tipologia costruttiva di tipo residenziale - è stato cautelativamente ricondotto alla categoria dei ricettori.
Rispetto a tali fabbricati, così selezionati e identificati con le sigle R5, R6, R9, R12, R26 e R41, in accordo con le indicazioni della D.G.R. RAS 59/90 del 2020, il posizionamento degli aerogeneratori ha assicurato una distanza minima di 500m.
Tra i fabbricati individuati nell'elaborato IT-VesNa-CLP-CW-CD-TR-003-Rev.0 è stata riscontrata la prevalente presenza di fabbricati per funzioni produttive connesse alle attività agricole (categoria catastale D10); si contano inoltre 13 unità con categoria catastale C, nello specifico Magazzini e locali di deposito, due fabbricati con categoria catastale F, unità collabente e unità in corso di costruzione.
Ai fini dell'individuazione dei ricettori di interesse per le finalità del presente Studio, in accordo con gli enunciati criteri della DGR 59/90 del 2020, sono stati ricondotti alla Categoria 1:

- gli edifici catastalmente classificati come A3 (Abitazioni di tipo economico) e A6 (Abitazioni di tipo rurale), assumendo prudenzialmente la presenza continuativa di persone in periodo diurno e notturno;
- Tre fabbricati non appartenenti alla categoria catastale "A" (R5 e R9 - non presenti al catasto fabbricati, R41 - categoria catastale C2) per i quali, in ragione della tipologia costruttiva o per informazioni acquisite sul territorio, si è prudenzialmente ritenuto di poterli assimilare ad ambienti abitativi.

[1] La distanza di 1000m dagli aerogeneratori, ai fini dell'individuazione dei ricettori, è pari al doppio di quella indicata dalla norma UNI/TS 11143-7 per descrivere l'"area di influenza" di un parco eolico.

4 Ipotesi alla base del calcolo e soglie di riferimento

L'analisi dell'effetto di shadow flickering è stata condotta con l'utilizzo del modulo SHADOW del software WindPro 3.4. Il programma esegue una simulazione completa del percorso del sole durante un intero anno.
I calcoli possono essere eseguiti secondo due scenari: lo scenario peggiore (*worst case*) e il caso reale (*real case*).

Nello scenario *worst case* nessuno, tra i fattori di influenza indicati al capitolo 2 è contemplato nei calcoli del modello di simulazione. In situazioni di cielo coperto o calma di vento, o in caso di direzione del vento tale da porre il piano del rotore in posizione parallela rispetto alla linea sole-ricettore, la WTG non produrrà ombra intermittente, ma il suo contributo teorico è comunque computato dal *software*.
Conseguentemente, nello scenario peggiore, è altamente verosimile che i ricettori considerati saranno soggetti ad un impatto da *shadow flickering* significativamente inferiore a quello ipotizzato dal modello.

Nello scenario *real case*, il software può tenere conto delle reali **condizioni di funzionamento degli aerogeneratori** (in termini di ore di funzionamento attese per ogni settore angolare di provenienza del vento) nonché delle condizioni di **Eliofania**, ossia di durata media del soleggiamento della specifica zona di studio.

Peraltro, in entrambi gli scenari di calcolo, se la simulazione contempla l'effetto dell'orografia sulla propagazione dell'ombra, la stessa ignora l'azione schermante "sito-specifica" esercitata dai manufatti e dalle alberature. In altre parole, il calcolo è sempre conservativo e rappresenta quindi il massimo rischio potenziale di disturbo.
In definitiva, affinché il fenomeno dell'ombra intermittente possa costituire un disturbo per i soggetti più sensibili dovrebbero verificarsi simultaneamente le seguenti circostanze:

- il vento deve soffiare ad una velocità superiore a 3 m/s (velocità di *cut-in* del rotore);
- presenza di luminosità solare diretta;
- l'osservatore deve risultare sufficientemente vicino alla sorgente di *shadow flickering*;
- il ricettore deve essere effettivamente esposto al campo di luce tremolante;
- l'illuminazione dell'ambiente residenziale deve essere bassa;
- il contrasto tra luci ed ombre deve essere alto;
- non devono essere presenti schermature che ostacolino la propagazione dell'ombra (come tendaggi o alberature);
- gli individui potenzialmente soggetti ad un impatto da *shadow flickering* dovrebbero permanere esposti alla luce tremolante per un tempo sufficiente ad avvertire fastidio.

Per le finalità del presente studio, in assenza di una specifica disciplina normativa nazionale o regionale, si è fatto riferimento alle linee guida elaborate dal Gruppo Federale tedesco di Controllo delle Emissioni (*Bund-/Länder-Arbeitsgemeinschaft für Immissionsschutz - LAI*) – aggiornamento 2020.
Per la valutazione degli effetti del tremolio dell'ombra, peraltro, lo stesso legislatore tedesco non ha finora emanato, né risulta che sia in procinto di emanare, norme giuridicamente vincolanti.
Secondo le richiamate linee guida, affinché il fenomeno di ombreggiamento sia significativo dovrebbero essere simultaneamente verificate le seguenti circostanze
- L'angolo del sole sopra l'orizzonte deve essere almeno 3°;
- l'ingombro della pala della turbina eolica deve coprire almeno il 20% del disco solare.

Il massimo ombreggiamento su un edificio secondo tali linee-guida è stabilito in:
- 30 ore di ombreggiamento annuale;
- 30 minuti di ombreggiamento giornaliero.

<u>In tali archi temporali (30 ore/anno e 30 minuti/giorno), trattandosi di un disturbo effettivamente avvertito dagli occupanti l'edificio, dovrebbero risultare simultaneamente verificate le seguenti condizioni</u>:

- gli ambienti esposti all'ombreggiamento sono occupati;
- gli occupanti sono svegli.

Considerata l'esigua probabilità che si verifichino contemporaneamente tutte le condizioni precedentemente illustrate per l'intera durata del fenomeno, ne deriva che il risultato del calcolo rappresenta comunque una stima prudenziale dell'impatto.
La Figura 4.1 e la Figura 4.2 mostrano i parametri necessari al modello utilizzato dal modulo SHADOW per valutare l'impatto del tremolio dell'ombra.

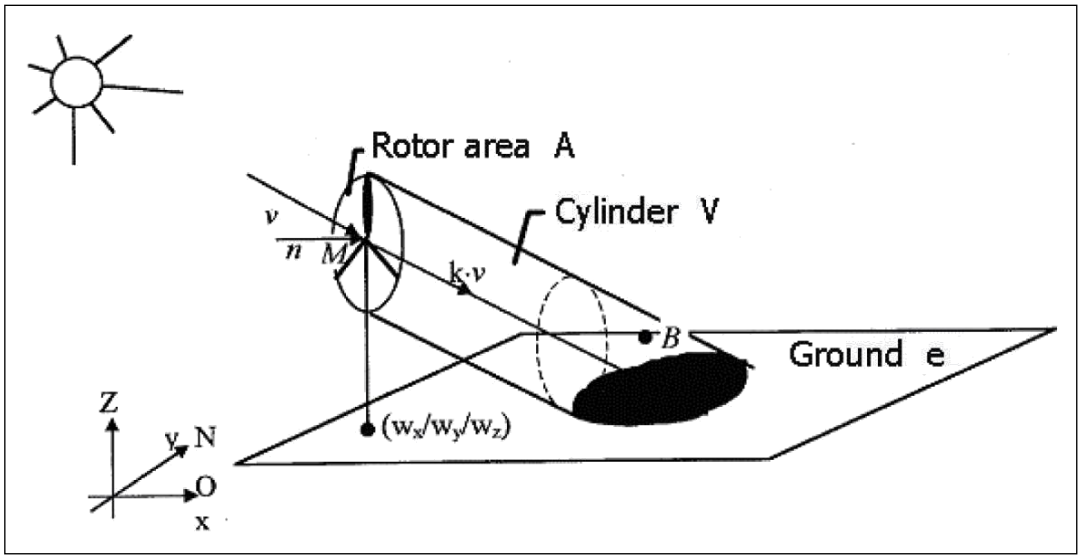

Figura 4.1: Rappresentazione schematica della proiezione dell'ombra del rotore.

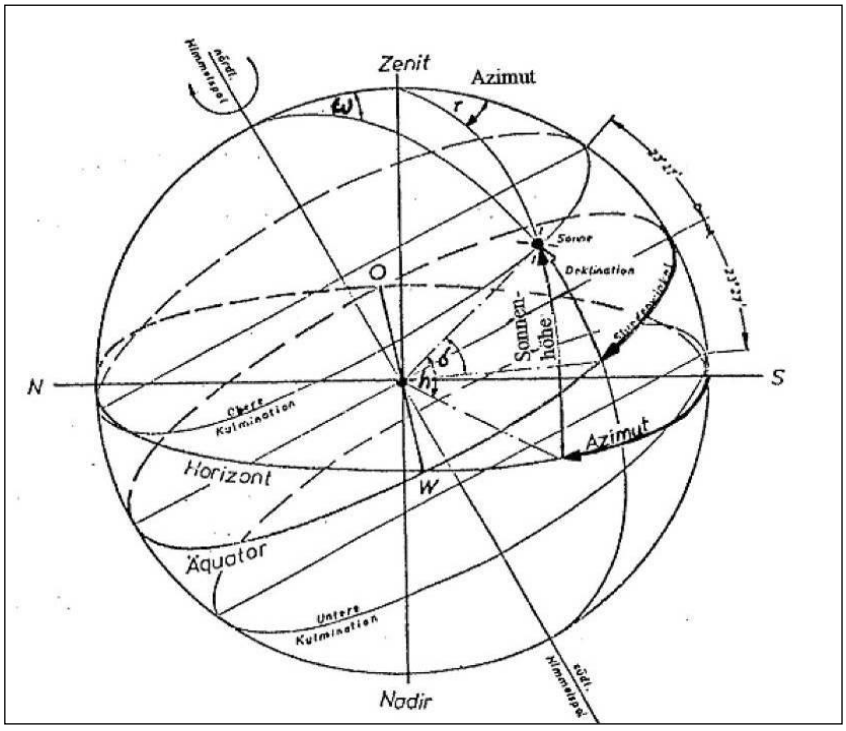

Figura 4.2: Schema dei moti terrestri e parametri di calcolo.

5 Lo scenario peggiore (*worst case*)

Questi calcoli sono basati sullo scenario più conservativo (ombra massima astronomica, ossia basata sulla posizione del sole rispetto alle WTG). Se il cielo è coperto o c'è calma di vento, o la direzione del vento è tale da porre il piano del rotore in posizione parallela rispetto alla linea sole-edificio, la WTG non produrrà ombra, ma la sua influenza apparirà comunque nei calcoli. In altre parole, il calcolo descrive lo scenario peggiore possibile, e rappresenta quindi il massimo rischio potenziale di impatto. Per ciascun ricettore il software produce un calendario che indica i giorni ed i periodi di tempo in cui l'ombra sarà presente.

6 Lo scenario reale (*real case*)

Oltre al calcolo che contempla le ore di "ombra massima astronomica" (detta anche ombra peggiore), il software WINDPRO consente di configurare i parametri statistici per calcolare l'"ombra meteorologica probabile" (detta anche ombra reale). In particolare, possono essere configurati due parametri statistici:

1. Statistica delle ore di funzionamento. È il periodo in cui le turbine saranno operative per ciascuna direzione di provenienza del vento nel corso dell'anno.
2. Statistica dell'eliofania. È la percentuale di ore di sole durante il dì (dall'alba al tramonto). Questa varia notevolmente da luogo a luogo, e si rende opportuno utilizzare, pertanto, una statistica proveniente da stazioni di misura vicine al sito.

WindPRO combina ZVI ed il calcolo dell'ombra in modo da escludere il contributo delle turbine non visibili dai recettori. Questo vale anche per la mappa dell'ombra, in cui saranno incluse solo le WTG visibili da ciascun punto di griglia.

Ai fini del calcolo del tremolio dell'ombra il software di simulazione considera i seguenti parametri:

- diametro del sole, D (1.390.000 km);
- distanza Terra-Sole, d (150.000.000 km);
- angolo di attacco (3°);
- coordinate geografiche e altitudine delle turbine in progetto;
- altezza al mozzo (125 m) e diametro del rotore (162 m);
- coordinate dei recettori;
- recettori considerati in modalità "serra", assumendo che vengano interessati dal fenomeno di shadow-flickering indipendentemente dall'orientamento delle finestre (ipotesi conservativa);
- modello digitale del terreno;
- eliofania del sito;
- statistica delle ore di funzionamento degli aerogeneratori in funzione delle frequenze di provenienza del vento su 12 quadranti convenzionali;
- modello di calcolo della simulazione, che tiene conto sia dell'orbita terrestre rispetto al Sole (rivoluzione), sia della rotazione rispetto al proprio asse.

7 Risultati

Il risultato dei calcoli è reso disponibile dal programma di simulazione (*Windpro*) sotto diversi formati:

- Tabellare, (calendario per ciascun ricettore) nel quale per ogni giorno dell'anno sono indicate le ore di luce e l'intervallo di tempo di esposizione all'ombra con l'orario in cui si verifica il fenomeno;
- Grafico, (per ciascun ricettore) nel quale vengono rappresentati i periodi dell'anno in cui si verifica il fenomeno, l'orario e le turbine responsabili dell'ombra;
- grafico globale, con la rappresentazione di isolinee rappresentanti l'incidenza dell'ombra espressa in ore/anno.

Con riferimento allo Scenario di progetto, le isolinee d'ombra sono state rappresentate su specifica tavola grafica, in scala adeguata alla dimensione territoriale da rappresentare, per facilitarne la lettura. La tavola è stata realizzata, pertanto, su base cartografica in scala 1:10.000 (Elaborato IT-VesNar-CLP-ENV-SF-DW-01-Rev.0).

I risultati forniti dal modello di calcolo consentono di valutare approssimativamente sia l'impatto puntuale sul singolo ricettore, sia l'impatto distribuito sul territorio (movimento e persistenza dell'ombra).

Nello specifico, all'interno degli allegati report di calcolo sono indicati, per il singolo ricettore, i valori totali di interferenza da *shadow flickering* (espressi in h/anno), il numero di giorni in cui si verifica l'interferenza ed infine la durata massima per singolo giorno.
I risultati numerici delle simulazioni modellistiche, condotti con riferimento a ciascuno scenario di calcolo (*worst e real case*), sono riportati in Appendice.

8 Analisi e post-elaborazione dei risultati

Le risultanze del calcolo modellistico atto a stimare i valori totali di potenziale interferenza da *shadow flickering* in corrispondenza dei ricettori nello scenario di progetto sono riportate in *Tabella 8.1*.

Tabella 8.1: Risultati dei calcoli di ombreggiamento intermittente presso i ricettori considerati

ID	RICETTORE	WTG SF	WTG Più prossimo	Dist. Min. WTG	h/anno SF Worst Case	h/giorno SF Worst Case	h/anno SF Real Case
1	R05	AG05	AG05	779	73:56:00	00:50	**30:50:00**
2	R06	AG06	AG04	516	4:04:00	0:15	**1:33:00**
3	R09	AG03, AG07, AG08	AG04	615	60:39:00	1:02	**23:10:00**
4	R12	AG01, AG07, AG08	AG02	600	53:47:00	0:42	**20:51:00**
5	R26	AG03, AG07, AG08	AG06	528	35:24:00	0:43	**11:27:00**
6	R41	AG05, AG06	AG06	541	44:10:00	0:55	**8:48:00**

Come si può osservare dall'esame della Tabella 6.1, l'incidenza dell'ombreggiamento intermittente presso i ricettori considerati nello "scenario reale" è sempre al disotto del valore guida di 30 h/anno (fabbricati R06, R09, R12, R26, R41), o alquanto prossima (R05).
In ragione di quanto precede, avuto riguardo della conservatività delle stime[2], è ragionevole affermare che l'effettivo potenziale disturbo da *shadow flickering* risulterà estremamente più contenuto di quello prospettato dal software di simulazione, tale da potersi ricondurre ai predetti "valori guida" e da non arrecare apprezzabili disturbi agli occupanti l'edificio più esposto (R05).
Ad ogni buon conto, laddove durante la fase operativa dell'impianto dovesse essere avvertito un effettivo disturbo da parte degli occupanti, saranno attuate – a cura e spese della società proponente - efficaci misure di mitigazione quali la creazione di una alberatura schermante sul lato nordest del fabbricato.

[2] Si ricorda che la soglia di 30 h/anno fa riferimento alle ore di disturbo effettivo, il che presuppone che gli occupanti l'edificio siano effettivamente presenti nei locali interessati dal fenomeno e la circostanza che gli stessi siano svegli.

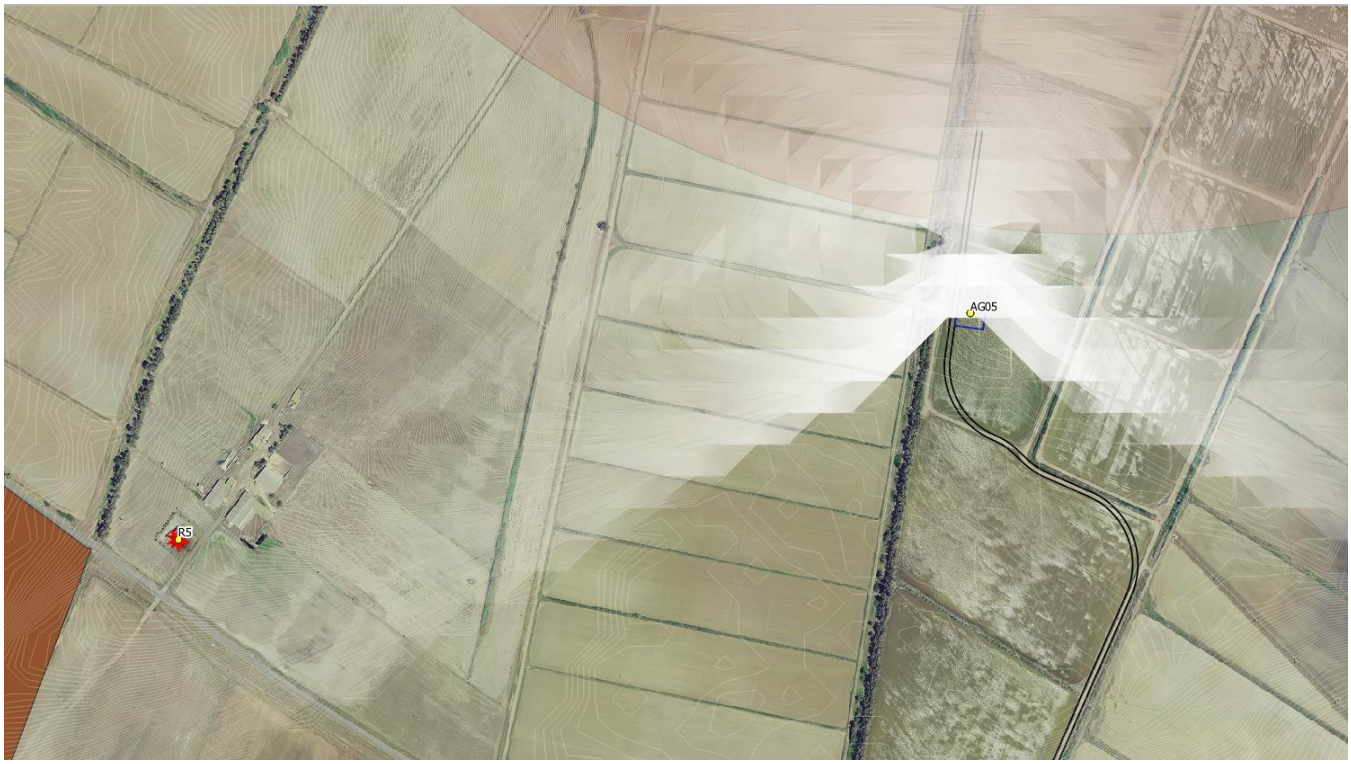

Figura 8.1 - Posizionamento del fabbricato R05 rispetto all'aerogeneratore AG05, origine del fenomeno di shadow-flickering sull'edificio (con tratto bianco le isoline di ombra intermittente)

Figura 8.2 – Edificio R05 ed isolinee d'ombra proiettate dall'aerogeneratore AG05 (vista zenitale). Si noti come la creazione di una barriera verde sul lato nordest potrebbe rappresentare, ove necessario, un efficacie misura di mitigazione

9 Conclusioni

Il documento ha esaminato compiutamente il potenziale disturbo da ombreggiamento intermittente (*shadow flickering*) in corrispondenza dei più prossimi fabbricati presenti nell'area interessata dal proposto parco eolico. L'individuazione dei ricettori ha fatto riferimento alla ricognizione sugli edifici esistenti eseguita nell'ambito della definizione del layout di impianto e dell'analisi ambientale, i cui risultati sono riepilogati in opportune "schede fabbricati" all'interno di apposito report allegato al progetto.

Ai fini dei calcoli di esposizione all'ombra intermittente - avuto riguardo dei criteri enunciati dalla DGR 59/90 del 2020 - sono stati individuati come ricettori n. 6 fabbricati, ubicati entro una distanza di 1000 m dalle postazioni eoliche in progetto.

Per le finalità del presente studio, in assenza di una specifica disciplina normativa nazionale o regionale, si è fatto riferimento alle linee guida elaborate dal Gruppo Federale tedesco di Controllo delle Emissioni (*Bund-/Länder-Arbeitsgemeinschaft für Immissionsschutz - LAI*) – aggiornamento 2020.

L'incidenza dell'ombreggiamento intermittente presso i ricettori considerati, stimata nello "scenario reale", è sempre al disotto del valore guida di 30 h/anno (fabbricati R06, R09, R12, R26, R41), o alquanto prossima (R05).

In ragione di quanto precede, avuto riguardo della circostanza che la soglia di 30 h/anno fa riferimento alle ore di disturbo effettivo (il che presuppone che gli occupanti l'edificio siano effettivamente presenti nei locali interessati dal fenomeno e la circostanza che gli stessi siano svegli) è ragionevole affermare che l'effettivo potenziale disturbo da *shadow flickering* risulterà estremamente più contenuto di quello prospettato dal software di simulazione, tale da potersi ricondurre ai predetti "valori guida" e da non arrecare apprezzabili disturbi agli occupanti l'edificio più esposto (R05).

Ad ogni buon conto, laddove durante la fase operativa dell'impianto dovesse essere verificato un effettivo disturbo da parte degli occupanti, saranno attuate – a cura e spese della società proponente - efficaci misure di mitigazione quali la creazione di una alberatura schermante sul lato nordest del fabbricato.

Allegato: Report di calcolo

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Calculated:
14/06/2022 17:04/3.4.415

SHADOW - Main Result

Calculation: Progetto_2022_06_14_Real_case

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) [CAGLIARI / ELMA S]

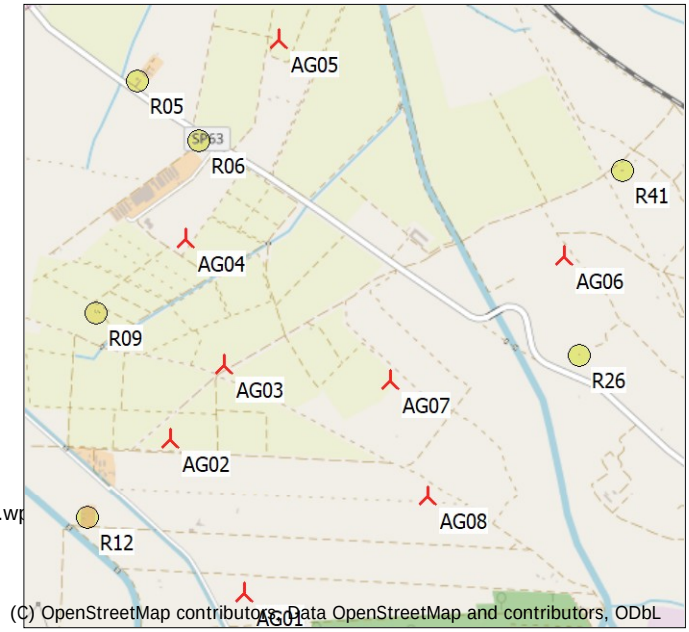
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

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_Progetto_Narbonis.wp
Obstacles used in calculation
Eye height for map: 1,5 m
Grid resolution: 1,0 m

All coordinates are in
Italian Gauss-Boaga west-ROMA40 (IT-peninsular <±4m)



Scale 1:40.000
New WTG
Shadow receptor

WTGs

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
AG01	1.478.083	4.378.262	53,7	VESTAS V162-6.0 6000 162.0 !...	Yes	VESTAS	V162-6.0-6.000	6.000	162,0	125,0	2.044	0,0
AG02	1.477.690	4.379.070	52,8	VESTAS V162-6.0 6000 162.0 !...	Yes	VESTAS	V162-6.0-6.000	6.000	162,0	125,0	2.044	0,0
AG03	1.477.980	4.379.461	49,7	VESTAS V162-6.0 6000 162.0 !...	Yes	VESTAS	V162-6.0-6.000	6.000	162,0	125,0	2.044	0,0
AG04	1.477.774	4.380.129	45,7	VESTAS V162-6.0 6000 162.0 !...	Yes	VESTAS	V162-6.0-6.000	6.000	162,0	125,0	2.044	0,0
AG05	1.478.272	4.381.174	40,0	VESTAS V162-6.0 6000 162.0 !...	Yes	VESTAS	V162-6.0-6.000	6.000	162,0	125,0	2.044	0,0
AG06	1.479.784	4.380.031	45,1	VESTAS V162-6.0 6000 162.0 !...	Yes	VESTAS	V162-6.0-6.000	6.000	162,0	125,0	2.044	0,0
AG07	1.478.854	4.379.381	44,6	VESTAS V162-6.0 6000 162.0 !...	Yes	VESTAS	V162-6.0-6.000	6.000	162,0	125,0	2.044	0,0
AG08	1.479.051	4.378.763	48,1	VESTAS V162-6.0 6000 162.0 !...	Yes	VESTAS	V162-6.0-6.000	6.000	162,0	125,0	2.044	0,0

Shadow receptor-Input

No.	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
R05	1.477.523	4.380.960	44,0	1,2	1,4	1,2	90,0	"Green house mode"	2,6
R06	1.477.850	4.380.640	42,6	1,2	1,4	1,2	90,0	"Green house mode"	2,6
R09	1.477.302	4.379.735	51,3	1,2	1,4	1,2	90,0	"Green house mode"	2,6
R12	1.477.253	4.378.659	59,9	1,2	1,4	1,2	90,0	"Green house mode"	2,6
R26	1.479.858	4.379.507	46,5	1,2	1,4	1,2	90,0	"Green house mode"	2,6
R41	1.480.090	4.380.477	48,5	1,2	1,4	1,2	90,0	"Green house mode"	2,6

Calculation Results

Shadow receptor

No.	Shadow, expected values Shadow hours per year [h/year]
R05	30:50
R06	1:33
R09	23:10
R12	20:51
R26	11:27
R41	8:48

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14/06/2022 17:04/3.4.415

SHADOW - Main Result

Calculation: Progetto_2022_06_14_Real_case

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

No.	Name	Worst case [h/year]	Expected [h/year]
AG01	VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (18)	33:22	12:28
AG02	VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (14)	0:00	0:00
AG03	VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (11)	52:00	20:05
AG04	VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (15)	0:00	0:00
AG05	VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (16)	80:09	33:57
AG06	VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (13)	42:01	7:41
AG07	VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (12)	44:12	17:00
AG08	VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (17)	20:39	5:55

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.

