Progetto di un nuovo Parco Eolico "Energia Monte Petralta"

Fred Olsen Renewables Italy S.r.l.

Studio di Impatto Ambientale

Allegato F - Studio evoluzione dell’ombra (Shadow flickering)

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Indice

1 Introduzione

La finalità della presente Relazione tecnica specialistica è quella di valutare l'eventuale impatto generato dall'evoluzione dell'ombra prodotta dalle pale eoliche degli aerogeneratori facenti parte del progetto di realizzazione del nuovo Parco Eolico "Energia Monte Petralta" che la Società Fred Olsen Renewables Italy S.r.l. intende realizzare nel Comune di Sestino (AR) in Regione Toscana.

Il progetto oggetto del presente studio prevede:

- impianto eolico con 6 nuovi aerogeneratori della potenza nominale di 5 MW ciascuno per una potenza nominale complessiva di 30 MW con relativa viabilità di accesso interna (la viabilità di accesso interna sarà in parte di nuova realizzazione ed in parte saranno adeguate strade esistenti), piazzole per lo stoccaggio dei componenti e per il loro montaggio, area temporanea di cantiere esterna dotata di parcheggi e uffici per il personale e zone di stoccaggio per elementi minori. Tali interventi interessano esclusivamente il Comune di Sestino (AR);
- di nuovi cavi interrati a 30 kV di connessione tra l'impianto eolico e la nuova Stazione Utente (SU). Tali cavi, nei tratti in cui si sviluppano in corrispondenza della viabilità interna di impianto, hanno una lunghezza complessiva di circa 4,2 km ed interessano il Comune di Sestino (AR) mentre nel tratto che si sviluppa su strada asfaltata esistente fino alla SU hanno una lunghezza di circa 25 km ed interessano i Comuni di Sestino (AR) e Badia Tedalda (AR) in Regione Toscana ed il Comune di Carpegna (PU) in Regione Marche;
- di una nuova Stazione Utente (SU) 30/36 kV ed un nuovo impianto BESS della potenza di 6 MW e relativa viabilità di accesso ubicati nella medesima area in Comune di Sestino (AR);
- un nuovo cavo interrato a 36 kV di connessione tra la nuova SU e la nuova Stazione elettrica RTN (SE) 132/36 kV "Badia Tedalda" della lunghezza di circa 150 m che interessa il Comune di Sestino (AR).

Inoltre completano il progetto, quali opere di rete per la connessione dell'impianto alla RTN:

- la realizzazione di una nuova Stazione Elettrica RTN (SE) 132/36 kV "Badia Tedalda" ubicata in Comune di Sestino (AR) nelle vicinanze della SU;
- la realizzazione dei nuovi raccordi aerei AT 132 kV di connessione tra la nuova SE "Badia Tedalda" e la linea aerea RT N 132 kV "Badia Tedalda – Talamello" esistente e relativi 8 nuovi sostegni (1N-4N e 1S-4S). I due nuovi raccordi, della lunghezza complessiva di circa 1,6 km, interessano il Comune di Sestino (AR);
- la demolizione di un tratto di circa 170 m e di 1 sostegno della Linea aerea RTN 132 kV "Badia Tedalda – Talamello". Il tratto da demolire ricade totalmente in Comune di Sestino (AR);
- la realizzazione di una nuova linea elettrica RTN in AT a 132 kV di connessione tra la SE "Mercatello" esistente e la nuova SE "Badia Tedalda" che per circa 15,5 km sarà realizzata in aereo e per circa 1,1 km in cavo interrato. Questa interessa i Comuni di Sestino (AR), Badia Tedalda (AR), Borgo Pace (PU) e Mercatello sul Metauro (PU).

La finalità del presente lavoro è quella di valutare l'eventuale impatto dell'ombreggiamento che può essere originato dagli aerogeneratori in progetto nella fase di esercizio andando a simulare l'effetto stroboscopico delle ombre proiettate dalle pale rotanti degli aerogeneratori eolici quando sussistono le condizioni meteorologiche opportune (Shadow Flickering).

Le valutazioni di cui sopra sono state effettuate con l'ausilio del software di simulazione specifico **WindPRO**.

2 Il fenomeno di evoluzione dell'ombra indotta da aerogenaratori

Lo shadow flickering (letteralmente ombreggiamento intermittente) descrive una fluttuazione periodica dell'intensità luminosa osservata da un recettore. Tale effetto (stroboscopico) è causato dalla proiezione, su una generica superficie, dell'ombra indotta da oggetti in movimento. Nel caso specifico di un impianto eolico il fenomeno è generato dalla proiezione, al suolo o su un recettore (abitazione), dell'ombra prodotta dalle pale degli aerogeneratori in rotazione in determinate condizioni di esposizione del sole.

Il fenomeno, dal punto di vista di un potenziale recettore, si traduce in una variazione alternata e ciclica di intensità luminosa che, a lungo andare, può provocare fastidio agli occupanti delle abitazioni le cui finestre risultano esposte al fenomeno stesso.
I parametri che concorrono al verificarsi dell'evento sono:

- Altezza del mozzo;
- Diametro del rotore delle WTG e larghezza della pala;
- Posizione del Sole;
- Condizioni climatiche (direzione del vento, velocità del vento, copertura nuvolosa).

Di seguito si riporta quanto ricavabile da letteratura per la valutazione della significatività del fenomeno in analisi.

Le frequenze che possono provocare un senso di fastidio, corrispondenti all'entità della variazione alternata e ciclica di intensità luminosa, sono comprese tra i **2.5 Hz ed i 20 Hz** (Verkuijlen and Westra, 1984).

L'**areale** entro cui il fenomeno risulta maggiormente percepibile è **compreso in un raggio di 500 m** con centro nell'aerogeneratore (*Journal of the Acoustical Society of America 139, 1480 (2016*)). Tra i 500 e 1000 m il fenomeno si verifica nelle prime ore del giorno o verso l'imbrunire, quando il sole è molto basso sull'orizzonte (con un **angolo minimo di 3°** sopra l'orizzonte) e le ombre diventano molto lunghe, pertanto esse si dissipano prima di raggiungere il suolo (o il ricettore) (si vedano Fig. 2a e 2b).

Figura 2a Grafico con curve d'ombra in funzione dell'altezza del sole sull'orizzonte

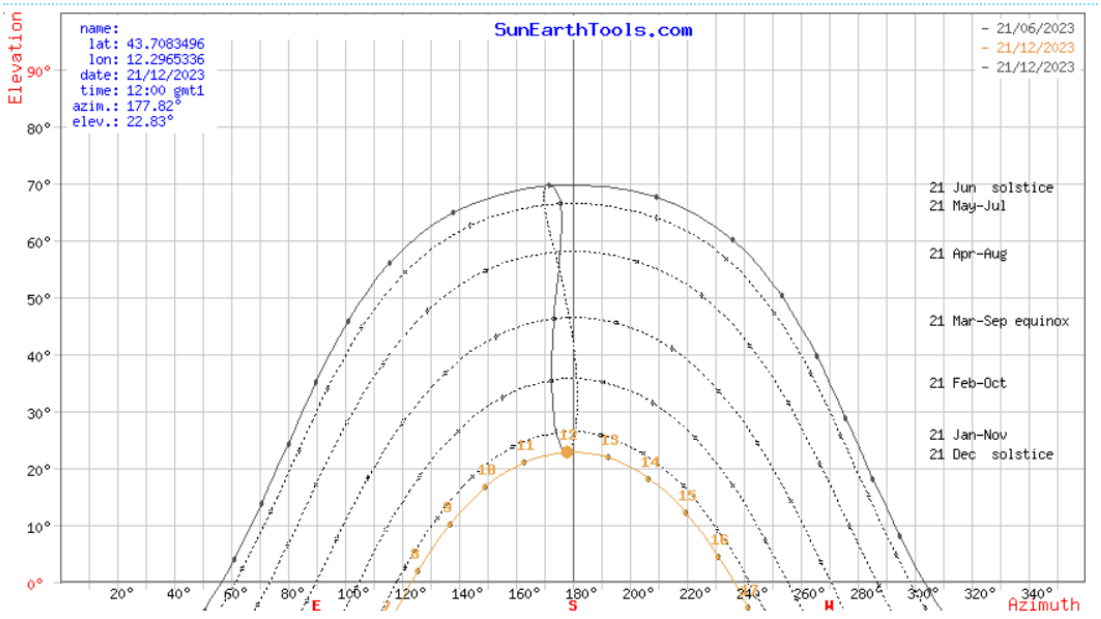
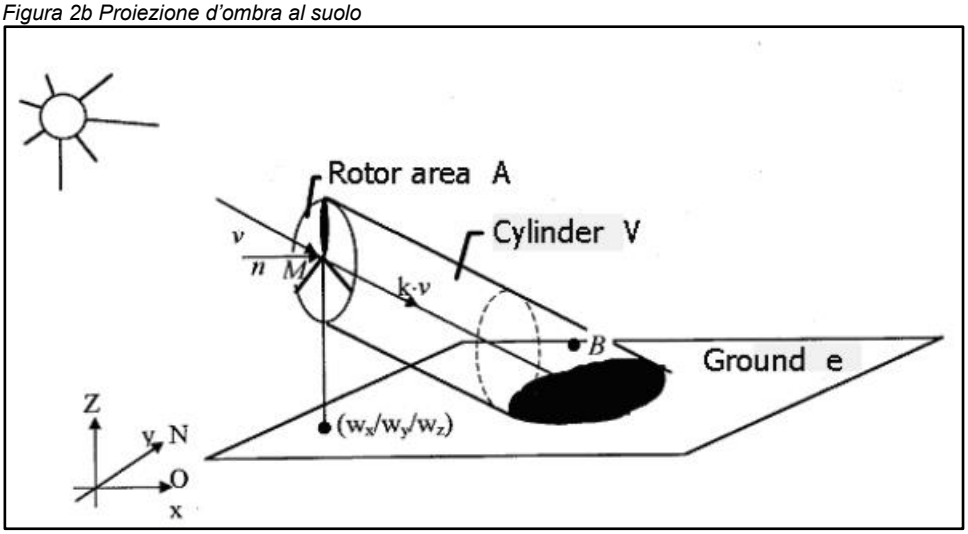


Figura 2b Proiezione d'ombra al suolo



La **durata massima del fenomeno** oltre cui può essere avvertito un potenziale fastidio da parte di un recettore su cui concordano linee guida tedesche di progettazione degli impianti eolici e vari studi di ricerca[1] è:

- Massimo **30 ore all'anno** di ombra massima astronomica;
- Massimo **30 minuti al giorno** di ombra massima astronomica.

Si rammenta che le condizioni di base sopracitate per la valutazione dell'esposizione non hanno alcun effetto prescrittivo ai fini della presente valutazione del fenomeno dello Shadow Flickering, il

[1] [Haac R., Darlow R., Kaliski K., Rand J., Hoen B., In the shadow of wind energy: Predicting community exposure and annoyance to wind turbine shadow flicker in the United States, Energy Research & Social Science, 87 (2022)]

quale si basa unicamente su esperienza di studio e di ricerca; tali valori di soglia costituiscono valori di riferimento di natura prettamente letteraria, non esistendo a oggi riferimenti normativi cogenti nell'ambito della giurisprudenza italiana in merito al fenomeno dello Shadow Flicker.

2.1 Normativa

Attualmente in Italia non sono state emanate specifiche norme o linee guida che regolamentino i limiti di esposizione al fenomeno dello Shadow flickering generato dall'esercizio degli impianti eolici, né è stata definita una distanza massima oltre la quale si ritiene improbabile il verificarsi di un impatto significativo sulla salute umana.

Sono da segnalare, a livello regionale, le indicazioni fornite dalla Regione Abruzzo che riporta, tra i requisiti di sicurezza per la salute umana da rispettare nella scelta della localizzazione degli impianti eolici, le distanze oltre le quali non sono da valutare gli effetti dello shadow flickering:

b. Distanza minima da edifici a carattere abitativo, commerciale, per servizi e turistico-ricreativo: **300** metri, previa verifica di compatibilità acustica; in caso contrario sarà compito del proponente l'impianto verificare e certificare che il rumore immesso dalle turbine in prossimità delle abitazioni non porti ad un superamento dei limiti imposti dalla normativa vigente, oltre a ciò il proponente dovrà garantire che non si creino effetti di Shadow-Flickering in prossimità delle abitazioni.

3 Ubicazione del progetto

Il Parco Eolico “Energia Monte Petralta” sarà realizzato in località Monte Petralta nel comune di Sestino (AR), in Regione Toscana.

L’area interessata dall’Impianto eolico è di tipo collinare, risulta lontana da centri abitati ed è posta a quote comprese fra 550 m e 850 m s.l.m..

I centri abitati più prossimi all’Impianto eolico sono Martigliano, posto a circa 800 m in direzione ovest rispetto agli aerogeneratori in progetto, Belforte all’Isauro, ubicato a circa 1,4 km in direzione sud est rispetto agli aerogeneratori in progetto e Casale, localizzato a circa 1,1 km in direzione sud ovest rispetto agli aerogeneratori in progetto.

Le caratteristiche geografiche dell’impianto eolico in progetto sono indicate nella seguente tabella (misurate in posizione baricentrica rispetto alla posizione degli aerogeneratori).

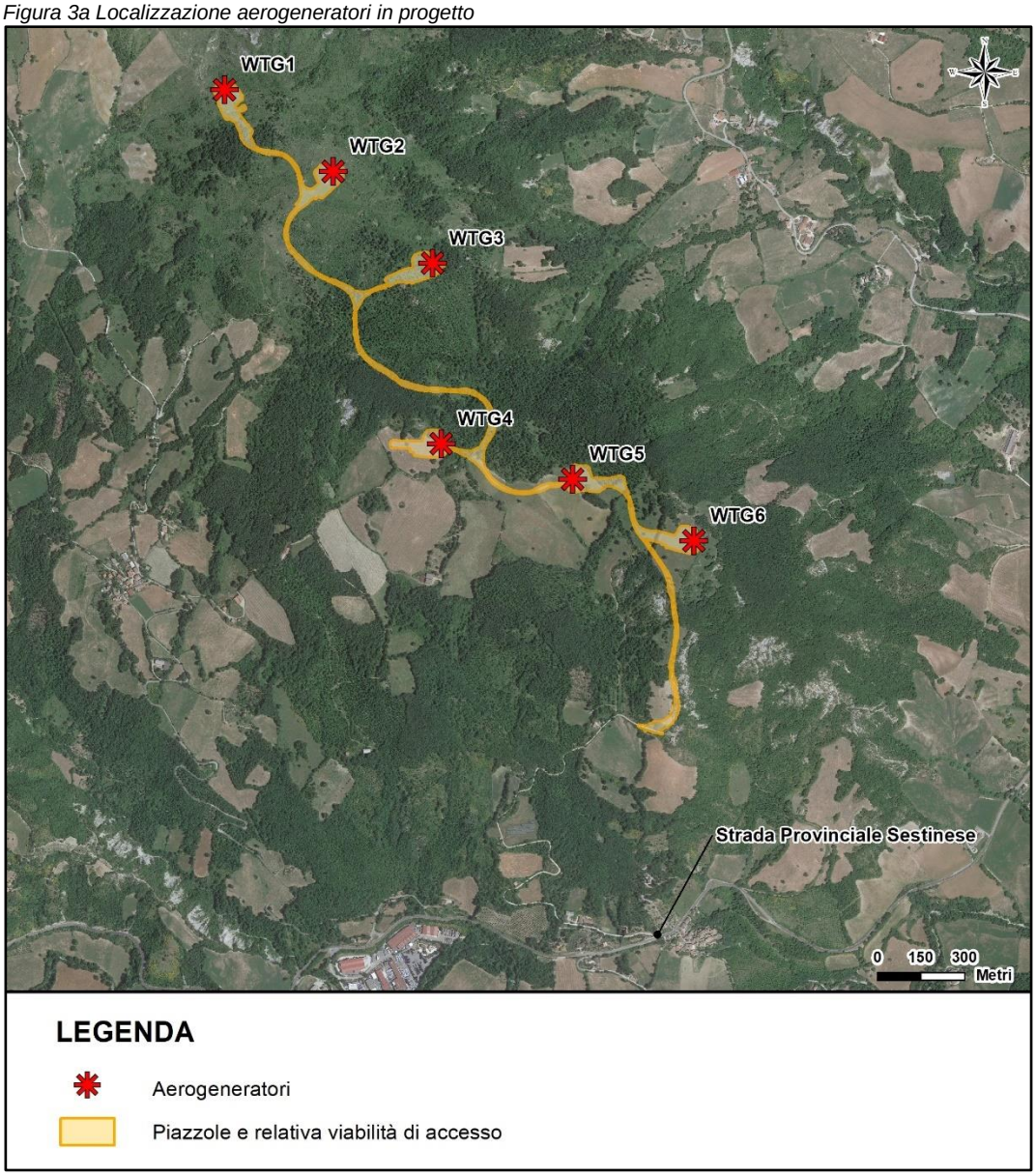
Tabella 3a Caratteristiche geografiche del sito di impianto

Nome impianto	Comuni	Provincia	Coordinate geografiche	Altitudine media (m s.l.m.)
Energia Monte Petralta	Sestino	Arezzo	43° 43' 41.57" N 12° 20' 36.28" E	~ 750

L’area dell’impianto eolico è raggiungibile tramite la Strada Provinciale Sestinese e dalla viabilità esistente che si dirama da quest’ultima a cui si collegherà la viabilità di nuova realizzazione per l’accesso all’impianto.

Nella seguente Figura 3a si riporta l’ubicazione degli aerogeneratori su immagine satellitare.

Figura 3a Localizzazione aerogeneratori in progetto



Di seguito si riportano le coordinate UTM 32N - WGS84 dei 6 nuovi aerogeneratori in progetto localizzati tutti nel territorio comunale di Sestino.

Tabella 3b *Localizzazione dei nuovi aerogeneratori in progetto*

ID	Coordinate UTM 32N - WGS84	
	X [m]	Y [m]
WTG1	768.564,3	4.848.043,3
WTG2	768.936,7	4.847.762,7
WTG3	769.278,6	4.847.446,8
WTG4	769.308,4	4.846.826,8
WTG5	769.760,2	4.846.705,1
WTG6	770.176,7	4.846.493,8

4 Caratteristiche delle turbine

Come anticipato nell'Introduzione, l'analisi è focalizzata sul progetto di realizzazione di un nuovo parco eolico costituito da 6 aerogeneratori. Ogni nuovo aerogeneratore avrà una potenza di 5,0 MW; la potenza totale dell'Impianto sarà di 30 MW. Gli aerogeneratori sono stati posizionati in maniera tale da rispettare una distanza reciproca pari a 3 diametri (465 m).

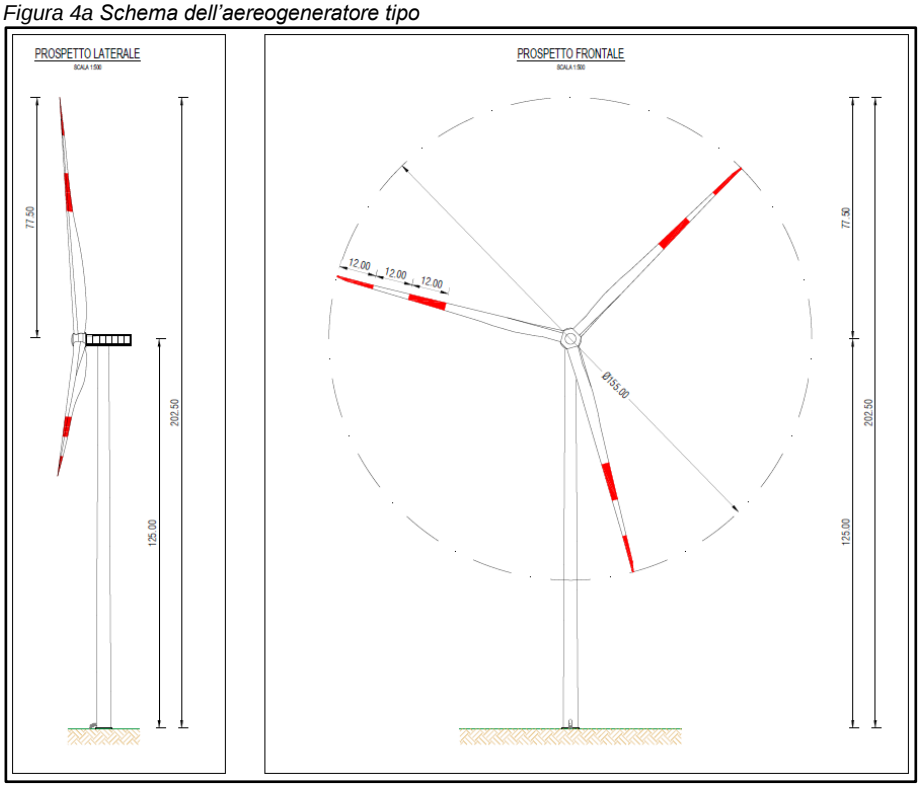
Di seguito si riportano le caratteristiche di un aerogeneratore tipo considerato ai fini dello sviluppo del progetto.
La potenza nominale delle turbine previste sarà pari a 5,0 MW.
L'aerogeneratore tipo utilizzato nel progetto ha le seguenti caratteristiche dimensionali (Figura 4a):

Altezza massima alla punta	h_{tip} = 202,5 m
Altezza al mozzo	hh = 125,0 m
Diametro del rotore	ϕ = 155,0 m

Ai fini del presente studio, scegliendo tra quelli disponibili nel *Catalog* del Software WindPro, sono stati utilizzati gli aerogeneratori Siemens Gamesa SG155 aventi le seguenti caratteristiche dimensionali (che più si avvicinano a quelle di progetto):

- ✓ Potenza: 6,60 MW;
- ✓ Diametro del rotore: 155 m;
- ✓ Altezza della torre: 102,5 m;
- ✓ Altezza mozzo: 105 m;
- ✓ Lunghezza massima della pala: 76 m;
- ✓ N. pale: 3;
- ✓ Velocità di rotazione (a regime): 28 RPM - 0,48 Hz (singola pala 9,3 RPM – 0,16 Hz).

Figura 4a Schema dell'aereogeneratore tipo



5 Recettori

Allo scopo di valutare l'eventuale impatto indotto sugli edifici da parte dell'impianto eolico in progetto, sono stati individuati i recettori presenti in un'areale corrispondente all'inviluppo delle aree buffer circolari di raggio pari a 1 km con centro coincidente con le postazioni delle WTG in oggetto (*Journal of the Acoustical Society of America 139, 1480 (2016)*).

Sul territorio oggetto dello studio sono stati individuati 16 recettori utilizzando i criteri di seguito specificati:

- ✓ Area di interesse riferita ad un intorno complessivo (inviluppo) di 1 km da tutti gli aerogeneratori.
- ✓ Utilizzo di ortofoto, estratti catastali ed esito di sopralluoghi per selezionare gli edifici.

Per ogni edificio individuato, nel modello di simulazione, è stato inserito il punto rappresentante il centroide dello stesso.

La posizione di tali recettori è mostrata nella mappa riportata in Figura 5a, mentre le caratteristiche sono descritte in Tabella 5a.

La sensibilità di un recettore rispetto al fenomeno di ombreggiamento dipende, oltre che alla sua posizione, anche dall'esposizione delle sue parti vetrate (finestre o altro) rispetto alla direttrice sole-turbina: infatti, nel caso in cui un edificio non abbia alcuna finestratura sul lato esposto al fenomeno di ombreggiamento, il fastidio per gli occupanti dello stesso sarà nullo.

Tuttavia, in una fase di simulazione iniziale, a favore di sicurezza, si è scelto di impostare per ciascun recettore la modalità "*greenhouse*" del modello, ossia ipotizzando che tutte le loro pareti siano vetrate e quindi potenzialmente esposte al fenomeno di ombreggiamento.
Inoltre, è stata trascurata la presenza di alberi o altri ostacoli che, intercettando le ombre prodotte dagli aerogeneratori che potrebbero ridurre il fenomeno.

Di seguito si riporta la tabella riepilogativa, in cui sono indicate per ciascun recettore individuato le relative coordinate (UTM 32N - WGS 84) e la classe catastale (tutti i ricettori individuati ricadono nel Comune di Sestino).

Tabella 5a Tabella coordinate, quota s.l.m. e tipologia dei recettori selezionati per lo studio

ID	Etichetta	X [m]	Y [m]	Z [m s.l.m]	Distanza dalla WTG più vicina [m]	Categoria catastale
A	RC1	768.383	4.846.525	656,5	973 m da WTG4	A4/C02
B	RC2	770.106	4.845.807	572,7	691 m da WTG6	A02/F02
C	RC3	770.180	4.847.877	524,2	999 m da WTG3	A03/C06
D	RC4	767.742	4.847.836	772,6	848 m da WTG1	A4
E	RC5	769.912	4.848.292	593,5	1.109 da WTG2	A03/C02/C06/F05
F	RC6	768.357	4.846.602	669,3	978 m da WTG4	A04
G	RC7	768.364	4.846.516	656,5	994 m da WTG4	A03/A04/C06
H	RC8	768.565	4.846.261	629,5	939 m da WTG4	A03/C02
I	RC9	768.371	4.846.605	670,6	963 m da WTG4	A04
J	RC10	768.391	4.846.544	657,1	960 m da WTG4	A04/C02
K	RC11	768.372	4.846.554	659,5	975 m da WTG4	A03
L	RC12	770.114	4.845.834	576,3	663 m da WTG6	A02/F02
M	RC13	770.395	4.847.706	510,6	1.147 m da WTG3	A03
N	RC14	769.929	4.848.229	595,2	1.017 m da WTG3	A03/C06
O	RC15	768.355	4.846.528	657,0	999 m da WTG4	A03
P	RC16	770.360	4.847.768	513,9	1.128 m da WTG3	A03

6 Modello di calcolo

L'analisi del potenziale impatto prodotto da un parco eolico in termini di shadow flickering è realizzata, generalmente, attraverso l'impiego di specifici applicativi che modellano il fenomeno in esame.
Nello specifico, nel presente studio, è stato impiegato il modulo shadow flickering del software **WindPro 3.6**.

L'analisi si basa necessariamente sull'impiego di un modello digitale del terreno dell'area oggetto di progettazione (per ricavare la topografia del terreno), sulla scelta e sul posizionamento degli aerogeneratori e dei potenziali ricettori, nonché sull'inserimento dei dati che correlano la posizione del sole nell'arco dell'anno con le condizioni operative delle turbine nello stesso arco di tempo.

Al fine di calcolare la posizione relativa del sole nell'arco di un anno rispetto al parco eolico ed ai ricettori è necessario definire la longitudine, la latitudine ed il fuso orario dell'area interessata dal progetto (coordinate baricentriche del dominio di calcolo).

Perseguendo l'obiettivo di ottenere una simulazione più cautelativa, a vantaggio di sicurezza, le simulazioni sono state effettuate ipotizzando le seguenti condizioni "sfavorevoli":

1. nessun ostacolo (oltre a quello orografico) è stato interposto fra turbine e recettori;
2. per ogni turbina: rotore in movimento alla massima frequenza e in moto continuo (nessuna schedulazione di funzionamento è stata imposta);
3. direzione del vento allineata con quella da turbina a recettore;
4. imposizione dei recettori come struttura dotata di finestre di apertura 1,5m x 1,5m prive di orientazione direzionale rispetto al Sud, settando quindi la modalità *greenhouse*, ossia ipotizzando che le finestre siano omnidirezionali e su tutte le pareti dei fabbricati.

Inoltre, sono stati impostati i seguenti parametri di simulazione secondo quanto riscontrato dalla letteratura esistente e dal settaggio di default del software di calcolo:

a) area di calcolo: 1000 m;
b) altezza del sole minima dall'orizzonte sotto la quale l'influenza risulta nulla: 3°;
c) altezza dal suolo a cui si calcola il percepimento del fenomeno: 2 m;
d) passo temporale di calcolo: 1 minuto;
e) passo spaziale della griglia di calcolo: 1 m.

Al momento del calcolo del fenomeno sono stati utilizzati i dati di eliofania reale rilevati dalla stazione metereologica più vicina e con condizioni geografiche assimilabili a quelle del sito, fra quelle presenti nel database del software, ovvero "Bologna" (Tabella 6a).

Tabella 6a Eliofania utilizzata nel modello, ricavata dalla stazione metereologica di Bologna (i valori indicano le ore/giorno in cui il sole splende non coperto da nubi, come media degli anni 1969-1989)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

7 Risultati

In Tabella 7a sono riportati, per ogni recettore, i risultati relativi alle ore/anno di ombreggiamento percepite calcolate dal modello. La Tabella 7b invece riporta, per ogni aerogeneratore, le ore/anno di ombreggiamento prodotte complessivamente verso i recettori.

Il risultato complessivo può essere visualizzato anche nell'Appendice 1 e nella mappa di Figura 7a.

Tabella 7a Risultati complessivi relativi a ciascun recettore; ore espresse in [hh:mm]

Nome	ID	Valore atteso
		Ore/anno
RC1	A	**31:40**
RC2	B	0:00
RC3	C	20:10
RC4	D	**35:28**
RC5	E	22:21
RC6	F	22:46
RC7	G	**30:09**
RC8	H	0:00
RC9	I	23:26
RC10	J	**30:03**
RC11	K	26:55
RC12	L	0:00
RC13	M	25:35
RC14	N	20:08
RC15	O	27:40
RC16	P	22:13

Tabella 7b Ore di ombreggiamento all'anno prodotte da ciascun generatore verso i recettori.

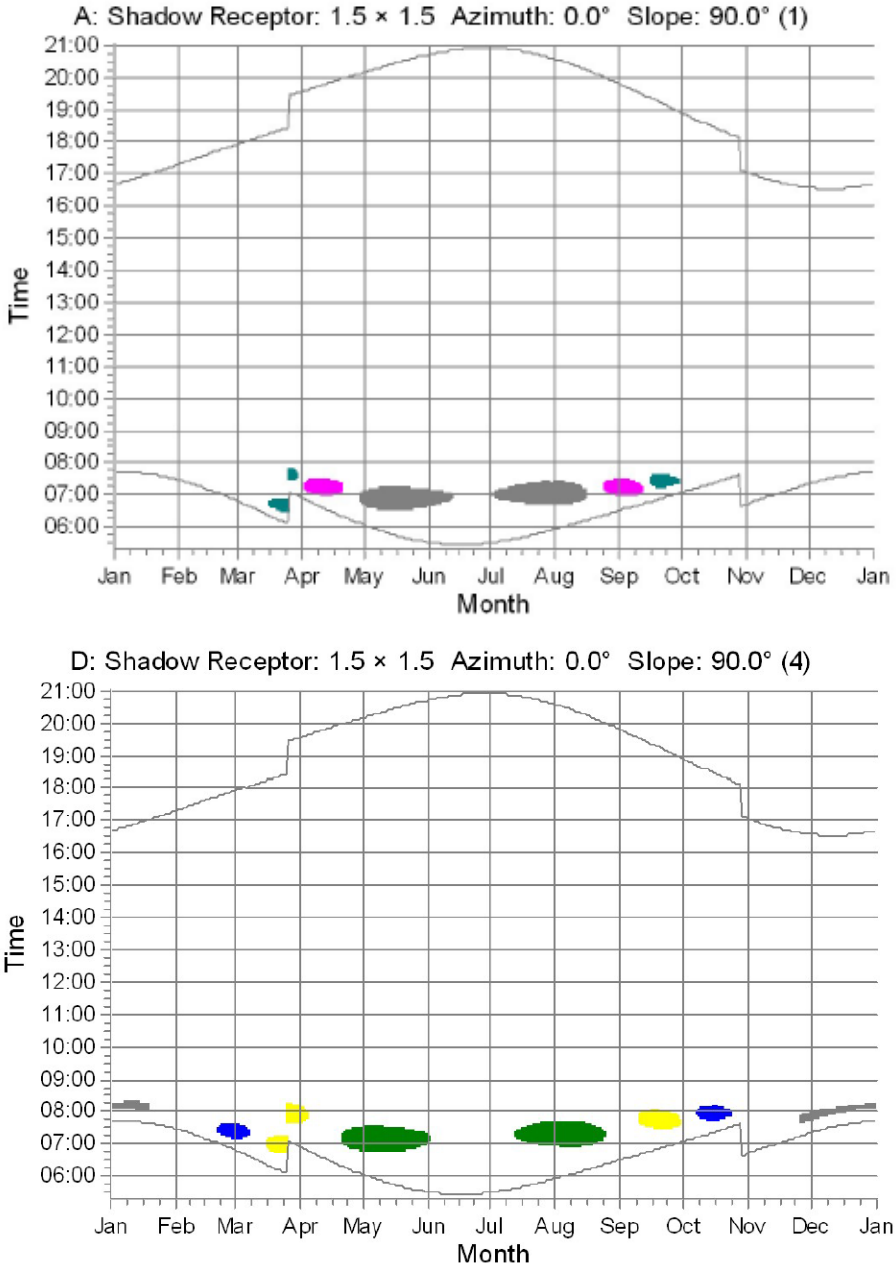
Nome	Valore atteso [hh:mm]
RI01	14:36
RI02	24:44
RI03	33:04
RI04	42:01
RI05	15:33
RI06	4:01

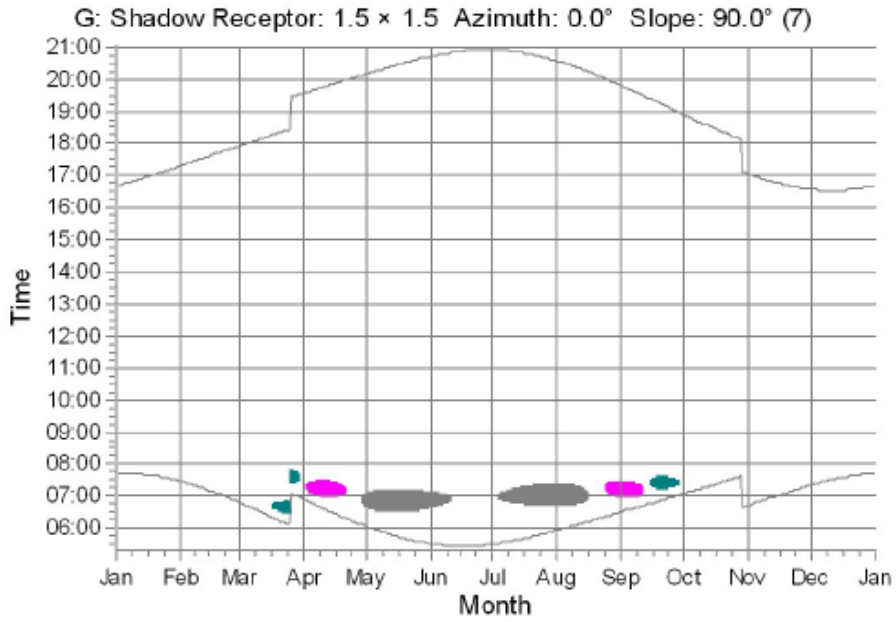
Rispetto alla simulazione effettuata si evidenzia che:

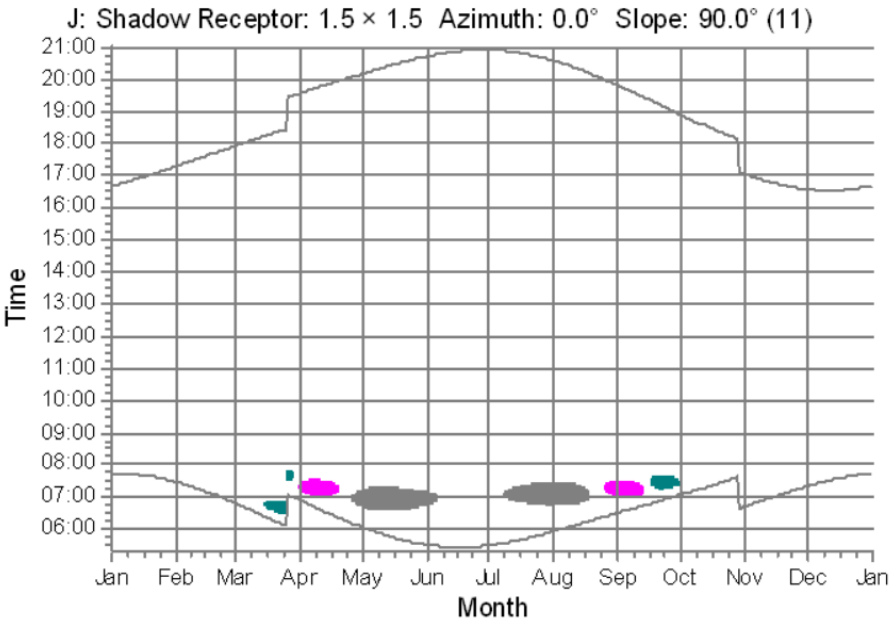
- ✓ Sono stati individuati nell'area di calcolo 16 recettori, edifici civili, che potrebbero essere interessati dal fenomeno.

- ✓ Di questi, 4 risultano interessati da un valore atteso di poco superiore alle 30 ore/anno di ombreggiamento (RC1/A; RC4/D; RC7/G; RC10/J).
- ✓ Il fenomeno dello shadow flickering percepito dai recettori RC1/A; RC7/G; RC10/J è di breve durata nel corso della giornata (minore di 30 min/d) e solo limitato alle prime ore del mattino come desumibile dalla Tabella 7a e dalle immagini sotto riportate:

Figura 7b Risultati calendario ombreggiamento recettore RC1/A; RC4/D; RC7/G; RC10/J



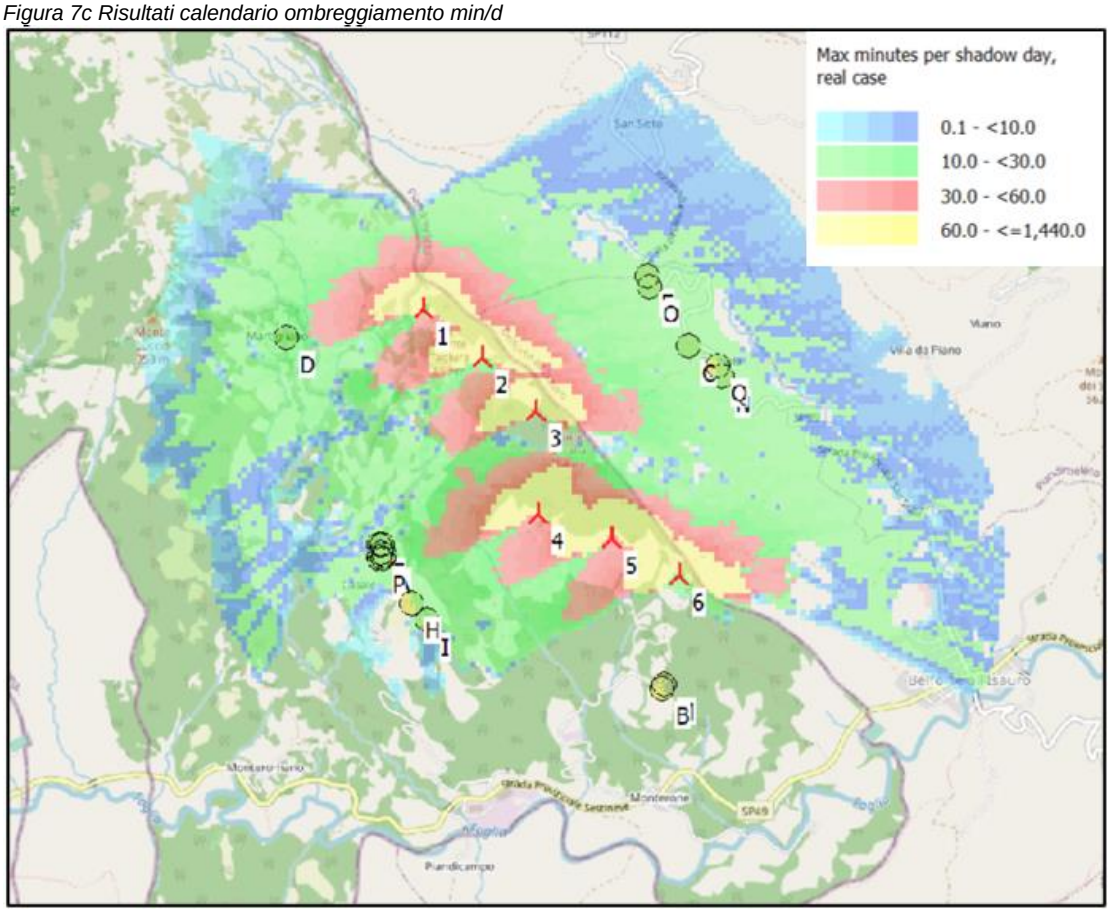




WTGs

1: Aerogeneratore 1	3: Aerogeneratore 3	5: Aerogeneratore 5
2: Aerogeneratore 2	4: Aerogeneratore 4	6: Aerogeneratore 6

Figura 7c Risultati calendario ombreggiamento min/d



- ✓ Si evidenzia come tutti i recettori siano posti a una distanza maggiore a 500 m dall'aerogeneratore più vicino pertanto, come esplicitato al §2, il fenomeno si verifica nelle prime ore del giorno, quando il sole è molto basso sull'orizzonte (con un angolo minimo di 3° sopra l'orizzonte) e le ombre diventano molto lunghe dissolvendosi, di fatto, prima di raggiungere il ricettore;
- ✓ Si ricorda che tra le ipotesi di base inserite nel software è stato assunto che:
  - la condizione "*greenhouse*" per i recettori, ovvero che l'edificio presenti tutte le pareti vetrate, pertanto l'effetto potrebbe essere ulteriormente ridotto nel caso si considerino le reali esposizioni delle finestre
  - non è stata considerata la presenza di ostacoli forniti dalla vegetazione lungo la direttrice di sviluppo dell'ombra che naturalmente andrebbero ad attenuare se non ad annullarne gli effetti specialmente per i ricettori ubicati a distanze maggiori di 500 m dagli aerogeneratori potenzialmente interessati dalle ombre delle prime ore del mattino.

Infine, si ricorda che secondo dati di letteratura la frequenza di rotazione delle pale eoliche può essere ritenuta "disturbante" se maggiore o uguale a 2.5 Hz. Gli aerogeneratori del caso studiato

hanno una velocità di rotazione tale che la frequenza risulta pari a 0,48 Hz, quindi nettamente al di sotto di quella critica.

In sintesi i risultati ottenuti, considerando anche le assunzioni cautelative adottate per la modellazione, inducono a considerare non significativo il disturbo indotto dall'ombreggiamento dei ricettori considerati causato dagli aerogeneratori in progetto.

In Appendice 1 vengono riportati i risultati estratti dal Software per ogni recettore.

8 Conclusioni

Lo studio ha permesso di valutare l'eventuale impatto indotto dall'effetto di sfarfallio dell'ombra (shadow flickering) che potrebbe essere causato dall'esercizio dei 6 nuovi aerogeneratori facenti parte del progetto di realizzazione del nuovo Parco Eolico "Energia Monte Petralta" che la Società Fred Olsen Renewables Italy S.r.l. intende realizzare nel Comune di Sestino (AR) in Regione Toscana.

Come riportato nei paragrafi precedenti in Italia, attualmente, non sono state emanate specifiche norme o linee guida che regolamentino i limiti di esposizione al fenomeno dello Shadow flickering generato dall'esercizio degli impianti eolici, né è stata definita una distanza massima oltre la quale si ritiene improbabile il verificarsi di un impatto significativo sulla salute umana; pertanto lo studio è stato basato su dati di letteratura e sui parametri forniti di default dal modello di calcolo utilizzato (WindPro 3.6).

I risultati ottenuti, considerando anche le assunzioni cautelative adottate per la simulazione, inducono a considerare non significativo il disturbo indotto dall'ombreggiamento dei ricettori considerati causato dall'esercizio degli aerogeneratori in progetto.

LEGENDA

Interventi in progetto

- Aerogeneratori (ID)
- Piazzole e relativa viabilità di accesso
- Area di cantiere esterna

- Ricettori (ID)

- Confini comunali
- Confini provinciali/regionali

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studio TECHNÉ

ENERGY ENVIRONMENT ENGINEERING

CLIENTE

Fred Olsen Renewables Italy S.r.l.

Fred. Olsen Renewables

PROGETTO:

Progetto di un nuovo Parco Eolico "Energia Monte Petralta"

Studio di Impatto Ambientale - Allegato F

Ns rif. 1669043_SES_067

REV.	DATA	DESCRIZIONE	ESEGUITO	CONTROLLATO	APPROVATO
0	NOV 2023	PRIMA EMISSIONE	TAUW	FRED.OLSEN	FRED.OLSEN

TITOLO:

Localizzazione dei ricettori considerati

CONVENZIONE	FORMATO	SCALA	FIGURA	REV.	N° FOGLIO
	A0	1:4.000	Figura 5a	0	1/1

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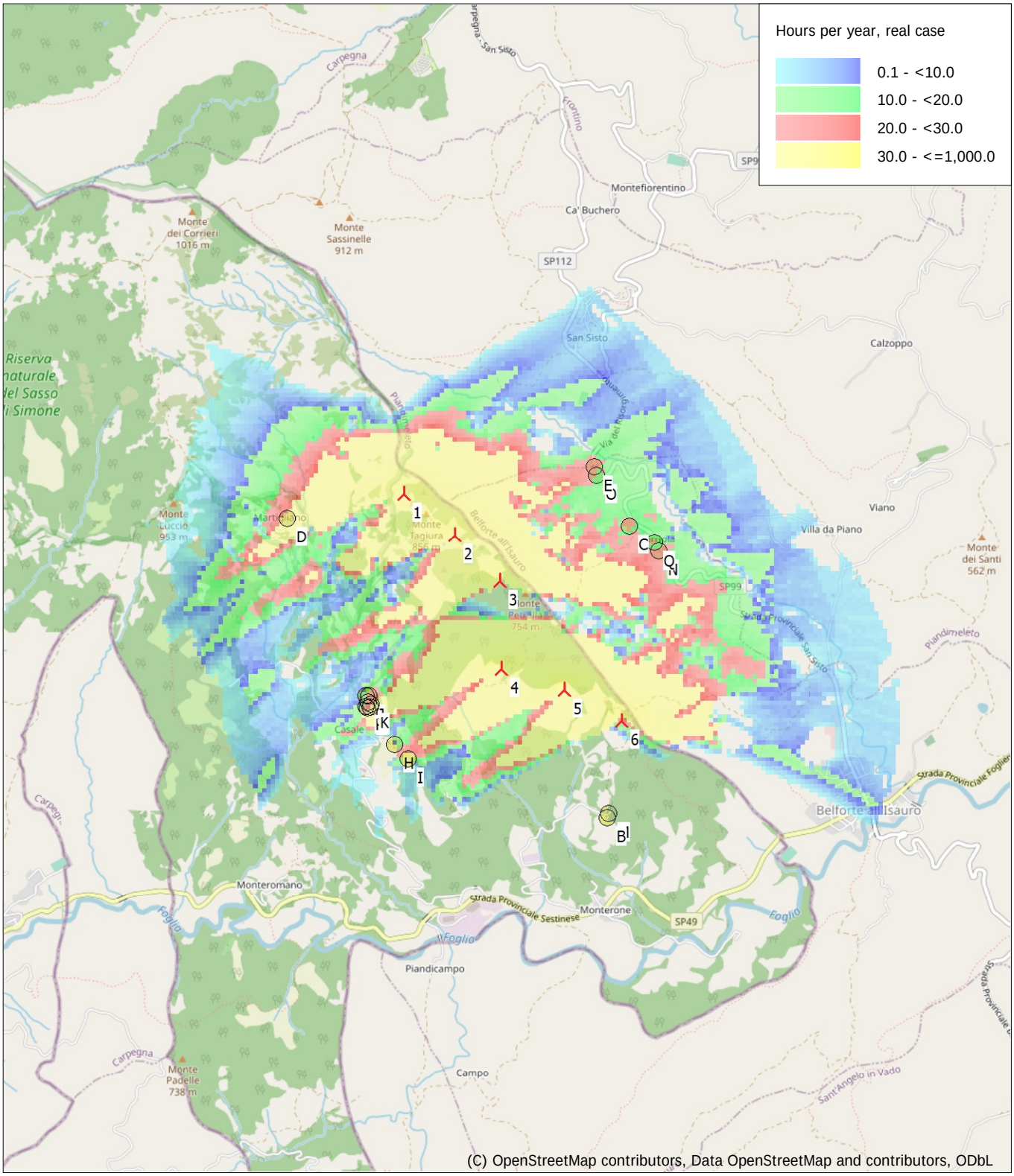
SHADOW - Map

Calculation: Real case_3



0 500 1000 1500 2000 m

Map: EMD OpenStreetMap , Print scale 1:40,000, Map center UTM (north)-WGS84 Zone: 32 East: 769,440.00 North: 4,847,520.00

New WTG Shadow receptor

Flicker map level: Elevation Grid Data Object: Sestino Shadow_EMDGrid_0.wpg (1)

Appendice 1

Risultati estratti dal Software WindPro

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SHADOW - Main Result

Calculation: Real case_3

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

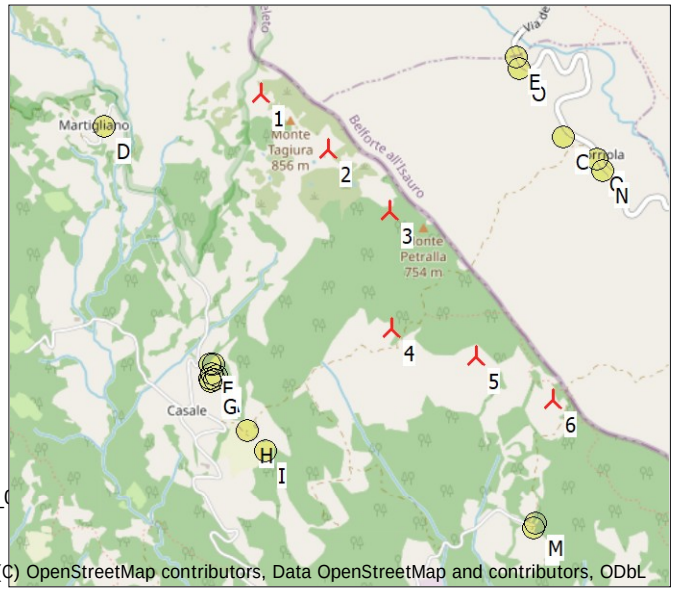
Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