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SHADOW - Calendar

Calculation: Progetto_2022_06_14_Real_caseShadow receptor: R05 - Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (26)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	January	February	March	April			May			June		
1	07:46	07:34	07:00	07:11			06:28		06:47 (AG05)	06:00		06:49 (AG05)
	17:12	17:45	18:17	19:49			20:19	43	07:30 (AG05)	20:46	36	07:25 (AG05)
2	07:46	07:33	06:59	07:10			06:26		06:45 (AG05)	06:00		06:50 (AG05)
	17:12	17:46	18:18	19:50			20:19	44	07:29 (AG05)	20:47	35	07:25 (AG05)
3	07:46	07:32	06:57	07:08			06:25		06:44 (AG05)	06:00		06:52 (AG05)
	17:13	17:47	18:19	19:51			20:20	46	07:30 (AG05)	20:48	33	07:25 (AG05)
4	07:47	07:31	06:56	07:07			06:24		06:44 (AG05)	05:59		06:52 (AG05)
	17:14	17:48	18:20	19:52			20:21	47	07:31 (AG05)	20:48	32	07:24 (AG05)
5	07:47	07:30	06:54	07:05			06:23		06:43 (AG05)	05:59		06:53 (AG05)
	17:15	17:49	18:21	19:53			20:22	48	07:31 (AG05)	20:49	30	07:23 (AG05)
6	07:47	07:29	06:53	07:04			06:22		06:43 (AG05)	05:59		06:54 (AG05)
	17:16	17:51	18:22	19:54			20:23	48	07:31 (AG05)	20:50	29	07:23 (AG05)
7	07:47	07:28	06:51	07:02			06:21		06:43 (AG05)	05:58		06:55 (AG05)
	17:17	17:52	18:23	19:55			20:24	48	07:31 (AG05)	20:50	28	07:23 (AG05)
8	07:46	07:27	06:50	07:00			06:19		06:42 (AG05)	05:58		06:54 (AG05)
	17:18	17:53	18:24	19:56			20:25	50	07:32 (AG05)	20:51	28	07:22 (AG05)
9	07:46	07:26	06:48	06:59			06:18		06:42 (AG05)	05:58		06:55 (AG05)
	17:19	17:54	18:25	19:57			20:26	50	07:32 (AG05)	20:52	27	07:22 (AG05)
10	07:46	07:25	06:46	06:57			06:17		06:42 (AG05)	05:58		06:56 (AG05)
	17:20	17:55	18:26	19:58			20:27	50	07:32 (AG05)	20:52	25	07:21 (AG05)
11	07:46	07:24	06:45	06:56			06:16		06:42 (AG05)	05:58		06:57 (AG05)
	17:21	17:56	18:27	19:59			20:28	50	07:32 (AG05)	20:53	24	07:21 (AG05)
12	07:46	07:23	06:43	06:54			06:15		06:42 (AG05)	05:58		06:58 (AG05)
	17:22	17:58	18:28	20:00			20:29	50	07:32 (AG05)	20:53	23	07:21 (AG05)
13	07:46	07:22	06:42	06:53			06:14		06:42 (AG05)	05:57		06:59 (AG05)
	17:23	17:59	18:30	20:01			20:30	49	07:31 (AG05)	20:54	22	07:21 (AG05)
14	07:45	07:20	06:40	06:51			06:13		06:42 (AG05)	05:57		06:59 (AG05)
	17:24	18:00	18:31	20:02			20:31	49	07:31 (AG05)	20:54	21	07:20 (AG05)
15	07:45	07:19	06:39	06:50			06:12		06:42 (AG05)	05:57		07:00 (AG05)
	17:25	18:01	18:32	20:03			20:32	49	07:31 (AG05)	20:54	20	07:20 (AG05)
16	07:45	07:18	06:37	06:48			06:11		06:42 (AG05)	05:57		07:00 (AG05)
	17:26	18:02	18:33	20:04			20:33	49	07:31 (AG05)	20:55	20	07:20 (AG05)
17	07:44	07:17	06:35	06:47			06:10		06:42 (AG05)	05:58		07:01 (AG05)
	17:27	18:03	18:34	20:05			20:34	48	07:30 (AG05)	20:55	19	07:20 (AG05)
18	07:44	07:15	06:34	06:45			06:10		06:42 (AG05)	05:58		07:01 (AG05)
	17:28	18:05	18:35	20:06			20:35	48	07:30 (AG05)	20:55	19	07:20 (AG05)
19	07:43	07:14	06:32	06:44			06:09		06:43 (AG05)	05:58		07:01 (AG05)
	17:29	18:06	18:36	20:07			20:36	47	07:30 (AG05)	20:56	18	07:19 (AG05)
20	07:43	07:13	06:31	06:42			06:08		06:43 (AG05)	05:58		07:03 (AG05)
	17:31	18:07	18:37	20:08			20:37	47	07:30 (AG05)	20:56	17	07:20 (AG05)
21	07:42	07:11	06:29	06:41			06:07		06:43 (AG05)	05:58		07:03 (AG05)
	17:32	18:08	18:38	20:09			20:38	46	07:29 (AG05)	20:56	17	07:20 (AG05)
22	07:42	07:10	06:27	06:40		07:02 (AG05)	06:06		06:44 (AG05)	05:58		07:03 (AG05)
	17:33	18:09	18:39	20:10	14	07:16 (AG05)	20:38	45	07:29 (AG05)	20:57	17	07:20 (AG05)
23	07:41	07:09	06:26	06:38		06:59 (AG05)	06:06		06:44 (AG05)	05:58		07:02 (AG05)
	17:34	18:10	18:40	20:11	21	07:20 (AG05)	20:39	45	07:29 (AG05)	20:57	18	07:20 (AG05)
24	07:40	07:07	06:24	06:37		06:55 (AG05)	06:05		06:45 (AG05)	05:59		07:03 (AG05)
	17:35	18:11	18:41	20:12	26	07:21 (AG05)	20:40	43	07:28 (AG05)	20:57	18	07:21 (AG05)
25	07:40	07:06	06:23	06:36		06:54 (AG05)	06:04		06:46 (AG05)	05:59		07:03 (AG05)
	17:36	18:12	18:42	20:13	29	07:23 (AG05)	20:41	42	07:28 (AG05)	20:57	19	07:22 (AG05)
26	07:39	07:04	06:21	06:34		06:53 (AG05)	06:04		06:46 (AG05)	05:59		07:02 (AG05)
	17:37	18:13	18:43	20:14	32	07:25 (AG05)	20:42	41	07:27 (AG05)	20:57	20	07:22 (AG05)
27	07:38	07:03	06:19	06:33		06:51 (AG05)	06:03		06:47 (AG05)	06:00		07:03 (AG05)
	17:39	18:15	18:44	20:15	35	07:26 (AG05)	20:43	41	07:28 (AG05)	20:57	20	07:23 (AG05)
28	07:38	07:02	06:18	06:32		06:50 (AG05)	06:02		06:47 (AG05)	06:00		07:02 (AG05)
	17:40	18:16	18:45	20:16	37	07:27 (AG05)	20:43	40	07:27 (AG05)	20:57	21	07:23 (AG05)
29	07:37		07:16	06:30		06:49 (AG05)	06:02		06:48 (AG05)	06:00		07:02 (AG05)
	17:41		19:46	20:17	39	07:28 (AG05)	20:44	39	07:27 (AG05)	20:57	22	07:24 (AG05)
30	07:36		07:15	06:29		06:48 (AG05)	06:01		06:48 (AG05)	06:01		07:02 (AG05)
	17:42		19:47	20:18	41	07:29 (AG05)	20:45	38	07:26 (AG05)	20:57	23	07:25 (AG05)
31	07:35		07:13				06:01		06:49 (AG05)			
	17:43		19:48				20:46	37	07:26 (AG05)			
Potential sun hours	301	299	370	397			444			447		
Total, worst case					274			1417			701	
Sun reduction					0,53			0,59			0,66	
Oper. time red.					0,86			0,86			0,86	
Wind dir. red.					0,73			0,73			0,73	
Total reduction					0,33			0,37			0,42	
Total, real					91			524			291	

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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Calculated:
14/06/2022 17:04/3.4.415

SHADOW - Calendar

Calculation: Progetto_2022_06_14_Real_caseShadow receptor: R05 - Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (26)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	July			August			September	October	November	December
1	06:01		07:01 (AG05)	06:24		06:52 (AG05)	06:53	07:21	06:53	07:26
	20:57	24	07:25 (AG05)	20:39	49	07:41 (AG05)	19:58	19:10	17:25	17:02
2	06:02		07:02 (AG05)	06:25		06:52 (AG05)	06:54	07:22	06:54	07:27
	20:57	24	07:26 (AG05)	20:38	49	07:41 (AG05)	19:57	19:08	17:24	17:02
3	06:02		07:01 (AG05)	06:26		06:52 (AG05)	06:55	07:23	06:55	07:28
	20:57	26	07:27 (AG05)	20:37	49	07:41 (AG05)	19:55	19:06	17:23	17:02
4	06:03		07:01 (AG05)	06:27		06:52 (AG05)	06:56	07:24	06:56	07:29
	20:57	27	07:28 (AG05)	20:36	49	07:41 (AG05)	19:53	19:05	17:22	17:02
5	06:03		07:00 (AG05)	06:28		06:52 (AG05)	06:57	07:25	06:57	07:30
	20:56	28	07:28 (AG05)	20:35	49	07:41 (AG05)	19:52	19:03	17:21	17:02
6	06:04		07:00 (AG05)	06:29		06:52 (AG05)	06:57	07:26	06:58	07:31
	20:56	29	07:29 (AG05)	20:34	49	07:41 (AG05)	19:50	19:02	17:19	17:01
7	06:04		06:59 (AG05)	06:29		06:53 (AG05)	06:58	07:27	07:00	07:32
	20:56	30	07:29 (AG05)	20:33	48	07:41 (AG05)	19:49	19:00	17:18	17:01
8	06:05		06:59 (AG05)	06:30		06:53 (AG05)	06:59	07:28	07:01	07:33
	20:56	31	07:30 (AG05)	20:32	48	07:41 (AG05)	19:47	18:59	17:17	17:01
9	06:06		06:59 (AG05)	06:31		06:53 (AG05)	07:00	07:29	07:02	07:34
	20:55	33	07:32 (AG05)	20:30	47	07:40 (AG05)	19:45	18:57	17:16	17:01
10	06:06		06:58 (AG05)	06:32		06:53 (AG05)	07:01	07:30	07:03	07:34
	20:55	34	07:32 (AG05)	20:29	46	07:39 (AG05)	19:44	18:55	17:15	17:01
11	06:07		06:58 (AG05)	06:33		06:54 (AG05)	07:02	07:31	07:04	07:35
	20:55	35	07:33 (AG05)	20:28	44	07:38 (AG05)	19:42	18:54	17:14	17:02
12	06:08		06:58 (AG05)	06:34		06:55 (AG05)	07:03	07:32	07:05	07:36
	20:54	36	07:34 (AG05)	20:27	42	07:37 (AG05)	19:41	18:52	17:14	17:02
13	06:08		06:57 (AG05)	06:35		06:56 (AG05)	07:04	07:33	07:06	07:37
	20:54	37	07:34 (AG05)	20:25	40	07:36 (AG05)	19:39	18:51	17:13	17:02
14	06:09		06:57 (AG05)	06:36		06:57 (AG05)	07:05	07:34	07:08	07:38
	20:53	38	07:35 (AG05)	20:24	39	07:36 (AG05)	19:37	18:49	17:12	17:02
15	06:10		06:57 (AG05)	06:37		06:58 (AG05)	07:06	07:35	07:09	07:38
	20:53	39	07:36 (AG05)	20:23	36	07:34 (AG05)	19:36	18:48	17:11	17:02
16	06:11		06:55 (AG05)	06:38		06:59 (AG05)	07:07	07:36	07:10	07:39
	20:52	41	07:36 (AG05)	20:21	34	07:33 (AG05)	19:34	18:46	17:10	17:03
17	06:11		06:55 (AG05)	06:39		07:00 (AG05)	07:08	07:37	07:11	07:40
	20:52	42	07:37 (AG05)	20:20	32	07:32 (AG05)	19:32	18:45	17:09	17:03
18	06:12		06:55 (AG05)	06:40		07:01 (AG05)	07:09	07:38	07:12	07:40
	20:51	42	07:37 (AG05)	20:19	29	07:30 (AG05)	19:31	18:44	17:09	17:03
19	06:13		06:55 (AG05)	06:41		07:03 (AG05)	07:09	07:39	07:13	07:41
	20:50	43	07:38 (AG05)	20:17	25	07:28 (AG05)	19:29	18:42	17:08	17:04
20	06:14		06:54 (AG05)	06:42		07:04 (AG05)	07:10	07:40	07:14	07:42
	20:50	44	07:38 (AG05)	20:16	20	07:24 (AG05)	19:28	18:41	17:07	17:04
21	06:14		06:54 (AG05)	06:43		07:08 (AG05)	07:11	07:41	07:15	07:42
	20:49	45	07:39 (AG05)	20:15	12	07:20 (AG05)	19:26	18:39	17:07	17:04
22	06:15		06:54 (AG05)	06:43			07:12	07:42	07:17	07:43
	20:48	45	07:39 (AG05)	20:13			19:24	18:38	17:06	17:05
23	06:16		06:54 (AG05)	06:44			07:13	07:43	07:18	07:43
	20:47	46	07:40 (AG05)	20:12			19:23	18:37	17:06	17:05
24	06:17		06:54 (AG05)	06:45			07:14	07:44	07:19	07:44
	20:47	46	07:40 (AG05)	20:10			19:21	18:35	17:05	17:06
25	06:18		06:53 (AG05)	06:46			07:15	06:45	07:20	07:44
	20:46	47	07:40 (AG05)	20:09			19:19	17:34	17:05	17:07
26	06:19		06:52 (AG05)	06:47			07:16	06:46	07:21	07:44
	20:45	48	07:40 (AG05)	20:07			19:18	17:33	17:04	17:07
27	06:20		06:52 (AG05)	06:48			07:17	06:47	07:22	07:45
	20:44	49	07:41 (AG05)	20:06			19:16	17:31	17:04	17:08
28	06:20		06:52 (AG05)	06:49			07:18	06:48	07:23	07:45
	20:43	49	07:41 (AG05)	20:04			19:14	17:30	17:03	17:08
29	06:21		06:52 (AG05)	06:50			07:19	06:50	07:24	07:45
	20:42	50	07:42 (AG05)	20:03			19:13	17:29	17:03	17:09
30	06:22		06:52 (AG05)	06:51			07:20	06:51	07:25	07:46
	20:41	50	07:42 (AG05)	20:01			19:11	17:27	17:03	17:10
31	06:23		06:52 (AG05)	06:52				06:52		07:46
	20:40	50	07:42 (AG05)	20:00				17:26		17:11
Potential sun hours	455			425			374	347	301	292
Total, worst case		1208			836					
Sun reduction		0,74			0,73					
Oper. time red.		0,86			0,86					
Wind dir. red.		0,73			0,73					
Total reduction		0,46			0,46					
Total, real		560			384					

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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Calculated:
14/06/2022 17:04/3.4.415

SHADOW - Calendar

Calculation: Progetto_2022_06_14_Real_caseShadow receptor: R06 - Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (27)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	January	February		March	April	May	June	July	August	September	October		November	December
1	07:46	07:34		07:00	07:11	06:28	06:00	06:01	06:24	06:53	07:21		06:53	07:26
	17:12	17:45		18:17	19:49	20:18	20:46	20:57	20:39	19:58	19:10		17:25	17:02
2	07:46	07:33		06:59	07:10	06:26	06:00	06:02	06:25	06:54	07:22		06:54	07:27
	17:12	17:46		18:18	19:50	20:19	20:47	20:57	20:38	19:57	19:08		17:24	17:02
3	07:46	07:32		06:57	07:08	06:25	06:00	06:02	06:26	06:55	07:23		06:55	07:28
	17:13	17:47		18:19	19:51	20:20	20:48	20:57	20:37	19:55	19:06		17:23	17:02
4	07:47	07:31		06:56	07:07	06:24	05:59	06:03	06:27	06:56	07:24		06:56	07:29
	17:14	17:48		18:20	19:52	20:21	20:48	20:57	20:36	19:53	19:05		17:22	17:02
5	07:47	07:30		06:54	07:05	06:23	05:59	06:03	06:28	06:57	07:25		06:57	07:30
	17:15	17:49		18:21	19:53	20:22	20:49	20:56	20:35	19:52	19:03		17:21	17:02
6	07:47	07:29		06:53	07:04	06:22	05:59	06:04	06:29	06:57	07:26		06:58	07:31
	17:16	17:50		18:22	19:54	20:23	20:50	20:56	20:34	19:50	19:02		17:19	17:01
7	07:47	07:28		06:51	07:02	06:21	05:58	06:04	06:29	06:58	07:27		07:00	07:32
	17:17	17:52		18:23	19:55	20:24	20:50	20:56	20:33	19:49	19:00		17:18	17:01
8	07:46	07:27		06:50	07:00	06:19	05:58	06:05	06:30	06:59	07:28		07:01	07:33
	17:18	17:53		18:24	19:56	20:25	20:51	20:56	20:32	19:47	18:59		17:17	17:01
9	07:46	07:26		06:48	06:59	06:18	05:58	06:06	06:31	07:00	07:29		07:02	07:34
	17:19	17:54		18:25	19:57	20:26	20:52	20:55	20:30	19:45	18:57		17:16	17:01
10	07:46	07:25		06:46	06:57	06:17	05:58	06:06	06:32	07:01	07:30		07:03	07:34
	17:20	17:55		18:26	19:58	20:27	20:52	20:55	20:29	19:44	18:55		17:15	17:01
11	07:46	07:24		06:45	06:56	06:16	05:58	06:07	06:33	07:02	07:31		07:04	07:35
	17:21	17:56		18:27	19:59	20:28	20:53	20:55	20:28	19:42	18:54		17:14	17:02
12	07:46	07:23		06:43	06:54	06:15	05:58	06:08	06:34	07:03	07:32		07:05	07:36
	17:22	17:58		18:28	20:00	20:29	20:53	20:54	20:27	19:41	18:52		17:14	17:02
13	07:46	07:22		06:42	06:53	06:14	05:57	06:08	06:35	07:04	07:33		07:06	07:37
	17:23	17:59		18:30	20:01	20:30	20:54	20:54	20:25	19:39	18:51		17:13	17:02
14	07:45	07:20		06:40	06:51	06:13	05:57	06:09	06:36	07:05	07:34		07:08	07:38
	17:24	18:00		18:31	20:02	20:31	20:54	20:53	20:24	19:37	18:49		17:12	17:02
15	07:45	07:19		06:39	06:50	06:12	05:57	06:10	06:37	07:06	07:35		07:09	07:38
	17:25	18:01	3	07:41 (AG06)	18:32	20:03	20:32	20:54	20:53	20:23	19:36	18:48		17:11	17:02
16	07:45	07:18		07:37 (AG06)	06:37	06:48	06:11	05:57	06:11	06:38	07:07	07:36	08:02 (AG06)	07:10	07:39
	17:26	18:02	5	07:42 (AG06)	18:33	20:04	20:33	20:55	20:52	20:21	19:34	18:46	8	08:10 (AG06)	17:10	17:03
17	07:44	07:17		07:35 (AG06)	06:35	06:47	06:10	05:57	06:11	06:39	07:08	07:37		08:00 (AG06)	07:11	07:40
	17:27	18:03	8	07:43 (AG06)	18:34	20:05	20:34	20:55	20:52	20:20	19:32	18:45	12	08:12 (AG06)	17:09	17:03
18	07:44	07:15		07:34 (AG06)	06:34	06:45	06:10	05:58	06:12	06:40	07:08	07:38		07:58 (AG06)	07:12	07:40
	17:28	18:05	9	07:43 (AG06)	18:35	20:06	20:35	20:55	20:51	20:19	19:31	18:43	15	08:13 (AG06)	17:09	17:03
19	07:43	07:14		07:33 (AG06)	06:32	06:44	06:09	05:58	06:13	06:41	07:09	07:39		07:59 (AG06)	07:13	07:41
	17:29	18:06	11	07:44 (AG06)	18:36	20:07	20:36	20:56	20:50	20:17	19:29	18:42	15	08:14 (AG06)	17:08	17:04
20	07:43	07:13		07:31 (AG06)	06:31	06:42	06:08	05:58	06:14	06:42	07:10	07:40		08:00 (AG06)	07:14	07:42
	17:31	18:07	12	07:43 (AG06)	18:37	20:08	20:37	20:56	20:50	20:16	19:28	18:41	14	08:14 (AG06)	17:07	17:04
21	07:42	07:11		07:30 (AG06)	06:29	06:41	06:07	05:58	06:14	06:43	07:11	07:41		08:01 (AG06)	07:15	07:42
	17:32	18:08	14	07:44 (AG06)	18:38	20:09	20:38	20:56	20:49	20:15	19:26	18:39	13	08:14 (AG06)	17:07	17:04
22	07:42	07:10		07:29 (AG06)	06:27	06:40	06:06	05:58	06:15	06:43	07:12	07:42		08:02 (AG06)	07:17	07:43
	17:33	18:09	14	07:43 (AG06)	18:39	20:10	20:38	20:56	20:48	20:13	19:24	18:38	12	08:14 (AG06)	17:06	17:05
23	07:41	07:09		07:27 (AG06)	06:26	06:38	06:06	05:58	06:16	06:44	07:13	07:43		08:03 (AG06)	07:18	07:43
	17:34	18:10	15	07:42 (AG06)	18:40	20:11	20:39	20:57	20:47	20:12	19:23	18:36	11	08:14 (AG06)	17:06	17:05
24	07:40	07:07		07:27 (AG06)	06:24	06:37	06:05	05:59	06:17	06:45	07:14	07:44		08:04 (AG06)	07:19	07:44
	17:35	18:11	14	07:41 (AG06)	18:41	20:12	20:40	20:57	20:47	20:10	19:21	18:35	9	08:13 (AG06)	17:05	17:06
25	07:40	07:06		07:28 (AG06)	06:23	06:35	06:04	05:59	06:18	06:46	07:15	06:45		07:06 (AG06)	07:20	07:44
	17:36	18:12	11	07:39 (AG06)	18:42	20:13	20:41	20:57	20:46	20:09	19:19	17:34	7	07:13 (AG06)	17:05	17:07
26	07:39	07:04		07:31 (AG06)	06:21	06:34	06:04	05:59	06:19	06:47	07:16	06:46		07:07 (AG06)	07:21	07:44
	17:37	18:13	5	07:36 (AG06)	18:43	20:14	20:42	20:57	20:45	20:07	19:18	17:32	5	07:12 (AG06)	17:04	17:07
27	07:38	07:03			06:19	06:33	06:03	06:00	06:20	06:48	07:17	06:47		07:08 (AG06)	07:22	07:45
	17:39	18:15			18:44	20:15	20:43	20:57	20:44	20:06	19:16	17:31	2	07:10 (AG06)	17:04	17:08
28	07:37	07:02			06:18	06:32	06:02	06:00	06:20	06:49	07:18	06:48			07:23	07:45
	17:40	18:16			18:45	20:16	20:43	20:57	20:43	20:04	19:14	17:30			17:03	17:08
29	07:37				07:16	06:30	06:02	06:00	06:21	06:50	07:19	06:50			07:24	07:45
	17:41				19:46	20:16	20:44	20:57	20:42	20:03	19:13	17:29			17:03	17:09
30	07:36				07:15	06:29	06:01	06:01	06:22	06:51	07:20	06:51			07:25	07:46
	17:42				19:47	20:17	20:45	20:57	20:41	20:01	19:11	17:27			17:03	17:10
31	07:35				07:13		06:01		06:23	06:52		06:52				07:46
	17:43				19:48		20:46		20:40	20:00		17:26				17:11
Potential sun hours	301	299		370	397	444	447	455	425	374	347		301	292
Total, worst case			121									123		
Sun reduction			0,47									0,54		
Oper. time red.			0,86									0,86		
Wind dir. red.			0,88									0,88		
Total reduction			0,36									0,41		
Total, real			43									51		

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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Calculated:
14/06/2022 17:04/3.4.415

SHADOW - Calendar

Calculation: Progetto_2022_06_14_Real_caseShadow receptor: R09 - Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (28)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	January			February			March			April	May	June
1	07:46			07:34			07:00		07:19 (AG07)	07:11	06:28	06:01
	17:12			17:45			18:17	62	08:26 (AG03)	19:49	20:18	20:46
2	07:46			07:33			06:59		07:17 (AG07)	07:10	06:26	06:00
	17:13			17:46			18:18	60	08:24 (AG03)	19:50	20:19	20:47
3	07:46			07:32		08:00 (AG03)	06:57		07:16 (AG07)	07:08	06:25	06:00
	17:13			17:47	8	08:08 (AG03)	18:19	61	08:24 (AG03)	19:51	20:20	20:48
4	07:47			07:31		07:55 (AG03)	06:56		07:14 (AG07)	07:07	06:24	05:59
	17:14			17:48	18	08:13 (AG03)	18:20	60	08:22 (AG03)	19:52	20:21	20:48
5	07:47			07:30		07:53 (AG03)	06:54		07:13 (AG07)	07:05	06:23	05:59
	17:15			17:49	23	08:16 (AG03)	18:21	58	08:21 (AG03)	19:53	20:22	20:49
6	07:47			07:29		07:51 (AG03)	06:53		07:11 (AG07)	07:04	06:22	05:59
	17:16			17:51	27	08:18 (AG03)	18:22	54	08:18 (AG03)	19:54	20:23	20:50
7	07:47			07:28		07:49 (AG03)	06:51		07:13 (AG07)	07:02	06:21	05:58
	17:17			17:52	31	08:20 (AG03)	18:23	49	08:17 (AG03)	19:55	20:24	20:50
8	07:46			07:27		07:47 (AG03)	06:50		07:14 (AG07)	07:00	06:19	05:58
	17:18			17:53	34	08:21 (AG03)	18:24	42	08:14 (AG03)	19:56	20:25	20:51
9	07:46			07:26		07:46 (AG03)	06:48		07:15 (AG07)	06:59	06:18	05:58
	17:19			17:54	37	08:23 (AG03)	18:25	31	08:10 (AG03)	19:57	20:26	20:52
10	07:46			07:25		07:45 (AG03)	06:46		07:20 (AG07)	06:57	06:17	05:58
	17:20			17:55	39	08:24 (AG03)	18:26	11	08:05 (AG03)	19:58	20:27	20:52
11	07:46			07:24		07:44 (AG03)	06:45			06:56	06:16	05:58
	17:21			17:56	41	08:25 (AG03)	18:27			19:59	20:28	20:53
12	07:46			07:23		07:43 (AG03)	06:43			06:54	06:15	05:58
	17:22			17:58	44	08:27 (AG03)	18:29			20:00	20:29	20:53
13	07:46			07:22		07:43 (AG03)	06:42			06:53	06:14	05:58
	17:23			17:59	45	08:28 (AG03)	18:30			20:01	20:30	20:54
14	07:45		08:06 (AG08)	07:20		07:41 (AG03)	06:40			06:51	06:13	05:57
	17:24	1	08:07 (AG08)	18:00	47	08:28 (AG03)	18:31			20:02	20:31	20:54
15	07:45		08:06 (AG08)	07:19		07:41 (AG03)	06:39			06:50	06:12	05:57
	17:25	3	08:09 (AG08)	18:01	47	08:28 (AG03)	18:32			20:03	20:32	20:54
16	07:45		08:05 (AG08)	07:18		07:40 (AG03)	06:37			06:48	06:11	05:57
	17:26	4	08:09 (AG08)	18:02	49	08:29 (AG03)	18:33			20:04	20:33	20:55
17	07:44		08:05 (AG08)	07:17		07:39 (AG03)	06:35			06:47	06:11	05:58
	17:27	6	08:11 (AG08)	18:03	50	08:29 (AG03)	18:34			20:05	20:34	20:55
18	07:44		08:04 (AG08)	07:15		07:39 (AG03)	06:34			06:45	06:10	05:58
	17:28	7	08:11 (AG08)	18:05	50	08:29 (AG03)	18:35			20:06	20:35	20:55
19	07:43		08:04 (AG08)	07:14		07:39 (AG03)	06:32			06:44	06:09	05:58
	17:29	8	08:12 (AG08)	18:06	51	08:30 (AG03)	18:36			20:07	20:36	20:56
20	07:43		08:03 (AG08)	07:13		07:38 (AG03)	06:31			06:43	06:08	05:58
	17:31	10	08:13 (AG08)	18:07	51	08:29 (AG03)	18:37			20:08	20:37	20:56
21	07:42		08:02 (AG08)	07:11		07:38 (AG03)	06:29			06:41	06:07	05:58
	17:32	11	08:13 (AG08)	18:08	52	08:30 (AG03)	18:38			20:09	20:38	20:56
22	07:42		08:02 (AG08)	07:10		07:39 (AG03)	06:27			06:40	06:06	05:58
	17:33	12	08:14 (AG08)	18:09	51	08:30 (AG03)	18:39			20:10	20:38	20:56
23	07:41		08:01 (AG08)	07:09		07:38 (AG03)	06:26			06:38	06:06	05:58
	17:34	13	08:14 (AG08)	18:10	51	08:29 (AG03)	18:40			20:11	20:39	20:57
24	07:40		08:00 (AG08)	07:07		07:26 (AG07)	06:24			06:37	06:05	05:59
	17:35	14	08:14 (AG08)	18:11	54	08:29 (AG03)	18:41			20:12	20:40	20:57
25	07:40		08:00 (AG08)	07:06		07:24 (AG07)	06:23			06:36	06:04	05:59
	17:36	14	08:14 (AG08)	18:12	58	08:28 (AG03)	18:42			20:13	20:41	20:57
26	07:39		07:59 (AG08)	07:04		07:23 (AG07)	06:21			06:34	06:04	05:59
	17:38	15	08:14 (AG08)	18:14	59	08:28 (AG03)	18:43			20:14	20:42	20:57
27	07:38		07:58 (AG08)	07:03		07:22 (AG07)	06:19			06:33	06:03	06:00
	17:39	16	08:14 (AG08)	18:15	60	08:28 (AG03)	18:44			20:15	20:43	20:57
28	07:37		07:57 (AG08)	07:02		07:20 (AG07)	06:18			06:32	06:03	06:00
	17:40	16	08:13 (AG08)	18:16	61	08:26 (AG03)	18:45			20:16	20:43	20:57
29	07:37		07:58 (AG08)				07:16			06:30	06:02	06:00
	17:41	14	08:12 (AG08)				19:46			20:17	20:44	20:57
30	07:36		08:00 (AG08)				07:15			06:29	06:01	06:01
	17:42	12	08:12 (AG08)				19:47			20:18	20:45	20:57
31	07:35		08:02 (AG08)				07:13				06:01	
	17:43	8	08:10 (AG08)				19:48				20:46	
Potential sun hours	301			299			370			397	444	447
Total, worst case		184			1138			488				
Sun reduction		0,45			0,47			0,49				
Oper. time red.		0,86			0,86			0,86				
Wind dir. red.		0,87			0,88			0,88				
Total reduction		0,34			0,36			0,37				
Total, real		62			407			182				

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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Calculated:
14/06/2022 17:04/3.4.415

SHADOW - Calendar

Calculation: Progetto_2022_06_14_Real_caseShadow receptor: R09 - Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (28)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	July	August	September	October			November			December
1	06:01	06:24	06:53	07:21			06:53		07:15 (AG03)	07:26
	20:57	20:39	19:58	19:10			17:25	39	07:54 (AG03)	17:02
2	06:02	06:25	06:54	07:22			06:54		07:16 (AG03)	07:27
	20:57	20:38	19:57	19:08			17:24	36	07:52 (AG03)	17:02
3	06:02	06:26	06:55	07:23			06:55		07:17 (AG03)	07:28
	20:57	20:37	19:55	19:06			17:23	34	07:51 (AG03)	17:02
4	06:03	06:27	06:56	07:24		07:54 (AG07)	06:56		07:18 (AG03)	07:29
	20:57	20:36	19:53	19:05	25	08:46 (AG03)	17:22	31	07:49 (AG03)	17:02
5	06:03	06:28	06:57	07:25		07:51 (AG07)	06:57		07:21 (AG03)	07:30
	20:56	20:35	19:52	19:03	37	08:49 (AG03)	17:21	27	07:48 (AG03)	17:02
6	06:04	06:29	06:57	07:26		07:49 (AG07)	06:58		07:23 (AG03)	07:31
	20:56	20:34	19:50	19:02	46	08:51 (AG03)	17:19	23	07:46 (AG03)	17:02
7	06:04	06:30	06:58	07:27		07:48 (AG07)	07:00		07:26 (AG03)	07:32
	20:56	20:33	19:49	19:00	52	08:53 (AG03)	17:18	17	07:43 (AG03)	17:01
8	06:05	06:30	06:59	07:28		07:47 (AG07)	07:01		07:31 (AG03)	07:33
	20:56	20:32	19:47	18:59	57	08:55 (AG03)	17:17	6	07:37 (AG03)	17:01
9	06:06	06:31	07:00	07:29		07:48 (AG07)	07:02			07:34
	20:55	20:30	19:45	18:57	58	08:56 (AG03)	17:16			17:01
10	06:06	06:32	07:01	07:30		07:49 (AG07)	07:03			07:34
	20:55	20:29	19:44	18:55	60	08:57 (AG03)	17:15			17:01
11	06:07	06:33	07:02	07:31		07:50 (AG07)	07:04		07:33 (AG08)	07:35
	20:55	20:28	19:42	18:54	61	08:58 (AG03)	17:15	8	07:41 (AG08)	17:02
12	06:08	06:34	07:03	07:32		07:51 (AG07)	07:05		07:31 (AG08)	07:36
	20:54	20:27	19:41	18:52	61	08:58 (AG03)	17:14	12	07:43 (AG08)	17:02
13	06:08	06:35	07:04	07:33		07:52 (AG07)	07:06		07:29 (AG08)	07:37
	20:54	20:25	19:39	18:51	61	08:59 (AG03)	17:13	15	07:44 (AG08)	17:02
14	06:09	06:36	07:05	07:34		07:53 (AG07)	07:08		07:30 (AG08)	07:38
	20:53	20:24	19:37	18:49	60	08:59 (AG03)	17:12	16	07:46 (AG08)	17:02
15	06:10	06:37	07:06	07:35		07:55 (AG07)	07:09		07:31 (AG08)	07:38
	20:53	20:23	19:36	18:48	59	09:00 (AG03)	17:11	16	07:47 (AG08)	17:02
16	06:11	06:38	07:07	07:36		07:56 (AG07)	07:10		07:32 (AG08)	07:39
	20:52	20:21	19:34	18:46	59	09:01 (AG03)	17:10	15	07:47 (AG08)	17:03
17	06:11	06:39	07:08	07:37		07:57 (AG07)	07:11		07:33 (AG08)	07:40
	20:52	20:20	19:32	18:45	56	09:01 (AG03)	17:09	14	07:47 (AG08)	17:03
18	06:12	06:40	07:09	07:38		07:58 (AG07)	07:12		07:34 (AG08)	07:40
	20:51	20:19	19:31	18:44	54	09:01 (AG03)	17:09	14	07:48 (AG08)	17:03
19	06:13	06:41	07:09	07:39		08:10 (AG03)	07:13		07:36 (AG08)	07:41
	20:50	20:17	19:29	18:42	51	09:01 (AG03)	17:08	13	07:49 (AG08)	17:04
20	06:14	06:42	07:10	07:40		08:09 (AG03)	07:14		07:37 (AG08)	07:42
	20:50	20:16	19:28	18:41	52	09:01 (AG03)	17:07	12	07:49 (AG08)	17:04
21	06:14	06:43	07:11	07:41		08:09 (AG03)	07:15		07:38 (AG08)	07:42
	20:49	20:15	19:26	18:39	51	09:00 (AG03)	17:07	11	07:49 (AG08)	17:04
22	06:15	06:44	07:12	07:42		08:09 (AG03)	07:17		07:39 (AG08)	07:43
	20:48	20:13	19:24	18:38	51	09:00 (AG03)	17:06	10	07:49 (AG08)	17:05
23	06:16	06:44	07:13	07:43		08:09 (AG03)	07:18		07:40 (AG08)	07:43
	20:47	20:12	19:23	18:37	50	08:59 (AG03)	17:06	8	07:48 (AG08)	17:05
24	06:17	06:45	07:14	07:44		08:09 (AG03)	07:19		07:41 (AG08)	07:44
	20:47	20:10	19:21	18:35	50	08:59 (AG03)	17:05	7	07:48 (AG08)	17:06
25	06:18	06:46	07:15	06:45		07:10 (AG03)	07:20		07:42 (AG08)	07:44
	20:46	20:09	19:19	17:34	49	07:59 (AG03)	17:05	6	07:48 (AG08)	17:07
26	06:19	06:47	07:16	06:46		07:10 (AG03)	07:21		07:44 (AG08)	07:44
	20:45	20:07	19:18	17:33	49	07:59 (AG03)	17:04	4	07:48 (AG08)	17:07
27	06:20	06:48	07:17	06:47		07:11 (AG03)	07:22		07:45 (AG08)	07:45
	20:44	20:06	19:16	17:31	47	07:58 (AG03)	17:04	3	07:48 (AG08)	17:08
28	06:20	06:49	07:18	06:48		07:11 (AG03)	07:23		07:46 (AG08)	07:45
	20:43	20:04	19:14	17:30	46	07:57 (AG03)	17:03	1	07:47 (AG08)	17:08
29	06:21	06:50	07:19	06:50		07:11 (AG03)	07:24			07:45
	20:42	20:03	19:13	17:29	45	07:56 (AG03)	17:03			17:09
30	06:22	06:51	07:20	06:51		07:12 (AG03)	07:25			07:46
	20:41	20:01	19:11	17:27	43	07:55 (AG03)	17:03			17:10
31	06:23	06:52		06:52		07:14 (AG03)				07:46
	20:40	20:00		17:26	41	07:55 (AG03)				17:11
Potential sun hours	455	425	374	347			301			292
Total, worst case					1431			398		
Sun reduction					0,54			0,50		
Oper. time red.					0,86			0,86		
Wind dir. red.					0,88			0,88		
Total reduction					0,41			0,38		
Total, real					589			151		

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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Calculated:
14/06/2022 17:04/3.4.415

SHADOW - Calendar

Calculation: Progetto_2022_06_14_Real_caseShadow receptor: R12 - Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (29)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	January			February			March			April			May			June		
1	07:46			07:34		07:54 (AG01)	07:00			07:11		07:30 (AG08)	06:28			06:01		06:21 (AG07)
	17:12			17:45	31	08:25 (AG01)	18:17			19:49	12	07:42 (AG08)	20:18			20:46	18	06:39 (AG07)
2	07:46			07:33		07:53 (AG01)	06:59			07:10		07:28 (AG08)	06:26			06:00		06:21 (AG07)
	17:13			17:46	33	08:26 (AG01)	18:18			19:50	13	07:41 (AG08)	20:19			20:47	18	06:39 (AG07)
3	07:46			07:32		07:52 (AG01)	06:57			07:08		07:26 (AG08)	06:25			06:00		06:21 (AG07)
	17:13			17:47	35	08:27 (AG01)	18:19			19:51	14	07:40 (AG08)	20:20			20:48	18	06:39 (AG07)
4	07:46			07:31		07:51 (AG01)	06:56			07:07		07:25 (AG08)	06:24			05:59		06:20 (AG07)
	17:14			17:48	36	08:27 (AG01)	18:20			19:52	15	07:40 (AG08)	20:21			20:48	18	06:38 (AG07)
5	07:47			07:30		07:50 (AG01)	06:54			07:05		07:23 (AG08)	06:23			05:59		06:20 (AG07)
	17:15			17:49	38	08:28 (AG01)	18:21			19:53	16	07:39 (AG08)	20:22			20:49	18	06:38 (AG07)
6	07:47			07:29		07:49 (AG01)	06:53			07:04		07:22 (AG08)	06:22			05:59		06:21 (AG07)
	17:16			17:51	39	08:28 (AG01)	18:22			19:54	16	07:38 (AG08)	20:23			20:50	17	06:38 (AG07)
7	07:46			07:28		07:48 (AG01)	06:51			07:02		07:22 (AG08)	06:21			05:58		06:22 (AG07)
	17:17			17:52	41	08:29 (AG01)	18:23			19:55	14	07:36 (AG08)	20:24			20:50	16	06:38 (AG07)
8	07:46			07:27		07:47 (AG01)	06:50			07:00		07:24 (AG08)	06:19			05:58		06:21 (AG07)
	17:18			17:53	41	08:28 (AG01)	18:24			19:56	10	07:34 (AG08)	20:25			20:51	16	06:37 (AG07)
9	07:46			07:26		07:47 (AG01)	06:48			06:59			06:18			05:58		06:22 (AG07)
	17:19			17:54	41	08:28 (AG01)	18:25			19:57			20:26			20:51	15	06:37 (AG07)
10	07:46			07:25		07:47 (AG01)	06:46			06:57			06:17			05:58		06:23 (AG07)
	17:20			17:55	42	08:29 (AG01)	18:26			19:58			20:27			20:52	14	06:37 (AG07)
11	07:46			07:24		07:47 (AG01)	06:45			06:56			06:16			05:58		06:24 (AG07)
	17:21			17:56	42	08:29 (AG01)	18:27			19:59			20:28			20:53	13	06:37 (AG07)
12	07:46			07:23		07:48 (AG01)	06:43			06:54			06:15			05:58		06:24 (AG07)
	17:22			17:58	41	08:29 (AG01)	18:29			20:00			20:29			20:53	13	06:37 (AG07)
13	07:45			07:22		07:48 (AG01)	06:42			06:53			06:14			05:58		06:25 (AG07)
	17:23			17:59	41	08:29 (AG01)	18:30			20:01			20:30			20:53	12	06:37 (AG07)
14	07:45			07:20		07:48 (AG01)	06:40			06:51			06:13			05:58		06:25 (AG07)
	17:24			18:00	40	08:28 (AG01)	18:31			20:02			20:31			20:54	11	06:36 (AG07)
15	07:45			07:19		07:48 (AG01)	06:39			06:50			06:12		06:32 (AG07)	05:58		06:26 (AG07)
	17:25			18:01	39	08:27 (AG01)	18:32			20:03			20:32	2	06:34 (AG07)	20:54	10	06:36 (AG07)
16	07:45			07:18		07:49 (AG01)	06:37			06:48			06:11		06:31 (AG07)	05:58		06:27 (AG07)
	17:26			18:02	38	08:27 (AG01)	18:33			20:04			20:33	4	06:35 (AG07)	20:55	9	06:36 (AG07)
17	07:44			07:17		07:49 (AG01)	06:35			06:47			06:11		06:30 (AG07)	05:58		06:27 (AG07)
	17:27			18:03	37	08:26 (AG01)	18:34			20:05			20:34	6	06:36 (AG07)	20:55	9	06:36 (AG07)
18	07:44			07:15		07:50 (AG01)	06:34			06:45			06:10		06:30 (AG07)	05:58		06:27 (AG07)
	17:28			18:05	35	08:25 (AG01)	18:35			20:06			20:35	7	06:37 (AG07)	20:55	9	06:36 (AG07)
19	07:43			07:14		07:52 (AG01)	06:32			06:44			06:09		06:29 (AG07)	05:58		06:28 (AG07)
	17:29			18:06	32	08:24 (AG01)	18:36			20:07			20:36	9	06:38 (AG07)	20:56	8	06:36 (AG07)
20	07:43			07:13		07:52 (AG01)	06:31			06:43			06:08		06:28 (AG07)	05:58		06:29 (AG07)
	17:31			18:07	30	08:22 (AG01)	18:37			20:08			20:37	10	06:38 (AG07)	20:56	7	06:36 (AG07)
21	07:42			07:11		07:54 (AG01)	06:29			06:41			06:07		06:27 (AG07)	05:58		06:29 (AG07)
	17:32			18:08	27	08:21 (AG01)	18:38			20:09			20:37	11	06:38 (AG07)	20:56	7	06:36 (AG07)
22	07:42			07:10		07:56 (AG01)	06:27			06:40			06:06		06:27 (AG07)	05:58		06:29 (AG07)
	17:33			18:09	23	08:19 (AG01)	18:39			20:10			20:38	12	06:39 (AG07)	20:56	7	06:36 (AG07)
23	07:41			07:09		07:58 (AG01)	06:26			06:38			06:06		06:26 (AG07)	05:59		06:29 (AG07)
	17:34			18:10	18	08:16 (AG01)	18:40			20:11			20:39	13	06:39 (AG07)	20:57	7	06:36 (AG07)
24	07:40		08:00 (AG01)	07:07		08:02 (AG01)	06:24			06:37			06:05		06:25 (AG07)	05:59		06:29 (AG07)
	17:35	11	08:11 (AG01)	18:11	10	08:12 (AG01)	18:41			20:12			20:40	14	06:39 (AG07)	20:57	9	06:38 (AG07)
25	07:40		08:00 (AG01)	07:06			06:23			06:36			06:04		06:25 (AG07)	05:59		06:29 (AG07)
	17:36	15	08:15 (AG01)	18:12			18:42			20:13			20:41	14	06:39 (AG07)	20:57	9	06:38 (AG07)
26	07:39		07:59 (AG01)	07:04			06:21			06:34			06:04		06:24 (AG07)	05:59		06:29 (AG07)
	17:38	18	08:17 (AG01)	18:14			18:43			20:14			20:42	15	06:39 (AG07)	20:57	9	06:38 (AG07)
27	07:38		07:58 (AG01)	07:03			06:19			06:33			06:03		06:24 (AG07)	06:00		06:29 (AG07)
	17:39	20	08:18 (AG01)	18:15			18:44			20:15			20:43	16	06:40 (AG07)	20:57	10	06:39 (AG07)
28	07:37		07:57 (AG01)	07:02			06:18		06:36 (AG08)	06:32			06:03		06:23 (AG07)	06:00		06:29 (AG07)
	17:40	23	08:20 (AG01)	18:16			18:45	3	06:39 (AG08)	20:15			20:43	16	06:39 (AG07)	20:57	10	06:39 (AG07)
29	07:37		07:56 (AG01)				07:16		07:34 (AG08)	06:30			06:02		06:23 (AG07)	06:00		06:28 (AG07)
	17:41	25	08:21 (AG01)				19:46	6	07:40 (AG08)	20:16			20:44	17	06:40 (AG07)	20:57	11	06:39 (AG07)
30	07:36		07:55 (AG01)				07:15		07:33 (AG08)	06:29			06:01		06:22 (AG07)	06:01		06:28 (AG07)
	17:42	27	08:22 (AG01)				19:47	8	07:41 (AG08)	20:17			20:45	17	06:39 (AG07)	20:57	13	06:41 (AG07)
31	07:35		07:55 (AG01)				07:13		07:31 (AG08)				06:01		06:22 (AG07)			
	17:43	29	08:24 (AG01)				19:48	10	07:41 (AG08)				20:46	17	06:39 (AG07)			
Potential sun hours	302			299			370			397			444			447		
Total, worst case		168			830			27			110			200			361	
Sun reduction		0,45			0,47			0,49			0,53			0,59			0,66	
Oper. time red.		0,86			0,86			0,86			0,86			0,86			0,86	
Wind dir. red.		0,88			0,88			0,82			0,82			0,67			0,67	
Total reduction		0,35			0,36			0,35			0,38			0,34			0,39	
Total, real		58			301			10			42			69			139	

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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Calculated:
14/06/2022 17:04/3.4.415