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

All coordinates are in
UTM (north)-WGS84 Zone: 32



Scale 1:40,000

New WTG Shadow receptor

WTGs

	Easting	Northing	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data Calculation distance [m]	RPM [RPM]
1	768,564.30	4,848,043.30	833.3	Aerogeneratore 1	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	122.5	2,006	9.3
2	768,936.70	4,847,762.70	837.4	Aerogeneratore 2	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	122.5	2,006	9.3
3	769,278.60	4,847,446.80	788.4	Aerogeneratore 3	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	122.5	2,006	9.3
4	769,308.40	4,846,826.80	716.3	Aerogeneratore 4	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	122.5	2,006	9.3
5	769,760.20	4,846,705.10	686.7	Aerogeneratore 5	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	122.5	2,006	9.3
6	770,176.70	4,846,493.80	676.0	Aerogeneratore 6	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	122.5	2,006	9.3

Shadow receptor-Input

No.	Easting	Northing	Z [m]	Width [m]	Height [m]	Elevation a.g.l. [m]	Slope of window [°]	Direction mode	Eye height (ZVI) a.g.l. [m]
A	768,383.00	4,846,525.00	656.5	1.5	1.5	1.0	90.0	"Green house mode"	2.5
B	770,106.00	4,845,807.00	572.7	1.5	1.5	1.0	90.0	"Green house mode"	2.5
C	770,180.00	4,847,877.00	524.2	1.5	1.5	1.0	90.0	"Green house mode"	2.5
D	767,742.00	4,847,836.00	772.6	1.5	1.5	1.0	90.0	"Green house mode"	2.5
E	769,912.00	4,848,292.00	593.5	1.5	1.5	1.0	90.0	"Green house mode"	2.5
F	768,357.00	4,846,602.00	669.3	1.5	1.5	1.0	90.0	"Green house mode"	2.5
G	768,364.00	4,846,516.00	656.5	1.5	1.5	1.0	90.0	"Green house mode"	2.5
H	768,565.00	4,846,261.00	629.5	1.5	1.5	1.0	90.0	"Green house mode"	2.5
I	768,669.31	4,846,165.10	618.2	1.5	1.5	1.0	90.0	"Green house mode"	2.5
J	768,371.00	4,846,605.00	670.6	1.5	1.5	1.0	90.0	"Green house mode"	2.5
K	768,391.00	4,846,544.00	657.1	1.5	1.5	1.0	90.0	"Green house mode"	2.5
L	768,372.00	4,846,554.00	659.5	1.5	1.5	1.0	90.0	"Green house mode"	2.5
M	770,114.00	4,845,834.00	576.3	1.5	1.5	1.0	90.0	"Green house mode"	2.5
N	770,395.00	4,847,706.00	510.6	1.5	1.5	1.0	90.0	"Green house mode"	2.5
O	769,929.00	4,848,229.00	595.2	1.5	1.5	1.0	90.0	"Green house mode"	2.5
P	768,355.00	4,846,528.00	657.0	1.5	1.5	1.0	90.0	"Green house mode"	2.5
Q	770,360.00	4,847,768.00	513.9	1.5	1.5	1.0	90.0	"Green house mode"	2.5

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SHADOW - Main Result

Calculation: Real case_3

Calculation Results

Shadow receptor

No.	Shadow, expected values Shadow hours per year [h/year]
A	31:40
B	0:00
C	20:10
D	35:28
E	22:21
F	22:46
G	30:09
H	0:00
I	17:58
J	23:26
K	30:03
L	26:55
M	0:00
N	25:35
O	20:08
P	27:40
Q	22:13

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

No.	Name	Expected [h/year]
1	Aerogeneratore 1	38:51
2	Aerogeneratore 2	31:28
3	Aerogeneratore 3	36:16
4	Aerogeneratore 4	43:19
5	Aerogeneratore 5	28:42
6	Aerogeneratore 6	8:51

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.

The calculation of the total expected values for a given receptor assumes a weighted average directional reduction for all WTGs contributing to shadow flicker within the same day. In the case where shadow flicker from different WTGs is not concurrent within the day, the total expected time at a given receptor may deviate marginally from the individual flicker time caused by each turbine separately.

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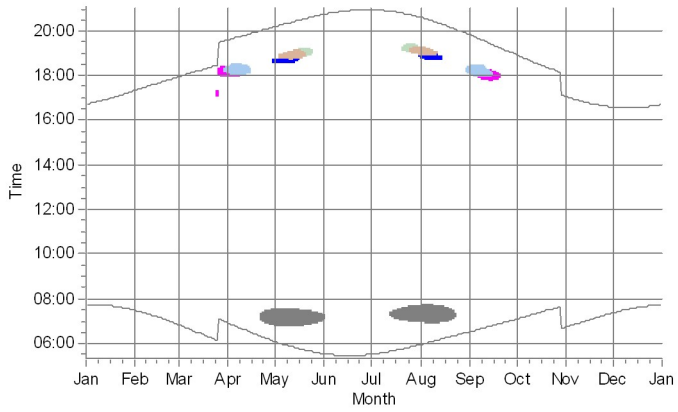
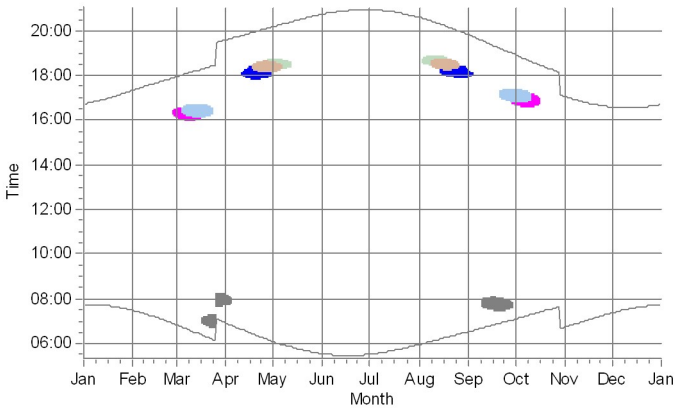
SHADOW - Calendar per WTG, graphical

Calculation: Real case_3

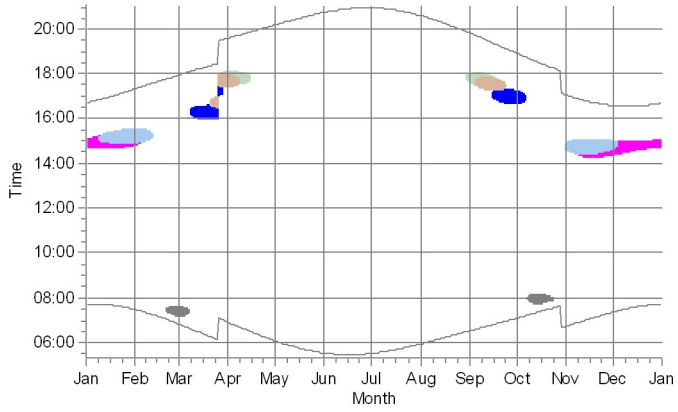
1: Aerogeneratore 1



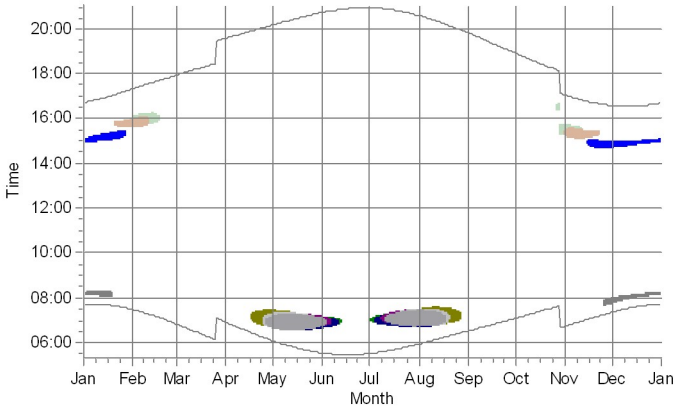
2: Aerogeneratore 2



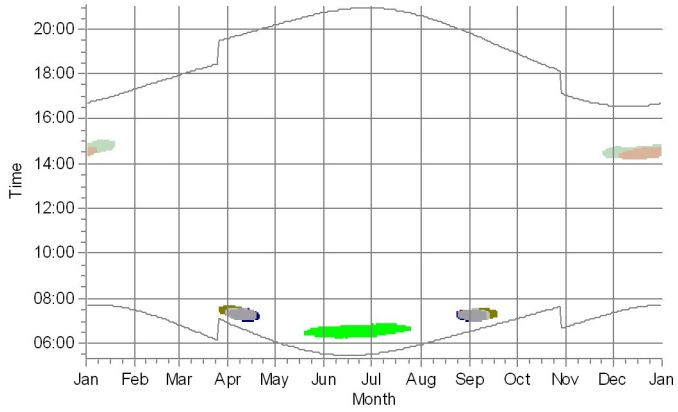
3: Aerogeneratore 3



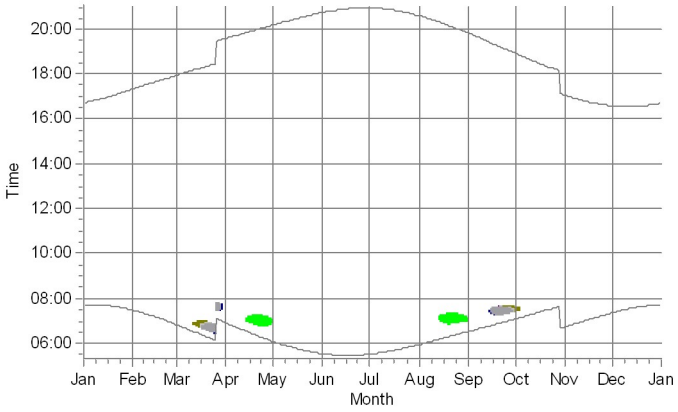
4: Aerogeneratore 4



5: Aerogeneratore 5



6: Aerogeneratore 6



Shadow receptors

- A: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (1)
- C: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (3)
- D: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (4)
- E: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (5)
- F: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (6)
- G: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (7)
- I: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (9)
- J: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (10)
- K: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (11)
- L: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (12)
- N: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (14)
- O: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (15)
- P: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (16)
- Q: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (17)

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SHADOW - Calendar per WTG

Calculation: Real case_3 WTG: 1 - Aerogeneratore 1

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January	February	March		April		May		June	
1	07:43	07:28	06:48		06:54	17:57-18:22/25	06:04	06:50-07:30/40	05:31	07:08-07:12/4
	16:41	17:17	17:55		19:34		20:09	18:36-18:40/4	20:42	
2	07:43	07:26	06:47		06:52	17:57-18:22/25	06:02	06:50-07:31/41	05:30	
	16:42	17:19	17:57		19:35		20:11	18:36-18:42/6	20:43	
3	07:43	07:25	06:45		06:50	17:57-18:24/27	06:01	06:49-07:30/41	05:30	
	16:43	17:20	17:58		19:36		20:12	18:35-18:42/7	20:44	
4	07:43	07:24	06:43		06:48	17:57-18:27/30	05:59	18:49-18:52/3 18:35-18:44/9	05:29	
	16:44	17:22	17:59		19:37		20:13	06:49-07:31/42	20:45	
5	07:43	07:23	06:42		06:46	17:58-18:29/31	05:58	18:49-18:53/4 18:35-18:45/10	05:29	
	16:45	17:23	18:00		19:38		20:14	06:49-07:31/42	20:46	
6	07:43	07:22	06:40		06:45	17:58-18:28/30	05:57	18:47-18:54/7 18:34-18:45/11	05:28	
	16:46	17:24	18:02		19:40		20:15	06:48-07:30/42	20:46	
7	07:43	07:21	06:38		06:43	17:59-18:28/29	05:55	18:47-18:56/9 18:34-18:46/12	05:28	
	16:47	17:26	18:03		19:41		20:16	06:48-07:31/43	20:47	
8	07:43	07:19	06:37		06:41	18:01-18:28/27	05:54	18:35-18:58/23	05:28	
	16:48	17:27	18:04		19:42		20:18	06:48-07:31/43	20:48	
9	07:42	07:18	06:35		06:39	18:03-18:27/24	05:53	18:36-19:00/24	05:27	
	16:49	17:28	18:05		19:43		20:19	06:48-07:31/43	20:48	
10	07:42	07:17	06:33		06:38	18:04-18:26/22	05:51	18:35-19:00/25	05:27	
	16:50	17:30	18:07		19:44		20:20	06:48-07:31/43	20:49	
11	07:42	07:16	06:31		06:36	18:04-18:24/20	05:50	18:36-19:02/26	05:27	
	16:51	17:31	18:08		19:46		20:21	06:48-07:30/42	20:50	
12	07:42	07:14	06:30		06:34	18:06-18:24/18	05:49	18:37-19:03/26	05:27	
	16:52	17:33	18:09		19:47		20:22	06:48-07:30/42	20:50	
13	07:41	07:13	06:28		06:32	18:07-18:21/14	05:48	18:39-19:04/25	05:27	
	16:53	17:34	18:10		19:48		20:23	06:48-07:29/41	20:51	
14	07:41	07:11	06:26		06:31	18:09-18:18/9	05:47	18:40-19:05/25	05:27	
	16:54	17:35	18:12		19:49		20:24	06:48-07:29/41	20:51	
15	07:40	07:10	06:24		06:29		05:45	18:48-19:06/18 18:44-18:47/3	05:26	
	16:55	17:37	18:13		19:50		20:26	06:49-07:29/40	20:52	
16	07:40	07:09	06:22		06:27		05:44	18:49-19:08/19	05:26	
	16:57	17:38	18:14		19:52		20:27	06:49-07:28/39	20:52	
17	07:39	07:07	06:21		06:26		05:43	18:50-19:09/19	05:26	
	16:58	17:39	18:15		19:53		20:28	06:50-07:28/38	20:53	
18	07:39	07:06	06:19		06:24		05:42	18:52-19:10/18	05:26	
	16:59	17:41	18:17		19:54		20:29	06:50-07:27/37	20:53	
19	07:38	07:04	06:17		06:22		05:41	18:53-19:10/17	05:26	
	17:00	17:42	18:18		19:55		20:30	06:51-07:27/36	20:53	
20	07:38	07:03	06:15		06:21		05:40	18:54-19:09/15	05:27	
	17:02	17:43	18:19		19:56		20:31	06:51-07:26/35	20:54	
21	07:37	07:01	06:13		06:19		05:39	18:55-19:09/14	05:27	
	17:03	17:45	18:20		19:58		20:32	06:52-07:25/33	20:54	
22	07:36	07:00	06:12		06:17	07:05-07:18/13	05:38	18:56-19:08/12	05:27	
	17:04	17:46	18:22		19:59		20:33	06:53-07:25/32	20:54	
23	07:36	06:58	06:10		06:16	07:02-07:22/20	05:37	18:58-19:07/9	05:27	
	17:05	17:47	18:23		20:00		20:34	06:54-07:24/30	20:54	
24	07:35	06:57	06:08		06:14	06:59-07:23/24	05:37	19:00-19:05/5	05:27	
	17:07	17:49	18:24		20:01		20:35	06:55-07:23/28	20:55	
25	07:34	06:55	06:06	17:07-17:14/7	06:13	06:58-07:25/27	05:36	06:55-07:22/27	05:28	
	17:08	17:50	18:25		20:02		20:36		20:55	
26	07:33	06:53	07:04	18:04-18:16/12	06:11	06:55-07:26/31	05:35	06:57-07:22/25	05:28	
	17:09	17:51	19:26		20:04		20:37		20:55	
27	07:32	06:52	07:03	18:02-18:18/16	06:10	06:55-07:28/33	05:34	06:58-07:21/23	05:28	
	17:11	17:53	19:28		20:05		20:38		20:55	
28	07:31	06:50	07:01	18:00-18:19/19	06:08	06:53-07:28/35	05:33	06:59-07:19/20	05:29	
	17:12	17:54	19:29		20:06		20:39		20:55	
29	07:31		06:59	17:59-18:20/21	06:07	06:52-07:29/37	05:33	07:01-07:19/18	05:29	
	17:13		19:30		20:07		20:40		20:55	
30	07:30		06:57	17:59-18:21/22	06:05	06:51-07:29/38	05:32	07:02-07:17/15	05:29	
	17:15		19:31		20:08	18:36-18:38/2	20:41		20:55	
31	07:29		06:55	17:58-18:22/24			05:32	07:05-07:15/10		
	17:16		19:32				20:42			
Potential sun hours	289	292	368		401		455		462	
Sum of minutes with flicker	0	0	121		591		1477		4	

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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar per WTG

Calculation: Real case_3 WTG: 1 - Aerogeneratore 1

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	July		August		September		October	November	December
1	05:30		05:56	18:49-19:14/25	06:30	18:06-18:22/16	07:04	06:42	07:21
	20:55		20:34	06:59-07:40/41	19:48		18:53	17:02	16:34
2	05:30		05:57	18:48-19:13/25	06:32	18:04-18:23/19	07:05	06:44	07:22
	20:55		20:33	06:59-07:41/42	19:46		18:51	17:01	16:33
3	05:31		05:58	18:47-19:12/25	06:33	18:02-18:23/21	07:07	06:45	07:23
	20:54		20:32	06:59-07:41/42	19:44		18:49	16:59	16:33
4	05:32		05:59	18:46-19:11/25	06:34	18:01-18:23/22	07:08	06:46	07:24
	20:54		20:30	06:58-07:41/43	19:42		18:48	16:58	16:33
5	05:32		06:00	18:46-19:09/23	06:35	17:59-18:25/26	07:09	06:48	07:25
	20:54		20:29	06:58-07:41/43	19:40		18:46	16:57	16:32
6	05:33		06:01	18:45-19:09/24	06:36	17:57-18:24/27	07:10	06:49	07:26
	20:54		20:28	06:58-07:41/43	19:39		18:44	16:55	16:32
7	05:33		06:02	18:45-19:07/22	06:37	17:55-18:24/29	07:11	06:50	07:27
	20:53		20:27	06:58-07:41/43	19:37		18:42	16:54	16:32
8	05:34		06:03	18:57-19:04/7 18:44-18:55/11	06:38	17:53-18:24/31	07:13	06:52	07:28
	20:53		20:25	06:58-07:41/43	19:35		18:40	16:53	16:32
9	05:35		06:05	18:58-19:03/5 18:44-18:54/10	06:39	17:52-18:23/31	07:14	06:53	07:29
	20:53		20:24	06:58-07:40/42	19:33		18:39	16:52	16:32
10	05:35		06:06	18:58-19:01/3 18:44-18:53/9	06:40	17:51-18:20/29	07:15	06:54	07:30
	20:52		20:22	06:58-07:40/42	19:31		18:37	16:50	16:32
11	05:36		06:07	18:59-19:00/1 18:44-18:52/8	06:42	17:50-18:17/27	07:16	06:56	07:31
	20:52		20:21	06:58-07:40/42	19:30		18:35	16:49	16:32
12	05:37		06:08	06:58-07:39/41	06:43	17:49-18:14/25	07:17	06:57	07:32
	20:51		20:20	18:44-18:50/6	19:28		18:33	16:48	16:32
13	05:38	07:16-07:20/4	06:09	06:59-07:38/39	06:44	17:49-18:13/24	07:19	06:58	07:33
	20:51		20:18	18:44-18:49/5	19:26		18:32	16:47	16:32
14	05:39	07:13-07:23/10	06:10	06:59-07:38/39	06:45	17:48-18:12/24	07:20	07:00	07:34
	20:50		20:17	18:45-18:47/2	19:24		18:30	16:46	16:32
15	05:39	07:11-07:26/15	06:11	06:59-07:37/38	06:46	17:48-18:10/22	07:21	07:01	07:34
	20:50		20:15		19:22		18:28	16:45	16:32
16	05:40	07:10-07:28/18	06:12	07:00-07:36/36	06:47	17:49-18:09/20	07:22	07:02	07:35
	20:49		20:14		19:21		18:27	16:44	16:32
17	05:41	07:08-07:28/20	06:13	07:01-07:34/33	06:48	17:50-18:08/18	07:23	07:03	07:36
	20:48		20:12		19:19		18:25	16:43	16:32
18	05:42	07:07-07:30/23	06:15	07:01-07:33/32	06:49	17:51-18:06/15	07:25	07:05	07:37
	20:47		20:11		19:17		18:23	16:42	16:33
19	05:43	07:06-07:31/25	06:16	07:03-07:31/28	06:51	17:52-18:03/11	07:26	07:06	07:37
	20:47		20:09		19:15		18:22	16:41	16:33
20	05:44	07:05-07:32/27	06:17	07:05-07:30/25	06:52	17:55-18:01/6	07:27	07:07	07:38
	20:46		20:08		19:13		18:20	16:40	16:33
21	05:45	19:10-19:15/5	06:18	07:07-07:28/21	06:53		07:28	07:09	07:38
	20:45	07:05-07:33/28	20:06		19:11		18:18	16:40	16:34
22	05:46	19:08-19:17/9	06:19	07:09-07:25/16	06:54		07:30	07:10	07:39
	20:44	07:04-07:34/30	20:04		19:09		18:17	16:39	16:34
23	05:47	19:07-19:19/12	06:20	07:14-07:19/5	06:55		07:31	07:11	07:40
	20:43	07:03-07:35/32	20:03		19:08		18:15	16:38	16:35
24	05:48	19:06-19:20/14	06:21		06:56		07:32	07:12	07:40
	20:42	07:03-07:36/33	20:01		19:06		18:14	16:37	16:35
25	05:49	19:04-19:19/15	06:23		06:57		07:33	07:14	07:40
	20:42	07:02-07:37/35	19:59		19:04		18:12	16:37	16:36
26	05:50	19:04-19:20/16	06:24		06:59		07:35	07:15	07:41
	20:41	07:02-07:38/36	19:58		19:02		18:11	16:36	16:36
27	05:51	19:02-19:21/19	06:25		07:00		07:36	07:16	07:41
	20:40	07:01-07:38/37	19:56		19:00		18:09	16:36	16:37
28	05:52	19:01-19:20/19	06:26		07:01		07:37	07:17	07:42
	20:39	07:01-07:39/38	19:54		18:58		18:08	16:35	16:38
29	05:53	18:59-19:18/19	06:27		07:02		06:39	07:18	07:42
	20:37	06:59-07:38/39	19:53		18:57		17:06	16:34	16:38
30	05:54	18:59-19:16/17	06:28	18:13-18:16/3	07:03		06:40	07:20	07:42
	20:36	06:59-07:39/40	19:51		18:55		17:05	16:34	16:39
31	05:55	18:51-19:15/24	06:29	18:08-18:20/12			06:41		07:42
	20:35	06:59-07:39/40	19:49				17:03		16:40
Potential sun hours	468		434		377		343	292	279
Sum of minutes with flicker		699		1070		443	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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SHADOW - Calendar per WTG

Calculation: Real case_3 WTG: 2 - Aerogeneratore 2

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January	February	March	April	May	June
1	07:43	07:27	06:48 16:08-16:27/19	06:54 07:44-08:07/23	06:04 18:12-18:41/29	05:31
	16:41	17:17	17:55	19:34	20:09	20:42
2	07:43	07:26	06:47 16:07-16:29/22	06:52 07:45-08:05/20	06:02 18:13-18:41/28	05:30
	16:42	17:19	17:57	19:35	20:11	20:43
3	07:43	07:25	06:45 16:05-16:30/25	06:50 07:47-08:03/16	06:01 18:13-18:40/27	05:30
	16:43	17:20	17:58	19:36	20:12	20:44
4	07:43	07:24	06:43 16:04-16:31/27	06:48 07:50-08:00/10	05:59 18:15-18:40/25	05:29
	16:44	17:22	17:59	19:37	20:13	20:45
5	07:43	07:23	06:42 16:04-16:32/28	06:46	05:58 18:17-18:40/23	05:29
	16:45	17:23	18:00	19:38	20:14	20:46
6	07:43	07:22	06:40 16:03-16:35/32	06:45	05:57 18:18-18:39/21	05:28
	16:46	17:24	18:02	19:40	20:15	20:46
7	07:43	07:21	06:38 16:02-16:36/34	06:43	05:55 18:19-18:38/19	05:28
	16:47	17:26	18:03	19:41	20:16	20:47
8	07:42	07:19	06:37 16:02-16:37/35	06:41	05:54 18:20-18:38/18	05:28
	16:48	17:27	18:04	19:42	20:18	20:48
9	07:42	07:18	06:35 16:02-16:39/37	06:39	05:53 18:22-18:37/15	05:27
	16:49	17:28	18:05	19:43	20:19	20:48
10	07:42	07:17	06:33 16:02-16:40/38	06:38	05:51 18:22-18:34/12	05:27
	16:50	17:30	18:07	19:44	20:20	20:49
11	07:42	07:16	06:31 16:02-16:40/38	06:36 18:01-18:06/5	05:50 18:25-18:32/7	05:27
	16:51	17:31	18:08	19:46	20:21	20:50
12	07:42	07:14	06:30 16:02-16:40/38	06:34 17:59-18:09/10	05:49	05:27
	16:52	17:33	18:09	19:47	20:22	20:50
13	07:41	07:13	06:28 16:03-16:40/37	06:32 17:57-18:11/14	05:48	05:27
	16:53	17:34	18:10	19:48	20:23	20:51
14	07:41	07:11	06:26 16:04-16:40/36	06:31 17:55-18:13/18	05:47	05:26
	16:54	17:35	18:12	19:49	20:24	20:51
15	07:40	07:10	06:24 16:05-16:40/35	06:29 17:55-18:16/21	05:45	05:26
	16:55	17:37	18:13	19:50	20:26	20:52
16	07:40	07:09	06:22 16:07-16:39/32	06:27 17:53-18:19/26	05:44	05:26
	16:57	17:38	18:14	19:52	20:27	20:52
17	07:39	07:07	06:21 16:09-16:38/29	06:26 17:52-18:18/26	05:43	05:26
	16:58	17:39	18:15 06:57-07:04/7	19:53	20:28	20:53
18	07:39	07:06	06:19 16:10-16:37/27	06:24 18:21-18:26/5	05:42	05:26
	16:59	17:41	18:17 06:53-07:08/15	19:54 17:53-18:19/26	20:29	20:53
19	07:38	07:04	06:17 16:11-16:37/26	06:22 17:52-18:28/36	05:41	05:26
	17:00	17:42	18:18 06:51-07:10/19	19:55	20:30	20:53
20	07:38	07:03	06:15 16:12-16:36/24	06:21 17:51-18:30/39	05:40	05:27
	17:02	17:43	18:19 06:49-07:11/22	19:56	20:31	20:54
21	07:37	07:01	06:13 16:13-16:34/21	06:19 17:52-18:32/40	05:39	05:27
	17:03	17:45	18:20 06:47-07:12/25	19:58	20:32	20:54
22	07:36	07:00	06:12 16:15-16:31/16	06:17 17:52-18:32/40	05:38	05:27
	17:04	17:46	18:22 06:46-07:12/26	19:59	20:33	20:54
23	07:36	06:58	06:10 16:17-16:28/11	06:16 17:53-18:34/41	05:37	05:27
	17:05	17:47	18:23 06:45-07:13/28	20:00	20:34	20:54
24	07:35	06:57	06:08 06:45-07:14/29	06:14 17:53-18:34/41	05:37	05:27
	17:07	17:49	18:24	20:01	20:35	20:55
25	07:34	06:55	06:06 06:44-07:13/29	06:13 17:54-18:35/41	05:36	05:28
	17:08	17:50	18:25	20:02	20:36	20:55
26	07:33	06:53	07:04 07:43-08:13/30	06:11 17:54-18:36/42	05:35	05:28
	17:09	17:51	19:26	20:04	20:37	20:55
27	07:32	06:52 16:15-16:22/7	07:03 07:43-08:12/29	06:10 17:56-18:38/42	05:34	05:28
	17:11	17:53	19:28	20:05	20:38	20:55
28	07:31	06:50 16:11-16:25/14	07:01 07:43-08:11/28	06:08 17:57-18:40/43	05:33	05:29
	17:12	17:54	19:29	20:06	20:39	20:55
29	07:30		06:59 07:42-08:10/28	06:07 18:11-18:41/30	05:33	05:29
	17:13		19:30	20:07 18:00-18:09/9	20:40	20:55
30	07:30		06:57 07:44-08:10/26	06:05 18:11-18:41/30	05:32	05:29
	17:15		19:31	20:08	20:41	20:55
31	07:29		06:55 07:44-08:09/25		05:32	
	17:16		19:32		20:42	
Potential sun hours	289	292	368	401	455	461
Sum of minutes with flicker	0	21	1033	694	224	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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SHADOW - Calendar per WTG

Calculation: Real case_3 WTG: 2 - Aerogeneratore 2

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	July	August	September	October	November	December
1	05:30	05:56	06:30 17:57-18:09/12	07:04 16:43-17:19/36	06:42	07:21
	20:55	20:34	19:47	18:53	17:02	16:34
2	05:30	05:57	06:32 17:59-18:06/7	07:05 16:42-17:20/38	06:44	07:22
	20:55	20:33	19:46	18:51	17:01	16:33
3	05:31	05:58 18:36-18:42/6	06:33 18:02-18:04/2	07:07 16:41-17:19/38	06:45	07:23
	20:54	20:32	19:44	18:49	16:59	16:33
4	05:32	05:59 18:33-18:44/11	06:34	07:08 16:40-17:18/38	06:46	07:24
	20:54	20:30	19:42	18:48	16:58	16:33
5	05:32	06:00 18:31-18:46/15	06:35	07:09 16:39-17:17/38	06:48	07:25
	20:54	20:29	19:40	18:46	16:57	16:32
6	05:33	06:01 18:31-18:48/17	06:36	07:10 16:38-17:15/37	06:49	07:26
	20:54	20:28	19:39	18:44	16:55	16:32
7	05:33	06:02 18:30-18:49/19	06:37	07:11 16:39-17:15/36	06:50	07:27
	20:53	20:27	19:37	18:42	16:54	16:32
8	05:34	06:03 18:29-18:49/20	06:38	07:13 16:38-17:13/35	06:52	07:28
	20:53	20:25	19:35	18:40	16:53	16:32
9	05:35	06:05 18:27-18:49/22	06:39	07:14 16:38-17:10/32	06:53	07:29
	20:53	20:24	19:33	18:39	16:52	16:32
10	05:35	06:06 18:25-18:50/25	06:40 07:42-07:55/13	07:15 16:38-17:07/29	06:54	07:30
	20:52	20:22	19:31	18:37	16:50	16:32
11	05:36	06:07 18:23-18:50/27	06:42 07:39-07:57/18	07:16 16:38-17:05/27	06:56	07:31
	20:52	20:21	19:30	18:35	16:49	16:32
12	05:37	06:08 18:21-18:50/29	06:43 07:37-07:58/21	07:17 16:39-17:05/26	06:57	07:32
	20:51	20:20	19:28	18:33	16:48	16:32
13	05:38	06:09 18:20-18:49/29	06:44 07:36-07:59/23	07:19 16:40-17:03/23	06:58	07:33
	20:51	20:18	19:26	18:32	16:47	16:32
14	05:39	06:10 18:19-18:49/30	06:45 07:34-08:00/26	07:20 16:41-17:01/20	07:00	07:34
	20:50	20:17	19:24	18:30	16:46	16:32
15	05:39	06:11 18:18-18:49/31	06:46 07:33-08:00/27	07:21 16:43-16:59/16	07:01	07:34
	20:49	20:15 18:09-18:15/6	19:22	18:28	16:45	16:32
16	05:40	06:12 18:05-18:48/43	06:47 07:33-08:01/28	07:22 16:46-16:55/9	07:02	07:35
	20:49	20:14	19:21	18:27	16:44	16:32
17	05:41	06:13 18:03-18:46/43	06:48 07:32-08:01/29	07:23	07:03	07:36
	20:48	20:12	19:19	18:25	16:43	16:32
18	05:42	06:15 18:01-18:43/42	06:49 07:31-08:01/30	07:25	07:05	07:37
	20:47	20:11	19:17	18:23	16:42	16:33
19	05:43	06:16 18:00-18:41/41	06:51 07:31-08:00/29	07:26	07:06	07:37
	20:47	20:09	19:15	18:22	16:41	16:33
20	05:44	06:17 17:58-18:40/42	06:52 07:31-08:00/29	07:27	07:07	07:38
	20:46	20:08	19:13	18:20	16:40	16:33
21	05:45	06:18 17:57-18:39/42	06:53 07:30-07:59/29	07:28	07:09	07:38
	20:45	20:06	19:11	18:18	16:40	16:34
22	05:46	06:19 17:57-18:38/41	06:54 17:02-17:15/13	07:30	07:10	07:39
	20:44	20:04	19:09 07:30-07:58/28	18:17	16:39	16:34
23	05:47	06:20 17:57-18:37/40	06:55 16:59-17:17/18	07:31	07:11	07:40
	20:43	20:03	19:08 07:31-07:57/26	18:15	16:38	16:35
24	05:48	06:21 17:56-18:35/39	06:56 16:57-17:18/21	07:32	07:12	07:40
	20:42	20:01	19:06 07:31-07:56/25	18:14	16:37	16:35
25	05:49	06:23 17:55-18:33/38	06:57 16:55-17:19/24	07:33	07:14	07:40
	20:42	19:59	19:04 07:33-07:55/22	18:12	16:37	16:36
26	05:50	06:24 17:55-18:30/35	06:59 16:54-17:20/26	07:35	07:15	07:41
	20:41	19:58	19:02 07:34-07:53/19	18:11	16:36	16:36
27	05:51	06:25 17:55-18:21/26	07:00 16:53-17:20/27	07:36	07:16	07:41
	20:40	19:56	19:00 07:36-07:50/14	18:09	16:36	16:37
28	05:52	06:26 17:55-18:20/25	07:01 16:50-17:20/30	07:37	07:17	07:42
	20:38	19:54	18:58 07:39-07:45/6	18:08	16:35	16:38
29	05:53	06:27 17:55-18:19/24	07:02 16:47-17:20/33	06:39	07:18	07:42
	20:37	19:53	18:57	17:06	16:34	16:38
30	05:54	06:28 17:55-18:15/20	07:03 16:45-17:20/35	06:40	07:20	07:42
	20:36	19:51	18:55	17:05	16:34	16:39
31	05:55	06:29 17:56-18:12/16		06:41		07:42
	20:35	19:49		17:03		16:40
Potential sun hours	468	434	377	343	292	279
Sum of minutes with flicker	0	844	690	478	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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05/12/2023 17:21/3.6.366

SHADOW - Calendar per WTG

Calculation: Real case_3 WTG: 3 - Aerogeneratore 3

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January	February	March	April	May	June
1	07:43 14:42-15:02/20 16:41	07:27 14:51-15:30/39 17:17	06:48 07:13-07:35/22 17:55	06:54 17:26-18:03/37 19:34	06:04 20:09	05:31 20:42
2	07:43 14:42-15:03/21 16:42	07:26 14:52-15:30/38 17:19	06:47 07:13-07:34/21 17:57	06:52 17:26-18:03/37 19:35	06:02 20:11	05:30 20:43
3	07:43 14:42-15:04/22 16:43	07:25 14:54-15:30/36 17:20	06:45 07:13-07:33/20 17:58	06:50 17:26-18:03/37 19:36	06:01 20:12	05:30 20:44
4	07:43 14:42-15:05/23 16:44	07:24 14:56-15:30/34 17:22	06:43 07:13-07:32/19 17:59	06:48 17:28-18:04/36 19:37	05:59 20:13	05:29 20:45
5	07:43 14:42-15:06/24 16:45	07:23 14:57-15:29/32 17:23	06:42 07:15-07:31/16 18:00	06:46 17:29-18:03/34 19:38	05:58 20:14	05:29 20:46
6	07:43 14:43-15:07/24 16:46	07:22 14:59-15:28/29 17:24	06:40 07:16-07:29/13 18:02	06:45 17:30-18:03/33 19:40	05:57 20:15	05:28 20:46
7	07:43 14:43-15:09/26 16:47	07:21 15:00-15:28/28 17:26	06:38 07:20-07:24/4 18:03	06:43 17:31-18:02/31 19:41	05:55 20:16	05:28 20:47
8	07:42 14:43-15:10/27 16:48	07:19 15:02-15:27/25 17:27	06:37 18:04	06:41 17:33-18:01/28 19:42	05:54 20:18	05:28 20:48
9	07:42 14:42-15:10/28 16:49	07:18 15:03-15:25/22 17:28	06:35 16:12-16:23/11 18:05	06:39 17:35-18:01/26 19:43	05:53 20:19	05:27 20:48
10	07:42 14:43-15:11/28 16:50	07:17 15:05-15:24/19 17:30	06:33 16:08-16:26/18 18:07	06:38 17:36-18:00/24 19:44	05:51 20:20	05:27 20:49
11	07:42 14:43-15:12/29 16:51	07:16 15:08-15:22/14 17:31	06:31 16:06-16:27/21 18:08	06:36 17:36-17:58/22 19:46	05:50 20:21	05:27 20:50
12	07:41 14:42-15:13/31 16:52	07:14 15:13-15:17/4 17:32	06:30 16:04-16:29/25 18:09	06:34 17:38-17:57/19 19:47	05:49 20:22	05:27 20:50
13	07:41 14:43-15:16/33 16:53	07:13 17:34	06:28 16:02-16:29/27 18:10	06:32 17:40-17:55/15 19:48	05:48 20:23	05:27 20:51
14	07:41 14:42-15:17/35 16:54	07:11 17:35	06:26 16:02-16:31/29 18:12	06:31 17:42-17:52/10 19:49	05:47 20:24	05:26 20:51
15	07:40 14:43-15:19/36 16:55	07:10 17:37	06:24 16:01-16:31/30 18:13	06:29 19:50	05:45 20:26	05:26 20:52
16	07:40 14:43-15:20/37 16:57	07:09 17:38	06:22 16:00-16:31/31 18:14	06:27 19:52	05:44 20:27	05:26 20:52
17	07:39 14:43-15:21/38 16:58	07:07 17:39	06:21 15:59-16:31/32 18:15	06:26 19:53	05:43 20:28	05:26 20:53
18	07:39 14:43-15:22/39 16:59	07:06 17:41	06:19 15:59-16:31/32 18:17	06:24 19:54	05:42 20:29	05:26 20:53
19	07:38 14:43-15:23/40 17:00	07:04 17:42	06:17 15:59-16:32/33 18:18	06:22 19:55	05:41 20:30	05:26 20:53
20	07:38 14:44-15:25/41 17:02	07:03 17:43	06:15 15:59-16:31/32 18:19	06:21 19:56	05:40 20:31	05:27 20:54
21	07:37 14:44-15:25/41 17:03	07:01 07:24-07:30/6 17:45	06:13 16:40-16:47/7 18:20 15:59-16:31/32	06:19 19:58	05:39 20:32	05:27 20:54
22	07:36 14:44-15:26/42 17:04	07:00 07:22-07:32/10 17:46	06:12 16:35-16:50/15 18:22 15:59-16:30/31	06:17 19:59	05:38 20:33	05:27 20:54
23	07:36 14:44-15:26/42 17:05	06:58 07:21-07:34/13 17:47	06:10 16:33-16:52/19 18:23 15:59-16:29/30	06:16 20:00	05:37 20:34	05:27 20:54
24	07:35 14:44-15:27/43 17:07	06:57 07:19-07:34/15 17:49	06:08 16:31-16:53/22 18:24 16:00-16:27/27	06:14 20:01	05:37 20:35	05:27 20:54
25	07:34 14:45-15:27/42 17:08	06:55 07:17-07:35/18 17:50	06:06 16:30-16:55/25 18:25 16:02-16:27/25	06:13 20:02	05:36 20:36	05:28 20:55
26	07:33 14:45-15:28/43 17:09	06:53 07:16-07:36/20 17:51	07:04 17:29-17:55/26 19:26 17:03-17:25/22	06:11 20:03	05:35 20:37	05:28 20:55
27	07:32 14:46-15:28/42 17:11	06:52 07:14-07:35/21 17:53	07:03 17:28-17:56/28 19:28 17:04-17:23/19	06:10 20:05	05:34 20:38	05:28 20:55
28	07:31 14:46-15:29/43 17:12	06:50 07:12-07:35/23 17:54	07:01 17:27-17:58/31 19:29 17:07-17:20/13	06:08 20:06	05:33 20:39	05:29 20:55
29	07:30 14:47-15:29/42 17:13		06:59 17:26-18:00/34 19:30	06:07 20:07	05:33 20:40	05:29 20:55
30	07:29 14:48-15:29/41 17:15		06:57 17:27-18:02/35 19:31	06:05 20:08	05:32 20:41	05:29 20:55
31	07:28 14:49-15:30/41 17:16		06:55 17:26-18:03/37 19:32		05:31 20:42	
Potential sun hours	289	292	368	401	455	461
Sum of minutes with flicker	1064	446	914	389	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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SHADOW - Calendar per WTG

Calculation: Real case_3 WTG: 3 - Aerogeneratore 3

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	July	August		September		October		November		December	
1	05:30	05:56		06:30	17:38-17:55/17	07:04	16:41-17:10/29	06:42	14:38-14:49/11	07:21	14:24-14:56/32
	20:55	20:34		19:47		18:53		17:02		16:34	
2	05:30	05:57		06:31	17:36-17:56/20	07:05	16:42-17:09/27	06:44	14:35-14:53/18	07:22	14:25-14:55/30
	20:55	20:33		19:46		18:51		17:01		16:33	
3	05:31	05:58		06:33	17:34-17:57/23	07:07	16:43-17:07/24	06:45	14:33-14:54/21	07:23	14:26-14:55/29
	20:54	20:32		19:44		18:49		16:59		16:33	
4	05:32	05:59		06:34	17:32-17:58/26	07:08	16:44-17:05/21	06:46	14:32-14:56/24	07:24	14:26-14:55/29
	20:54	20:30		19:42		18:48		16:58		16:33	
5	05:32	06:00		06:35	17:32-17:59/27	07:09	16:45-17:03/18	06:48	14:30-14:57/27	07:25	14:27-14:54/27
	20:54	20:29		19:40		18:46		16:57		16:32	
6	05:33	06:01		06:36	17:29-17:59/30	07:10	16:48-16:59/11	06:49	14:30-14:58/28	07:26	14:28-14:54/26
	20:54	20:28		19:39		18:44		16:55		16:32	
7	05:33	06:02		06:37	17:27-17:59/32	07:11		06:50	14:28-14:59/31	07:27	14:29-14:54/25
	20:53	20:27		19:37		18:42		16:54		16:32	
8	05:34	06:03		06:38	17:24-17:58/34	07:12	07:56-08:00/4	06:52	14:27-14:59/32	07:28	14:30-14:54/24
	20:53	20:25		19:35		18:40		16:53		16:32	
9	05:35	06:05		06:39	17:23-17:58/35	07:14	07:52-08:04/12	06:53	14:25-15:00/35	07:29	14:30-14:54/24
	20:53	20:24		19:33		18:39		16:52		16:32	
10	05:35	06:06		06:40	17:21-17:57/36	07:15	07:49-08:05/16	06:54	14:23-15:00/37	07:30	14:31-14:54/23
	20:52	20:22		19:31		18:37		16:50		16:32	
11	05:36	06:07		06:42	17:20-17:56/36	07:16	07:48-08:07/19	06:56	14:23-15:01/38	07:31	14:32-14:54/22
	20:52	20:21		19:30		18:35		16:49		16:32	
12	05:37	06:08		06:43	17:19-17:55/36	07:17	07:47-08:07/20	06:57	14:21-15:01/40	07:32	14:33-14:54/21
	20:51	20:20		19:28		18:33		16:48		16:32	
13	05:38	06:09		06:44	17:18-17:54/36	07:18	07:46-08:07/21	06:58	14:20-15:01/41	07:33	14:34-14:54/20
	20:51	20:18		19:26		18:32		16:47		16:32	
14	05:39	06:10		06:45	17:17-17:53/36	07:20	07:45-08:07/22	07:00	14:20-15:02/42	07:34	14:35-14:53/18
	20:50	20:17		19:24		18:30		16:46		16:32	
15	05:39	06:11		06:46	17:16-17:51/35	07:21	07:45-08:08/23	07:01	14:19-15:01/42	07:34	14:36-14:54/18
	20:49	20:15		19:22		18:28		16:45		16:32	
16	05:40	06:12		06:47	17:16-17:49/33	07:22	07:46-08:08/22	07:02	14:20-15:02/42	07:35	14:37-14:54/17
	20:49	20:14		19:20	16:59-17:06/7	18:27		16:44		16:32	
17	05:41	06:13		06:48	17:17-17:47/30	07:23	07:47-08:07/20	07:03	14:19-15:02/43	07:36	14:38-14:54/16
	20:48	20:12		19:19	16:55-17:10/15	18:25		16:43		16:32	
18	05:42	06:15		06:49	17:16-17:44/28	07:25	07:49-08:07/18	07:05	14:19-15:01/42	07:37	14:38-14:54/16
	20:47	20:11		19:17	16:52-17:12/20	18:23		16:42		16:33	
19	05:43	06:16		06:51	17:17-17:43/26	07:26	07:50-08:06/16	07:06	14:19-15:02/43	07:37	14:39-14:54/15
	20:47	20:09		19:15	16:50-17:13/23	18:22		16:41		16:33	
20	05:44	06:17		06:52	17:17-17:41/24	07:27	07:51-08:04/13	07:07	14:19-15:01/42	07:38	14:40-14:55/15
	20:46	20:08		19:13	16:48-17:14/26	18:20		16:40		16:33	
21	05:45	06:18		06:53	17:18-17:39/21	07:28	07:52-08:03/11	07:09	14:20-15:02/42	07:38	14:40-14:55/15
	20:45	20:06		19:11	16:46-17:14/28	18:18		16:40		16:34	
22	05:46	06:19		06:54	17:19-17:37/18	07:30	07:54-08:01/7	07:10	14:19-15:01/42	07:39	14:41-14:56/15
	20:44	20:04		19:09	16:45-17:15/30	18:17		16:39		16:34	
23	05:47	06:20		06:55	17:21-17:34/13	07:31	07:55-07:57/2	07:11	14:19-15:01/42	07:40	14:41-14:56/15
	20:43	20:03		19:08	16:44-17:15/31	18:15		16:38		16:35	
24	05:48	06:21		06:56	17:25-17:29/4	07:32		07:12	14:20-15:01/41	07:40	14:42-14:57/15
	20:42	20:01		19:06	16:43-17:14/31	18:14		16:37		16:35	
25	05:49	06:22		06:57	16:42-17:14/32	07:33		07:14	14:21-15:00/39	07:40	14:42-14:57/15
	20:41	19:59		19:04		18:12		16:37		16:36	
26	05:50	06:24		06:59	16:42-17:15/33	07:35		07:15	14:21-14:59/38	07:41	14:42-14:57/15
	20:41	19:58		19:02		18:11		16:36		16:36	
27	05:51	06:25		07:00	16:41-17:14/33	07:36		07:16	14:21-14:59/38	07:41	14:43-14:59/16
	20:39	19:56		19:00		18:09		16:36		16:37	
28	05:52	06:26		07:01	16:41-17:13/32	07:37		07:17	14:22-14:59/37	07:42	14:43-14:59/16
	20:38	19:54		18:58		18:08		16:35		16:38	
29	05:53	06:27		07:02	16:41-17:12/31	06:39		07:18	14:23-14:58/35	07:42	14:43-15:00/17
	20:37	19:53		18:57		17:06		16:34		16:38	
30	05:54	06:28	17:45-17:50/5	07:03	16:41-17:11/30	06:40		07:19	14:23-14:57/34	07:42	14:43-15:01/18
	20:36	19:51		18:55		17:05		16:34		16:39	
31	05:55	06:29	17:41-17:54/13			06:41				07:42	14:43-15:01/18
	20:35	19:49				17:03				16:40	
Potential sun hours	468	434		377		343		292		279	
Sum of minutes with flicker	0	18		1058		376		1067		622	

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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SHADOW - Calendar per WTG