SHADOW - Calendar

Calculation: Progetto_2022_06_14_Real_caseShadow receptor: R12 - Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (29)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	July			August	September			October			November			December
1	06:01		06:28 (AG07)	06:24	06:53			07:21			06:53		07:17 (AG01)	07:26
	20:57	13	06:41 (AG07)	20:39	19:58			19:10			17:25	41	07:58 (AG01)	17:02
2	06:02		06:28 (AG07)	06:25	06:54			07:22			06:54		07:17 (AG01)	07:27
	20:57	14	06:42 (AG07)	20:38	19:57			19:08			17:24	41	07:58 (AG01)	17:02
3	06:02		06:27 (AG07)	06:26	06:55			07:23			06:55		07:17 (AG01)	07:28
	20:57	15	06:42 (AG07)	20:37	19:55			19:06			17:23	41	07:58 (AG01)	17:02
4	06:03		06:28 (AG07)	06:27	06:56		07:21 (AG08)	07:24			06:56		07:17 (AG01)	07:29
	20:57	15	06:43 (AG07)	20:36	19:53	10	07:31 (AG08)	19:05			17:22	41	07:58 (AG01)	17:02
5	06:03		06:27 (AG07)	06:28	06:57		07:19 (AG08)	07:25			06:57		07:19 (AG01)	07:30
	20:56	16	06:43 (AG07)	20:35	19:52	14	07:33 (AG08)	19:03			17:21	39	07:58 (AG01)	17:02
6	06:04		06:27 (AG07)	06:29	06:57		07:18 (AG08)	07:26			06:58		07:20 (AG01)	07:31
	20:56	17	06:44 (AG07)	20:34	19:50	16	07:34 (AG08)	19:02			17:20	38	07:58 (AG01)	17:02
7	06:05		06:26 (AG07)	06:30	06:58		07:18 (AG08)	07:27			07:00		07:21 (AG01)	07:32
	20:56	18	06:44 (AG07)	20:33	19:49	16	07:34 (AG08)	19:00			17:18	36	07:57 (AG01)	17:01
8	06:05		06:27 (AG07)	06:30	06:59		07:19 (AG08)	07:28			07:01		07:22 (AG01)	07:33
	20:56	18	06:45 (AG07)	20:32	19:47	15	07:34 (AG08)	18:59			17:17	34	07:56 (AG01)	17:01
9	06:06		06:28 (AG07)	06:31	07:00		07:20 (AG08)	07:29			07:02		07:23 (AG01)	07:34
	20:55	18	06:46 (AG07)	20:30	19:45	14	07:34 (AG08)	18:57			17:16	33	07:56 (AG01)	17:01
10	06:06		06:28 (AG07)	06:32	07:01		07:21 (AG08)	07:30			07:03		07:25 (AG01)	07:34
	20:55	18	06:46 (AG07)	20:29	19:44	13	07:34 (AG08)	18:55			17:15	31	07:56 (AG01)	17:02
11	06:07		06:29 (AG07)	06:33	07:02		07:22 (AG08)	07:31			07:04		07:26 (AG01)	07:35
	20:55	18	06:47 (AG07)	20:28	19:42	12	07:34 (AG08)	18:54			17:15	29	07:55 (AG01)	17:02
12	06:08		06:30 (AG07)	06:34	07:03		07:23 (AG08)	07:32			07:05		07:27 (AG01)	07:36
	20:54	17	06:47 (AG07)	20:27	19:41	10	07:33 (AG08)	18:52			17:14	27	07:54 (AG01)	17:02
13	06:08		06:30 (AG07)	06:35	07:04		07:24 (AG08)	07:33			07:06		07:28 (AG01)	07:37
	20:54	17	06:47 (AG07)	20:25	19:39	9	07:33 (AG08)	18:51			17:13	25	07:53 (AG01)	17:02
14	06:09		06:31 (AG07)	06:36	07:05		07:25 (AG08)	07:34			07:08		07:30 (AG01)	07:38
	20:53	17	06:48 (AG07)	20:24	19:37	6	07:31 (AG08)	18:49			17:12	23	07:53 (AG01)	17:02
15	06:10		06:32 (AG07)	06:37	07:06		07:25 (AG08)	07:35			07:09		07:31 (AG01)	07:38
	20:53	16	06:48 (AG07)	20:23	19:36	4	07:29 (AG08)	18:48			17:11	20	07:51 (AG01)	17:02
16	06:11		06:32 (AG07)	06:38	07:07			07:36			07:10		07:32 (AG01)	07:39
	20:52	16	06:48 (AG07)	20:21	19:34			18:46			17:10	18	07:50 (AG01)	17:03
17	06:11		06:33 (AG07)	06:39	07:08			07:37			07:11		07:33 (AG01)	07:40
	20:51	15	06:48 (AG07)	20:20	19:32			18:45			17:10	15	07:48 (AG01)	17:03
18	06:12		06:34 (AG07)	06:40	07:09			07:38		08:32 (AG01)	07:12		07:34 (AG01)	07:40
	20:51	15	06:49 (AG07)	20:19	19:31			18:44	13	08:45 (AG01)	17:09	11	07:45 (AG01)	17:03
19	06:13		06:35 (AG07)	06:41	07:09			07:39		08:29 (AG01)	07:13			07:41
	20:50	14	06:49 (AG07)	20:17	19:29			18:42	19	08:48 (AG01)	17:08			17:04
20	06:14		06:35 (AG07)	06:42	07:10			07:40		08:26 (AG01)	07:14			07:42
	20:50	13	06:48 (AG07)	20:16	19:28			18:41	24	08:50 (AG01)	17:07			17:04
21	06:15		06:36 (AG07)	06:43	07:11			07:41		08:24 (AG01)	07:15			07:42
	20:49	12	06:48 (AG07)	20:15	19:26			18:39	28	08:52 (AG01)	17:07			17:04
22	06:15		06:37 (AG07)	06:44	07:12			07:42		08:22 (AG01)	07:16			07:43
	20:48	12	06:49 (AG07)	20:13	19:24			18:38	31	08:53 (AG01)	17:06			17:05
23	06:16		06:38 (AG07)	06:44	07:13			07:43		08:21 (AG01)	07:18			07:43
	20:47	11	06:49 (AG07)	20:12	19:23			18:37	33	08:54 (AG01)	17:06			17:05
24	06:17		06:39 (AG07)	06:45	07:14			07:44		08:20 (AG01)	07:19			07:44
	20:47	9	06:48 (AG07)	20:10	19:21			18:35	35	08:55 (AG01)	17:05			17:06
25	06:18		06:40 (AG07)	06:46	07:15			06:45		07:20 (AG01)	07:20			07:44
	20:46	8	06:48 (AG07)	20:09	19:19			17:34	36	07:56 (AG01)	17:05			17:07
26	06:19		06:40 (AG07)	06:47	07:16			06:46		07:19 (AG01)	07:21			07:44
	20:45	7	06:47 (AG07)	20:07	19:18			17:33	38	07:57 (AG01)	17:04			17:07
27	06:20		06:41 (AG07)	06:48	07:17			06:47		07:18 (AG01)	07:22			07:45
	20:44	5	06:46 (AG07)	20:06	19:16			17:31	39	07:57 (AG01)	17:04			17:08
28	06:20		06:42 (AG07)	06:49	07:18			06:48		07:17 (AG01)	07:23			07:45
	20:43	3	06:45 (AG07)	20:04	19:14			17:30	40	07:57 (AG01)	17:03			17:09
29	06:21		06:43 (AG07)	06:50	07:19			06:50		07:17 (AG01)	07:24			07:45
	20:42	1	06:44 (AG07)	20:03	19:13			17:29	41	07:58 (AG01)	17:03			17:09
30	06:22			06:51	07:20			06:51		07:16 (AG01)	07:25			07:46
	20:41			20:01	19:11			17:27	42	07:58 (AG01)	17:03			17:10
31	06:23			06:52				06:52		07:17 (AG01)				07:46
	20:40			20:00				17:26	42	07:59 (AG01)				17:11
Potential sun hours	454			425	374			347			301			292
Total, worst case		388				139			461			543		
Sun reduction		0,74				0,65			0,54			0,50		
Oper. time red.		0,86				0,86			0,86			0,86		
Wind dir. red.		0,67				0,82			0,88			0,88		
Total reduction		0,43				0,46			0,42			0,39		
Total, real		167				64			192			210		

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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Calculated:
14/06/2022 17:04/3.4.415

SHADOW - Calendar

Calculation: Progetto_2022_06_14_Real_caseShadow receptor: R26 - Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (30)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	January			February	March			April	May	June
1	07:46		15:57 (AG08)	07:34	07:00			07:11	06:28	06:00
	17:12	18	16:15 (AG08)	17:44	18:17			19:49	20:18	20:46
2	07:46		15:58 (AG08)	07:33	06:58			07:10	06:26	06:00
	17:12	17	16:15 (AG08)	17:46	18:18			19:50	20:19	20:47
3	07:46		16:00 (AG08)	07:32	06:57			07:08	06:25	06:00
	17:13	14	16:14 (AG08)	17:47	18:19			19:51	20:20	20:48
4	07:46		16:01 (AG08)	07:31	06:56			07:07	06:24	05:59
	17:14	13	16:14 (AG08)	17:48	18:20			19:52	20:21	20:48
5	07:46		16:03 (AG08)	07:30	06:54			07:05	06:23	05:59
	17:15	10	16:13 (AG08)	17:49	18:21			19:53	20:22	20:49
6	07:46		16:06 (AG08)	07:29	06:52		17:52 (AG07)	07:03	06:22	05:59
	17:16	5	16:11 (AG08)	17:50	18:22	9	18:01 (AG07)	19:54	20:23	20:50
7	07:46			07:28	06:51		17:47 (AG07)	07:02	06:20	05:58
	17:17			17:52	18:23	15	18:02 (AG07)	19:55	20:24	20:50
8	07:46			07:27	06:49		17:45 (AG07)	07:00	06:19	05:58
	17:18			17:53	18:24	19	18:04 (AG07)	19:56	20:25	20:51
9	07:46			07:26	06:48		17:43 (AG07)	06:59	06:18	05:58
	17:19			17:54	18:25	21	18:04 (AG07)	19:57	20:26	20:51
10	07:46			07:25	06:46		17:42 (AG07)	06:57	06:17	05:58
	17:20			17:55	18:26	24	18:06 (AG07)	19:57	20:27	20:52
11	07:46			07:24	06:45		17:40 (AG07)	06:56	06:16	05:58
	17:21			17:56	18:27	27	18:07 (AG07)	19:58	20:28	20:52
12	07:46			07:23	06:43		17:39 (AG07)	06:54	06:15	05:57
	17:22			17:57	18:28	29	18:08 (AG07)	19:59	20:29	20:53
13	07:45			07:21	06:42		17:38 (AG07)	06:53	06:14	05:57
	17:23			17:59	18:29	31	18:09 (AG07)	20:00	20:30	20:53
14	07:45			07:20	06:40		17:37 (AG07)	06:51	06:13	05:57
	17:24			18:00	18:30	32	18:09 (AG07)	20:01	20:31	20:54
15	07:45			07:19	06:39		17:37 (AG07)	06:50	06:12	05:57
	17:25			18:01	18:31	34	18:11 (AG07)	20:02	20:32	20:54
16	07:44			07:18	06:37		17:36 (AG07)	06:48	06:11	05:57
	17:26			18:02	18:33	36	18:12 (AG07)	20:03	20:33	20:55
17	07:44			07:16	06:35		17:36 (AG07)	06:47	06:10	05:57
	17:27			18:03	18:34	37	18:13 (AG07)	20:04	20:34	20:55
18	07:44			07:15	06:34		17:35 (AG07)	06:45	06:10	05:58
	17:28			18:04	18:35	38	18:14 (AG03)	20:05	20:35	20:55
19	07:43			07:14	06:32		17:35 (AG07)	06:44	06:09	05:58
	17:29			18:06	18:36	40	18:15 (AG03)	20:06	20:36	20:56
20	07:43			07:13	06:31		17:35 (AG07)	06:42	06:08	05:58
	17:30			18:07	18:37	41	18:16 (AG03)	20:07	20:36	20:56
21	07:42			07:11	06:29		17:35 (AG07)	06:41	06:07	05:58
	17:32			18:08	18:38	42	18:17 (AG03)	20:08	20:37	20:56
22	07:41			07:10	06:27		17:36 (AG07)	06:40	06:06	05:58
	17:33			18:09	18:39	42	18:18 (AG03)	20:09	20:38	20:56
23	07:41			07:08	06:26		17:36 (AG07)	06:38	06:06	05:58
	17:34			18:10	18:40	43	18:19 (AG03)	20:10	20:39	20:57
24	07:40			07:07	06:24		17:37 (AG07)	06:37	06:05	05:59
	17:35			18:11	18:41	43	18:20 (AG03)	20:11	20:40	20:57
25	07:40			07:06	06:23		17:38 (AG07)	06:35	06:04	05:59
	17:36			18:12	18:42	42	18:21 (AG03)	20:12	20:41	20:57
26	07:39			07:04	06:21		17:39 (AG07)	06:34	06:04	05:59
	17:37			18:13	18:43	40	18:22 (AG03)	20:13	20:42	20:57
27	07:38			07:03	06:19		17:41 (AG07)	06:33	06:03	06:00
	17:39			18:15	18:44	35	18:22 (AG03)	20:14	20:42	20:57
28	07:37			07:01	06:18		17:44 (AG07)	06:31	06:02	06:00
	17:40			18:16	18:45	29	18:22 (AG03)	20:15	20:43	20:57
29	07:37				07:16		19:09 (AG03)	06:30	06:02	06:00
	17:41				19:46	10	19:19 (AG03)	20:16	20:44	20:57
30	07:36				07:15			06:29	06:01	06:01
	17:42				19:47			20:17	20:45	20:57
31	07:35				07:13				06:01	
	17:43				19:48				20:46	
Potential sun hours	301			299	370			397	444	447
Total, worst case		77				759				
Sun reduction		0,45				0,49				
Oper. time red.		0,86				0,86				
Wind dir. red.		0,48				0,80				
Total reduction		0,18				0,33				
Total, real		14				253				

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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Calculated:
14/06/2022 17:04/3.4.415

SHADOW - Calendar

Calculation: Progetto_2022_06_14_Real_caseShadow receptor: R26 - Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (30)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	July	August	September			October			November	December		
1	06:01	06:24	06:53			07:21		18:17 (AG07)	06:53	07:26		
	20:57	20:39	19:58			19:10	30	18:47 (AG07)	17:25	17:02		
2	06:02	06:25	06:54			07:22		18:18 (AG07)	06:54	07:27		
	20:57	20:38	19:56			19:08	28	18:46 (AG07)	17:24	17:02		
3	06:02	06:26	06:55			07:23		18:19 (AG07)	06:55	07:28		
	20:57	20:37	19:55			19:06	25	18:44 (AG07)	17:23	17:02		
4	06:03	06:27	06:55			07:24		18:20 (AG07)	06:56	07:29		
	20:56	20:36	19:53			19:05	22	18:42 (AG07)	17:22	17:02		
5	06:03	06:28	06:56			07:25		18:21 (AG07)	06:57	07:30		
	20:56	20:35	19:52			19:03	20	18:41 (AG07)	17:20	17:01		
6	06:04	06:28	06:57			07:25		18:23 (AG07)	06:58	07:31		15:53 (AG08)
	20:56	20:34	19:50			19:02	16	18:39 (AG07)	17:19	17:01	3	15:56 (AG08)
7	06:04	06:29	06:58			07:26		18:25 (AG07)	06:59	07:32		15:50 (AG08)
	20:56	20:33	19:49			19:00	13	18:38 (AG07)	17:18	17:01	10	16:00 (AG08)
8	06:05	06:30	06:59			07:27			07:01	07:33		15:49 (AG08)
	20:56	20:31	19:47			18:58			17:17	17:01	13	16:02 (AG08)
9	06:06	06:31	07:00			07:28			07:02	07:33		15:48 (AG08)
	20:55	20:30	19:45			18:57			17:16	17:01	14	16:02 (AG08)
10	06:06	06:32	07:01			07:29			07:03	07:34		15:47 (AG08)
	20:55	20:29	19:44			18:55			17:15	17:01	17	16:04 (AG08)
11	06:07	06:33	07:02			07:30			07:04	07:35		15:47 (AG08)
	20:54	20:28	19:42			18:54			17:14	17:01	18	16:05 (AG08)
12	06:08	06:34	07:03			07:31			07:05	07:36		15:47 (AG08)
	20:54	20:27	19:40			18:52			17:13	17:02	19	16:06 (AG08)
13	06:08	06:35	07:04			07:32			07:06	07:37		15:48 (AG08)
	20:54	20:25	19:39			18:51			17:13	17:02	20	16:08 (AG08)
14	06:09	06:36	07:05		18:59 (AG03)	07:33			07:07	07:37		15:47 (AG08)
	20:53	20:24	19:37	10	19:09 (AG03)	18:49			17:12	17:02	21	16:08 (AG08)
15	06:10	06:37	07:06		18:34 (AG07)	07:35			07:09	07:38		15:47 (AG08)
	20:53	20:23	19:36	26	19:11 (AG03)	18:48			17:11	17:02	22	16:09 (AG08)
16	06:10	06:38	07:07		18:30 (AG07)	07:36			07:10	07:39		15:48 (AG08)
	20:52	20:21	19:34	36	19:12 (AG03)	18:46			17:10	17:02	22	16:10 (AG08)
17	06:11	06:39	07:07		18:28 (AG07)	07:37			07:11	07:40		15:47 (AG08)
	20:51	20:20	19:32	39	19:10 (AG03)	18:45			17:09	17:03	23	16:10 (AG08)
18	06:12	06:40	07:08		18:26 (AG07)	07:38			07:12	07:40		15:48 (AG08)
	20:51	20:19	19:31	42	19:09 (AG03)	18:43			17:09	17:03	23	16:11 (AG08)
19	06:13	06:41	07:09		18:24 (AG07)	07:39			07:13	07:41		15:49 (AG08)
	20:50	20:17	19:29	43	19:07 (AG03)	18:42			17:08	17:03	23	16:12 (AG08)
20	06:14	06:42	07:10		18:23 (AG07)	07:40			07:14	07:41		15:49 (AG08)
	20:49	20:16	19:27	43	19:06 (AG03)	18:41			17:07	17:04	23	16:12 (AG08)
21	06:14	06:42	07:11		18:22 (AG07)	07:41			07:15	07:42		15:49 (AG08)
	20:49	20:14	19:26	42	19:04 (AG03)	18:39			17:07	17:04	24	16:13 (AG08)
22	06:15	06:43	07:12		18:21 (AG07)	07:42			07:16	07:43		15:49 (AG08)
	20:48	20:13	19:24	42	19:03 (AG03)	18:38			17:06	17:05	24	16:13 (AG08)
23	06:16	06:44	07:13		18:20 (AG07)	07:43			07:17	07:43		15:50 (AG08)
	20:47	20:12	19:23	41	19:01 (AG03)	18:36			17:05	17:05	23	16:13 (AG08)
24	06:17	06:45	07:14		18:19 (AG07)	07:44			07:19	07:43		15:51 (AG08)
	20:46	20:10	19:21	40	18:59 (AG03)	18:35			17:05	17:06	23	16:14 (AG08)
25	06:18	06:46	07:15		18:18 (AG07)	06:45			07:20	07:44		15:51 (AG08)
	20:46	20:09	19:19	39	18:57 (AG03)	17:34			17:04	17:06	23	16:14 (AG08)
26	06:19	06:47	07:16		18:17 (AG07)	06:46			07:21	07:44		15:52 (AG08)
	20:45	20:07	19:18	37	18:54 (AG07)	17:32			17:04	17:07	23	16:15 (AG08)
27	06:19	06:48	07:17		18:17 (AG07)	06:47			07:22	07:45		15:53 (AG08)
	20:44	20:06	19:16	37	18:54 (AG07)	17:31			17:04	17:08	22	16:15 (AG08)
28	06:20	06:49	07:18		18:17 (AG07)	06:48			07:23	07:45		15:53 (AG08)
	20:43	20:04	19:14	35	18:52 (AG07)	17:30			17:03	17:08	22	16:15 (AG08)
29	06:21	06:50	07:19		18:17 (AG07)	06:49			07:24	07:45		15:54 (AG08)
	20:42	20:03	19:13	33	18:50 (AG07)	17:29			17:03	17:09	21	16:15 (AG08)
30	06:22	06:51	07:20		18:17 (AG07)	06:51			07:25	07:46		15:55 (AG08)
	20:41	20:01	19:11	32	18:49 (AG07)	17:27			17:03	17:10	21	16:16 (AG08)
31	06:23	06:52				06:52				07:46		15:56 (AG08)
	20:40	20:00				17:26				17:11	20	16:16 (AG08)
Potential sun hours	455	425	374			347			301	292		
Total, worst case				617			154				517	
Sun reduction				0,65			0,54				0,45	
Oper. time red.				0,86			0,86				0,86	
Wind dir. red.				0,80			0,80				0,48	
Total reduction				0,44			0,36				0,18	
Total, real				270			56				94	

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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Calculated:
14/06/2022 17:04/3.4.415

SHADOW - Calendar

Calculation: Progetto_2022_06_14_Real_caseShadow receptor: R41 - Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (31)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	January			February	March	April	May			June
1	07:46		14:40 (AG06)	07:34	07:00	07:11	06:28			06:00
	17:12	50	15:30 (AG06)	17:44	18:17	19:49	20:18			20:46
2	07:46		14:41 (AG06)	07:33	06:58	07:10	06:26			06:00
	17:12	49	15:30 (AG06)	17:46	18:18	19:50	20:19			20:47
3	07:46		14:41 (AG06)	07:32	06:57	07:08	06:25			06:00
	17:13	49	15:30 (AG06)	17:47	18:19	19:51	20:20			20:48
4	07:46		14:43 (AG06)	07:31	06:56	07:07	06:24			05:59
	17:14	47	15:30 (AG06)	17:48	18:20	19:52	20:21			20:48
5	07:46		14:44 (AG06)	07:30	06:54	07:05	06:23		19:59 (AG05)	05:59
	17:15	46	15:30 (AG06)	17:49	18:21	19:53	20:22	1	20:00 (AG05)	20:49
6	07:46		14:45 (AG06)	07:29	06:52	07:03	06:22		19:57 (AG05)	05:59
	17:16	45	15:30 (AG06)	17:50	18:22	19:54	20:23	4	20:01 (AG05)	20:50
7	07:46		14:46 (AG06)	07:28	06:51	07:02	06:20		19:57 (AG05)	05:58
	17:17	44	15:30 (AG06)	17:52	18:23	19:55	20:24	5	20:02 (AG05)	20:50
8	07:46		14:48 (AG06)	07:27	06:49	07:00	06:19		19:56 (AG05)	05:58
	17:18	42	15:30 (AG06)	17:53	18:24	19:56	20:25	7	20:03 (AG05)	20:51
9	07:46		14:48 (AG06)	07:26	06:48	06:59	06:18		19:55 (AG05)	05:58
	17:19	40	15:28 (AG06)	17:54	18:25	19:57	20:26	9	20:04 (AG05)	20:51
10	07:46		14:50 (AG06)	07:25	06:46	06:57	06:17		19:55 (AG05)	05:58
	17:20	38	15:28 (AG06)	17:55	18:26	19:57	20:27	10	20:05 (AG05)	20:52
11	07:46		14:52 (AG06)	07:24	06:45	06:56	06:16		19:55 (AG05)	05:58
	17:21	36	15:28 (AG06)	17:56	18:27	19:58	20:28	11	20:06 (AG05)	20:52
12	07:46		14:54 (AG06)	07:23	06:43	06:54	06:15		19:55 (AG05)	05:57
	17:22	33	15:27 (AG06)	17:57	18:28	19:59	20:29	11	20:06 (AG05)	20:53
13	07:45		14:56 (AG06)	07:21	06:42	06:53	06:14		19:55 (AG05)	05:57
	17:23	29	15:25 (AG06)	17:59	18:29	20:00	20:30	12	20:07 (AG05)	20:53
14	07:45		14:59 (AG06)	07:20	06:40	06:51	06:13		19:55 (AG05)	05:57
	17:24	25	15:24 (AG06)	18:00	18:30	20:01	20:31	13	20:08 (AG05)	20:54
15	07:45		15:01 (AG06)	07:19	06:39	06:50	06:12		19:55 (AG05)	05:57
	17:25	21	15:22 (AG06)	18:01	18:31	20:02	20:32	14	20:09 (AG05)	20:54
16	07:44		15:05 (AG06)	07:18	06:37	06:48	06:11		19:55 (AG05)	05:57
	17:26	14	15:19 (AG06)	18:02	18:32	20:03	20:33	14	20:09 (AG05)	20:55
17	07:44			07:16	06:35	06:47	06:10		19:55 (AG05)	05:57
	17:27			18:03	18:34	20:04	20:34	15	20:10 (AG05)	20:55
18	07:44			07:15	06:34	06:45	06:09		19:56 (AG05)	05:57
	17:28			18:04	18:35	20:05	20:35	15	20:11 (AG05)	20:55
19	07:43			07:14	06:32	06:44	06:09		19:57 (AG05)	05:58
	17:29			18:06	18:36	20:06	20:36	15	20:12 (AG05)	20:56
20	07:43			07:13	06:31	06:42	06:08		19:58 (AG05)	05:58
	17:30			18:07	18:37	20:07	20:37	13	20:11 (AG05)	20:56
21	07:42			07:11	06:29	06:41	06:07		19:59 (AG05)	05:58
	17:32			18:08	18:38	20:08	20:37	11	20:10 (AG05)	20:56
22	07:41			07:10	06:27	06:40	06:06		20:01 (AG05)	05:58
	17:33			18:09	18:39	20:09	20:38	7	20:08 (AG05)	20:56
23	07:41			07:08	06:26	06:38	06:06			05:58
	17:34			18:10	18:40	20:10	20:39			20:57
24	07:40			07:07	06:24	06:37	06:05			05:59
	17:35			18:11	18:41	20:11	20:40			20:57
25	07:40			07:06	06:23	06:35	06:04			05:59
	17:36			18:12	18:42	20:12	20:41			20:57
26	07:39			07:04	06:21	06:34	06:04			05:59
	17:37			18:13	18:43	20:13	20:42			20:57
27	07:38			07:03	06:19	06:33	06:03			06:00
	17:39			18:14	18:44	20:14	20:42			20:57
28	07:37			07:01	06:18	06:31	06:02			06:00
	17:40			18:16	18:45	20:15	20:43			20:57
29	07:37				07:16	06:30	06:02			06:00
	17:41				19:46	20:16	20:44			20:57
30	07:36				07:15	06:29	06:01			06:01
	17:42				19:47	20:17	20:45			20:57
31	07:35				07:13		06:01			
	17:43				19:48		20:46			
Potential sun hours	301			299	370	397	444			447
Total, worst case		608						187		
Sun reduction		0,45						0,59		
Oper. time red.		0,86						0,86		
Wind dir. red.		0,41						0,88		
Total reduction		0,15						0,42		
Total, real		93						79		