Calculation: Real case_3 WTG: 4 - Aerogeneratore 4

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January		February		March	April		May		June	
1	07:43	08:09-08:12/3	07:27	15:38-15:59/21	06:48	06:54		06:04	06:42-07:24/42	05:31	06:41-07:07/26
	16:41	14:59-15:04/5	17:17		17:55	19:34		20:09		20:42	
2	07:43	08:09-08:13/4	07:26	15:38-16:04/26	06:47	06:52		06:02	06:41-07:24/43	05:30	06:43-07:07/24
	16:42	14:59-15:04/5	17:19		17:57	19:35		20:11		20:43	
3	07:43	08:09-08:13/4	07:25	15:39-16:06/27	06:45	06:50		06:01	06:40-07:23/43	05:30	06:43-07:06/23
	16:43	14:59-15:05/6	17:20		17:58	19:36		20:12		20:44	
4	07:43	08:09-08:14/5	07:24	15:39-16:07/28	06:43	06:48		05:59	06:39-07:23/44	05:29	06:44-07:06/22
	16:44	14:59-15:06/7	17:22		17:59	19:37		20:13		20:45	
5	07:43	08:09-08:14/5	07:23	15:39-16:07/28	06:42	06:46		05:58	06:38-07:23/45	05:29	06:45-07:04/19
	16:45	15:00-15:07/7	17:23		18:00	19:38		20:14		20:46	
6	07:43	08:09-08:15/6	07:22	15:40-16:08/28	06:40	06:45		05:57	06:36-07:22/46	05:28	06:46-07:04/18
	16:46	15:00-15:08/8	17:24		18:02	19:40		20:15		20:46	
7	07:43	08:09-08:15/6	07:21	15:41-16:09/28	06:38	06:43		05:55	06:36-07:22/46	05:28	06:48-07:04/16
	16:47	15:01-15:10/9	17:26		18:03	19:41		20:16		20:47	
8	07:42	08:09-08:16/7	07:19	15:42-16:09/27	06:37	06:41		05:54	06:35-07:21/46	05:28	06:48-07:02/14
	16:48	15:01-15:11/10	17:27		18:04	19:42		20:18		20:48	
9	07:42	08:08-08:15/7	07:18	15:43-16:09/26	06:35	06:39		05:53	06:35-07:21/46	05:27	06:49-07:02/13
	16:49	15:01-15:11/10	17:28		18:05	19:43		20:19		20:48	
10	07:42	08:08-08:16/8	07:17	15:45-16:10/25	06:33	06:38		05:51	06:35-07:20/45	05:27	06:51-07:01/10
	16:50	15:02-15:12/10	17:30		18:07	19:44		20:20		20:49	
11	07:42	08:08-08:16/8	07:16	15:48-16:11/23	06:31	06:36		05:50	06:34-07:18/44	05:27	06:53-07:00/7
	16:51	15:02-15:13/11	17:31		18:08	19:46		20:21		20:50	
12	07:41	08:07-08:16/9	07:14	15:49-16:11/22	06:30	06:34		05:49	06:34-07:17/43	05:27	06:56-06:57/1
	16:52	15:02-15:13/11	17:33		18:09	19:47		20:22		20:50	
13	07:41	08:07-08:16/9	07:13	15:50-16:12/22	06:28	06:32		05:48	06:34-07:16/42	05:27	
	16:53	15:03-15:15/12	17:34		18:10	19:48		20:23		20:51	
14	07:41	08:06-08:15/9	07:11	15:51-16:10/19	06:26	06:31		05:47	06:34-07:16/42	05:27	
	16:54	15:03-15:15/12	17:35		18:12	19:49		20:24		20:51	
15	07:40	08:06-08:15/9	07:10	15:53-16:10/17	06:24	06:29		05:45	06:34-07:15/41	05:26	
	16:55	15:04-15:16/12	17:37		18:13	19:50		20:26		20:52	
16	07:40	08:05-08:14/9	07:09	15:54-16:07/13	06:22	06:27		05:44	06:34-07:15/41	05:26	
	16:57	15:04-15:17/13	17:38		18:14	19:52		20:27		20:52	
17	07:39	08:05-08:14/9	07:07	15:58-16:04/6	06:21	06:26	07:04-07:12/8	05:43	06:34-07:15/41	05:26	
	16:58	15:05-15:18/13	17:39		18:15	19:53		20:28		20:53	
18	07:39	08:06-08:12/6	07:06		06:19	06:24	07:00-07:16/16	05:42	06:34-07:14/40	05:26	
	16:59	15:05-15:19/14	17:41		18:17	19:54		20:29		20:53	
19	07:38	15:06-15:19/13	07:04		06:17	06:22	06:57-07:18/21	05:41	06:34-07:14/40	05:26	
	17:00		17:42		18:18	19:55		20:30		20:53	
20	07:38	15:06-15:20/14	07:03		06:15	06:21	06:55-07:20/25	05:40	06:34-07:14/40	05:27	
	17:02		17:43		18:19	19:56		20:31		20:54	
21	07:37	15:45-15:46/1	07:01		06:13	06:19	06:54-07:21/27	05:39	06:34-07:13/39	05:27	
	17:03	15:08-15:22/14	17:45		18:20	19:57		20:32		20:54	
22	07:36	15:43-15:48/5	07:00		06:12	06:17	06:52-07:22/30	05:38	06:36-07:13/37	05:27	
	17:04	15:08-15:22/14	17:46		18:22	19:59		20:33		20:54	
23	07:36	15:41-15:49/8	06:58		06:10	06:16	06:51-07:23/32	05:37	06:36-07:13/37	05:27	
	17:05	15:09-15:23/14	17:47		18:23	20:00		20:34		20:54	
24	07:35	15:40-15:50/10	06:57		06:08	06:14	06:50-07:23/33	05:37	06:36-07:12/36	05:27	
	17:07	15:10-15:24/14	17:49		18:24	20:01		20:35		20:54	
25	07:34	15:39-15:51/12	06:55		06:06	06:13	06:49-07:24/35	05:36	06:36-07:11/35	05:28	
	17:08	15:12-15:25/13	17:50		18:25	20:02		20:36		20:55	
26	07:33	15:39-15:51/12	06:53		07:04	06:11	06:48-07:24/36	05:35	06:38-07:11/33	05:28	
	17:09	15:14-15:26/12	17:51		19:26	20:03		20:37		20:55	
27	07:32	15:38-15:52/14	06:52		07:03	06:10	06:48-07:25/37	05:34	06:38-07:11/33	05:28	
	17:11	15:16-15:25/9	17:53		19:28	20:05		20:38		20:55	
28	07:31	15:38-15:53/15	06:50		07:01	06:08	06:46-07:24/38	05:34	06:38-07:10/32	05:29	
	17:12		17:54		19:29	20:06		20:39		20:55	
29	07:30	15:38-15:53/15			06:59	06:07	06:45-07:25/40	05:33	06:39-07:09/30	05:29	
	17:13				19:30	20:07		20:40		20:55	
30	07:29	15:38-15:54/16			06:57	06:05	06:43-07:24/41	05:32	06:40-07:08/28	05:29	
	17:15				19:31	20:08		20:41		20:55	
31	07:28	15:38-15:55/17			06:55			05:32	06:41-07:08/27		
	17:16				19:32			20:42			
Potential sun hours	289		292		368	401		455		461	
Sum of minutes with flicker	540		386		0	419		1227		193	

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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SHADOW - Calendar per WTG

Calculation: Real case_3 WTG: 4 - Aerogeneratore 4

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	July		August		September		October		November		December	
1	05:30		05:56	06:45-07:27/42	06:30		07:04		06:42	15:18-15:40/22	07:21	07:48-07:57/9
	20:55		20:34		19:47		18:53		17:02		16:34	14:44-14:55/11
2	05:30	06:59-07:02/3	05:57	06:45-07:28/43	06:31		07:05		06:44	15:15-15:40/25	07:22	07:50-07:58/8
	20:54		20:33		19:46		18:51		17:01		16:33	14:45-14:56/11
3	05:31	06:58-07:05/7	05:58	06:45-07:29/44	06:33		07:07		06:45	15:13-15:39/26	07:23	07:51-07:59/8
	20:54		20:32		19:44		18:49		16:59		16:33	14:45-14:56/11
4	05:32	06:56-07:06/10	05:59	06:45-07:30/45	06:34		07:08		06:46	15:12-15:39/27	07:24	07:52-08:00/8
	20:54		20:30		19:42		18:48		16:58		16:33	14:45-14:56/11
5	05:32	06:55-07:08/13	06:00	06:45-07:31/46	06:35		07:09		06:48	15:11-15:38/27	07:25	07:53-08:00/7
	20:54		20:29		19:40		18:46		16:57		16:32	14:46-14:55/9
6	05:33	06:54-07:08/14	06:01	06:46-07:31/45	06:36		07:10		06:49	15:10-15:38/28	07:26	07:54-08:01/7
	20:54		20:28		19:39		18:44		16:55		16:32	14:46-14:55/9
7	05:33	06:53-07:10/17	06:02	06:46-07:32/46	06:37		07:11		06:50	15:10-15:38/28	07:27	07:55-08:01/6
	20:53		20:27		19:37		18:42		16:54		16:32	14:47-14:55/8
8	05:34	06:53-07:11/18	06:03	06:46-07:32/46	06:38		07:12		06:52	15:09-15:37/28	07:28	07:56-08:02/6
	20:53		20:25		19:35		18:40		16:53		16:32	14:47-14:55/8
9	05:35	06:52-07:11/19	06:05	06:47-07:32/45	06:39		07:14		06:53	15:09-15:37/28	07:29	07:57-08:02/5
	20:53		20:24		19:33		18:39		16:52		16:32	14:48-14:55/7
10	05:35	06:51-07:13/22	06:06	06:48-07:33/45	06:40		07:15		06:54	15:09-15:36/27	07:30	07:58-08:03/5
	20:52		20:22		19:31		18:37		16:50		16:32	14:48-14:55/7
11	05:36	06:51-07:14/23	06:07	06:49-07:33/44	06:42		07:16		06:56	15:09-15:34/25	07:31	07:59-08:03/4
	20:52		20:21		19:30		18:35		16:49		16:32	14:49-14:55/6
12	05:37	06:50-07:14/24	06:08	06:49-07:33/44	06:43		07:17		06:57	15:09-15:28/19	07:32	08:00-08:04/4
	20:51		20:20		19:28		18:33		16:48		16:32	14:50-14:55/5
13	05:38	06:49-07:15/26	06:09	06:50-07:33/43	06:44		07:18		06:58	15:09-15:26/17	07:33	08:01-08:04/3
	20:51		20:18		19:26		18:32		16:47		16:32	14:50-14:55/5
14	05:39	06:49-07:16/27	06:10	06:51-07:32/41	06:45		07:20		06:59	15:10-15:26/16	07:34	08:02-08:05/3
	20:50		20:17		19:24		18:30		16:46		16:32	14:50-14:55/5
15	05:39	06:49-07:17/28	06:11	06:52-07:32/40	06:46		07:21		07:01	15:10-15:25/15	07:34	08:02-08:05/3
	20:49		20:15		19:22		18:28		16:45		16:32	14:51-14:55/4
16	05:40	06:48-07:18/30	06:12	06:53-07:32/39	06:47		07:22		07:02	15:11-15:26/15	07:35	08:03-08:05/2
	20:49		20:14		19:20		18:27		16:44	14:53-14:56/3	16:32	14:52-14:56/4
17	05:41	06:47-07:19/32	06:13	06:54-07:31/37	06:48		07:23		07:03	15:12-15:25/13	07:36	08:04-08:06/2
	20:48		20:12		19:19		18:25		16:43	14:49-15:00/11	16:32	14:53-14:56/3
18	05:42	06:47-07:20/33	06:15	06:54-07:31/37	06:49		07:25		07:05	15:12-15:25/13	07:37	08:04-08:06/2
	20:47		20:11		19:17		18:23		16:42	14:46-14:59/13	16:33	14:53-14:56/3
19	05:43	06:47-07:20/33	06:16	06:55-07:30/35	06:51		07:26		07:06	15:14-15:25/11	07:37	08:05-08:07/2
	20:47		20:09		19:15		18:22		16:41	14:46-14:59/13	16:33	14:54-14:56/2
20	05:44	06:46-07:21/35	06:17	06:56-07:30/34	06:52		07:27		07:07	15:15-15:24/9	07:38	08:06-08:07/1
	20:46		20:08		19:13		18:20		16:40	14:44-14:58/14	16:33	14:55-14:57/2
21	05:45	06:46-07:22/36	06:18	06:56-07:29/33	06:53		07:28		07:09	15:17-15:24/7	07:38	08:06-08:07/1
	20:45		20:06		19:11		18:18		16:40	14:44-14:58/14	16:34	14:55-14:57/2
22	05:46	06:46-07:23/37	06:19	06:57-07:28/31	06:54		07:30		07:10	15:19-15:23/4	07:39	08:07-08:08/1
	20:44		20:04		19:09		18:17		16:39	14:44-14:57/13	16:34	14:55-14:58/3
23	05:47	06:46-07:23/37	06:20	06:58-07:26/28	06:55		07:31		07:11	14:43-14:57/14	07:39	08:07-08:08/1
	20:43		20:03		19:08		18:15		16:38		16:35	14:55-14:58/3
24	05:48	06:45-07:24/39	06:21	06:59-07:25/26	06:56		07:32		07:12	14:43-14:57/14	07:40	08:08-08:09/1
	20:42		20:01		19:06		18:14		16:37		16:35	14:56-14:58/2
25	05:49	06:45-07:25/40	06:23	07:00-07:23/23	06:57		07:33		07:14	14:43-14:57/14	07:40	08:08-08:09/1
	20:41		19:59		19:04		18:12		16:37		16:36	14:57-14:59/2
26	05:50	06:45-07:25/40	06:24	07:02-07:20/18	06:59		07:35		07:15	07:43-07:50/7	07:41	08:08-08:10/2
	20:40		19:58		19:02		18:11		16:36	14:43-14:56/13	16:36	14:57-14:59/2
27	05:51	06:45-07:25/40	06:25	07:05-07:17/12	07:00		07:36	16:24-16:36/12	07:16	07:44-07:53/9	07:41	08:09-08:11/2
	20:39		19:56		19:00		18:09		16:36	14:43-14:56/13	16:37	14:57-15:00/3
28	05:52	06:45-07:26/41	06:26		07:01		07:37	16:23-16:39/16	07:17	07:45-07:54/9	07:42	08:09-08:11/2
	20:38		19:54		18:58		18:08		16:35	14:43-14:56/13	16:38	14:58-15:01/3
29	05:53	06:44-07:25/41	06:27		07:02		06:39	15:21-15:40/19	07:18	07:46-07:55/9	07:42	08:09-08:11/2
	20:37		19:53		18:57		17:06		16:34	14:43-14:56/13	16:38	14:58-15:02/4
30	05:54	06:44-07:25/41	06:28		07:03		06:40	15:20-15:41/21	07:19	07:47-07:56/9	07:42	08:09-08:12/3
	20:36		19:51		18:55		17:05		16:34	14:43-14:55/12	16:39	14:58-15:02/4
31	05:55	06:44-07:26/42	06:29				06:41	15:19-15:41/22			07:42	08:09-08:12/3
	20:35		19:49				17:03				16:40	14:58-15:03/5
Potential sun hours	468		434		377		343		292		279	
Sum of minutes with flicker	848		1012		0		90		660		278	

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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05/12/2023 17:21/3.6.366

SHADOW - Calendar per WTG

Calculation: Real case_3 WTG: 5 - Aerogeneratore 5

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January		February	March		April		May		June	
1	07:42	14:22-14:49/27	07:27	06:48		06:54	07:15-07:38/23	06:04		05:31	06:19-06:40/21
	16:41		17:17	17:55		19:34		20:09		20:42	
2	07:43	14:23-14:50/27	07:26	06:47		06:52	07:13-07:38/25	06:02		05:30	06:19-06:41/22
	16:42		17:19	17:56		19:35		20:11		20:43	
3	07:43	14:24-14:51/27	07:25	06:45		06:50	07:11-07:38/27	06:01		05:30	06:19-06:41/22
	16:43		17:20	17:58		19:36		20:12		20:44	
4	07:43	14:26-14:52/26	07:24	06:43		06:48	07:10-07:38/28	05:59		05:29	06:19-06:42/23
	16:44		17:22	17:59		19:37		20:13		20:45	
5	07:43	14:27-14:53/26	07:23	06:42		06:46	07:08-07:37/29	05:58		05:29	06:18-06:41/23
	16:45		17:23	18:00		19:38		20:14		20:46	
6	07:43	14:29-14:54/25	07:22	06:40		06:45	07:06-07:36/30	05:57		05:28	06:18-06:42/24
	16:46		17:24	18:02		19:40		20:15		20:46	
7	07:43	14:31-14:55/24	07:21	06:38		06:43	07:04-07:35/31	05:55		05:28	06:18-06:42/24
	16:47		17:26	18:03		19:41		20:16		20:47	
8	07:42	14:32-14:57/25	07:19	06:37		06:41	07:04-07:35/31	05:54		05:28	06:17-06:42/25
	16:48		17:27	18:04		19:42		20:18		20:48	
9	07:42	14:32-14:58/26	07:18	06:35		06:39	07:03-07:33/30	05:53		05:27	06:17-06:42/25
	16:49		17:28	18:05		19:43		20:19		20:48	
10	07:42	14:33-14:59/26	07:17	06:33		06:38	07:02-07:31/29	05:51		05:27	06:17-06:43/26
	16:50		17:30	18:07		19:44		20:20		20:49	
11	07:42	14:34-14:59/25	07:15	06:31		06:36	07:01-07:30/29	05:50		05:27	06:17-06:43/26
	16:51		17:31	18:08		19:46		20:21		20:50	
12	07:41	14:35-14:59/24	07:14	06:30		06:34	07:02-07:30/28	05:49		05:27	06:17-06:44/27
	16:52		17:32	18:09		19:47		20:22		20:50	
13	07:41	14:36-14:59/23	07:13	06:28		06:32	07:01-07:29/28	05:48		05:27	06:18-06:44/26
	16:53		17:34	18:10		19:48		20:23		20:51	
14	07:41	14:37-14:58/21	07:11	06:26		06:31	07:01-07:27/26	05:47		05:26	06:18-06:44/26
	16:54		17:35	18:12		19:49		20:24		20:51	
15	07:40	14:39-14:58/19	07:10	06:24		06:29	07:02-07:27/25	05:45		05:26	06:17-06:44/27
	16:55		17:37	18:13		19:50		20:25		20:52	
16	07:40	14:40-14:57/17	07:09	06:22		06:27	07:02-07:25/23	05:44		05:26	06:18-06:45/27
	16:57		17:38	18:14		19:51		20:27		20:52	
17	07:39	14:43-14:56/13	07:07	06:21		06:26	07:03-07:23/20	05:43		05:26	06:18-06:45/27
	16:58		17:39	18:15		19:53		20:28		20:53	
18	07:39	14:45-14:54/9	07:06	06:19		06:24	07:05-07:21/16	05:42		05:26	06:18-06:45/27
	16:59		17:41	18:17		19:54		20:29		20:53	
19	07:38		07:04	06:17		06:22	07:06-07:19/13	05:41		05:26	06:18-06:45/27
	17:00		17:42	18:18		19:55		20:30		20:53	
20	07:38		07:03	06:15		06:21	07:09-07:14/5	05:40	06:25-06:27/2	05:27	06:18-06:45/27
	17:02		17:43	18:19		19:56		20:31		20:54	
21	07:37		07:01	06:13		06:19		05:39	06:24-06:30/6	05:27	06:18-06:45/27
	17:03		17:45	18:20		19:57		20:32		20:54	
22	07:36		07:00	06:12		06:17		05:38	06:24-06:33/9	05:27	06:18-06:45/27
	17:04		17:46	18:21		19:59		20:33		20:54	
23	07:36		06:58	06:10		06:16		05:37	06:24-06:34/10	05:27	06:18-06:45/27
	17:05		17:47	18:23		20:00		20:34		20:54	
24	07:35		06:56	06:08		06:14		05:37	06:23-06:35/12	05:27	06:19-06:46/27
	17:07		17:49	18:24		20:01		20:35		20:54	
25	07:34		06:55	06:06		06:13		05:36	06:22-06:36/14	05:28	06:19-06:46/27
	17:08		17:50	18:25		20:02		20:36		20:55	
26	07:33		06:53	07:04		06:11		05:35	06:22-06:37/15	05:28	06:19-06:46/27
	17:09		17:51	19:26		20:03		20:37		20:55	
27	07:32		06:52	07:03	07:24-07:33/9	06:10		05:34	06:21-06:38/17	05:28	06:20-06:47/27
	17:11		17:53	19:28		20:05		20:38		20:55	
28	07:31		06:50	07:01	07:22-07:35/13	06:08		05:33	06:21-06:38/17	05:29	06:20-06:47/27
	17:12		17:54	19:29		20:06		20:39		20:55	
29	07:30			06:59	07:20-07:36/16	06:07		05:33	06:21-06:39/18	05:29	06:21-06:47/26
	17:13			19:30		20:07		20:40		20:55	
30	07:29			06:57	07:19-07:38/19	06:05		05:32	06:20-06:39/19	05:29	06:21-06:47/26
	17:15			19:31		20:08		20:41		20:55	
31	07:28			06:55	07:17-07:38/21			05:31	06:20-06:40/20		
	17:16			19:32				20:42			
Potential sun hours	289		292	368		401		455		461	
Sum of minutes with flicker	410		0	78		496		159		770	

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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar per WTG

Calculation: Real case_3 WTG: 5 - Aerogeneratore 5

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	July		August		September		October	November		December	
1	05:30	06:21-06:47/26	05:56		06:30	07:00-07:28/28	07:04	06:42		07:21	14:17-14:40/23
	20:55		20:34		19:47		18:53	17:02		16:34	
2	05:30	06:21-06:48/27	05:57		06:31	07:00-07:28/28	07:05	06:44		07:22	14:16-14:41/25
	20:54		20:33		19:46		18:51	17:01		16:33	
3	05:31	06:21-06:47/26	05:58		06:33	07:00-07:29/29	07:07	06:45		07:23	14:17-14:42/25
	20:54		20:32		19:44		18:49	16:59		16:33	
4	05:32	06:22-06:48/26	05:59		06:34	07:00-07:30/30	07:08	06:46		07:24	14:17-14:43/26
	20:54		20:30		19:42		18:48	16:58		16:33	
5	05:32	06:23-06:48/25	06:00		06:35	07:00-07:31/31	07:09	06:48		07:25	14:17-14:42/25
	20:54		20:29		19:40		18:46	16:57		16:32	
6	05:33	06:23-06:48/25	06:01		06:36	07:01-07:32/31	07:10	06:49		07:26	14:16-14:41/25
	20:54		20:28		19:39		18:44	16:55		16:32	
7	05:33	06:24-06:48/24	06:02		06:37	07:01-07:32/31	07:11	06:50		07:27	14:16-14:41/25
	20:53		20:26		19:37		18:42	16:54		16:32	
8	05:34	06:25-06:49/24	06:03		06:38	07:02-07:32/30	07:12	06:52		07:28	14:15-14:41/26
	20:53		20:25		19:35		18:40	16:53		16:32	
9	05:35	06:25-06:48/23	06:04		06:39	07:03-07:32/29	07:14	06:53		07:29	14:15-14:41/26
	20:53		20:24		19:33		18:39	16:52		16:32	
10	05:35	06:26-06:49/23	06:06		06:40	07:04-07:32/28	07:15	06:54		07:30	14:14-14:41/27
	20:52		20:22		19:31		18:37	16:50		16:32	
11	05:36	06:27-06:49/22	06:07		06:42	07:05-07:31/26	07:16	06:56		07:31	14:14-14:41/27
	20:52		20:21		19:30		18:35	16:49		16:32	
12	05:37	06:26-06:48/22	06:08		06:43	07:06-07:30/24	07:17	06:57		07:32	14:14-14:41/27
	20:51		20:20		19:28		18:33	16:48		16:32	
13	05:38	06:27-06:48/21	06:09		06:44	07:07-07:29/22	07:18	06:58		07:33	14:14-14:41/27
	20:51		20:18		19:26		18:32	16:47		16:32	
14	05:39	06:28-06:48/20	06:10		06:45	07:08-07:28/20	07:20	06:59		07:33	14:13-14:41/28
	20:50		20:17		19:24		18:30	16:46		16:32	
15	05:39	06:29-06:48/19	06:11		06:46	07:09-07:27/18	07:21	07:01		07:34	14:14-14:41/27
	20:49		20:15		19:22		18:28	16:45		16:32	
16	05:40	06:30-06:48/18	06:12		06:47	07:11-07:26/15	07:22	07:02		07:35	14:14-14:41/27
	20:49		20:14		19:20		18:27	16:44		16:32	
17	05:41	06:30-06:47/17	06:13		06:48	07:12-07:24/12	07:23	07:03		07:36	14:14-14:42/28
	20:48		20:12		19:19		18:25	16:43		16:32	
18	05:42	06:30-06:47/17	06:15		06:49	07:13-07:21/8	07:25	07:05		07:36	14:14-14:42/28
	20:47		20:11		19:17		18:23	16:42		16:33	
19	05:43	06:31-06:46/15	06:16		06:51		07:26	07:06		07:37	14:15-14:42/27
	20:47		20:09		19:15		18:22	16:41		16:33	
20	05:44	06:32-06:46/14	06:17		06:52		07:27	07:07		07:38	14:16-14:43/27
	20:46		20:07		19:13		18:20	16:40		16:33	
21	05:45	06:33-06:45/12	06:18		06:53		07:28	07:09		07:38	14:15-14:43/28
	20:45		20:06		19:11		18:18	16:40		16:34	
22	05:46	06:34-06:44/10	06:19		06:54		07:30	07:10		07:39	14:16-14:44/28
	20:44		20:04		19:09		18:17	16:39		16:34	
23	05:47	06:34-06:43/9	06:20		06:55		07:31	07:11		07:39	14:16-14:44/28
	20:43		20:03		19:08		18:15	16:38		16:35	
24	05:48	06:35-06:41/6	06:21		06:56		07:32	07:12		07:40	14:16-14:44/28
	20:42		20:01		19:06		18:14	16:37		16:35	
25	05:49	06:36-06:38/2	06:22	07:11-07:21/10	06:57		07:33	07:14	14:25-14:30/5	07:40	14:18-14:45/27
	20:41		19:59		19:04		18:12	16:37		16:36	
26	05:50		06:24	07:08-07:23/15	06:59		07:35	07:15	14:21-14:33/12	07:41	14:18-14:45/27
	20:40		19:58		19:02		18:11	16:36		16:36	
27	05:51		06:25	07:06-07:25/19	07:00		07:36	07:16	14:20-14:35/15	07:41	14:18-14:46/28
	20:39		19:56		19:00		18:09	16:36		16:37	
28	05:52		06:26	07:04-07:26/22	07:01		07:37	07:17	14:19-14:37/18	07:42	14:20-14:47/27
	20:38		19:54		18:58		18:08	16:35		16:38	
29	05:53		06:27	07:03-07:27/24	07:02		06:39	07:18	14:18-14:38/20	07:42	14:20-14:48/28
	20:37		19:53		18:57		17:06	16:34		16:38	
30	05:54		06:28	07:02-07:28/26	07:03		06:40	07:19	14:17-14:39/22	07:42	14:21-14:48/27
	20:36		19:51		18:55		17:05	16:34		16:39	
31	05:55		06:29	07:01-07:28/27			06:41			07:42	14:21-14:49/28
	20:35		19:49				17:03			16:40	
Potential sun hours	468		434		377		343	292		279	
Sum of minutes with flicker	473		143		440		0	92		830	

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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05/12/2023 17:21/3.6.366

SHADOW - Calendar per WTG

Calculation: Real case_3 WTG: 6 - Aerogeneratore 6

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:42	07:27	06:48	06:54	06:04	05:31	05:30	05:56	06:30	07:04 07:27-07:35/8	06:42	07:21
	16:41	17:17	17:55	19:34	20:09	20:42	20:55	20:34	19:47	18:53	17:02	16:34
2	07:43	07:26	06:47	06:52	06:02	05:30	05:30	05:57	06:31	07:05 07:29-07:34/5	06:44	07:22
	16:42	17:19	17:56	19:35	20:11	20:43	20:54	20:33	19:46	18:51	17:01	16:33
3	07:43	07:25	06:45	06:50	06:01	05:30	05:31	05:58	06:33	07:07 07:30-07:32/2	06:45	07:23
	16:43	17:20	17:58	19:36	20:12	20:44	20:54	20:32	19:44	18:49	16:59	16:33
4	07:43	07:24	06:43	06:48	05:59	05:29	05:32	05:59	06:34	07:08	06:46	07:24
	16:44	17:22	17:59	19:37	20:13	20:45	20:54	20:30	19:42	18:48	16:58	16:33
5	07:43	07:23	06:42	06:46	05:58	05:29	05:32	06:00	06:35	07:09	06:48	07:25
	16:45	17:23	18:00	19:38	20:14	20:46	20:54	20:29	19:40	18:46	16:57	16:32
6	07:43	07:22	06:40	06:45	05:57	05:28	05:33	06:01	06:36	07:10	06:49	07:26
	16:46	17:24	18:02	19:40	20:15	20:46	20:54	20:28	19:39	18:44	16:55	16:32
7	07:43	07:21	06:38	06:43	05:55	05:28	05:33	06:02	06:37	07:11	06:50	07:27
	16:47	17:26	18:03	19:41	20:16	20:47	20:53	20:26	19:37	18:42	16:54	16:32
8	07:42	07:19	06:36	06:41	05:54	05:28	05:34	06:03	06:38	07:12	06:52	07:28
	16:48	17:27	18:04	19:42	20:18	20:48	20:53	20:25	19:35	18:40	16:53	16:32
9	07:42	07:18	06:35	06:39	05:53	05:27	05:35	06:04	06:39	07:14	06:53	07:29
	16:49	17:28	18:05	19:43	20:19	20:48	20:52	20:24	19:33	18:39	16:52	16:32
10	07:42	07:17	06:33	06:38	05:51	05:27	05:35	06:06	06:40	07:15	06:54	07:30
	16:50	17:30	18:07	19:44	20:20	20:49	20:52	20:22	19:31	18:37	16:50	16:32
11	07:42	07:15	06:31	06:36	05:50	05:27	05:36	06:07	06:42	07:16	06:56	07:31
	16:51	17:31	18:08	19:45	20:21	20:50	20:52	20:21	19:30	18:35	16:49	16:32
12	07:41	07:14	06:29 06:51-06:53/2	06:34	05:49	05:27	05:37	06:08	06:43	07:17	06:57	07:32
	16:52	17:32	18:09	19:47	20:22	20:50	20:51	20:20	19:28	18:33	16:48	16:32
13	07:41	07:13	06:28 06:50-06:55/5	06:32	05:48	05:27	05:38	06:09	06:44	07:18	06:58	07:33
	16:53	17:34	18:10	19:48	20:23	20:51	20:51	20:18	19:26	18:32	16:47	16:32
14	07:41	07:11	06:26 06:48-06:56/8	06:31 07:00-07:07/7	05:47	05:26	05:38	06:10 07:04-07:09/5	06:45	07:20	06:59	07:33
	16:54	17:35	18:12	19:49	20:24	20:51	20:50	20:17	19:24	18:30	16:46	16:32
15	07:40	07:10	06:24 06:46-06:57/11	06:29 07:00-07:10/10	05:45	05:26	05:39	06:11 07:01-07:12/11	06:46 07:25-07:27/2	07:21	07:01	07:34
	16:55	17:37	18:13	19:50	20:25	20:52	20:49	20:15	19:22	18:28	16:45	16:32
16	07:40	07:09	06:22 06:44-06:57/13	06:27 06:58-07:10/12	05:44	05:26	05:40	06:12 06:59-07:14/15	06:47 07:21-07:32/11	07:22	07:02	07:35
	16:57	17:38	18:14	19:51	20:27	20:52	20:49	20:14	19:20	18:27	16:44	16:32
17	07:39	07:07	06:21 06:42-06:57/15	06:26 06:56-07:11/15	05:43	05:26	05:41	06:13 06:57-07:15/18	06:48 07:19-07:34/15	07:23	07:03	07:36
	16:58	17:39	18:15	19:53	20:28	20:52	20:48	20:12	19:19	18:25	16:43	16:32
18	07:39	07:06	06:19 06:40-06:56/16	06:24 06:56-07:12/16	05:42	05:26	05:42	06:15 06:56-07:15/19	06:49 07:17-07:35/18	07:25	07:05	07:36
	16:59	17:41	18:17	19:54	20:29	20:53	20:47	20:11	19:17	18:23	16:42	16:33
19	07:38	07:04	06:17 06:39-06:56/17	06:22 06:54-07:12/18	05:41	05:26	05:43	06:16 06:55-07:16/21	06:51 07:16-07:36/20	07:26	07:06	07:37
	17:00	17:42	18:18	19:55	20:30	20:53	20:47	20:09	19:15	18:22	16:41	16:33
20	07:38	07:03	06:15 06:37-06:55/18	06:21 06:53-07:12/19	05:40	05:27	05:44	06:17 06:54-07:16/22	06:52 07:15-07:36/21	07:27	07:07	07:38
	17:02	17:43	18:19	19:56	20:31	20:54	20:46	20:07	19:13	18:20	16:40	16:33
21	07:37	07:01	06:13 06:35-06:54/19	06:19 06:52-07:12/20	05:39	05:27	05:45	06:18 06:55-07:17/22	06:53 07:16-07:37/21	07:28	07:08	07:38
	17:03	17:45	18:20	19:57	20:32	20:54	20:45	20:06	19:11	18:18	16:40	16:34
22	07:36	07:00	06:12 06:33-06:52/19	06:17 06:50-07:12/22	05:38	05:27	05:46	06:19 06:55-07:17/22	06:54 07:17-07:37/20	07:30	07:10	07:39
	17:04	17:46	18:21	19:59	20:33	20:54	20:44	20:04	19:09	18:17	16:39	16:34
23	07:36	06:58	06:10 06:31-06:51/20	06:16 06:50-07:12/22	05:37	05:27	05:47	06:20 06:56-07:17/21	06:55 07:18-07:37/19	07:31	07:11	07:39
	17:05	17:47	18:23	20:00	20:34	20:54	20:43	20:03	19:08	18:15	16:38	16:35
24	07:35	06:56	06:08 06:30-06:51/21	06:14 06:48-07:11/23	05:37	05:27	05:48	06:21 06:57-07:16/19	06:56 07:19-07:38/19	07:32	07:12	07:40
	17:07	17:49	18:24	20:01	20:35	20:54	20:42	20:01	19:06	18:14	16:37	16:35
25	07:34	06:55	06:06 06:29-06:50/21	06:13 06:49-07:11/22	05:36	05:28	05:49	06:22 06:57-07:16/19	06:57 07:21-07:39/18	07:33	07:13	07:40
	17:08	17:50	18:25	20:02	20:36	20:55	20:41	19:59	19:04	18:12	16:37	16:36
26	07:33	06:53	07:04 07:29-07:48/19	06:11 06:49-07:09/20	05:35	05:28	05:50	06:24 06:58-07:15/17	06:59 07:22-07:39/17	07:35	07:15	07:41
	17:09	17:51	19:26	20:03	20:37	20:55	20:40	19:58	19:02	18:11	16:36	16:36
27	07:32	06:52	07:03 07:29-07:46/17	06:10 06:50-07:09/19	05:34	05:28	05:51	06:25 06:59-07:14/15	07:00 07:23-07:39/16	07:36	07:16	07:41
	17:11	17:53	19:28	20:05	20:38	20:55	20:39	19:56	19:00	18:09	16:36	16:37
28	07:31	06:50	07:01 07:30-07:44/14	06:08 06:51-07:07/16	05:33	05:29	05:52	06:26 06:59-07:13/14	07:01 07:24-07:38/14	07:37	07:17	07:41
	17:12	17:54	19:29	20:06	20:39	20:55	20:38	19:54	18:58	18:08	16:35	16:38
29	07:30		06:59 07:32-07:41/9	06:07 06:53-07:05/12	05:33	05:29	05:53	06:27 07:00-07:11/11	07:02 07:25-07:38/13	06:39	07:18	07:42
	17:13		19:30	20:07	20:40	20:55	20:37	19:53	18:57	17:06	16:34	16:38
30	07:29		06:57	06:05 06:55-07:02/7	05:32	05:29	05:54	06:28 07:00-07:09/9	07:03 07:26-07:36/10	06:40	07:19	07:42
	17:15		19:31	20:08	20:41	20:55	20:36	19:51	18:55	17:05	16:34	16:39
31	07:28		06:55		05:31		05:55	06:29 07:01-07:04/3		06:41		07:42
	17:16		19:32		20:41		20:35	19:49		17:03		16:40
Potential sun hours	289	292	368	401	455	461	468	434	377	343	292	279
Sum of minutes with flicker	0	0	264	280	0	0	0	283	254	15	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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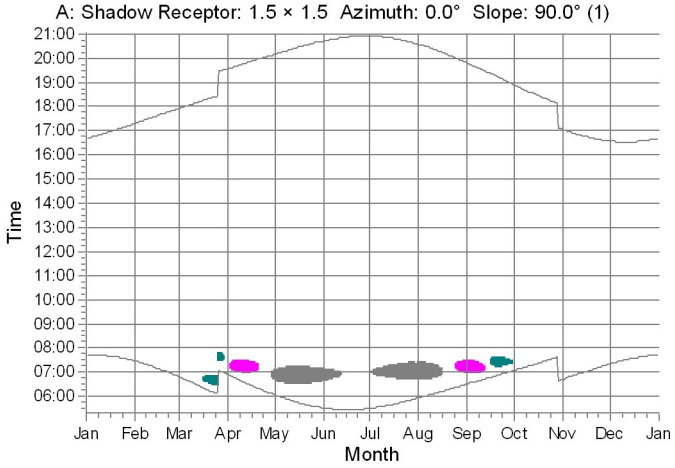
05/12/2023 17:21/3.6.366

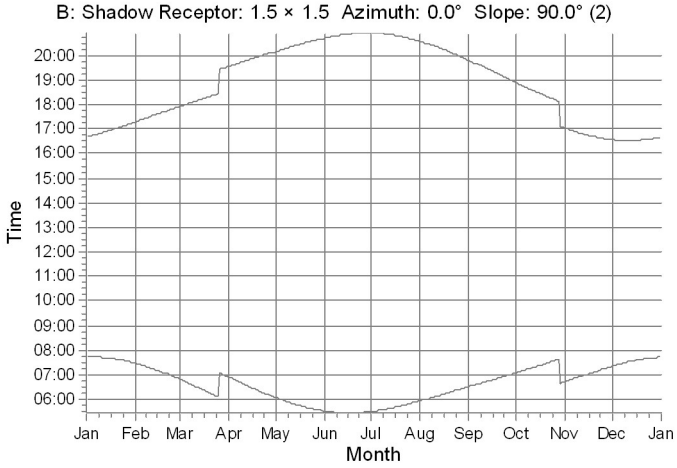
SHADOW - Calendar, graphical

Calculation: Real case_3

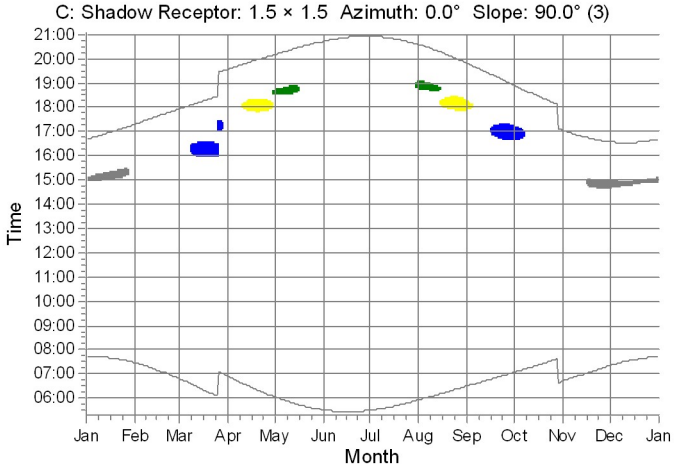
A: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (1)



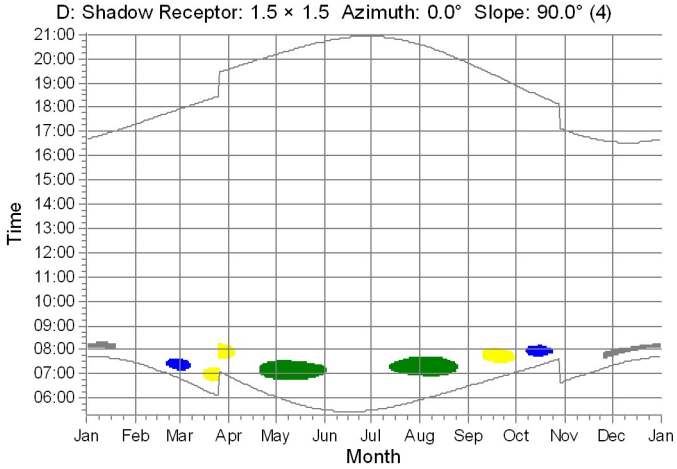
B: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (2)



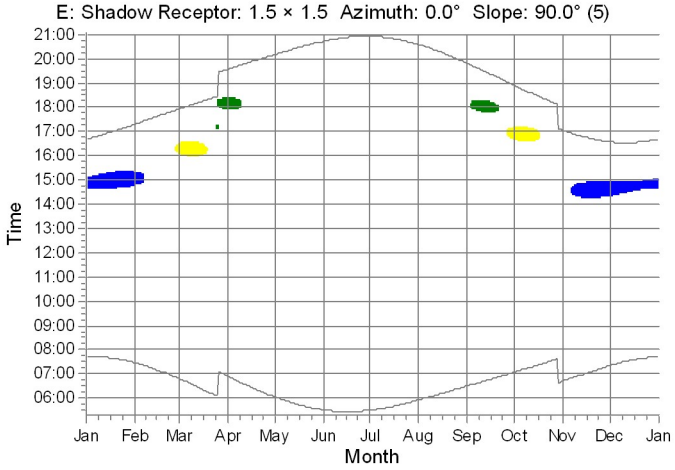
C: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (3)



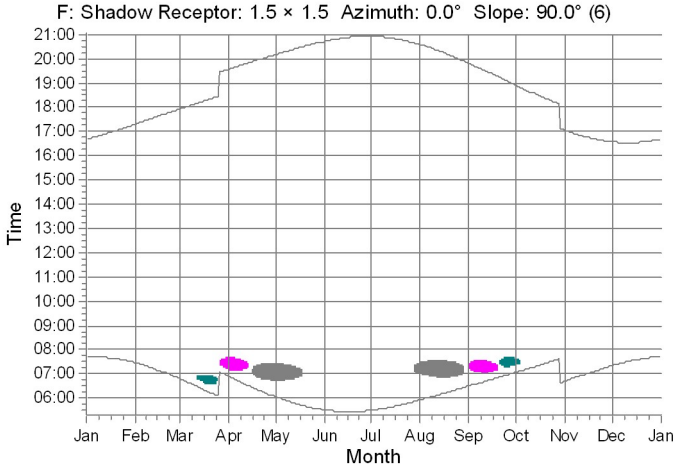
D: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (4)



E: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (5)



F: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (6)



WTGs

1: Aerogeneratore 1	3: Aerogeneratore 3	5: Aerogeneratore 5
2: Aerogeneratore 2	4: Aerogeneratore 4	6: Aerogeneratore 6

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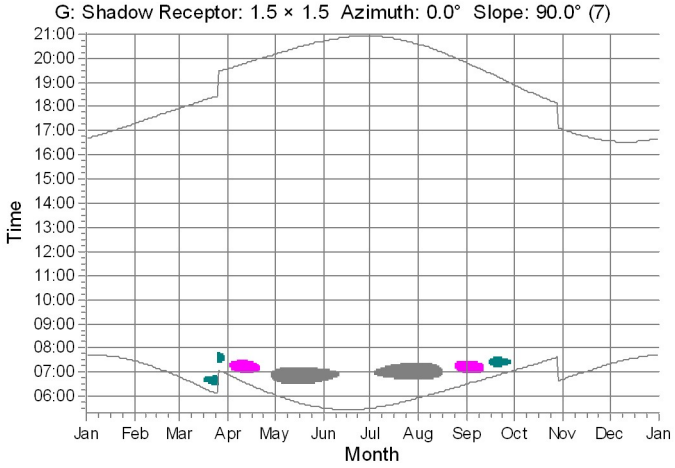
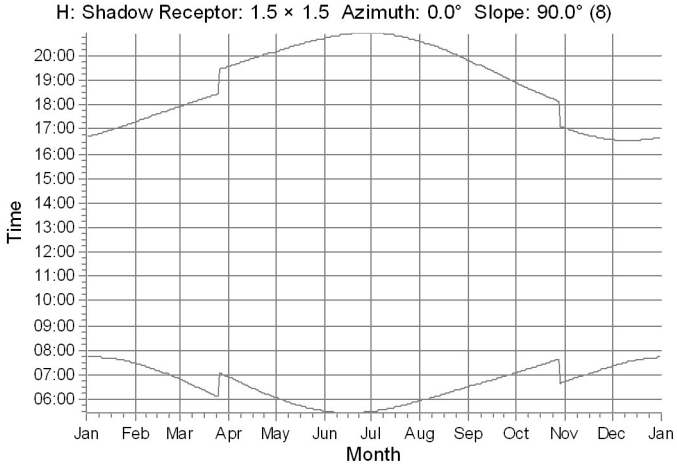
SHADOW - Calendar, graphical

Calculation: Real case_3

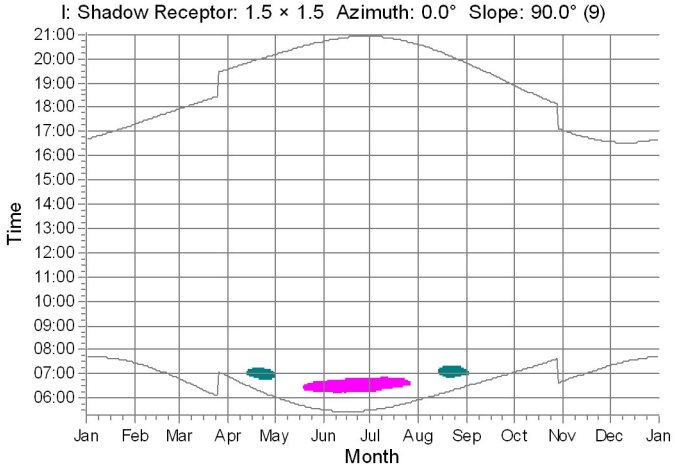
G: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (7)



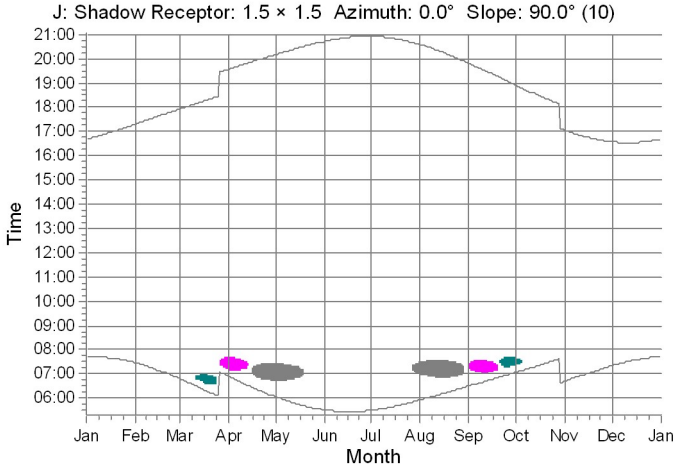
H: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (8)



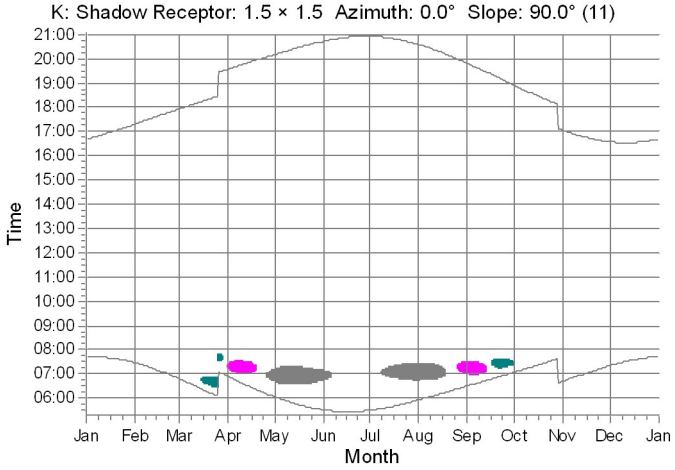
I: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (9)



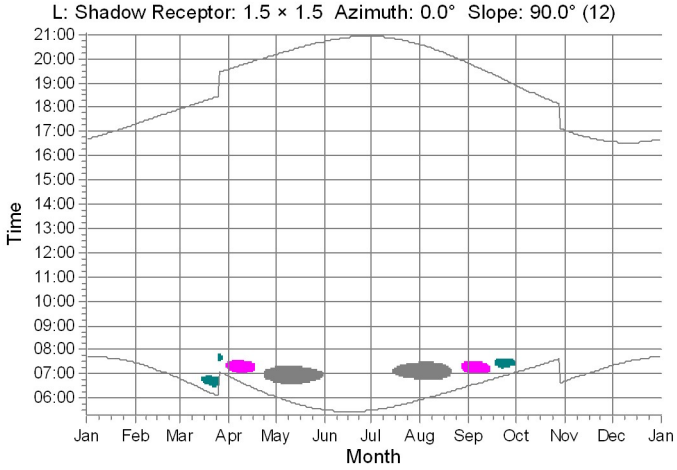
J: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (10)



K: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (11)



L: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (12)



WTGs

4: Aerogeneratore 4 5: Aerogeneratore 5 6: Aerogeneratore 6

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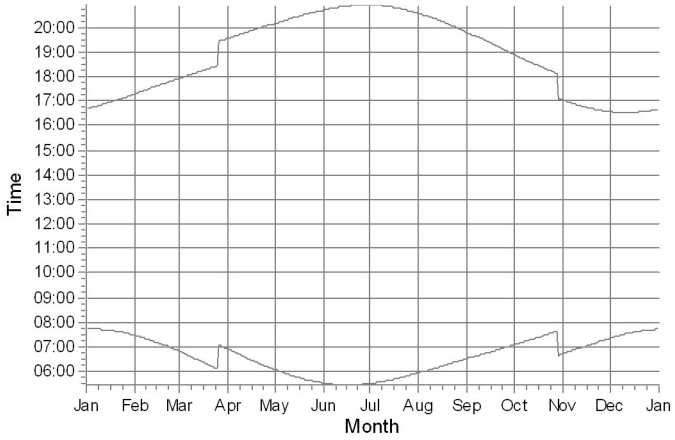
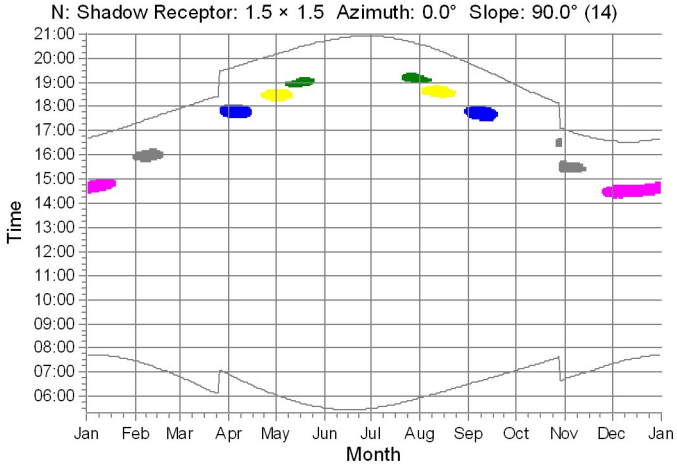
SHADOW - Calendar, graphical