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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Calculated:
14/06/2022 17:04/3.4.415

SHADOW - Calendar

Calculation: Progetto_2022_06_14_Real_caseShadow receptor: R41 - Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (31)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	July			August			September	October	November			December		
1	06:01			06:24		20:04 (AG05)	06:53	07:21	06:53			07:26		14:34 (AG06)
	20:57			20:39	12	20:16 (AG05)	19:58	19:10	17:25			17:02	36	15:10 (AG06)
2	06:02			06:25		20:05 (AG05)	06:54	07:22	06:54			07:27		14:33 (AG06)
	20:57			20:38	10	20:15 (AG05)	19:56	19:08	17:24			17:02	38	15:11 (AG06)
3	06:02			06:26		20:05 (AG05)	06:55	07:23	06:55			07:28		14:33 (AG06)
	20:57			20:37	9	20:14 (AG05)	19:55	19:06	17:23			17:02	39	15:12 (AG06)
4	06:03			06:27		20:05 (AG05)	06:55	07:24	06:56			07:29		14:32 (AG06)
	20:57			20:36	8	20:13 (AG05)	19:53	19:05	17:22			17:02	42	15:14 (AG06)
5	06:03			06:28		20:06 (AG05)	06:56	07:25	06:57			07:30		14:31 (AG06)
	20:56			20:35	6	20:12 (AG05)	19:52	19:03	17:20			17:01	44	15:15 (AG06)
6	06:04			06:28		20:07 (AG05)	06:57	07:25	06:58			07:31		14:31 (AG06)
	20:56			20:34	4	20:11 (AG05)	19:50	19:02	17:19			17:01	45	15:16 (AG06)
7	06:04			06:29		20:08 (AG05)	06:58	07:26	06:59			07:32		14:31 (AG06)
	20:56			20:33	2	20:10 (AG05)	19:49	19:00	17:18			17:01	46	15:17 (AG06)
8	06:05			06:30			06:59	07:27	07:01			07:33		14:31 (AG06)
	20:56			20:31			19:47	18:58	17:17			17:01	47	15:18 (AG06)
9	06:06			06:31			07:00	07:28	07:02			07:33		14:30 (AG06)
	20:55			20:30			19:45	18:57	17:16			17:01	48	15:18 (AG06)
10	06:06			06:32			07:01	07:29	07:03			07:34		14:30 (AG06)
	20:55			20:29			19:44	18:55	17:15			17:01	49	15:19 (AG06)
11	06:07			06:33			07:02	07:30	07:04			07:35		14:30 (AG06)
	20:54			20:28			19:42	18:54	17:14			17:01	50	15:20 (AG06)
12	06:08			06:34			07:03	07:31	07:05			07:36		14:30 (AG06)
	20:54			20:27			19:40	18:52	17:13			17:02	51	15:21 (AG06)
13	06:08			06:35			07:04	07:32	07:06			07:37		14:30 (AG06)
	20:54			20:25			19:39	18:51	17:13			17:02	52	15:22 (AG06)
14	06:09			06:36			07:05	07:33	07:07			07:37		14:30 (AG06)
	20:53			20:24			19:37	18:49	17:12			17:02	52	15:22 (AG06)
15	06:10			06:37			07:06	07:34	07:09			07:38		14:30 (AG06)
	20:53			20:23			19:36	18:48	17:11			17:02	53	15:23 (AG06)
16	06:10			06:38			07:07	07:36	07:10			07:39		14:31 (AG06)
	20:52			20:21			19:34	18:46	17:10			17:02	53	15:24 (AG06)
17	06:11			06:39			07:07	07:37	07:11			07:40		14:30 (AG06)
	20:51			20:20			19:32	18:45	17:09			17:03	54	15:24 (AG06)
18	06:12			06:40			07:08	07:38	07:12			07:40		14:31 (AG06)
	20:51			20:19			19:31	18:43	17:09			17:03	54	15:25 (AG06)
19	06:13			06:41			07:09	07:39	07:13			07:41		14:32 (AG06)
	20:50			20:17			19:29	18:42	17:08			17:03	54	15:26 (AG06)
20	06:14			06:42			07:10	07:40	07:14			07:41		14:32 (AG06)
	20:49			20:16			19:27	18:41	17:07			17:04	54	15:26 (AG06)
21	06:14		20:13 (AG05)	06:42			07:11	07:41	07:15			07:42		14:32 (AG06)
	20:49	3	20:16 (AG05)	20:14			19:26	18:39	17:07			17:04	55	15:27 (AG06)
22	06:15		20:10 (AG05)	06:43			07:12	07:42	07:16			07:43		14:32 (AG06)
	20:48	9	20:19 (AG05)	20:13			19:24	18:38	17:06			17:05	55	15:27 (AG06)
23	06:16		20:09 (AG05)	06:44			07:13	07:43	07:18			07:43		14:34 (AG06)
	20:47	12	20:21 (AG05)	20:12			19:23	18:36	17:05			17:05	54	15:28 (AG06)
24	06:17		20:08 (AG05)	06:45			07:14	07:44	07:19			07:43		14:34 (AG06)
	20:46	14	20:22 (AG05)	20:10			19:21	18:35	17:05			17:06	54	15:28 (AG06)
25	06:18		20:07 (AG05)	06:46			07:15	06:45	07:20			07:44		14:34 (AG06)
	20:46	15	20:22 (AG05)	20:09			19:19	17:34	17:04			17:06	54	15:28 (AG06)
26	06:19		20:06 (AG05)	06:47			07:16	06:46	07:21		14:43 (AG06)	07:44		14:35 (AG06)
	20:45	15	20:21 (AG05)	20:07			19:18	17:32	17:04	14	14:57 (AG06)	17:07	54	15:29 (AG06)
27	06:19		20:06 (AG05)	06:48			07:17	06:47	07:22		14:41 (AG06)	07:45		14:36 (AG06)
	20:44	14	20:20 (AG05)	20:06			19:16	17:31	17:04	20	15:01 (AG06)	17:08	53	15:29 (AG06)
28	06:20		20:06 (AG05)	06:49			07:18	06:48	07:23		14:39 (AG06)	07:45		14:36 (AG06)
	20:43	14	20:20 (AG05)	20:04			19:14	17:30	17:03	25	15:04 (AG06)	17:08	53	15:29 (AG06)
29	06:21		20:05 (AG05)	06:50			07:19	06:49	07:24		14:37 (AG06)	07:45		14:36 (AG06)
	20:42	14	20:19 (AG05)	20:03			19:13	17:29	17:03	29	15:06 (AG06)	17:09	53	15:29 (AG06)
30	06:22		20:05 (AG05)	06:51			07:20	06:51	07:25		14:36 (AG06)	07:46		14:38 (AG06)
	20:41	13	20:18 (AG05)	20:01			19:11	17:27	17:02	32	15:08 (AG06)	17:10	52	15:30 (AG06)
31	06:23		20:04 (AG05)	06:52				06:52				07:46		14:39 (AG06)
	20:40	12	20:16 (AG05)	20:00				17:26				17:11	51	15:30 (AG06)
Potential sun hours	455			425			374	347	301			292		
Total, worst case		135			51					120			1549	
Sun reduction		0,74			0,73					0,50			0,45	
Oper. time red.		0,86			0,86					0,86			0,86	
Wind dir. red.		0,88			0,88					0,41			0,41	
Total reduction		0,53			0,53					0,17			0,15	
Total, real		72			27					20			237	

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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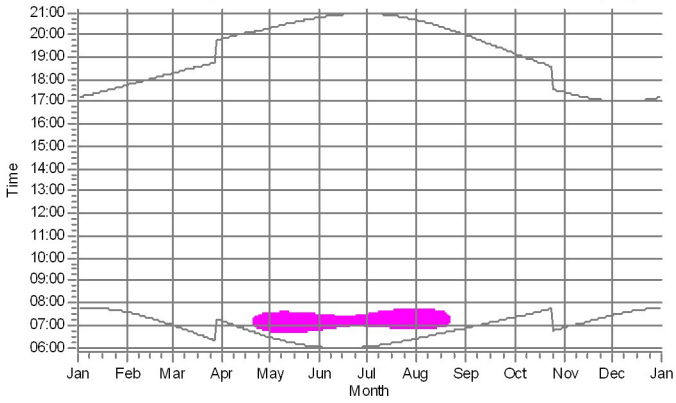
14/06/2022 17:04/3.4.415

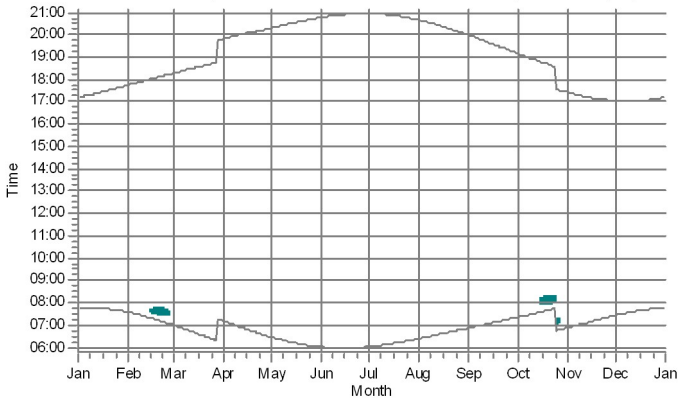
SHADOW - Calendar, graphical

Calculation: Progetto_2022_06_14_Real_case

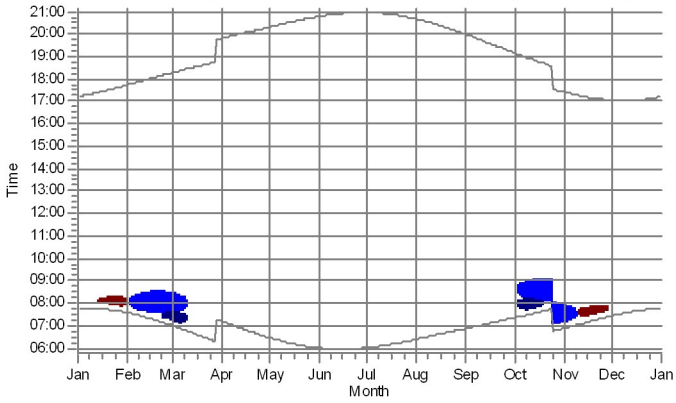
R05: Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (26)



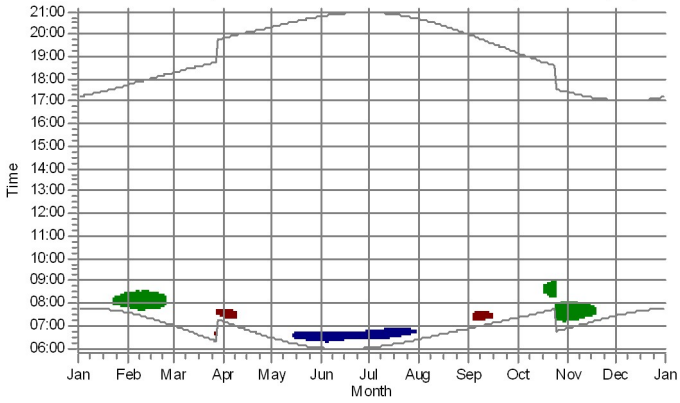
R06: Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (27)



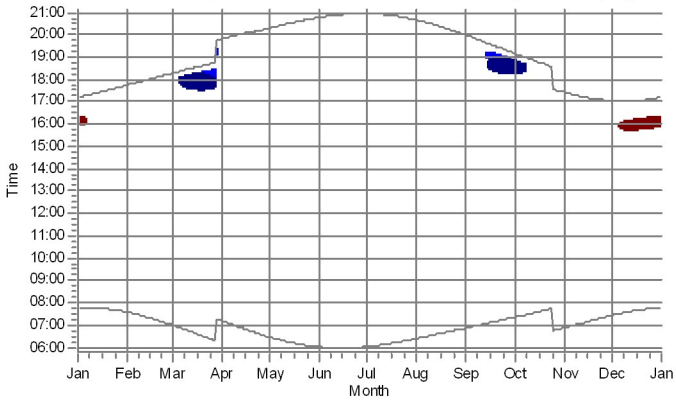
R09: Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (28)



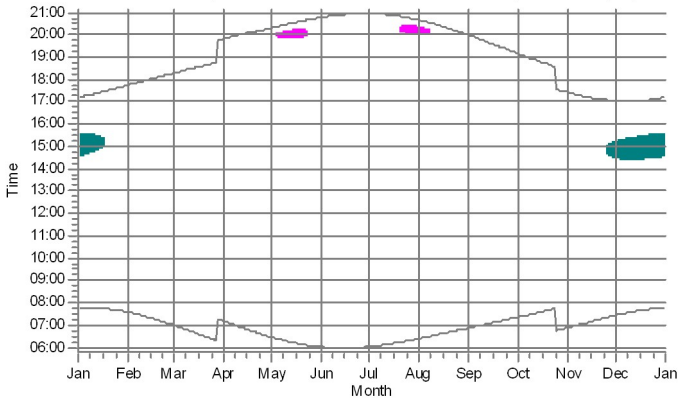
R12: Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (29)



R26: Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (30)



R41: Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (31)



WTGs

- AG01: VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (18)
- AG03: VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (11)
- AG05: VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (16)
- AG06: VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (13)
- AG07: VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (12)
- AG08: VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (17)

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SHADOW - Calendar per WTG

Calculation: Progetto_2022_06_14_Real_caseWTG: AG01 - VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (18)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:46	07:34 07:54-08:25/31	07:00	07:11	06:28	06:01	06:01	06:24	06:53	07:21	06:53 07:17-07:58/41	07:26
	17:12	17:45	18:17	19:49	20:18	20:46	20:57	20:39	19:58	19:10	17:25	17:02
2	07:46	07:33 07:53-08:26/33	06:59	07:10	06:26	06:00	06:02	06:25	06:54	07:22	06:54 07:17-07:58/41	07:27
	17:13	17:46	18:18	19:50	20:19	20:47	20:57	20:38	19:57	19:08	17:24	17:02
3	07:46	07:32 07:52-08:27/35	06:57	07:08	06:25	06:00	06:02	06:26	06:55	07:23	06:55 07:17-07:58/41	07:28
	17:13	17:47	18:19	19:51	20:20	20:48	20:57	20:37	19:55	19:06	17:23	17:02
4	07:46	07:31 07:51-08:27/36	06:56	07:07	06:24	05:59	06:03	06:27	06:56	07:24	06:56 07:17-07:58/41	07:29
	17:14	17:48	18:20	19:52	20:21	20:48	20:57	20:36	19:53	19:05	17:22	17:02
5	07:46	07:30 07:50-08:28/38	06:54	07:05	06:23	05:59	06:03	06:28	06:57	07:25	06:57 07:19-07:58/39	07:30
	17:15	17:49	18:21	19:53	20:22	20:49	20:56	20:35	19:52	19:03	17:21	17:02
6	07:46	07:29 07:49-08:28/39	06:53	07:04	06:22	05:59	06:04	06:29	06:57	07:26	06:58 07:20-07:58/38	07:31
	17:16	17:51	18:22	19:54	20:23	20:50	20:56	20:34	19:50	19:02	17:19	17:02
7	07:46	07:28 07:48-08:29/41	06:51	07:02	06:21	05:58	06:04	06:30	06:58	07:27	07:00 07:21-07:57/36	07:32
	17:17	17:52	18:23	19:55	20:24	20:50	20:56	20:33	19:49	19:00	17:18	17:01
8	07:46	07:27 07:47-08:28/41	06:50	07:00	06:19	05:58	06:05	06:30	06:59	07:28	07:01 07:22-07:56/34	07:33
	17:18	17:53	18:24	19:56	20:25	20:51	20:56	20:31	19:47	18:59	17:17	17:01
9	07:46	07:26 07:47-08:28/41	06:48	06:59	06:18	05:58	06:06	06:31	07:00	07:29	07:02 07:23-07:56/33	07:34
	17:19	17:54	18:25	19:57	20:26	20:51	20:55	20:30	19:45	18:57	17:16	17:01
10	07:46	07:25 07:47-08:29/42	06:46	06:57	06:17	05:58	06:06	06:32	07:01	07:30	07:03 07:25-07:56/31	07:34
	17:20	17:55	18:26	19:58	20:27	20:52	20:55	20:29	19:44	18:55	17:15	17:01
11	07:46	07:24 07:47-08:29/42	06:45	06:56	06:16	05:58	06:07	06:33	07:02	07:31	07:04 07:26-07:55/29	07:35
	17:21	17:56	18:27	19:59	20:28	20:52	20:54	20:28	19:42	18:54	17:15	17:02
12	07:46	07:23 07:48-08:29/41	06:43	06:54	06:15	05:58	06:08	06:34	07:03	07:32	07:05 07:27-07:54/27	07:36
	17:22	17:58	18:28	20:00	20:29	20:53	20:54	20:27	19:41	18:52	17:14	17:02
13	07:45	07:21 07:48-08:29/41	06:42	06:53	06:14	05:58	06:08	06:35	07:04	07:33	07:06 07:28-07:53/25	07:37
	17:23	17:59	18:30	20:01	20:30	20:53	20:54	20:25	19:39	18:51	17:13	17:02
14	07:45	07:20 07:48-08:28/40	06:40	06:51	06:13	05:57	06:09	06:36	07:05	07:34	07:07 07:30-07:53/23	07:38
	17:24	18:00	18:31	20:02	20:31	20:54	20:53	20:24	19:37	18:49	17:12	17:02
15	07:45	07:19 07:48-08:27/39	06:39	06:50	06:12	05:57	06:10	06:37	07:06	07:35	07:09 07:31-07:51/20	07:38
	17:25	18:01	18:32	20:03	20:32	20:54	20:53	20:23	19:36	18:48	17:11	17:02
16	07:44	07:18 07:49-08:27/38	06:37	06:48	06:11	05:58	06:11	06:38	07:07	07:36	07:10 07:32-07:50/18	07:39
	17:26	18:02	18:33	20:04	20:33	20:55	20:52	20:21	19:34	18:46	17:10	17:03
17	07:44	07:17 07:49-08:26/37	06:35	06:47	06:11	05:58	06:11	06:39	07:08	07:37	07:11 07:33-07:48/15	07:40
	17:27	18:03	18:34	20:05	20:34	20:55	20:51	20:20	19:32	18:45	17:09	17:03
18	07:44	07:15 07:50-08:25/35	06:34	06:45	06:10	05:58	06:12	06:40	07:08	07:38 08:32-08:45/13	07:12 07:34-07:45/11	07:40
	17:28	18:05	18:35	20:06	20:35	20:55	20:51	20:19	19:31	18:44	17:09	17:03
19	07:43	07:14 07:52-08:24/32	06:32	06:44	06:09	05:58	06:13	06:41	07:09	07:39 08:29-08:48/19	07:13	07:41
	17:29	18:06	18:36	20:07	20:36	20:56	20:50	20:17	19:29	18:42	17:08	17:04
20	07:43	07:13 07:52-08:22/30	06:31	06:42	06:08	05:58	06:14	06:42	07:10	07:40 08:26-08:50/24	07:14	07:41
	17:31	18:07	18:37	20:07	20:37	20:56	20:50	20:16	19:28	18:41	17:07	17:04
21	07:42	07:11 07:54-08:21/27	06:29	06:41	06:07	05:58	06:14	06:43	07:11	07:41 08:24-08:52/28	07:15	07:42
	17:32	18:08	18:38	20:08	20:37	20:56	20:49	20:14	19:26	18:39	17:07	17:04
22	07:42	07:10 07:56-08:19/23	06:27	06:40	06:06	05:58	06:15	06:44	07:12	07:42 08:22-08:53/31	07:16	07:43
	17:33	18:09	18:39	20:09	20:38	20:56	20:48	20:13	19:24	18:38	17:06	17:05
23	07:41	07:09 07:58-08:16/18	06:26	06:38	06:06	05:58	06:16	06:44	07:13	07:43 08:21-08:54/33	07:18	07:43
	17:34	18:10	18:40	20:10	20:39	20:57	20:47	20:12	19:23	18:37	17:06	17:05
24	07:40 08:00-08:11/11	07:07 08:02-08:12/10	06:24	06:37	06:05	05:59	06:17	06:45	07:14	07:44 08:20-08:55/35	07:19	07:44
	17:35	18:11	18:41	20:11	20:40	20:57	20:47	20:10	19:21	18:35	17:05	17:06
25	07:40 08:00-08:15/15	07:06	06:23	06:36	06:04	05:59	06:18	06:46	07:15	06:45 07:20-07:56/36	07:20	07:44
	17:36	18:12	18:42	20:12	20:41	20:57	20:46	20:09	19:19	17:34	17:05	17:07
26	07:39 07:59-08:17/18	07:04	06:21	06:34	06:04	05:59	06:19	06:47	07:16	06:46 07:19-07:57/38	07:21	07:44
	17:37	18:13	18:43	20:13	20:42	20:57	20:45	20:07	19:18	17:33	17:04	17:07
27	07:38 07:58-08:18/20	07:03	06:19	06:33	06:03	06:00	06:20	06:48	07:17	06:47 07:18-07:57/39	07:22	07:45
	17:39	18:15	18:44	20:14	20:42	20:57	20:44	20:06	19:16	17:31	17:04	17:08
28	07:37 07:57-08:20/23	07:01	06:18	06:32	06:03	06:00	06:20	06:49	07:18	06:48 07:17-07:57/40	07:23	07:45
	17:40	18:16	18:45	20:15	20:43	20:57	20:43	20:04	19:14	17:30	17:03	17:08
29	07:37 07:56-08:21/25		07:16	06:30	06:02	06:00	06:21	06:50	07:19	06:49 07:17-07:58/41	07:24	07:45
	17:41		19:46	20:16	20:44	20:57	20:42	20:03	19:13	17:29	17:03	17:09
30	07:36 07:55-08:22/27		07:15	06:29	06:01	06:01	06:22	06:51	07:20	06:51 07:16-07:58/42	07:25	07:46
	17:42		19:47	20:17	20:45	20:57	20:41	20:01	19:11	17:27	17:03	17:10
31	07:35 07:55-08:24/29		07:13		06:01		06:23	06:52		06:52 07:17-07:59/42		07:46
	17:43		19:48		20:46		20:40	20:00		17:26		17:11
Potential sun hours	302	299	370	397	444	447	454	425	374	347	301	292
Sum of minutes with flicker	168	830	0	0	0	0	0	0	0	461	543	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

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Calculated:
14/06/2022 17:04/3.4.415