Calculation: Real case_3

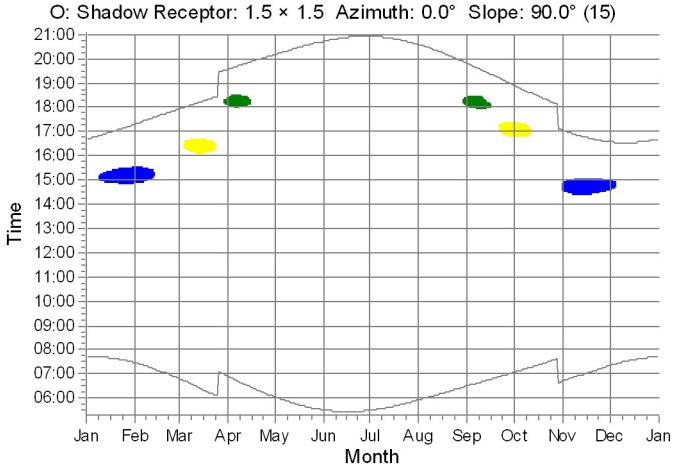
M: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (13)



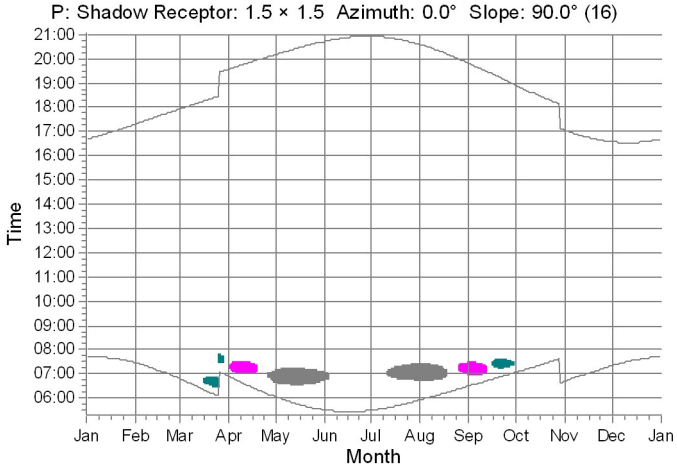
N: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (14)



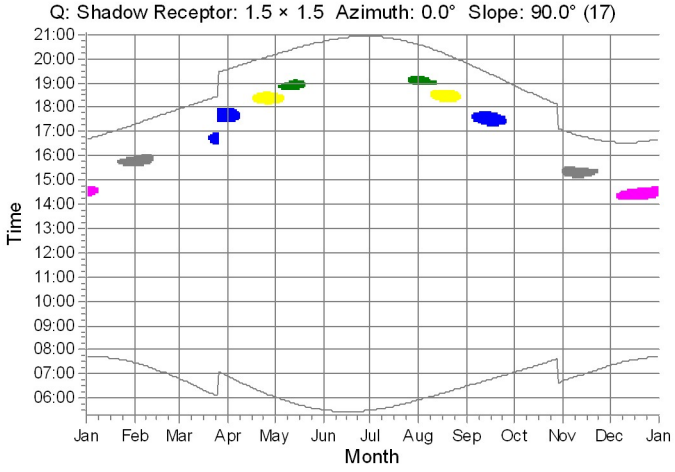
O: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (15)



P: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (16)



Q: Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (17)



WTGs

1: Aerogeneratore 1	3: Aerogeneratore 3	5: Aerogeneratore 5
2: Aerogeneratore 2	4: Aerogeneratore 4	6: Aerogeneratore 6

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Calculated:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: A - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (1)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January		February		March		April			May			June		
1	07:43		07:27		06:48		06:54			06:04		06:44 (4)	05:31		06:42 (4)
	16:41		17:18		17:55		19:34			20:09	21	07:05 (4)	20:42	25	07:07 (4)
2	07:43		07:26		06:47		06:52			06:02		06:43 (4)	05:30		06:43 (4)
	16:42		17:19		17:57		19:35			20:11	24	07:07 (4)	20:43	24	07:07 (4)
3	07:43		07:25		06:45		06:50		07:13 (5)	06:01		06:40 (4)	05:30		06:43 (4)
	16:43		17:20		17:58		19:36	9	07:22 (5)	20:12	27	07:07 (4)	20:44	23	07:06 (4)
4	07:43		07:24		06:43		06:48		07:10 (5)	05:59		06:39 (4)	05:29		06:45 (4)
	16:44		17:22		17:59		19:37	15	07:25 (5)	20:13	30	07:09 (4)	20:45	21	07:06 (4)
5	07:43		07:23		06:42		06:46		07:08 (5)	05:58		06:39 (4)	05:29		06:45 (4)
	16:45		17:23		18:00		19:38	19	07:27 (5)	20:14	31	07:10 (4)	20:46	19	07:04 (4)
6	07:43		07:22		06:40		06:45		07:06 (5)	05:57		06:37 (4)	05:29		06:46 (4)
	16:46		17:24		18:02		19:40	21	07:27 (5)	20:15	33	07:10 (4)	20:46	18	07:04 (4)
7	07:43		07:21		06:38		06:43		07:05 (5)	05:55		06:37 (4)	05:28		06:48 (4)
	16:47		17:26		18:03		19:41	23	07:28 (5)	20:16	34	07:11 (4)	20:47	16	07:04 (4)
8	07:42		07:19		06:37		06:41		07:04 (5)	05:54		06:36 (4)	05:28		06:48 (4)
	16:48		17:27		18:04		19:42	25	07:29 (5)	20:18	35	07:11 (4)	20:48	14	07:02 (4)
9	07:42		07:18		06:35		06:39		07:03 (5)	05:53		06:36 (4)	05:28		06:49 (4)
	16:49		17:28		18:05		19:43	26	07:29 (5)	20:19	36	07:12 (4)	20:48	13	07:02 (4)
10	07:42		07:17		06:33		06:38		07:03 (5)	05:51		06:36 (4)	05:27		06:51 (4)
	16:50		17:30		18:07		19:44	25	07:28 (5)	20:20	36	07:12 (4)	20:49	10	07:01 (4)
11	07:42		07:16		06:31		06:36		07:02 (5)	05:50		06:34 (4)	05:27		06:53 (4)
	16:51		17:31		18:08		19:46	26	07:28 (5)	20:21	38	07:12 (4)	20:50	7	07:00 (4)
12	07:42		07:14		06:30		06:34		07:02 (5)	05:49		06:34 (4)	05:27		06:56 (4)
	16:52		17:33		18:09		19:47	26	07:28 (5)	20:22	38	07:12 (4)	20:50	1	06:57 (4)
13	07:41		07:13		06:28		06:32		07:02 (5)	05:48		06:34 (4)	05:27		
	16:53		17:34		18:10		19:48	25	07:27 (5)	20:23	38	07:12 (4)	20:51		
14	07:41		07:11		06:26		06:31		07:02 (5)	05:47		06:34 (4)	05:27		
	16:54		17:35		18:12		19:49	24	07:26 (5)	20:24	38	07:12 (4)	20:51		
15	07:40		07:10		06:24		06:29		07:03 (5)	05:46		06:34 (4)	05:26		
	16:55		17:37		18:13		19:50	23	07:26 (5)	20:26	38	07:12 (4)	20:52		
16	07:40		07:09		06:22		06:27		07:03 (5)	05:44		06:34 (4)	05:26		
	16:57		17:38		18:14		19:52	21	07:24 (5)	20:27	38	07:12 (4)	20:52		
17	07:39		07:07		06:21	06:42 (6)	06:26		07:04 (5)	05:43		06:34 (4)	05:26		
	16:58		17:39		18:15	2 06:44 (6)	19:53	19	07:23 (5)	20:28	38	07:12 (4)	20:53		
18	07:39		07:06		06:19	06:40 (6)	06:24		07:06 (5)	05:42		06:35 (4)	05:26		
	16:59		17:41		18:17	7 06:47 (6)	19:54	15	07:21 (5)	20:29	37	07:12 (4)	20:53		
19	07:38		07:04		06:17	06:39 (6)	06:22		07:08 (5)	05:41		06:35 (4)	05:27		
	17:00		17:42		18:18	10 06:49 (6)	19:55	11	07:19 (5)	20:30	37	07:12 (4)	20:53		
20	07:38		07:03		06:15	06:37 (6)	06:21			05:40		06:35 (4)	05:27		
	17:02		17:43		18:19	12 06:49 (6)	19:56			20:31	36	07:11 (4)	20:54		
21	07:37		07:01		06:13	06:35 (6)	06:19			05:39		06:35 (4)	05:27		
	17:03		17:45		18:20	15 06:50 (6)	19:58			20:32	36	07:11 (4)	20:54		
22	07:36		07:00		06:12	06:33 (6)	06:17			05:38		06:36 (4)	05:27		
	17:04		17:46		18:22	17 06:50 (6)	19:59			20:33	36	07:12 (4)	20:54		
23	07:36		06:58		06:10	06:31 (6)	06:16			05:38		06:36 (4)	05:27		
	17:05		17:47		18:23	18 06:49 (6)	20:00			20:34	35	07:11 (4)	20:54		
24	07:35		06:57		06:08	06:30 (6)	06:14			05:37		06:37 (4)	05:27		
	17:07		17:49		18:24	20 06:50 (6)	20:01			20:35	34	07:11 (4)	20:55		
25	07:34		06:55		06:06	06:30 (6)	06:13			05:36		06:37 (4)	05:28		
	17:08		17:50		18:25	19 06:49 (6)	20:02			20:36	33	07:10 (4)	20:55		
26	07:33		06:53		07:04	07:30 (6)	06:11			05:35		06:38 (4)	05:28		
	17:09		17:51		19:26	17 07:47 (6)	20:04			20:37	32	07:10 (4)	20:55		
27	07:32		06:52		07:03	07:30 (6)	06:10			05:34		06:38 (4)	05:28		
	17:11		17:53		19:28	16 07:46 (6)	20:05			20:38	31	07:09 (4)	20:55		
28	07:31		06:50		07:01	07:32 (6)	06:08			05:34		06:39 (4)	05:29		
	17:12		17:54		19:29	12 07:44 (6)	20:06			20:39	30	07:09 (4)	20:55		
29	07:30				06:59	07:34 (6)	06:07		06:50 (4)	05:33		06:40 (4)	05:29		
	17:13				19:30	6 07:40 (6)	20:07	10	07:00 (4)	20:40	29	07:09 (4)	20:55		
30	07:30				06:57		06:05		06:46 (4)	05:32		06:40 (4)	05:30		
	17:15				19:31		20:08	16	07:02 (4)	20:41	28	07:08 (4)	20:55		
31	07:29				06:55					05:32		06:41 (4)			
	17:16				19:32					20:42	27	07:08 (4)			
Potential sun hours	289		292		368		401			455			461		
Total, worst case					171			379			1034			191	
Sun reduction					0.38			0.43			0.49			0.54	
Oper. time red.					1.00			1.00			1.00			1.00	
Wind dir. red.					1.00			1.00			1.00			1.00	
Total reduction					0.38			0.43			0.49			0.54	
Total, real					65			162			503			104	

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

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

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SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: A - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (1)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	July			August			September			October	November	December
1	05:30			05:56		06:45 (4)	06:30		07:01 (5)	07:04	06:42	07:21
	20:55			20:34	38	07:23 (4)	19:48	26	07:27 (5)	18:53	17:02	16:34
2	05:31		06:59 (4)	05:57		06:45 (4)	06:32		07:01 (5)	07:05	06:44	07:22
	20:55	3	07:02 (4)	20:33	38	07:23 (4)	19:46	26	07:27 (5)	18:51	17:01	16:33
3	05:31		06:58 (4)	05:58		06:46 (4)	06:33		07:00 (5)	07:07	06:45	07:23
	20:54	7	07:05 (4)	20:32	37	07:23 (4)	19:44	26	07:26 (5)	18:49	16:59	16:33
4	05:32		06:56 (4)	05:59		06:46 (4)	06:34		07:01 (5)	07:08	06:46	07:24
	20:54	10	07:06 (4)	20:30	37	07:23 (4)	19:42	26	07:27 (5)	18:48	16:58	16:33
5	05:32		06:55 (4)	06:00		06:46 (4)	06:35		07:01 (5)	07:09	06:48	07:25
	20:54	13	07:08 (4)	20:29	36	07:22 (4)	19:40	25	07:26 (5)	18:46	16:57	16:32
6	05:33		06:54 (4)	06:01		06:46 (4)	06:36		07:01 (5)	07:10	06:49	07:26
	20:54	14	07:08 (4)	20:28	36	07:22 (4)	19:39	24	07:25 (5)	18:44	16:55	16:32
7	05:33		06:53 (4)	06:02		06:47 (4)	06:37		07:01 (5)	07:11	06:50	07:27
	20:53	17	07:10 (4)	20:27	34	07:21 (4)	19:37	23	07:24 (5)	18:42	16:54	16:32
8	05:34		06:53 (4)	06:03		06:47 (4)	06:38		07:02 (5)	07:13	06:52	07:28
	20:53	18	07:11 (4)	20:25	33	07:20 (4)	19:35	20	07:22 (5)	18:40	16:53	16:32
9	05:35		06:52 (4)	06:05		06:48 (4)	06:39		07:03 (5)	07:14	06:53	07:29
	20:53	19	07:11 (4)	20:24	31	07:19 (4)	19:33	17	07:20 (5)	18:39	16:52	16:32
10	05:35		06:52 (4)	06:06		06:49 (4)	06:41		07:05 (5)	07:15	06:54	07:30
	20:52	21	07:13 (4)	20:22	29	07:18 (4)	19:31	13	07:18 (5)	18:37	16:50	16:32
11	05:36		06:51 (4)	06:07		06:49 (4)	06:42		07:08 (5)	07:16	06:56	07:31
	20:52	23	07:14 (4)	20:21	28	07:17 (4)	19:30	6	07:14 (5)	18:35	16:49	16:32
12	05:37		06:50 (4)	06:08		06:50 (4)	06:43			07:17	06:57	07:32
	20:51	24	07:14 (4)	20:20	25	07:15 (4)	19:28			18:33	16:48	16:32
13	05:38		06:50 (4)	06:09		06:52 (4)	06:44			07:19	06:58	07:33
	20:51	25	07:15 (4)	20:18	22	07:14 (4)	19:26			18:32	16:47	16:32
14	05:39		06:49 (4)	06:10		06:54 (4)	06:45			07:20	07:00	07:34
	20:50	27	07:16 (4)	20:17	17	07:11 (4)	19:24			18:30	16:46	16:32
15	05:39		06:49 (4)	06:11		06:56 (4)	06:46			07:21	07:01	07:34
	20:49	28	07:17 (4)	20:15	12	07:08 (4)	19:22			18:28	16:45	16:32
16	05:40		06:49 (4)	06:12			06:47		07:23 (6)	07:22	07:02	07:35
	20:49	29	07:18 (4)	20:14			19:21	9	07:32 (6)	18:27	16:44	16:32
17	05:41		06:48 (4)	06:14			06:48		07:21 (6)	07:23	07:03	07:36
	20:48	30	07:18 (4)	20:12			19:19	13	07:34 (6)	18:25	16:43	16:32
18	05:42		06:47 (4)	06:15			06:50		07:19 (6)	07:25	07:05	07:37
	20:47	31	07:18 (4)	20:11			19:17	16	07:35 (6)	18:23	16:42	16:33
19	05:43		06:47 (4)	06:16			06:51		07:17 (6)	07:26	07:06	07:37
	20:47	32	07:19 (4)	20:09			19:15	18	07:35 (6)	18:22	16:41	16:33
20	05:44		06:47 (4)	06:17			06:52		07:16 (6)	07:27	07:07	07:38
	20:46	33	07:20 (4)	20:08			19:13	19	07:35 (6)	18:20	16:41	16:33
21	05:45		06:47 (4)	06:18			06:53		07:16 (6)	07:28	07:09	07:38
	20:45	34	07:21 (4)	20:06			19:11	19	07:35 (6)	18:18	16:40	16:34
22	05:46		06:46 (4)	06:19			06:54		07:17 (6)	07:30	07:10	07:39
	20:44	35	07:21 (4)	20:04			19:10	18	07:35 (6)	18:17	16:39	16:34
23	05:47		06:46 (4)	06:20			06:55		07:18 (6)	07:31	07:11	07:40
	20:43	36	07:22 (4)	20:03			19:08	16	07:34 (6)	18:15	16:38	16:35
24	05:48		06:46 (4)	06:21			06:56		07:19 (6)	07:32	07:12	07:40
	20:42	36	07:22 (4)	20:01			19:06	14	07:33 (6)	18:14	16:37	16:35
25	05:49		06:46 (4)	06:23		07:12 (5)	06:57		07:21 (6)	07:33	07:14	07:40
	20:42	36	07:22 (4)	19:59	9	07:21 (5)	19:04	12	07:33 (6)	18:12	16:37	16:36
26	05:50		06:46 (4)	06:24		07:09 (5)	06:59		07:22 (6)	07:35	07:15	07:41
	20:41	37	07:23 (4)	19:58	14	07:23 (5)	19:02	9	07:31 (6)	18:11	16:36	16:36
27	05:51		06:46 (4)	06:25		07:07 (5)	07:00		07:23 (6)	07:36	07:16	07:41
	20:40	37	07:23 (4)	19:56	18	07:25 (5)	19:00	6	07:29 (6)	18:09	16:36	16:37
28	05:52		06:45 (4)	06:26		07:05 (5)	07:01		07:24 (6)	07:37	07:17	07:42
	20:38	38	07:23 (4)	19:54	21	07:26 (5)	18:58	2	07:26 (6)	18:08	16:35	16:38
29	05:53		06:44 (4)	06:27		07:04 (5)	07:02			06:39	07:18	07:42
	20:37	38	07:22 (4)	19:53	22	07:26 (5)	18:57			17:06	16:35	16:38
30	05:54		06:44 (4)	06:28		07:03 (5)	07:03			06:40	07:20	07:42
	20:36	38	07:22 (4)	19:51	24	07:27 (5)	18:55			17:05	16:34	16:39
31	05:55		06:44 (4)	06:29		07:02 (5)				06:41		07:42
	20:35	38	07:22 (4)	19:49	25	07:27 (5)				17:03		16:40
Potential sun hours	468			434			377			343	292	279
Total, worst case		807			586			403				
Sun reduction		0.62			0.60			0.53				
Oper. time red.		1.00			1.00			1.00				
Wind dir. red.		1.00			1.00			1.00				
Total reduction		0.62			0.60			0.53				
Total, real		501			351			214				

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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: B - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (2)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:42	07:27	06:48	06:54	06:04	05:31	05:30	05:56	06:30	07:04	06:42	07:21
	16:41	17:17	17:55	19:34	20:09	20:42	20:55	20:34	19:47	18:53	17:02	16:34
2	07:43	07:26	06:47	06:52	06:02	05:30	05:30	05:57	06:31	07:05	06:44	07:22
	16:42	17:19	17:56	19:35	20:11	20:43	20:54	20:33	19:46	18:51	17:01	16:33
3	07:43	07:25	06:45	06:50	06:01	05:30	05:31	05:58	06:33	07:07	06:45	07:23
	16:43	17:20	17:58	19:36	20:12	20:44	20:54	20:32	19:44	18:49	16:59	16:33
4	07:43	07:24	06:43	06:48	05:59	05:29	05:32	05:59	06:34	07:08	06:46	07:24
	16:44	17:22	17:59	19:37	20:13	20:45	20:54	20:30	19:42	18:48	16:58	16:33
5	07:43	07:23	06:42	06:46	05:58	05:29	05:32	06:00	06:35	07:09	06:48	07:25
	16:45	17:23	18:00	19:38	20:14	20:45	20:54	20:29	19:40	18:46	16:57	16:32
6	07:43	07:22	06:40	06:45	05:57	05:28	05:33	06:01	06:36	07:10	06:49	07:26
	16:46	17:24	18:02	19:40	20:15	20:46	20:54	20:28	19:39	18:44	16:55	16:32
7	07:43	07:21	06:38	06:43	05:55	05:28	05:33	06:02	06:37	07:11	06:50	07:27
	16:47	17:26	18:03	19:41	20:16	20:47	20:53	20:26	19:37	18:42	16:54	16:32
8	07:42	07:19	06:36	06:41	05:54	05:28	05:34	06:03	06:38	07:12	06:52	07:28
	16:48	17:27	18:04	19:42	20:18	20:48	20:53	20:25	19:35	18:40	16:53	16:32
9	07:42	07:18	06:35	06:39	05:53	05:27	05:35	06:05	06:39	07:14	06:53	07:29
	16:49	17:28	18:05	19:43	20:19	20:48	20:52	20:24	19:33	18:39	16:52	16:32
10	07:42	07:17	06:33	06:38	05:51	05:27	05:35	06:06	06:40	07:15	06:54	07:30
	16:50	17:30	18:07	19:44	20:20	20:49	20:52	20:22	19:31	18:37	16:50	16:32
11	07:42	07:15	06:31	06:36	05:50	05:27	05:36	06:07	06:42	07:16	06:55	07:31
	16:51	17:31	18:08	19:45	20:21	20:50	20:52	20:21	19:30	18:35	16:49	16:32
12	07:41	07:14	06:29	06:34	05:49	05:27	05:37	06:08	06:43	07:17	06:57	07:32
	16:52	17:32	18:09	19:47	20:22	20:50	20:51	20:20	19:28	18:33	16:48	16:32
13	07:41	07:13	06:28	06:32	05:48	05:27	05:38	06:09	06:44	07:18	06:58	07:33
	16:53	17:34	18:10	19:48	20:23	20:51	20:51	20:18	19:26	18:32	16:47	16:32
14	07:41	07:11	06:26	06:31	05:47	05:27	05:39	06:10	06:45	07:20	06:59	07:33
	16:54	17:35	18:12	19:49	20:24	20:51	20:50	20:17	19:24	18:30	16:46	16:32
15	07:40	07:10	06:24	06:29	05:45	05:26	05:39	06:11	06:46	07:21	07:01	07:34
	16:55	17:37	18:13	19:50	20:25	20:52	20:49	20:15	19:22	18:28	16:45	16:32
16	07:40	07:09	06:22	06:27	05:44	05:26	05:40	06:12	06:47	07:22	07:02	07:35
	16:57	17:38	18:14	19:51	20:27	20:52	20:49	20:14	19:20	18:27	16:44	16:32
17	07:39	07:07	06:21	06:26	05:43	05:26	05:41	06:13	06:48	07:23	07:03	07:36
	16:58	17:39	18:15	19:53	20:28	20:52	20:48	20:12	19:19	18:25	16:43	16:32
18	07:39	07:06	06:19	06:24	05:42	05:26	05:42	06:15	06:49	07:25	07:05	07:36
	16:59	17:41	18:17	19:54	20:29	20:53	20:47	20:11	19:17	18:23	16:42	16:33
19	07:38	07:04	06:17	06:22	05:41	05:26	05:43	06:16	06:51	07:26	07:06	07:37
	17:00	17:42	18:18	19:55	20:30	20:53	20:47	20:09	19:15	18:22	16:41	16:33
20	07:38	07:03	06:15	06:21	05:40	05:27	05:44	06:17	06:52	07:27	07:07	07:38
	17:02	17:43	18:19	19:56	20:31	20:54	20:46	20:07	19:13	18:20	16:40	16:33
21	07:37	07:01	06:13	06:19	05:39	05:27	05:45	06:18	06:53	07:28	07:08	07:38
	17:03	17:45	18:20	19:57	20:32	20:54	20:45	20:06	19:11	18:18	16:40	16:34
22	07:36	07:00	06:12	06:17	05:38	05:27	05:46	06:19	06:54	07:30	07:10	07:39
	17:04	17:46	18:21	19:59	20:33	20:54	20:44	20:04	19:09	18:17	16:39	16:34
23	07:35	06:58	06:10	06:16	05:37	05:27	05:47	06:20	06:55	07:31	07:11	07:39
	17:05	17:47	18:23	20:00	20:34	20:54	20:43	20:03	19:08	18:15	16:38	16:35
24	07:35	06:56	06:08	06:14	05:37	05:27	05:48	06:21	06:56	07:32	07:12	07:40
	17:07	17:49	18:24	20:01	20:35	20:54	20:42	20:01	19:06	18:14	16:37	16:35
25	07:34	06:55	06:06	06:13	05:36	05:28	05:49	06:22	06:57	07:33	07:13	07:40
	17:08	17:50	18:25	20:02	20:36	20:55	20:41	19:59	19:04	18:12	16:37	16:36
26	07:33	06:53	07:04	06:11	05:35	05:28	05:50	06:24	06:59	07:35	07:15	07:41
	17:09	17:51	19:26	20:03	20:37	20:55	20:40	19:58	19:02	18:11	16:36	16:36
27	07:32	06:52	07:03	06:10	05:34	05:28	05:51	06:25	07:00	07:36	07:16	07:41
	17:11	17:53	19:28	20:05	20:38	20:55	20:39	19:56	19:00	18:09	16:36	16:37
28	07:31	06:50	07:01	06:08	05:33	05:29	05:52	06:26	07:01	07:37	07:17	07:41
	17:12	17:54	19:29	20:06	20:39	20:55	20:38	19:54	18:58	18:08	16:35	16:38
29	07:30		06:59	06:07	05:33	05:29	05:53	06:27	07:02	06:38	07:18	07:42
	17:13		19:30	20:07	20:40	20:55	20:37	19:53	18:57	17:06	16:34	16:38
30	07:29		06:57	06:05	05:32	05:29	05:54	06:28	07:03	06:40	07:19	07:42
	17:15		19:31	20:08	20:41	20:55	20:36	19:51	18:55	17:05	16:34	16:39
31	07:28		06:55		05:32		05:55	06:29		06:41		07:42
	17:16		19:32		20:41		20:35	19:49		17:03		16:40
Potential sun hours	289	292	368	401	455	461	468	434	377	343	292	279
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