SHADOW - Calendar per WTG

Calculation: Progetto_2022_06_14_Real_caseWTG: AG02 - VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (14)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:46	07:34	07:00	07:11	06:28	06:01	06:01	06:24	06:53	07:21	06:53	07:26
	17:12	17:45	18:17	19:49	20:18	20:46	20:57	20:39	19:58	19:10	17:25	17:02
2	07:46	07:33	06:59	07:10	06:26	06:00	06:02	06:25	06:54	07:22	06:54	07:27
	17:13	17:46	18:18	19:50	20:19	20:47	20:57	20:38	19:57	19:08	17:24	17:02
3	07:46	07:32	06:57	07:08	06:25	06:00	06:02	06:26	06:55	07:23	06:55	07:28
	17:13	17:47	18:19	19:51	20:20	20:48	20:57	20:37	19:55	19:06	17:23	17:02
4	07:46	07:31	06:56	07:07	06:24	05:59	06:03	06:27	06:56	07:24	06:56	07:29
	17:14	17:48	18:20	19:52	20:21	20:48	20:57	20:36	19:53	19:05	17:22	17:02
5	07:47	07:30	06:54	07:05	06:23	05:59	06:03	06:28	06:57	07:25	06:57	07:30
	17:15	17:49	18:21	19:53	20:22	20:49	20:56	20:35	19:52	19:03	17:21	17:02
6	07:47	07:29	06:53	07:04	06:22	05:59	06:04	06:29	06:57	07:26	06:58	07:31
	17:16	17:51	18:22	19:54	20:23	20:50	20:56	20:34	19:50	19:02	17:19	17:02
7	07:46	07:28	06:51	07:02	06:21	05:58	06:04	06:30	06:58	07:27	07:00	07:32
	17:17	17:52	18:23	19:55	20:24	20:50	20:56	20:33	19:49	19:00	17:18	17:01
8	07:46	07:27	06:50	07:00	06:19	05:58	06:05	06:30	06:59	07:28	07:01	07:33
	17:18	17:53	18:24	19:56	20:25	20:51	20:56	20:32	19:47	18:59	17:17	17:01
9	07:46	07:26	06:48	06:59	06:18	05:58	06:06	06:31	07:00	07:29	07:02	07:34
	17:19	17:54	18:25	19:57	20:26	20:51	20:55	20:30	19:45	18:57	17:16	17:01
10	07:46	07:25	06:46	06:57	06:17	05:58	06:06	06:32	07:01	07:30	07:03	07:34
	17:20	17:55	18:26	19:58	20:27	20:52	20:55	20:29	19:44	18:55	17:15	17:01
11	07:46	07:24	06:45	06:56	06:16	05:58	06:07	06:33	07:02	07:31	07:04	07:35
	17:21	17:56	18:27	19:59	20:28	20:53	20:55	20:28	19:42	18:54	17:15	17:02
12	07:46	07:23	06:43	06:54	06:15	05:58	06:08	06:34	07:03	07:32	07:05	07:36
	17:22	17:58	18:28	20:00	20:29	20:53	20:54	20:27	19:41	18:52	17:14	17:02
13	07:45	07:21	06:42	06:53	06:14	05:58	06:08	06:35	07:04	07:33	07:06	07:37
	17:23	17:59	18:30	20:01	20:30	20:53	20:54	20:25	19:39	18:51	17:13	17:02
14	07:45	07:20	06:40	06:51	06:13	05:57	06:09	06:36	07:05	07:34	07:08	07:38
	17:24	18:00	18:31	20:02	20:31	20:54	20:53	20:24	19:37	18:49	17:12	17:02
15	07:45	07:19	06:39	06:50	06:12	05:57	06:10	06:37	07:06	07:35	07:09	07:38
	17:25	18:01	18:32	20:03	20:32	20:54	20:53	20:23	19:36	18:48	17:11	17:02
16	07:44	07:18	06:37	06:48	06:11	05:57	06:11	06:38	07:07	07:36	07:10	07:39
	17:26	18:02	18:33	20:04	20:33	20:55	20:52	20:21	19:34	18:46	17:10	17:03
17	07:44	07:17	06:35	06:47	06:11	05:58	06:11	06:39	07:08	07:37	07:11	07:40
	17:27	18:03	18:34	20:05	20:34	20:55	20:51	20:20	19:32	18:45	17:09	17:03
18	07:44	07:15	06:34	06:45	06:10	05:58	06:12	06:40	07:08	07:38	07:12	07:40
	17:28	18:05	18:35	20:06	20:35	20:55	20:51	20:19	19:31	18:44	17:09	17:03
19	07:43	07:14	06:32	06:44	06:09	05:58	06:13	06:41	07:09	07:39	07:13	07:41
	17:29	18:06	18:36	20:07	20:36	20:56	20:50	20:17	19:29	18:42	17:08	17:04
20	07:43	07:13	06:31	06:42	06:08	05:58	06:14	06:42	07:10	07:40	07:14	07:42
	17:31	18:07	18:37	20:08	20:37	20:56	20:50	20:16	19:28	18:41	17:07	17:04
21	07:42	07:11	06:29	06:41	06:07	05:58	06:14	06:43	07:11	07:41	07:15	07:42
	17:32	18:08	18:38	20:09	20:37	20:56	20:49	20:15	19:26	18:39	17:07	17:04
22	07:42	07:10	06:27	06:40	06:06	05:58	06:15	06:44	07:12	07:42	07:16	07:43
	17:33	18:09	18:39	20:10	20:38	20:56	20:48	20:13	19:24	18:38	17:06	17:05
23	07:41	07:09	06:26	06:38	06:06	05:58	06:16	06:44	07:13	07:43	07:18	07:43
	17:34	18:10	18:40	20:11	20:39	20:57	20:47	20:12	19:23	18:37	17:06	17:05
24	07:40	07:07	06:24	06:37	06:05	05:59	06:17	06:45	07:14	07:44	07:19	07:44
	17:35	18:11	18:41	20:12	20:40	20:57	20:47	20:10	19:21	18:35	17:05	17:06
25	07:40	07:06	06:23	06:36	06:04	05:59	06:18	06:46	07:15	06:45	07:20	07:44
	17:36	18:12	18:42	20:13	20:41	20:57	20:46	20:09	19:19	17:34	17:05	17:07
26	07:39	07:04	06:21	06:34	06:04	05:59	06:19	06:47	07:16	06:46	07:21	07:44
	17:37	18:14	18:43	20:13	20:42	20:57	20:45	20:07	19:18	17:33	17:04	17:07
27	07:38	07:03	06:19	06:33	06:03	06:00	06:20	06:48	07:17	06:47	07:22	07:45
	17:39	18:15	18:44	20:14	20:43	20:57	20:44	20:06	19:16	17:31	17:04	17:08
28	07:37	07:01	06:18	06:32	06:03	06:00	06:20	06:49	07:18	06:48	07:23	07:45
	17:40	18:16	18:45	20:15	20:43	20:57	20:43	20:04	19:14	17:30	17:03	17:08
29	07:37		07:16	06:30	06:02	06:00	06:21	06:50	07:19	06:50	07:24	07:45
	17:41		19:46	20:16	20:44	20:57	20:42	20:03	19:13	17:29	17:03	17:09
30	07:36		07:15	06:29	06:01	06:01	06:22	06:51	07:20	06:51	07:25	07:46
	17:42		19:47	20:17	20:45	20:57	20:41	20:01	19:11	17:27	17:03	17:10
31	07:35		07:13		06:01		06:23	06:52		06:52		07:46
	17:43		19:48		20:46		20:40	20:00		17:26		17:11
Potential sun hours	302	299	370	397	444	447	454	425	374	347	301	292
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

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Calculated:
14/06/2022 17:04/3.4.415

SHADOW - Calendar per WTG

Calculation: Progetto_2022_06_14_Real_caseWTG: AG03 - VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (11)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:46	07:34	07:00 07:40-08:26/46	07:11	06:28	06:00	06:01	06:24	06:53	07:21	06:53 07:15-07:54/39	07:26
	17:12	17:45	18:17	19:49	20:18	20:46	20:57	20:39	19:58	19:10	17:25	17:02
2	07:46	07:33	06:59 07:41-08:24/43	07:10	06:26	06:00	06:02	06:25	06:54	07:22	06:54 07:16-07:52/36	07:27
	17:13	17:46	18:18	19:50	20:19	20:47	20:57	20:38	19:57	19:08	17:24	17:02
3	07:46	07:32 08:00-08:08/8	06:57 07:42-08:24/42	07:08	06:25	06:00	06:02	06:26	06:55	07:23	06:55 07:17-07:51/34	07:28
	17:13	17:47	18:19	19:51	20:20	20:48	20:57	20:37	19:55	19:06	17:23	17:02
4	07:46	07:31 07:55-08:13/18	06:56 07:42-08:22/40	07:07	06:24	05:59	06:03	06:27	06:56	07:24 08:30-08:46/16	06:56 07:18-07:49/31	07:29
	17:14	17:48	18:20	19:52	20:21	20:48	20:57	20:36	19:53	19:05	17:22	17:02
5	07:47	07:30 07:53-08:16/23	06:54 07:44-08:21/37	07:05	06:23	05:59	06:03	06:28	06:57	07:25 08:26-08:49/23	06:57 07:21-07:48/27	07:30
	17:15	17:49	18:21	19:53	20:22	20:49	20:56	20:35	19:52	19:03	17:21	17:02
6	07:47	07:29 07:51-08:18/27	06:53 07:45-08:18/33	07:04	06:22	05:59	06:04	06:29	06:57	07:26 08:23-08:51/28	06:58 07:23-07:46/23	07:31
	17:16	17:51	18:22	19:54	20:23	20:50	20:56	20:34	19:50	19:02	17:19	17:01
7	07:46	07:28 07:49-08:20/31	06:51 07:47-08:17/30	07:02	06:21	05:58	06:04	06:30	06:58	07:27 08:21-08:53/32	07:00 07:26-07:43/17	07:32
	17:17	17:52	18:23	19:55	20:24	20:50	20:56	20:33	19:49	19:00	17:18	17:01
8	07:46	07:27 07:47-08:21/34	06:50 07:48-08:14/26	07:00	06:19	05:58	06:05	06:30	06:59	07:28 08:19-08:55/36	07:01 07:31-07:37/6	07:33
	17:18	17:53	18:24	19:56	20:25	20:51	20:56	20:32	19:47	18:59	17:17	17:01
9	07:46	07:26 07:46-08:23/37	06:48 07:51-08:10/19	06:59	06:18	05:58	06:06	06:31	07:00	07:29 08:18-08:56/38	07:02	07:34
	17:19	17:54	18:25	19:57	20:26	20:51	20:55	20:30	19:45	18:57	17:16	17:01
10	07:46	07:25 07:45-08:24/39	06:46 07:56-08:05/9	06:57	06:17	05:58	06:06	06:32	07:01	07:30 08:16-08:57/41	07:03	07:34
	17:20	17:55	18:26	19:58	20:27	20:52	20:55	20:29	19:44	18:55	17:15	17:01
11	07:46	07:24 07:44-08:25/41	06:45	06:56	06:16	05:58	06:07	06:33	07:02	07:31 08:15-08:58/43	07:04	07:35
	17:21	17:56	18:27	19:59	20:28	20:53	20:55	20:28	19:42	18:54	17:14	17:02
12	07:46	07:23 07:43-08:27/44	06:43	06:54	06:15	05:58	06:08	06:34	07:03	07:32 08:14-08:58/44	07:05	07:36
	17:22	17:58	18:28	20:00	20:29	20:53	20:54	20:27	19:41	18:52	17:14	17:02
13	07:45	07:21 07:43-08:28/45	06:42	06:53	06:14	05:58	06:08	06:35	07:04	07:33 08:13-08:59/46	07:06	07:37
	17:23	17:59	18:30	20:01	20:30	20:53	20:54	20:25	19:39	18:51	17:13	17:02
14	07:45	07:20 07:41-08:28/47	06:40	06:51	06:13	05:57	06:09	06:36	07:05 18:59-19:09/10	07:34 08:12-08:59/47	07:08	07:38
	17:24	18:00	18:31	20:02	20:31	20:54	20:53	20:24	19:37	18:49	17:12	17:02
15	07:45	07:19 07:41-08:28/47	06:39	06:50	06:12	05:57	06:10	06:37	07:06 18:57-19:11/14	07:35 08:12-09:00/48	07:09	07:38
	17:25	18:01	18:32	20:03	20:32	20:54	20:53	20:23	19:36	18:48	17:11	17:02
16	07:44	07:18 07:40-08:29/49	06:37	06:48	06:11	05:57	06:11	06:38	07:07 18:55-19:12/17	07:36 08:11-09:01/50	07:10	07:39
	17:26	18:02	18:33	20:04	20:33	20:55	20:52	20:21	19:34	18:46	17:10	17:03
17	07:44	07:17 07:39-08:29/50	06:35	06:47	06:10	05:58	06:11	06:39	07:08 18:54-19:10/16	07:37 08:11-09:01/50	07:11	07:40
	17:27	18:03	18:34	20:05	20:34	20:55	20:51	20:20	19:32	18:45	17:09	17:03
18	07:44	07:15 07:39-08:29/50	06:34 18:13-18:14/1	06:45	06:10	05:58	06:12	06:40	07:08 18:53-19:09/16	07:38 08:10-09:01/51	07:12	07:40
	17:28	18:05	18:35	20:06	20:35	20:55	20:51	20:19	19:31	18:43	17:09	17:03
19	07:43	07:14 07:39-08:30/51	06:32 18:10-18:15/5	06:44	06:09	05:58	06:13	06:41	07:09 18:53-19:07/14	07:39 08:10-09:01/51	07:13	07:41
	17:29	18:06	18:36	20:07	20:36	20:56	20:50	20:17	19:29	18:42	17:08	17:04
20	07:43	07:13 07:38-08:29/51	06:31 18:09-18:16/7	06:42	06:08	05:58	06:14	06:42	07:10 18:52-19:06/14	07:40 08:09-09:01/52	07:14	07:42
	17:31	18:07	18:37	20:08	20:37	20:56	20:50	20:16	19:28	18:41	17:07	17:04
21	07:42	07:11 07:38-08:30/52	06:29 18:07-18:17/10	06:41	06:07	05:58	06:14	06:43	07:11 18:52-19:04/12	07:41 08:09-09:00/51	07:15	07:42
	17:32	18:08	18:38	20:09	20:37	20:56	20:49	20:14	19:26	18:39	17:07	17:04
22	07:42	07:10 07:39-08:30/51	06:27 18:07-18:18/11	06:40	06:06	05:58	06:15	06:43	07:12 18:52-19:03/11	07:42 08:09-09:00/51	07:16	07:43
	17:33	18:09	18:39	20:10	20:38	20:56	20:48	20:13	19:24	18:38	17:06	17:05
23	07:41	07:09 07:38-08:29/51	06:26 18:06-18:19/13	06:38	06:06	05:58	06:16	06:44	07:13 18:53-19:01/8	07:43 08:09-08:59/50	07:18	07:43
	17:34	18:10	18:40	20:11	20:39	20:57	20:47	20:12	19:23	18:36	17:06	17:05
24	07:40	07:07 07:39-08:29/50	06:24 18:05-18:20/15	06:37	06:05	05:59	06:17	06:45	07:14 18:54-18:59/5	07:44 08:09-08:59/50	07:19	07:44
	17:35	18:11	18:41	20:11	20:40	20:57	20:47	20:10	19:21	18:35	17:05	17:06
25	07:40	07:06 07:38-08:28/50	06:23 18:06-18:21/15	06:36	06:04	05:59	06:18	06:46	07:15 18:54-18:57/3	06:45 07:10-07:59/49	07:20	07:44
	17:36	18:12	18:42	20:12	20:41	20:57	20:46	20:09	19:19	17:34	17:05	17:07
26	07:39	07:04 07:39-08:28/49	06:21 18:06-18:22/16	06:34	06:04	05:59	06:19	06:47	07:16	06:46 07:10-07:59/49	07:21	07:44
	17:37	18:13	18:43	20:13	20:42	20:57	20:45	20:07	19:18	17:33	17:04	17:07
27	07:38	07:03 07:40-08:28/48	06:19 18:06-18:22/16	06:33	06:03	06:00	06:20	06:48	07:17	06:47 07:11-07:58/47	07:22	07:45
	17:39	18:15	18:44	20:14	20:43	20:57	20:44	20:06	19:16	17:31	17:04	17:08
28	07:37	07:01 07:39-08:26/47	06:18 18:07-18:22/15	06:32	06:02	06:00	06:20	06:49	07:18	06:48 07:11-07:57/46	07:23	07:45
	17:40	18:16	18:45	20:15	20:43	20:57	20:43	20:04	19:14	17:30	17:03	17:08
29	07:37		07:16 19:09-19:19/10	06:30	06:02	06:00	06:21	06:50	07:19	06:49 07:11-07:56/45	07:24	07:45
	17:41		19:46	20:16	20:44	20:57	20:42	20:03	19:13	17:29	17:03	17:09
30	07:36		07:15	06:29	06:01	06:01	06:22	06:51	07:20	06:51 07:12-07:55/43	07:25	07:46
	17:42		19:47	20:17	20:45	20:57	20:41	20:01	19:11	17:27	17:03	17:10
31	07:35		07:13		06:01		06:23	06:52		06:52 07:14-07:55/41		07:46
	17:43		19:48		20:46		20:40	20:00		17:26		17:11
Potential sun hours	301	299	370	397	444	447	455	425	374	347	301	292
Sum of minutes with flicker	0	1090	459	0	0	0	0	0	140	1218	213	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

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Calculated:
14/06/2022 17:04/3.4.415

SHADOW - Calendar per WTG

Calculation: Progetto_2022_06_14_Real_caseWTG: AG04 - VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (15)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:46	07:34	07:00	07:11	06:28	06:00	06:01	06:24	06:53	07:21	06:53	07:26
	17:12	17:45	18:17	19:49	20:18	20:46	20:57	20:39	19:58	19:10	17:25	17:02
2	07:46	07:33	06:59	07:10	06:26	06:00	06:02	06:25	06:54	07:22	06:54	07:27
	17:12	17:46	18:18	19:50	20:19	20:47	20:57	20:38	19:57	19:08	17:24	17:02
3	07:46	07:32	06:57	07:08	06:25	06:00	06:02	06:26	06:55	07:23	06:55	07:28
	17:13	17:47	18:19	19:51	20:20	20:48	20:57	20:37	19:55	19:06	17:23	17:02
4	07:46	07:31	06:56	07:07	06:24	05:59	06:03	06:27	06:56	07:24	06:56	07:29
	17:14	17:48	18:20	19:52	20:21	20:48	20:57	20:36	19:53	19:05	17:22	17:02
5	07:47	07:30	06:54	07:05	06:23	05:59	06:03	06:28	06:57	07:25	06:57	07:30
	17:15	17:49	18:21	19:53	20:22	20:49	20:56	20:35	19:52	19:03	17:21	17:02
6	07:47	07:29	06:53	07:04	06:22	05:59	06:04	06:29	06:57	07:26	06:58	07:31
	17:16	17:51	18:22	19:54	20:23	20:50	20:56	20:34	19:50	19:02	17:19	17:01
7	07:46	07:28	06:51	07:02	06:21	05:58	06:04	06:29	06:58	07:27	07:00	07:32
	17:17	17:52	18:23	19:55	20:24	20:50	20:56	20:33	19:49	19:00	17:18	17:01
8	07:46	07:27	06:50	07:00	06:19	05:58	06:05	06:30	06:59	07:28	07:01	07:33
	17:18	17:53	18:24	19:56	20:25	20:51	20:56	20:32	19:47	18:59	17:17	17:01
9	07:46	07:26	06:48	06:59	06:18	05:58	06:06	06:31	07:00	07:29	07:02	07:34
	17:19	17:54	18:25	19:57	20:26	20:51	20:55	20:30	19:45	18:57	17:16	17:01
10	07:46	07:25	06:46	06:57	06:17	05:58	06:06	06:32	07:01	07:30	07:03	07:34
	17:20	17:55	18:26	19:58	20:27	20:52	20:55	20:29	19:44	18:55	17:15	17:01
11	07:46	07:24	06:45	06:56	06:16	05:58	06:07	06:33	07:02	07:31	07:04	07:35
	17:21	17:56	18:27	19:59	20:28	20:53	20:55	20:28	19:42	18:54	17:14	17:02
12	07:46	07:23	06:43	06:54	06:15	05:58	06:08	06:34	07:03	07:32	07:05	07:36
	17:22	17:58	18:28	20:00	20:29	20:53	20:54	20:27	19:41	18:52	17:14	17:02
13	07:45	07:22	06:42	06:53	06:14	05:58	06:08	06:35	07:04	07:33	07:06	07:37
	17:23	17:59	18:30	20:01	20:30	20:54	20:54	20:25	19:39	18:51	17:13	17:02
14	07:45	07:20	06:40	06:51	06:13	05:57	06:09	06:36	07:05	07:34	07:08	07:38
	17:24	18:00	18:31	20:02	20:31	20:54	20:53	20:24	19:37	18:49	17:12	17:02
15	07:45	07:19	06:39	06:50	06:12	05:57	06:10	06:37	07:06	07:35	07:09	07:38
	17:25	18:01	18:32	20:03	20:32	20:54	20:53	20:23	19:36	18:48	17:11	17:02
16	07:45	07:18	06:37	06:48	06:11	05:57	06:11	06:38	07:07	07:36	07:10	07:39
	17:26	18:02	18:33	20:04	20:33	20:55	20:52	20:21	19:34	18:46	17:10	17:03
17	07:44	07:17	06:35	06:47	06:10	05:58	06:11	06:39	07:08	07:37	07:11	07:40
	17:27	18:03	18:34	20:05	20:34	20:55	20:52	20:20	19:32	18:45	17:09	17:03
18	07:44	07:15	06:34	06:45	06:10	05:58	06:12	06:40	07:08	07:38	07:12	07:40
	17:28	18:05	18:35	20:06	20:35	20:55	20:51	20:19	19:31	18:43	17:09	17:03
19	07:43	07:14	06:32	06:44	06:09	05:58	06:13	06:41	07:09	07:39	07:13	07:41
	17:29	18:06	18:36	20:07	20:36	20:56	20:50	20:17	19:29	18:42	17:08	17:04
20	07:43	07:13	06:31	06:42	06:08	05:58	06:14	06:42	07:10	07:40	07:14	07:42
	17:31	18:07	18:37	20:08	20:37	20:56	20:50	20:16	19:28	18:41	17:07	17:04
21	07:42	07:11	06:29	06:41	06:07	05:58	06:14	06:43	07:11	07:41	07:15	07:42
	17:32	18:08	18:38	20:09	20:37	20:56	20:49	20:15	19:26	18:39	17:07	17:04
22	07:42	07:10	06:27	06:40	06:06	05:58	06:15	06:43	07:12	07:42	07:17	07:43
	17:33	18:09	18:39	20:10	20:38	20:56	20:48	20:13	19:24	18:38	17:06	17:05
23	07:41	07:09	06:26	06:38	06:06	05:58	06:16	06:44	07:13	07:43	07:18	07:43
	17:34	18:10	18:40	20:11	20:39	20:57	20:47	20:12	19:23	18:36	17:06	17:05
24	07:40	07:07	06:24	06:37	06:05	05:59	06:17	06:45	07:14	07:44	07:19	07:44
	17:35	18:11	18:41	20:12	20:40	20:57	20:47	20:10	19:21	18:35	17:05	17:06
25	07:40	07:06	06:23	06:36	06:04	05:59	06:18	06:46	07:15	06:45	07:20	07:44
	17:36	18:12	18:42	20:13	20:41	20:57	20:46	20:09	19:19	17:34	17:05	17:07
26	07:39	07:04	06:21	06:34	06:04	05:59	06:19	06:47	07:16	06:46	07:21	07:44
	17:37	18:13	18:43	20:14	20:42	20:57	20:45	20:07	19:18	17:33	17:04	17:07
27	07:38	07:03	06:19	06:33	06:03	06:00	06:20	06:48	07:17	06:47	07:22	07:45
	17:39	18:15	18:44	20:15	20:43	20:57	20:44	20:06	19:16	17:31	17:04	17:08
28	07:37	07:02	06:18	06:32	06:02	06:00	06:20	06:49	07:18	06:48	07:23	07:45
	17:40	18:16	18:45	20:15	20:43	20:57	20:43	20:04	19:14	17:30	17:03	17:08
29	07:37		07:16	06:30	06:02	06:00	06:21	06:50	07:19	06:50	07:24	07:45
	17:41		19:46	20:16	20:44	20:57	20:42	20:03	19:13	17:29	17:03	17:09
30	07:36		07:15	06:29	06:01	06:01	06:22	06:51	07:20	06:51	07:25	07:46
	17:42		19:47	20:17	20:45	20:57	20:41	20:01	19:11	17:27	17:03	17:10
31	07:35		07:13		06:01		06:23	06:52		06:52		07:46
	17:43		19:48		20:46		20:40	20:00		17:26		17:11
Potential sun hours	301	299	370	397	444	447	455	425	374	347	301	292
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

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Calculated:
14/06/2022 17:04/3.4.415

SHADOW - Calendar per WTG

Calculation: Progetto_2022_06_14_Real_caseWTG: AG05 - VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (16)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:46	07:34	07:00	07:11	06:28 06:47-07:30/43	06:00 06:49-07:25/36	06:01 07:01-07:25/24	06:24 20:04-20:16/12	06:53	07:21	06:53	07:26
	17:12	17:45	18:17	19:49	20:18	20:46	20:57	20:39 06:52-07:41/49	19:58	19:10	17:25	17:02
2	07:46	07:33	06:59	07:10	06:26 06:45-07:29/44	06:00 06:50-07:25/35	06:02 07:02-07:26/24	06:25 20:05-20:15/10	06:54	07:22	06:54	07:27
	17:12	17:46	18:18	19:50	20:19	20:47	20:57	20:38 06:52-07:41/49	19:57	19:08	17:24	17:02
3	07:46	07:32	06:57	07:08	06:25 06:44-07:30/46	06:00 06:52-07:25/33	06:02 07:01-07:27/26	06:26 20:05-20:14/9	06:55	07:23	06:55	07:28
	17:13	17:47	18:19	19:51	20:20	20:48	20:57	20:37 06:52-07:41/49	19:55	19:06	17:23	17:02
4	07:46	07:31	06:56	07:07	06:24 06:44-07:31/47	05:59 06:52-07:24/32	06:03 07:01-07:28/27	06:27 20:05-20:13/8	06:56	07:24	06:56	07:29
	17:14	17:48	18:20	19:52	20:21	20:48	20:57	20:36 06:52-07:41/49	19:53	19:05	17:22	17:02
5	07:47	07:30	06:54	07:05	06:23 19:59-20:00/1	05:59 06:53-07:23/30	06:03 07:00-07:28/28	06:28 20:06-20:12/6	06:56	07:25	06:57	07:30
	17:15	17:49	18:21	19:53	20:22 06:43-07:31/48	20:49	20:56	20:35 06:52-07:41/49	19:52	19:03	17:20	17:02
6	07:47	07:29	06:53	07:04	06:22 19:57-20:01/4	05:59 06:54-07:23/29	06:04 07:00-07:29/29	06:29 20:07-20:11/4	06:57	07:26	06:58	07:31
	17:16	17:50	18:22	19:54	20:23 06:43-07:31/48	20:50	20:56	20:34 06:52-07:41/49	19:50	19:02	17:19	17:01
7	07:46	07:28	06:51	07:02	06:21 19:57-20:02/5	05:58 06:55-07:23/28	06:04 06:59-07:29/30	06:29 20:08-20:10/2	06:58	07:27	07:00	07:32
	17:17	17:52	18:23	19:55	20:24 06:43-07:31/48	20:50	20:56	20:33 06:53-07:41/48	19:49	19:00	17:18	17:01
8	07:46	07:27	06:50	07:00	06:19 19:56-20:03/7	05:58 06:54-07:22/28	06:05 06:59-07:30/31	06:30 06:53-07:41/48	06:59	07:28	07:01	07:33
	17:18	17:53	18:24	19:56	20:25 06:42-07:32/50	20:51	20:56	20:32	19:47	18:58	17:17	17:01
9	07:46	07:26	06:48	06:59	06:18 19:55-20:04/9	05:58 06:55-07:22/27	06:06 06:59-07:32/33	06:31 06:53-07:40/47	07:00	07:29	07:02	07:34
	17:19	17:54	18:25	19:57	20:26 06:42-07:32/50	20:52	20:55	20:30	19:45	18:57	17:16	17:01
10	07:46	07:25	06:46	06:57	06:17 19:55-20:05/10	05:58 06:56-07:21/25	06:06 06:58-07:32/34	06:32 06:53-07:39/46	07:01	07:30	07:03	07:34
	17:20	17:55	18:26	19:58	20:27 06:42-07:32/50	20:52	20:55	20:29	19:44	18:55	17:15	17:01
11	07:46	07:24	06:45	06:56	06:16 19:55-20:06/11	05:58 06:57-07:21/24	06:07 06:58-07:33/35	06:33 06:54-07:38/44	07:02	07:31	07:04	07:35
	17:21	17:56	18:27	19:59	20:28 06:42-07:32/50	20:53	20:55	20:28	19:42	18:54	17:14	17:01
12	07:46	07:23	06:43	06:54	06:15 19:55-20:06/11	05:58 06:58-07:21/23	06:08 06:58-07:34/36	06:34 06:55-07:37/42	07:03	07:32	07:05	07:36
	17:22	17:58	18:28	20:00	20:29 06:42-07:32/50	20:53	20:54	20:27	19:41	18:52	17:14	17:02
13	07:46	07:22	06:42	06:53	06:14 19:55-20:07/12	05:57 06:59-07:21/22	06:08 06:57-07:34/37	06:35 06:56-07:36/40	07:04	07:33	07:06	07:37
	17:23	17:59	18:29	20:01	20:30 06:42-07:31/49	20:54	20:54	20:25	19:39	18:51	17:13	17:02
14	07:45	07:20	06:40	06:51	06:13 19:55-20:08/13	05:57 06:59-07:20/21	06:09 06:57-07:35/38	06:36 06:57-07:36/39	07:05	07:34	07:08	07:38
	17:24	18:00	18:31	20:02	20:31 06:42-07:31/49	20:54	20:53	20:24	19:37	18:49	17:12	17:02
15	07:45	07:19	06:39	06:50	06:12 19:55-20:09/14	05:57 07:00-07:20/20	06:10 06:57-07:36/39	06:37 06:58-07:34/36	07:06	07:35	07:09	07:38
	17:25	18:01	18:32	20:03	20:32 06:42-07:31/49	20:54	20:53	20:23	19:36	18:48	17:11	17:02
16	07:45	07:18	06:37	06:48	06:11 19:55-20:09/14	05:57 07:00-07:20/20	06:10 06:55-07:36/41	06:38 06:59-07:33/34	07:07	07:36	07:10	07:39
	17:26	18:02	18:33	20:04	20:33 06:42-07:31/49	20:55	20:52	20:21	19:34	18:46	17:10	17:02
17	07:44	07:17	06:35	06:47	06:10 19:55-20:10/15	05:57 07:01-07:20/19	06:11 06:55-07:37/42	06:39 07:00-07:32/32	07:08	07:37	07:11	07:40
	17:27	18:03	18:34	20:05	20:34 06:42-07:30/48	20:55	20:52	20:20	19:32	18:45	17:09	17:03
18	07:44	07:15	06:34	06:45	06:10 19:56-20:11/15	05:58 07:01-07:20/19	06:12 06:55-07:37/42	06:40 07:01-07:30/29	07:08	07:38	07:12	07:40
	17:28	18:04	18:35	20:06	20:35 06:42-07:30/48	20:55	20:51	20:19	19:31	18:43	17:09	17:03
19	07:43	07:14	06:32	06:44	06:09 19:57-20:12/15	05:58 07:01-07:19/18	06:13 06:55-07:38/43	06:41 07:03-07:28/25	07:09	07:39	07:13	07:41
	17:29	18:06	18:36	20:07	20:36 06:43-07:30/47	20:56	20:50	20:17	19:29	18:42	17:08	17:04
20	07:43	07:13	06:31	06:42	06:08 19:58-20:11/13	05:58 07:03-07:20/17	06:14 06:54-07:38/44	06:42 07:04-07:24/20	07:10	07:40	07:14	07:42
	17:31	18:07	18:37	20:08	20:37 06:43-07:30/47	20:56	20:50	20:16	19:28	18:41	17:07	17:04
21	07:42	07:11	06:29	06:41	06:07 19:59-20:10/11	05:58 07:03-07:20/17	06:14 20:13-20:16/3	06:43 07:08-07:20/12	07:11	07:41	07:15	07:42
	17:32	18:08	18:38	20:09	20:37 06:43-07:29/46	20:56	20:49 06:54-07:39/45	20:15	19:26	18:39	17:07	17:04
22	07:42	07:10	06:27	06:40 07:02-07:16/14	06:06 20:01-20:08/7	05:58 07:03-07:20/17	06:15 20:10-20:19/9	06:43	07:12	07:42	07:17	07:43
	17:33	18:09	18:39	20:10	20:38 06:44-07:29/45	20:56	20:48 06:54-07:39/45	20:13	19:24	18:38	17:06	17:05
23	07:41	07:09	06:26	06:38 06:59-07:20/21	06:06 06:44-07:29/45	05:58 07:02-07:20/18	06:16 20:09-20:21/12	06:44	07:13	07:43	07:18	07:43
	17:34	18:10	18:40	20:11	20:39	20:57	20:47 06:54-07:40/46	20:12	19:23	18:36	17:06	17:05
24	07:40	07:07	06:24	06:37 06:55-07:21/26	06:05 06:45-07:28/43	05:59 07:03-07:21/18	06:17 20:08-20:22/14	06:45	07:14	07:44	07:19	07:44
	17:35	18:11	18:41	20:12	20:40	20:57	20:47 06:54-07:40/46	20:10	19:21	18:35	17:05	17:06
25	07:40	07:06	06:23	06:35 06:54-07:23/29	06:04 06:46-07:28/42	05:59 07:03-07:22/19	06:18 20:07-20:22/15	06:46	07:15	06:45	07:20	07:44
	17:36	18:12	18:42	20:13	20:41	20:57	20:46 06:53-07:40/47	20:09	19:19	17:34	17:05	17:06
26	07:39	07:04	06:21	06:34 06:53-07:25/32	06:04 06:46-07:27/41	05:59 07:02-07:22/20	06:19 20:06-20:21/15	06:47	07:16	06:46	07:21	07:44
	17:37	18:13	18:43	20:14	20:42	20:57	20:45 06:52-07:40/48	20:07	19:18	17:32	17:04	17:07
27	07:38	07:03	06:19	06:33 06:51-07:26/35	06:03 06:47-07:28/41	06:00 07:03-07:23/20	06:19 20:06-20:20/14	06:48	07:17	06:47	07:22	07:45
	17:39	18:15	18:44	20:14	20:43	20:57	20:44 06:52-07:41/49	20:06	19:16	17:31	17:04	17:08
28	07:37	07:01	06:18	06:31 06:50-07:27/37	06:02 06:47-07:27/40	06:00 07:02-07:23/21	06:20 20:06-20:20/14	06:49	07:18	06:48	07:23	07:45
	17:40	18:16	18:45	20:15	20:43	20:57	20:43 06:52-07:41/49	20:04	19:14	17:30	17:03	17:08
29	07:37		07:16	06:30 06:49-07:28/39	06:02 06:48-07:27/39	06:00 07:02-07:24/22	06:21 20:05-20:19/14	06:50	07:19	06:50	07:24	07:45
	17:41		19:46	20:16	20:44	20:57	20:42 06:52-07:42/50	20:03	19:13	17:29	17:03	17:09
30	07:36		07:15	06:29 06:48-07:29/41	06:01 06:48-07:26/38	06:01 07:02-07:25/23	06:22 20:05-20:18/13	06:51	07:20	06:51	07:25	07:46
	17:42		19:47	20:17	20:45	20:57	20:41 06:52-07:42/50	20:01	19:11	17:27	17:03	17:10
31	07:35		07:13		06:01 06:49-07:26/37		06:23 20:04-20:16/12	06:52		06:52		07:46
	17:43		19:48		20:46		20:40 06:52-07:42/50	20:00		17:26		17:11
Potential sun hours	301	299	370	397	444	448	455	425	374	347	301	292
Sum of minutes with flicker	0	0	0	274	1604	701	1343	887	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

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Calculated:
14/06/2022 17:04/3.4.415

SHADOW - Calendar per WTG

Calculation: Progetto_2022_06_14_Real_caseWTG: AG06 - VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (13)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:46 14:40-15:30/50	07:34	07:00	07:11	06:28	06:00	06:01	06:24	06:53	07:21	06:53	07:26 14:34-15:10/36
	17:12	17:44	18:17	19:49	20:18	20:46	20:57	20:39	19:58	19:10	17:25	17:02
2	07:46 14:41-15:30/49	07:33	06:58	07:10	06:26	06:00	06:02	06:25	06:54	07:22	06:54	07:27 14:33-15:11/38
	17:12	17:46	18:18	19:50	20:19	20:47	20:57	20:38	19:56	19:08	17:24	17:02
3	07:46 14:41-15:30/49	07:32	06:57	07:08	06:25	06:00	06:02	06:26	06:55	07:23	06:55	07:28 14:33-15:12/39
	17:13	17:47	18:19	19:51	20:20	20:48	20:57	20:37	19:55	19:06	17:23	17:02
4	07:46 14:43-15:30/47	07:31	06:56	07:07	06:24	05:59	06:03	06:27	06:55	07:24	06:56	07:29 14:32-15:14/42
	17:14	17:48	18:20	19:52	20:21	20:48	20:57	20:36	19:53	19:05	17:22	17:02
5	07:46 14:44-15:30/46	07:30	06:54	07:05	06:23	05:59	06:03	06:28	06:56	07:25	06:57	07:30 14:31-15:15/44
	17:15	17:49	18:21	19:53	20:22	20:49	20:56	20:35	19:52	19:03	17:20	17:01
6	07:46 14:45-15:30/45	07:29	06:52	07:03	06:22	05:59	06:04	06:28	06:57	07:25	06:58	07:31 14:31-15:16/45
	17:16	17:50	18:22	19:54	20:23	20:50	20:56	20:34	19:50	19:02	17:19	17:01
7	07:46 14:46-15:30/44	07:28	06:51	07:02	06:20	05:58	06:04	06:29	06:58	07:26	06:59	07:32 14:31-15:17/46
	17:17	17:52	18:23	19:55	20:24	20:50	20:56	20:33	19:49	19:00	17:18	17:01
8	07:46 14:48-15:30/42	07:27	06:49	07:00	06:19	05:58	06:05	06:30	06:59	07:27	07:01	07:33 14:31-15:18/47
	17:18	17:53	18:24	19:56	20:25	20:51	20:56	20:31	19:47	18:58	17:17	17:01
9	07:46 14:48-15:28/40	07:26	06:48	06:59	06:18	05:58	06:06	06:31	07:00	07:28	07:02	07:33 14:30-15:18/48
	17:19	17:54	18:25	19:57	20:26	20:51	20:55	20:30	19:45	18:57	17:16	17:01
10	07:46 14:50-15:28/38	07:25	06:46	06:57	06:17	05:58	06:06	06:32	07:01	07:29	07:03	07:34 14:30-15:19/49
	17:20	17:55	18:26	19:58	20:27	20:52	20:55	20:29	19:44	18:55	17:15	17:01
11	07:46 14:52-15:28/36	07:24	06:45	06:56	06:16	05:58	06:07	06:33	07:02	07:30	07:04	07:35 14:30-15:20/50
	17:21	17:56	18:27	19:59	20:28	20:52	20:54	20:28	19:42	18:54	17:14	17:01
12	07:46 14:54-15:27/33	07:23	06:43	06:54	06:15	05:57	06:08	06:34	07:03	07:31	07:05	07:36 14:30-15:21/51
	17:22	17:57	18:28	19:59	20:29	20:53	20:54	20:27	19:41	18:52	17:13	17:02
13	07:45 14:56-15:25/29	07:21	06:42	06:53	06:14	05:57	06:08	06:35	07:04	07:32	07:06	07:37 14:30-15:22/52
	17:23	17:59	18:29	20:00	20:30	20:53	20:54	20:25	19:39	18:51	17:13	17:02
14	07:45 14:59-15:24/25	07:20	06:40	06:51	06:13	05:57	06:09	06:36	07:05	07:33	07:07	07:37 14:30-15:22/52
	17:24	18:00	18:30	20:01	20:31	20:54	20:53	20:24	19:37	18:49	17:12	17:02
15	07:45 15:01-15:22/21	07:19 07:38-07:41/3	06:39	06:50	06:12	05:57	06:10	06:37	07:06	07:35	07:09	07:38 14:30-15:23/53
	17:25	18:01	18:31	20:02	20:32	20:54	20:53	20:23	19:36	18:48	17:11	17:02
16	07:44 15:05-15:19/14	07:18 07:37-07:42/5	06:37	06:48	06:11	05:57	06:10	06:38	07:07	07:36 08:02-08:10/8	07:10	07:39 14:31-15:24/53
	17:26	18:02	18:33	20:03	20:33	20:55	20:52	20:21	19:34	18:46	17:10	17:02
17	07:44	07:16 07:35-07:43/8	06:35	06:47	06:10	05:57	06:11	06:39	07:07	07:37 08:00-08:12/12	07:11	07:40 14:30-15:24/54
	17:27	18:03	18:34	20:04	20:34	20:55	20:51	20:20	19:32	18:45	17:09	17:03
18	07:44	07:15 07:34-07:43/9	06:34	06:45	06:10	05:58	06:12	06:40	07:08	07:38 07:58-08:13/15	07:12	07:40 14:31-15:25/54
	17:28	18:04	18:35	20:05	20:35	20:55	20:51	20:19	19:31	18:43	17:09	17:03
19	07:43	07:14 07:33-07:44/11	06:32	06:44	06:09	05:58	06:13	06:41	07:09	07:39 07:59-08:14/15	07:13	07:41 14:32-15:26/54
	17:29	18:06	18:36	20:06	20:36	20:56	20:50	20:17	19:29	18:42	17:08	17:03
20	07:43	07:13 07:31-07:43/12	06:31	06:42	06:08	05:58	06:14	06:42	07:10	07:40 08:00-08:14/14	07:14	07:41 14:32-15:26/54
	17:30	18:07	18:37	20:07	20:37	20:56	20:49	20:16	19:27	18:41	17:07	17:04
21	07:42	07:11 07:30-07:44/14	06:29	06:41	06:07	05:58	06:14	06:42	07:11	07:41 08:01-08:14/13	07:15	07:42 14:32-15:27/55
	17:32	18:08	18:38	20:08	20:37	20:56	20:49	20:14	19:26	18:39	17:07	17:04
22	07:41	07:10 07:29-07:43/14	06:27	06:40	06:06	05:58	06:15	06:43	07:12	07:42 08:02-08:14/12	07:16	07:43 14:32-15:27/55
	17:33	18:09	18:39	20:09	20:38	20:56	20:48	20:13	19:24	18:38	17:06	17:05
23	07:41	07:08 07:27-07:42/15	06:26	06:38	06:06	05:58	06:16	06:44	07:13	07:43 08:03-08:14/11	07:18	07:43 14:34-15:28/54
	17:34	18:10	18:40	20:10	20:39	20:57	20:47	20:12	19:23	18:36	17:05	17:05
24	07:40	07:07 07:27-07:41/14	06:24	06:37	06:05	05:59	06:17	06:45	07:14	07:44 08:04-08:13/9	07:19	07:43 14:34-15:28/54
	17:35	18:11	18:41	20:11	20:40	20:57	20:46	20:10	19:21	18:35	17:05	17:06
25	07:40	07:06 07:28-07:39/11	06:23	06:35	06:04	05:59	06:18	06:46	07:15	06:45 07:06-07:13/7	07:20	07:44 14:34-15:28/54
	17:36	18:12	18:42	20:12	20:41	20:57	20:46	20:09	19:19	17:34	17:04	17:06
26	07:39	07:04 07:31-07:36/5	06:21	06:34	06:04	05:59	06:19	06:47	07:16	06:46 07:07-07:12/5	07:21 14:43-14:57/14	07:44 14:35-15:29/54
	17:37	18:13	18:43	20:13	20:42	20:57	20:45	20:07	19:18	17:32	17:04	17:07
27	07:38	07:03	06:19	06:33	06:03	06:00	06:19	06:48	07:17	06:47 07:08-07:10/2	07:22 14:41-15:01/20	07:45 14:36-15:29/53
	17:39	18:15	18:44	20:14	20:42	20:57	20:44	20:06	19:16	17:31	17:04	17:08
28	07:37	07:01	06:18	06:31	06:02	06:00	06:20	06:49	07:18	06:48	07:23 14:39-15:04/25	07:45 14:36-15:29/53
	17:40	18:16	18:45	20:15	20:43	20:57	20:43	20:04	19:14	17:30	17:03	17:08
29	07:37		07:16	06:30	06:02	06:00	06:21	06:50	07:19	06:49	07:24 14:37-15:06/29	07:45 14:36-15:29/53
	17:41		19:46	20:16	20:44	20:57	20:42	20:03	19:13	17:29	17:03	17:09
30	07:36		07:15	06:29	06:01	06:01	06:22	06:51	07:20	06:51	07:25 14:36-15:08/32	07:46 14:38-15:30/52
	17:42		19:47	20:17	20:45	20:57	20:41	20:01	19:11	17:27	17:03	17:10
31	07:35		07:13		06:01		06:23	06:52		06:52		07:46 14:39-15:30/51
	17:43		19:48		20:46		20:40	20:00		17:26		17:11
Potential sun hours	301	299	370	397	444	447	455	425	374	347	301	292
Sum of minutes with flicker	608	121	0	0	0	0	0	0	0	123	120	1549

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

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Calculated:
14/06/2022 17:04/3.4.415

SHADOW - Calendar per WTG

Calculation: Progetto_2022_06_14_Real_caseWTG: AG07 - VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (12)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	January	February	March	April	May	June
1	07:46	07:34	07:00 07:19-07:35/16	07:11	06:28	06:00 06:21-06:39/18
	17:12	17:45	18:17	19:49	20:18	20:46
2	07:46	07:33	06:59 07:17-07:34/17	07:10	06:26	06:00 06:21-06:39/18
	17:12	17:46	18:18	19:50	20:19	20:47
3	07:46	07:32	06:57 07:16-07:35/19	07:08	06:25	06:00 06:21-06:39/18
	17:13	17:47	18:19	19:51	20:20	20:48
4	07:46	07:31	06:56 07:14-07:34/20	07:07	06:24	05:59 06:20-06:38/18
	17:14	17:48	18:20	19:52	20:21	20:48
5	07:46	07:30	06:54 07:13-07:34/21	07:05	06:23	05:59 06:20-06:38/18
	17:15	17:49	18:21	19:53	20:22	20:49
6	07:46	07:29	06:53 17:52-18:01/9	07:04	06:22	05:59 06:21-06:38/17
	17:16	17:50	18:22 07:11-07:32/21	19:54	20:23	20:50
7	07:46	07:28	06:51 17:47-18:02/15	07:02	06:21	05:58 06:22-06:38/16
	17:17	17:52	18:23 07:13-07:32/19	19:55	20:24	20:50
8	07:46	07:27	06:49 17:45-18:04/19	07:00	06:19	05:58 06:21-06:37/16
	17:18	17:53	18:24 07:14-07:30/16	19:56	20:25	20:51
9	07:46	07:26	06:48 17:43-18:04/21	06:59	06:18	05:58 06:22-06:37/15
	17:19	17:54	18:25 07:15-07:27/12	19:57	20:26	20:51
10	07:46	07:25	06:46 17:42-18:06/24	06:57	06:17	05:58 06:23-06:37/14
	17:20	17:55	18:26 07:20-07:22/2	19:58	20:27	20:52
11	07:46	07:24	06:45 17:40-18:07/27	06:56	06:16	05:58 06:24-06:37/13
	17:21	17:56	18:27	19:59	20:28	20:52
12	07:46	07:23	06:43 17:39-18:08/29	06:54	06:15	05:58 06:24-06:37/13
	17:22	17:58	18:28	20:00	20:29	20:53
13	07:45	07:21	06:42 17:38-18:09/31	06:53	06:14	05:57 06:25-06:37/12
	17:23	17:59	18:29	20:01	20:30	20:53
14	07:45	07:20	06:40 17:37-18:09/32	06:51	06:13	05:57 06:25-06:36/11
	17:24	18:00	18:30	20:02	20:31	20:54
15	07:45	07:19	06:39 17:37-18:11/34	06:50	06:12 06:32-06:34/2	05:57 06:26-06:36/10
	17:25	18:01	18:32	20:03	20:32	20:54
16	07:44	07:18	06:37 17:36-18:12/36	06:48	06:11 06:31-06:35/4	05:57 06:27-06:36/9
	17:26	18:02	18:33	20:04	20:33	20:55
17	07:44	07:17	06:35 17:36-18:13/37	06:47	06:10 06:30-06:36/6	05:57 06:27-06:36/9
	17:27	18:03	18:34	20:04	20:34	20:55
18	07:44	07:15	06:34 17:35-18:12/37	06:45	06:10 06:30-06:37/7	05:58 06:27-06:36/9
	17:28	18:04	18:35	20:05	20:35	20:55
19	07:43	07:14	06:32 17:35-18:11/36	06:44	06:09 06:29-06:38/9	05:58 06:28-06:36/8
	17:29	18:06	18:36	20:06	20:36	20:56
20	07:43	07:13	06:31 17:35-18:11/36	06:42	06:08 06:28-06:38/10	05:58 06:29-06:36/7
	17:31	18:07	18:37	20:07	20:37	20:56
21	07:42	07:11	06:29 17:35-18:10/35	06:41	06:07 06:27-06:38/11	05:58 06:29-06:36/7
	17:32	18:08	18:38	20:08	20:37	20:56
22	07:42	07:10	06:27 17:36-18:10/34	06:40	06:06 06:27-06:39/12	05:58 06:29-06:36/7
	17:33	18:09	18:39	20:09	20:38	20:56
23	07:41	07:09	06:26 17:36-18:08/32	06:38	06:06 06:26-06:39/13	05:58 06:29-06:36/7
	17:34	18:10	18:40	20:10	20:39	20:57
24	07:40	07:07 07:26-07:30/4	06:24 17:37-18:06/29	06:37	06:05 06:25-06:39/14	05:59 06:29-06:38/9
	17:35	18:11	18:41	20:11	20:40	20:57
25	07:40	07:06 07:24-07:32/8	06:23 17:38-18:05/27	06:35	06:04 06:25-06:39/14	05:59 06:29-06:38/9
	17:36	18:12	18:42	20:12	20:41	20:57
26	07:39	07:04 07:23-07:33/10	06:21 17:39-18:03/24	06:34	06:04 06:24-06:39/15	05:59 06:29-06:38/9
	17:37	18:13	18:43	20:13	20:42	20:57
27	07:38	07:03 07:22-07:34/12	06:19 17:41-18:00/19	06:33	06:03 06:24-06:40/16	06:00 06:29-06:39/10
	17:39	18:15	18:44	20:14	20:42	20:57
28	07:37	07:01 07:20-07:34/14	06:18 17:44-17:58/14	06:31	06:02 06:23-06:39/16	06:00 06:29-06:39/10
	17:40	18:16	18:45	20:15	20:43	20:57
29	07:37		07:16	06:30	06:02 06:23-06:40/17	06:00 06:28-06:39/11
	17:41		19:46	20:16	20:44	20:57
30	07:36		07:15	06:29	06:01 06:22-06:39/17	06:01 06:28-06:41/13
	17:42		19:47	20:17	20:45	20:57
31	07:35		07:13		06:01 06:22-06:39/17	
	17:43		19:48		20:46	
Potential sun hours	301	299	370	397	444	447
Sum of minutes with flicker	0	48	800	0	200	361

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

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Calculated:
14/06/2022 17:04/3.4.415

SHADOW - Calendar per WTG

Calculation: Progetto_2022_06_14_Real_caseWTG: AG07 - VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (12)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	July		August	September		October		November	December
1	06:01	06:28-06:41/13	06:24	06:53		07:21	18:17-18:47/30	06:53	07:26
	20:57		20:39	19:58		19:10		17:25	17:02
2	06:02	06:28-06:42/14	06:25	06:54		07:22	18:18-18:46/28	06:54	07:27
	20:57		20:38	19:57		19:08		17:24	17:02
3	06:02	06:27-06:42/15	06:26	06:55		07:23	18:19-18:44/25	06:55	07:28
	20:57		20:37	19:55		19:06		17:23	17:02
4	06:03	06:28-06:43/15	06:27	06:56		07:24	18:20-18:42/22	06:56	07:29
	20:57		20:36	19:53		19:05	07:54-08:03/9	17:22	17:02
5	06:03	06:27-06:43/16	06:28	06:56		07:25	18:21-18:41/20	06:57	07:30
	20:56		20:35	19:52		19:03	07:51-08:05/14	17:20	17:02
6	06:04	06:27-06:44/17	06:29	06:57		07:26	18:23-18:39/16	06:58	07:31
	20:56		20:34	19:50		19:02	07:49-08:07/18	17:19	17:01
7	06:04	06:26-06:44/18	06:29	06:58		07:27	18:25-18:38/13	07:00	07:32
	20:56		20:33	19:49		19:00	07:48-08:08/20	17:18	17:01
8	06:05	06:27-06:45/18	06:30	06:59		07:28	07:47-08:08/21	07:01	07:33
	20:56		20:31	19:47		18:58		17:17	17:01
9	06:06	06:28-06:46/18	06:31	07:00		07:28	07:48-08:08/20	07:02	07:34
	20:55		20:30	19:45		18:57		17:16	17:01
10	06:06	06:28-06:46/18	06:32	07:01		07:29	07:49-08:08/19	07:03	07:34
	20:55		20:29	19:44		18:55		17:15	17:01
11	06:07	06:29-06:47/18	06:33	07:02		07:30	07:50-08:08/18	07:04	07:35
	20:54		20:28	19:42		18:54		17:14	17:02
12	06:08	06:30-06:47/17	06:34	07:03		07:31	07:51-08:08/17	07:05	07:36
	20:54		20:27	19:41		18:52		17:14	17:02
13	06:08	06:30-06:47/17	06:35	07:04		07:33	07:52-08:07/15	07:06	07:37
	20:54		20:25	19:39		18:51		17:13	17:02
14	06:09	06:31-06:48/17	06:36	07:05		07:34	07:53-08:06/13	07:07	07:38
	20:53		20:24	19:37		18:49		17:12	17:02
15	06:10	06:32-06:48/16	06:37	07:06	18:34-18:46/12	07:35	07:55-08:06/11	07:09	07:38
	20:53		20:23	19:36		18:48		17:11	17:02
16	06:11	06:32-06:48/16	06:38	07:07	18:30-18:49/19	07:36	07:56-08:05/9	07:10	07:39
	20:52		20:21	19:34		18:46		17:10	17:03
17	06:11	06:33-06:48/15	06:39	07:08	18:28-18:51/23	07:37	07:57-08:03/6	07:11	07:40
	20:51		20:20	19:32		18:45		17:09	17:03
18	06:12	06:34-06:49/15	06:40	07:08	18:26-18:52/26	07:38	07:58-08:01/3	07:12	07:40
	20:51		20:19	19:31		18:43		17:09	17:03
19	06:13	06:35-06:49/14	06:41	07:09	18:24-18:53/29	07:39		07:13	07:41
	20:50		20:17	19:29		18:42		17:08	17:04
20	06:14	06:35-06:48/13	06:42	07:10	18:23-18:54/31	07:40		07:14	07:41
	20:50		20:16	19:27		18:41		17:07	17:04
21	06:14	06:36-06:48/12	06:43	07:11	18:22-18:55/33	07:41		07:15	07:42
	20:49		20:14	19:26		18:39		17:07	17:04
22	06:15	06:37-06:49/12	06:43	07:12	18:21-18:55/34	07:42		07:16	07:43
	20:48		20:13	19:24		18:38		17:06	17:05
23	06:16	06:38-06:49/11	06:44	07:13	18:20-18:55/35	07:43		07:18	07:43
	20:47		20:12	19:23		18:36		17:06	17:05
24	06:17	06:39-06:48/9	06:45	07:14	18:19-18:55/36	07:44		07:19	07:44
	20:47		20:10	19:21		18:35		17:05	17:06
25	06:18	06:40-06:48/8	06:46	07:15	18:18-18:54/36	06:45		07:20	07:44
	20:46		20:09	19:19		17:34		17:05	17:07
26	06:19	06:40-06:47/7	06:47	07:16	18:17-18:54/37	06:46		07:21	07:44
	20:45		20:07	19:18		17:32		17:04	17:07
27	06:20	06:41-06:46/5	06:48	07:17	18:17-18:54/37	06:47		07:22	07:45
	20:44		20:06	19:16		17:31		17:04	17:08
28	06:20	06:42-06:45/3	06:49	07:18	18:17-18:52/35	06:48		07:23	07:45
	20:43		20:04	19:14		17:30		17:03	17:08
29	06:21	06:43-06:44/1	06:50	07:19	18:17-18:50/33	06:49		07:24	07:45
	20:42		20:03	19:13		17:29		17:03	17:09
30	06:22		06:51	07:20	18:17-18:49/32	06:51		07:25	07:46
	20:41		20:01	19:11		17:27		17:03	17:10
31	06:23		06:52			06:52			07:46
	20:40		20:00			17:26			17:11
Potential sun hours	455		425	374		347		301	292
Sum of minutes with flicker	388		0	488		367		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

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Calculated:
14/06/2022 17:04/3.4.415

SHADOW - Calendar per WTG

Calculation: Progetto_2022_06_14_Real_caseWTG: AG08 - VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (17)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	January		February	March		April		May	June
1	07:46	15:57-16:15/18	07:34	07:00		07:11	07:30-07:42/12	06:28	06:00
	17:12		17:45	18:17		19:49		20:18	20:46
2	07:46	15:58-16:15/17	07:33	06:59		07:10	07:28-07:41/13	06:26	06:00
	17:12		17:46	18:18		19:50		20:19	20:47
3	07:46	16:00-16:14/14	07:32	06:57		07:08	07:26-07:40/14	06:25	06:00
	17:13		17:47	18:19		19:51		20:20	20:48
4	07:46	16:01-16:14/13	07:31	06:56		07:07	07:25-07:40/15	06:24	05:59
	17:14		17:48	18:20		19:52		20:21	20:48
5	07:46	16:03-16:13/10	07:30	06:54		07:05	07:23-07:39/16	06:23	05:59
	17:15		17:49	18:21		19:53		20:22	20:49
6	07:46	16:06-16:11/5	07:29	06:53		07:03	07:22-07:38/16	06:22	05:59
	17:16		17:50	18:22		19:54		20:23	20:50
7	07:46		07:28	06:51		07:02	07:22-07:36/14	06:21	05:58
	17:17		17:52	18:23		19:55		20:24	20:50
8	07:46		07:27	06:49		07:00	07:24-07:34/10	06:19	05:58
	17:18		17:53	18:24		19:56		20:25	20:51
9	07:46		07:26	06:48		06:59		06:18	05:58
	17:19		17:54	18:25		19:57		20:26	20:51
10	07:46		07:25	06:46		06:57		06:17	05:58
	17:20		17:55	18:26		19:58		20:27	20:52
11	07:46		07:24	06:45		06:56		06:16	05:58
	17:21		17:56	18:27		19:59		20:28	20:52
12	07:46		07:23	06:43		06:54		06:15	05:58
	17:22		17:58	18:28		20:00		20:29	20:53
13	07:45		07:21	06:42		06:53		06:14	05:57
	17:23		17:59	18:29		20:01		20:30	20:53
14	07:45	08:06-08:07/1	07:20	06:40		06:51		06:13	05:57
	17:24		18:00	18:30		20:02		20:31	20:54
15	07:45	08:06-08:09/3	07:19	06:39		06:50		06:12	05:57
	17:25		18:01	18:32		20:02		20:32	20:54
16	07:44	08:05-08:09/4	07:18	06:37		06:48		06:11	05:57
	17:26		18:02	18:33		20:03		20:33	20:55
17	07:44	08:05-08:11/6	07:16	06:35		06:47		06:10	05:57
	17:27		18:03	18:34		20:04		20:34	20:55
18	07:44	08:04-08:11/7	07:15	06:34		06:45		06:10	05:58
	17:28		18:04	18:35		20:05		20:35	20:55
19	07:43	08:04-08:12/8	07:14	06:32		06:44		06:09	05:58
	17:29		18:06	18:36		20:06		20:36	20:56
20	07:43	08:03-08:13/10	07:13	06:31		06:42		06:08	05:58
	17:31		18:07	18:37		20:07		20:37	20:56
21	07:42	08:02-08:13/11	07:11	06:29		06:41		06:07	05:58
	17:32		18:08	18:38		20:08		20:37	20:56
22	07:41	08:02-08:14/12	07:10	06:27		06:40		06:06	05:58
	17:33		18:09	18:39		20:09		20:38	20:56
23	07:41	08:01-08:14/13	07:09	06:26		06:38		06:06	05:58
	17:34		18:10	18:40		20:10		20:39	20:57
24	07:40	08:00-08:14/14	07:07	06:24		06:37		06:05	05:59
	17:35		18:11	18:41		20:11		20:40	20:57
25	07:40	08:00-08:14/14	07:06	06:23		06:35		06:04	05:59
	17:36		18:12	18:42		20:12		20:41	20:57
26	07:39	07:59-08:14/15	07:04	06:21		06:34		06:04	05:59
	17:37		18:13	18:43		20:13		20:42	20:57
27	07:38	07:58-08:14/16	07:03	06:19		06:33		06:03	06:00
	17:39		18:15	18:44		20:14		20:42	20:57
28	07:37	07:57-08:13/16	07:01	06:18	06:36-06:39/3	06:31		06:02	06:00
	17:40		18:16	18:45		20:15		20:43	20:57
29	07:37	07:58-08:12/14		07:16	07:34-07:40/6	06:30		06:02	06:00
	17:41			19:46		20:16		20:44	20:57
30	07:36	08:00-08:12/12		07:15	07:33-07:41/8	06:29		06:01	06:01
	17:42			19:47		20:17		20:45	20:57
31	07:35	08:02-08:10/8		07:13	07:31-07:41/10			06:01	
	17:43			19:48				20:46	
Potential sun hours	302		299	370		397		444	447
Sum of minutes with flicker	261		0	27		110		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

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14/06/2022 17:04/3.4.415

SHADOW - Calendar per WTG

Calculation: Progetto_2022_06_14_Real_caseWTG: AG08 - VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (17)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4,40	5,05	5,88	7,00	8,45	9,88	10,82	10,03	8,08	6,09	5,07	4,27

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
187	75	129	415	910	1.145	176	86	148	799	2.539	905	7.514

	July	August	September	October	November	December
1	06:01	06:24	06:53	07:21	06:53	07:26
	20:57	20:39	19:58	19:10	17:25	17:02
2	06:02	06:25	06:54	07:22	06:54	07:27
	20:57	20:38	19:56	19:08	17:24	17:02
3	06:02	06:26	06:55	07:23	06:55	07:28
	20:57	20:37	19:55	19:06	17:23	17:02
4	06:03	06:27	06:56 07:21-07:31/10	07:24	06:56	07:29
	20:57	20:36	19:53	19:05	17:22	17:02
5	06:03	06:28	06:56 07:19-07:33/14	07:25	06:57	07:30
	20:56	20:35	19:52	19:03	17:20	17:02
6	06:04	06:29	06:57 07:18-07:34/16	07:26	06:58	07:31 15:53-15:56/3
	20:56	20:34	19:50	19:02	17:19	17:01
7	06:04	06:29	06:58 07:18-07:34/16	07:27	07:00	07:32 15:50-16:00/10
	20:56	20:33	19:49	19:00	17:18	17:01
8	06:05	06:30	06:59 07:19-07:34/15	07:27	07:01	07:33 15:49-16:02/13
	20:56	20:31	19:47	18:58	17:17	17:01
9	06:06	06:31	07:00 07:20-07:34/14	07:28	07:02	07:33 15:48-16:02/14
	20:55	20:30	19:45	18:57	17:16	17:01
10	06:06	06:32	07:01 07:21-07:34/13	07:29	07:03	07:34 15:47-16:04/17
	20:55	20:29	19:44	18:55	17:15	17:01
11	06:07	06:33	07:02 07:22-07:34/12	07:30	07:04 07:33-07:41/8	07:35 15:47-16:05/18
	20:54	20:28	19:42	18:54	17:14	17:02
12	06:08	06:34	07:03 07:23-07:33/10	07:31	07:05 07:31-07:43/12	07:36 15:47-16:06/19
	20:54	20:27	19:41	18:52	17:14	17:02
13	06:08	06:35	07:04 07:24-07:33/9	07:32	07:06 07:29-07:44/15	07:37 15:48-16:08/20
	20:54	20:25	19:39	18:51	17:13	17:02
14	06:09	06:36	07:05 07:25-07:31/6	07:34	07:07 07:30-07:46/16	07:37 15:47-16:08/21
	20:53	20:24	19:37	18:49	17:12	17:02
15	06:10	06:37	07:06 07:25-07:29/4	07:35	07:09 07:31-07:47/16	07:38 15:47-16:09/22
	20:53	20:23	19:36	18:48	17:11	17:02
16	06:11	06:38	07:07	07:36	07:10 07:32-07:47/15	07:39 15:48-16:10/22
	20:52	20:21	19:34	18:46	17:10	17:03
17	06:11	06:39	07:08	07:37	07:11 07:33-07:47/14	07:40 15:47-16:10/23
	20:51	20:20	19:32	18:45	17:09	17:03
18	06:12	06:40	07:08	07:38	07:12 07:34-07:48/14	07:40 15:48-16:11/23
	20:51	20:19	19:31	18:43	17:09	17:03
19	06:13	06:41	07:09	07:39	07:13 07:36-07:49/13	07:41 15:49-16:12/23
	20:50	20:17	19:29	18:42	17:08	17:04
20	06:14	06:42	07:10	07:40	07:14 07:37-07:49/12	07:41 15:49-16:12/23
	20:49	20:16	19:27	18:41	17:07	17:04
21	06:14	06:43	07:11	07:41	07:15 07:38-07:49/11	07:42 15:49-16:13/24
	20:49	20:14	19:26	18:39	17:07	17:04
22	06:15	06:43	07:12	07:42	07:16 07:39-07:49/10	07:43 15:49-16:13/24
	20:48	20:13	19:24	18:38	17:06	17:05
23	06:16	06:44	07:13	07:43	07:18 07:40-07:48/8	07:43 15:50-16:13/23
	20:47	20:12	19:23	18:36	17:06	17:05
24	06:17	06:45	07:14	07:44	07:19 07:41-07:48/7	07:43 15:51-16:14/23
	20:46	20:10	19:21	18:35	17:05	17:06
25	06:18	06:46	07:15	06:45	07:20 07:42-07:48/6	07:44 15:51-16:14/23
	20:46	20:09	19:19	17:34	17:05	17:07
26	06:19	06:47	07:16	06:46	07:21 07:44-07:48/4	07:44 15:52-16:15/23
	20:45	20:07	19:18	17:32	17:04	17:07
27	06:20	06:48	07:17	06:47	07:22 07:45-07:48/3	07:45 15:53-16:15/22
	20:44	20:06	19:16	17:31	17:04	17:08
28	06:20	06:49	07:18	06:48	07:23 07:46-07:47/1	07:45 15:53-16:15/22
	20:43	20:04	19:14	17:30	17:03	17:08
29	06:21	06:50	07:19	06:49	07:24	07:45 15:54-16:15/21
	20:42	20:03	19:13	17:29	17:03	17:09
30	06:22	06:51	07:20	06:51	07:25	07:46 15:55-16:16/21
	20:41	20:01	19:11	17:27	17:03	17:10
31	06:23	06:52		06:52		07:46 15:56-16:16/20
	20:40	20:00		17:26		17:11
Potential sun hours	454	425	374	347	301	292
Sum of minutes with flicker	0	0	139	0	185	517

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

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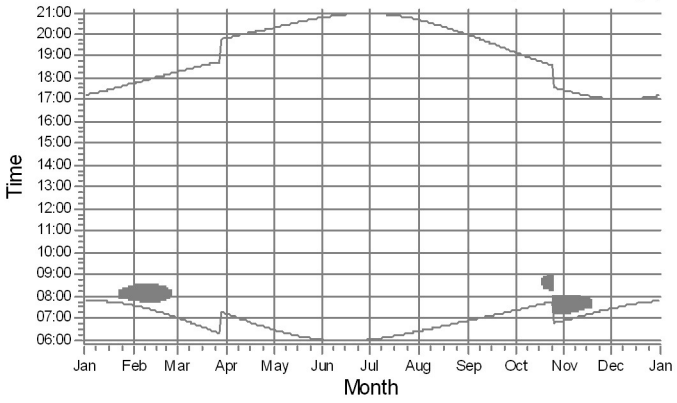
14/06/2022 17:04/3.4.415

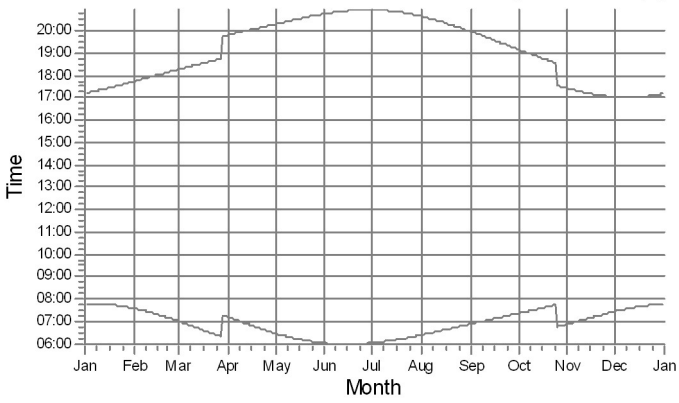
SHADOW - Calendar per WTG, graphical

Calculation: Progetto_2022_06_14_Real_case

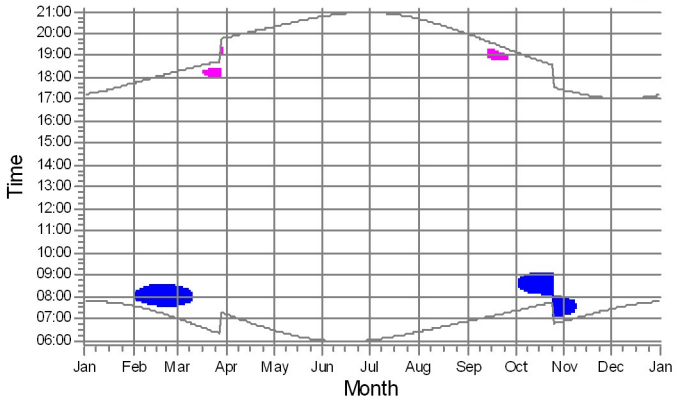
AG01: VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (18



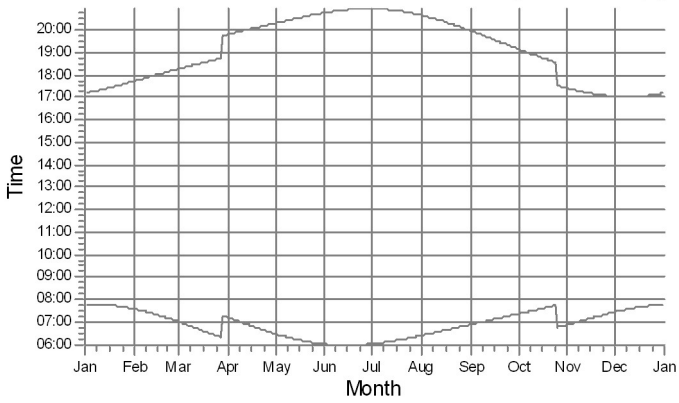
AG02: VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (14



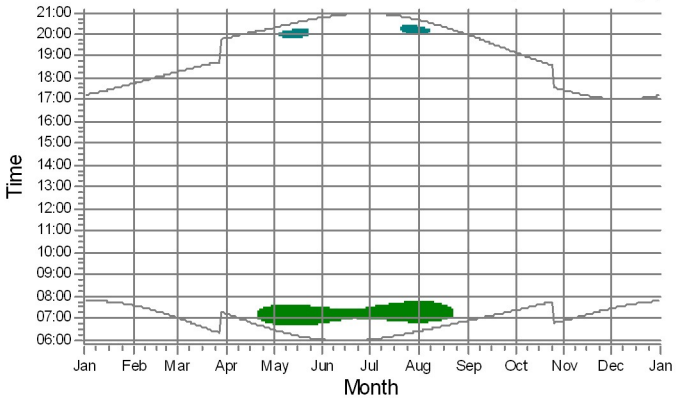
AG03: VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (11



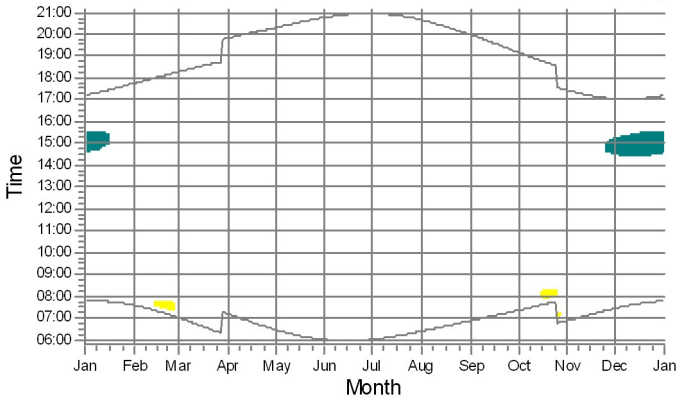
AG04: VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (15



AG05: VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (16



AG06: VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (13



Shadow receptors

- R05: Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (26)
- R06: Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (27)
- R09: Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (28)
- R12: Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (29)
- R26: Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (30)
- R41: Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (31)

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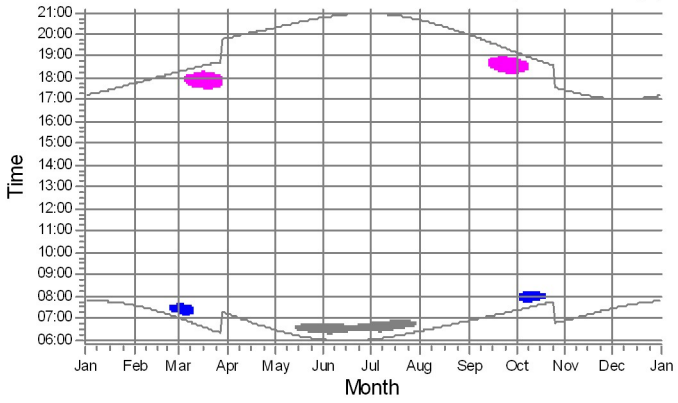
Calculated:
14/06/2022 17:04/3.4.415

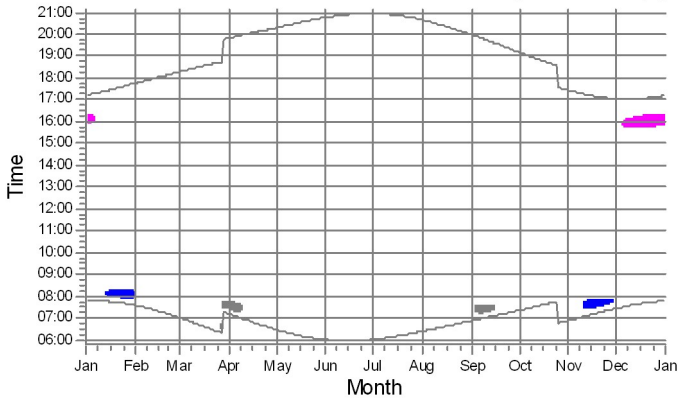
SHADOW - Calendar per WTG, graphical

Calculation: Progetto_2022_06_14_Real_case

AG07: VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (12



AG08: VESTAS V162-6.0 6000 162.0 !O! hub: 125,0 m (TOT: 206,0 m) (17



Shadow receptors

- R09: Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (28)
- R12: Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (29)
- R26: Shadow Receptor: 1,2 × 1,4 Azimuth: 0,0° Slope: 90,0° (30)