Day in month	Sun rise (hh:mm) 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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: C - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (3)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January			February		March			April			May			June	
1	07:43		14:59 (4)	07:27		06:48			06:54			06:04		18:36 (1)	05:31	
	16:41	5	15:04 (4)	17:17		17:55			19:34			20:09	4	18:40 (1)	20:42	
2	07:43		14:59 (4)	07:26		06:47			06:52			06:02		18:36 (1)	05:30	
	16:42	5	15:04 (4)	17:19		17:56			19:35			20:11	6	18:42 (1)	20:43	
3	07:43		14:59 (4)	07:25		06:45			06:50			06:01		18:35 (1)	05:30	
	16:43	6	15:05 (4)	17:20		17:58			19:36			20:12	7	18:42 (1)	20:44	
4	07:43		14:59 (4)	07:24		06:43			06:48			05:59		18:35 (1)	05:29	
	16:44	7	15:06 (4)	17:21		17:59			19:37			20:13	9	18:44 (1)	20:45	
5	07:43		15:00 (4)	07:23		06:42			06:46			05:58		18:35 (1)	05:29	
	16:45	7	15:07 (4)	17:23		18:00			19:38			20:14	10	18:45 (1)	20:46	
6	07:43		15:00 (4)	07:22		06:40			06:45			05:57		18:34 (1)	05:28	
	16:45	8	15:08 (4)	17:24		18:02			19:40			20:15	11	18:45 (1)	20:46	
7	07:43		15:01 (4)	07:21		06:38			06:43			05:55		18:34 (1)	05:28	
	16:46	9	15:10 (4)	17:26		18:03			19:41			20:16	12	18:46 (1)	20:47	
8	07:42		15:01 (4)	07:19		06:36			06:41			05:54		18:35 (1)	05:28	
	16:47	10	15:11 (4)	17:27		18:04			19:42			20:18	13	18:48 (1)	20:48	
9	07:42		15:01 (4)	07:18		06:35		16:12 (3)	06:39			05:53		18:36 (1)	05:27	
	16:49	10	15:11 (4)	17:28		18:05	11	16:23 (3)	19:43			20:19	13	18:49 (1)	20:48	
10	07:42		15:02 (4)	07:17		06:33		16:08 (3)	06:38			05:51		18:35 (1)	05:27	
	16:50	10	15:12 (4)	17:30		18:07	18	16:26 (3)	19:44			20:20	14	18:49 (1)	20:49	
11	07:42		15:02 (4)	07:15		06:31		16:06 (3)	06:36		18:01 (2)	05:50		18:36 (1)	05:27	
	16:51	11	15:13 (4)	17:31		18:08	21	16:27 (3)	19:45	5	18:06 (2)	20:21	14	18:50 (1)	20:50	
12	07:41		15:02 (4)	07:14		06:29		16:04 (3)	06:34		17:59 (2)	05:49		18:37 (1)	05:27	
	16:52	11	15:13 (4)	17:32		18:09	25	16:29 (3)	19:47	10	18:09 (2)	20:22	14	18:51 (1)	20:50	
13	07:41		15:03 (4)	07:13		06:28		16:02 (3)	06:32		17:57 (2)	05:48		18:39 (1)	05:27	
	16:53	12	15:15 (4)	17:34		18:10	27	16:29 (3)	19:48	14	18:11 (2)	20:23	12	18:51 (1)	20:51	
14	07:41		15:03 (4)	07:11		06:26		16:02 (3)	06:31		17:55 (2)	05:47		18:40 (1)	05:26	
	16:54	12	15:15 (4)	17:35		18:12	29	16:31 (3)	19:49	18	18:13 (2)	20:24	10	18:50 (1)	20:51	
15	07:40		15:04 (4)	07:10		06:24		16:01 (3)	06:29		17:55 (2)	05:45		18:44 (1)	05:26	
	16:55	12	15:16 (4)	17:37		18:13	30	16:31 (3)	19:50	21	18:16 (2)	20:25	3	18:47 (1)	20:52	
16	07:40		15:04 (4)	07:09		06:22		16:00 (3)	06:27		17:53 (2)	05:44			05:26	
	16:57	13	15:17 (4)	17:38		18:14	31	16:31 (3)	19:51	26	18:19 (2)	20:27			20:52	
17	07:39		15:05 (4)	07:07		06:21		15:59 (3)	06:26		17:52 (2)	05:43			05:26	
	16:58	13	15:18 (4)	17:39		18:15	32	16:31 (3)	19:53	26	18:18 (2)	20:28			20:53	
18	07:39		15:05 (4)	07:06		06:19		15:59 (3)	06:24		17:53 (2)	05:42			05:26	
	16:59	14	15:19 (4)	17:41		18:17	32	16:31 (3)	19:54	26	18:19 (2)	20:29			20:53	
19	07:38		15:06 (4)	07:04		06:17		15:59 (3)	06:22		17:52 (2)	05:41			05:26	
	17:00	13	15:19 (4)	17:42		18:18	33	16:32 (3)	19:55	27	18:19 (2)	20:30			20:53	
20	07:38		15:06 (4)	07:03		06:15		15:59 (3)	06:21		17:51 (2)	05:40			05:26	
	17:01	14	15:20 (4)	17:43		18:19	32	16:31 (3)	19:56	27	18:18 (2)	20:31			20:54	
21	07:37		15:08 (4)	07:01		06:13		15:59 (3)	06:19		17:52 (2)	05:39			05:27	
	17:03	14	15:22 (4)	17:45		18:20	32	16:31 (3)	19:57	27	18:19 (2)	20:32			20:54	
22	07:36		15:08 (4)	07:00		06:12		15:59 (3)	06:17		17:52 (2)	05:38			05:27	
	17:04	14	15:22 (4)	17:46		18:21	31	16:30 (3)	19:59	26	18:18 (2)	20:33			20:54	
23	07:36		15:09 (4)	06:58		06:10		15:59 (3)	06:16		17:53 (2)	05:37			05:27	
	17:05	14	15:23 (4)	17:47		18:23	30	16:29 (3)	20:00	25	18:18 (2)	20:34			20:54	
24	07:35		15:10 (4)	06:56		06:08		16:00 (3)	06:14		17:53 (2)	05:37			05:27	
	17:07	14	15:24 (4)	17:49		18:24	27	16:27 (3)	20:01	23	18:16 (2)	20:35			20:54	
25	07:34		15:12 (4)	06:55		06:06		16:02 (3)	06:13		17:54 (2)	05:36			05:28	
	17:08	13	15:25 (4)	17:50		18:25	25	16:27 (3)	20:02	22	18:16 (2)	20:36			20:55	
26	07:33		15:14 (4)	06:53		07:04		17:03 (3)	06:11		17:54 (2)	05:35			05:28	
	17:09	12	15:26 (4)	17:51		19:26	22	17:25 (3)	20:03	20	18:14 (2)	20:37			20:55	
27	07:32		15:16 (4)	06:52		07:03		17:04 (3)	06:10		17:56 (2)	05:34			05:28	
	17:11	9	15:25 (4)	17:53		19:28	19	17:23 (3)	20:05	17	18:13 (2)	20:38			20:55	
28	07:31			06:50		07:01		17:07 (3)	06:08		17:57 (2)	05:33			05:29	
	17:12			17:54		19:29	13	17:20 (3)	20:06	14	18:11 (2)	20:39			20:55	
29	07:30					06:59			06:07		18:00 (2)	05:33			05:29	
	17:13					19:30			20:07	9	18:09 (2)	20:40			20:55	
30	07:29					06:57			06:05		18:36 (1)	05:32			05:29	
	17:15					19:31			20:08	2	18:38 (1)	20:41			20:55	
31	07:28					06:55						05:31				
	17:16					19:32						20:42				
Potential sun hours	289			292		368			401			455			462	
Total, worst case		292					520			385			152			
Sun reduction		0.27					0.38			0.43			0.49			
Oper. time red.		1.00					1.00			1.00			1.00			
Wind dir. red.		1.00					1.00			1.00			1.00			
Total reduction		0.27					0.38			0.43			0.49			
Total, real		78					197			165			74			

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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: C - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (3)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	July			August			September			October			November			December		
1	05:30		18:49 (1)	05:56		18:49 (1)	06:30		17:57 (2)	07:04		16:41 (3)	06:42		14:44 (4)	07:21		14:44 (4)
	20:55		19:01 (1)	20:34	12	19:01 (1)	19:47	12	18:09 (2)	18:53	29	17:10 (3)	17:02		14:55 (4)	16:34	11	14:55 (4)
2	05:30		18:48 (1)	05:57		18:48 (1)	06:31		17:59 (2)	07:05		16:42 (3)	06:44		14:45 (4)	07:22		14:45 (4)
	20:54		19:02 (1)	20:33	14	19:02 (1)	19:46	7	18:06 (2)	18:51	27	17:09 (3)	17:00		14:56 (4)	16:33	11	14:56 (4)
3	05:31		18:47 (1)	05:58		18:47 (1)	06:33		18:02 (2)	07:07		16:43 (3)	06:45		14:45 (4)	07:23		14:45 (4)
	20:54		19:01 (1)	20:32	14	19:01 (1)	19:44	2	18:04 (2)	18:49	24	17:07 (3)	16:59		14:56 (4)	16:33	11	14:56 (4)
4	05:31		18:46 (1)	05:59		18:46 (1)	06:34			07:08		16:44 (3)	06:46		14:45 (4)	07:24		14:45 (4)
	20:54		18:59 (1)	20:30	13	18:59 (1)	19:42			18:48	21	17:05 (3)	16:58		14:56 (4)	16:32	11	14:56 (4)
5	05:32		18:46 (1)	06:00		18:46 (1)	06:35			07:09		16:45 (3)	06:48		14:46 (4)	07:25		14:46 (4)
	20:54		18:59 (1)	20:29	13	18:59 (1)	19:40			18:46	18	17:03 (3)	16:56		14:55 (4)	16:32	9	14:55 (4)
6	05:33		18:45 (1)	06:01		18:45 (1)	06:36			07:10		16:48 (3)	06:49		14:46 (4)	07:26		14:46 (4)
	20:54		18:58 (1)	20:28	13	18:58 (1)	19:39			18:44	11	16:59 (3)	16:55		14:55 (4)	16:32	9	14:55 (4)
7	05:33		18:45 (1)	06:02		18:45 (1)	06:37			07:11			06:50		14:47 (4)	07:27		14:47 (4)
	20:53		18:57 (1)	20:26	12	18:57 (1)	19:37			18:42			16:54		14:55 (4)	16:32	8	14:55 (4)
8	05:34		18:44 (1)	06:03		18:44 (1)	06:38			07:12			06:52		14:47 (4)	07:28		14:47 (4)
	20:53		18:55 (1)	20:25	11	18:55 (1)	19:35			18:40			16:53		14:55 (4)	16:32	8	14:55 (4)
9	05:35		18:44 (1)	06:04		18:44 (1)	06:39			07:14			06:53		14:48 (4)	07:29		14:48 (4)
	20:53		18:54 (1)	20:24	10	18:54 (1)	19:33			18:39			16:52		14:55 (4)	16:32	7	14:55 (4)
10	05:35		18:44 (1)	06:06		18:44 (1)	06:40			07:15			06:54		14:48 (4)	07:30		14:48 (4)
	20:52		18:53 (1)	20:22	9	18:53 (1)	19:31			18:37			16:50		14:55 (4)	16:32	7	14:55 (4)
11	05:36		18:44 (1)	06:07		18:44 (1)	06:42			07:16			06:56		14:49 (4)	07:31		14:49 (4)
	20:52		18:52 (1)	20:21	8	18:52 (1)	19:30			18:35			16:49		14:55 (4)	16:31	6	14:55 (4)
12	05:37		18:44 (1)	06:08		18:44 (1)	06:43			07:17			06:57		14:50 (4)	07:32		14:50 (4)
	20:51		18:50 (1)	20:20	6	18:50 (1)	19:28			18:33			16:48		14:55 (4)	16:32	5	14:55 (4)
13	05:38		18:44 (1)	06:09		18:44 (1)	06:44			07:18			06:58		14:50 (4)	07:33		14:50 (4)
	20:51		18:49 (1)	20:18	5	18:49 (1)	19:26			18:32			16:47		14:55 (4)	16:32	5	14:55 (4)
14	05:38		18:45 (1)	06:10		18:45 (1)	06:45			07:20			06:59		14:50 (4)	07:33		14:50 (4)
	20:50		18:47 (1)	20:17	2	18:47 (1)	19:24			18:30			16:46		14:55 (4)	16:32	5	14:55 (4)
15	05:39		18:09 (2)	06:11		18:09 (2)	06:46			07:21			07:01		14:51 (4)	07:34		14:51 (4)
	20:49		18:15 (2)	20:15	6	18:15 (2)	19:22			18:28			16:45		14:55 (4)	16:32	4	14:55 (4)
16	05:40		18:05 (2)	06:12		18:05 (2)	06:47		16:59 (3)	07:22			07:02		14:53 (4)	07:35		14:52 (4)
	20:49		18:18 (2)	20:14	13	18:18 (2)	19:20	7	17:06 (3)	18:27			16:44	3	14:56 (4)	16:32	4	14:56 (4)
17	05:41		18:03 (2)	06:13		18:03 (2)	06:48		16:55 (3)	07:23			07:03		14:49 (4)	07:36		14:53 (4)
	20:48		18:19 (2)	20:12	16	18:19 (2)	19:19	15	17:10 (3)	18:25			16:43	11	15:00 (4)	16:32	3	14:56 (4)
18	05:42		18:01 (2)	06:15		18:01 (2)	06:49		16:52 (3)	07:25			07:05		14:46 (4)	07:37		14:53 (4)
	20:47		18:20 (2)	20:11	19	18:20 (2)	19:17	20	17:12 (3)	18:23			16:42	13	14:59 (4)	16:33	3	14:56 (4)
19	05:43		18:00 (2)	06:16		18:00 (2)	06:51		16:50 (3)	07:26			07:06		14:46 (4)	07:37		14:54 (4)
	20:47		18:21 (2)	20:09	21	18:21 (2)	19:15	23	17:13 (3)	18:22			16:41	13	14:59 (4)	16:33	2	14:56 (4)
20	05:44		17:58 (2)	06:17		17:58 (2)	06:52		16:48 (3)	07:27			07:07		14:44 (4)	07:38		14:55 (4)
	20:46		18:22 (2)	20:07	24	18:22 (2)	19:13	26	17:14 (3)	18:20			16:40	14	14:58 (4)	16:33	2	14:57 (4)
21	05:45		17:57 (2)	06:18		17:57 (2)	06:53		16:46 (3)	07:28			07:09		14:44 (4)	07:38		14:55 (4)
	20:45		18:22 (2)	20:06	25	18:22 (2)	19:11	28	17:14 (3)	18:18			16:40	14	14:58 (4)	16:34	2	14:57 (4)
22	05:46		17:57 (2)	06:19		17:57 (2)	06:54		16:45 (3)	07:30			07:10		14:44 (4)	07:39		14:55 (4)
	20:44		18:23 (2)	20:04	26	18:23 (2)	19:09	30	17:15 (3)	18:17			16:39	13	14:57 (4)	16:34	3	14:58 (4)
23	05:47		17:57 (2)	06:20		17:57 (2)	06:55		16:44 (3)	07:31			07:11		14:43 (4)	07:39		14:55 (4)
	20:43		18:23 (2)	20:03	26	18:23 (2)	19:08	31	17:15 (3)	18:15			16:38	14	14:57 (4)	16:35	3	14:58 (4)
24	05:48		17:56 (2)	06:21		17:56 (2)	06:56		16:43 (3)	07:32			07:12		14:43 (4)	07:40		14:56 (4)
	20:42		18:23 (2)	20:01	27	18:23 (2)	19:06	31	17:14 (3)	18:14			16:37	14	14:57 (4)	16:35	2	14:58 (4)
25	05:49		17:55 (2)	06:22		17:55 (2)	06:57		16:42 (3)	07:33			07:14		14:43 (4)	07:40		14:57 (4)
	20:41		18:22 (2)	19:59	27	18:22 (2)	19:04	32	17:14 (3)	18:12			16:37	14	14:57 (4)	16:36	2	14:59 (4)
26	05:50		17:55 (2)	06:24		17:55 (2)	06:58		16:42 (3)	07:35			07:15		14:43 (4)	07:41		14:57 (4)
	20:40		18:22 (2)	19:58	27	18:22 (2)	19:02	33	17:15 (3)	18:11			16:36	13	14:56 (4)	16:36	2	14:59 (4)
27	05:51		17:55 (2)	06:25		17:55 (2)	07:00		16:41 (3)	07:36			07:16		14:43 (4)	07:41		14:57 (4)
	20:39		18:21 (2)	19:56	26	18:21 (2)	19:00	33	17:14 (3)	18:09			16:35	13	14:56 (4)	16:37	3	15:00 (4)
28	05:52		17:55 (2)	06:26		17:55 (2)	07:01		16:41 (3)	07:37			07:17		14:43 (4)	07:42		14:58 (4)
	20:38		18:20 (2)	19:54	25	18:20 (2)	18:58	32	17:13 (3)	18:08			16:35	13	14:56 (4)	16:38	3	15:01 (4)
29	05:53		17:55 (2)	06:27		17:55 (2)	07:02		16:41 (3)	06:39			07:18		14:43 (4)	07:42		14:58 (4)
	20:37		18:19 (2)	19:53	24	18:19 (2)	18:57	31	17:12 (3)	17:06			16:34	13	14:56 (4)	16:38	4	15:02 (4)
30	05:54		17:55 (2)	06:28		17:55 (2)	07:03		16:41 (3)	06:40			07:19		14:43 (4)	07:42		14:58 (4)
	20:36		18:15 (2)	19:51	20	18:15 (2)	18:55	30	17:11 (3)	17:05			16:34	12	14:55 (4)	16:39	4	15:02 (4)
31	05:55	18:51 (1)	17:56 (2)	06:29		17:56 (2)				06:41						07:42		14:58 (4)
	20:35	9	19:00 (1)	19:49	16	18:12 (2)				17:03						16:40	5	15:03 (4)
Potential sun hours	468			434			377			343			292			279		
Total, worst case	9			510			423			130			187			164		
Sun reduction	0.62			0.60			0.53			0.44			0.30			0.28		
Oper. time red.	1.00			1.00			1.00			1.00			1.00			1.00		
Wind dir. red.	1.00			1.00			1.00			1.00			1.00			1.00		
Total reduction	0.62			0.60			0.53			0.44			0.30			0.28		
Total, real	6			306			225			57			57			47		

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

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

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sse / s.screnci@tauw.com
Calculated:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: D - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (4)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January			February			March			April			May			June		
1	07:43		08:09 (4)	07:28			06:48		07:13 (3)	06:54		07:44 (2)	06:04		06:50 (1)	05:31		07:08 (1)
	16:41	3	08:12 (4)	17:18			17:55	22	07:35 (3)	19:34	23	08:07 (2)	20:10	40	07:30 (1)	20:42	4	07:12 (1)
2	07:43		08:09 (4)	07:26			06:47		07:13 (3)	06:52		07:45 (2)	06:02		06:50 (1)	05:30		
	16:42	4	08:13 (4)	17:19			17:57	21	07:34 (3)	19:35	20	08:05 (2)	20:11	41	07:31 (1)	20:43		
3	07:43		08:09 (4)	07:25			06:45		07:13 (3)	06:50		07:47 (2)	06:01		06:49 (1)	05:30		
	16:43	4	08:13 (4)	17:20			17:58	20	07:33 (3)	19:36	16	08:03 (2)	20:12	41	07:30 (1)	20:44		
4	07:43		08:09 (4)	07:24			06:43		07:13 (3)	06:48		07:50 (2)	05:59		06:49 (1)	05:29		
	16:44	5	08:14 (4)	17:22			17:59	19	07:32 (3)	19:37	10	08:00 (2)	20:13	42	07:31 (1)	20:45		
5	07:43		08:09 (4)	07:23			06:42		07:15 (3)	06:47			05:58		06:49 (1)	05:29		
	16:45	5	08:14 (4)	17:23			18:00	16	07:31 (3)	19:38			20:14	42	07:31 (1)	20:46		
6	07:43		08:09 (4)	07:22			06:40		07:16 (3)	06:45			05:57		06:48 (1)	05:29		
	16:46	6	08:15 (4)	17:24			18:02	13	07:29 (3)	19:40			20:15	42	07:30 (1)	20:46		
7	07:43		08:09 (4)	07:21			06:38		07:20 (3)	06:43			05:55		06:48 (1)	05:28		
	16:47	6	08:15 (4)	17:26			18:03	4	07:24 (3)	19:41			20:17	43	07:31 (1)	20:47		
8	07:43		08:09 (4)	07:19			06:37			06:41			05:54		06:48 (1)	05:28		
	16:48	7	08:16 (4)	17:27			18:04			19:42			20:18	43	07:31 (1)	20:48		
9	07:42		08:08 (4)	07:18			06:35			06:39			05:53		06:48 (1)	05:28		
	16:49	7	08:15 (4)	17:28			18:06			19:43			20:19	43	07:31 (1)	20:48		
10	07:42		08:08 (4)	07:17			06:33			06:38			05:51		06:48 (1)	05:27		
	16:50	8	08:16 (4)	17:30			18:07			19:44			20:20	43	07:31 (1)	20:49		
11	07:42		08:08 (4)	07:16			06:31			06:36			05:50		06:48 (1)	05:27		
	16:51	8	08:16 (4)	17:31			18:08			19:46			20:21	42	07:30 (1)	20:50		
12	07:42		08:07 (4)	07:14			06:30			06:34			05:49		06:48 (1)	05:27		
	16:52	9	08:16 (4)	17:33			18:09			19:47			20:22	42	07:30 (1)	20:50		
13	07:41		08:07 (4)	07:13			06:28			06:32			05:48		06:48 (1)	05:27		
	16:53	9	08:16 (4)	17:34			18:11			19:48			20:23	41	07:29 (1)	20:51		
14	07:41		08:06 (4)	07:12			06:26			06:31			05:47		06:48 (1)	05:27		
	16:54	9	08:15 (4)	17:35			18:12			19:49			20:25	41	07:29 (1)	20:51		
15	07:40		08:06 (4)	07:10			06:24			06:29			05:46		06:49 (1)	05:26		
	16:55	9	08:15 (4)	17:37			18:13			19:50			20:26	40	07:29 (1)	20:52		
16	07:40		08:05 (4)	07:09			06:23			06:27			05:44		06:49 (1)	05:26		
	16:57	9	08:14 (4)	17:38			18:14			19:52			20:27	39	07:28 (1)	20:52		
17	07:39		08:05 (4)	07:07			06:21		06:57 (2)	06:26			05:43		06:50 (1)	05:26		
	16:58	9	08:14 (4)	17:39			18:15	7	07:04 (2)	19:53			20:28	38	07:28 (1)	20:53		
18	07:39		08:06 (4)	07:06			06:19		06:53 (2)	06:24			05:42		06:50 (1)	05:26		
	16:59	6	08:12 (4)	17:41			18:17	15	07:08 (2)	19:54			20:29	37	07:27 (1)	20:53		
19	07:38			07:04			06:17		06:51 (2)	06:22			05:41		06:51 (1)	05:27		
	17:00			17:42			18:18	19	07:10 (2)	19:55			20:30	36	07:27 (1)	20:53		
20	07:38			07:03			06:15		06:49 (2)	06:21			05:40		06:51 (1)	05:27		
	17:02			17:43			18:19	22	07:11 (2)	19:56			20:31	35	07:26 (1)	20:54		
21	07:37			07:01		07:24 (3)	06:14		06:47 (2)	06:19			05:39		06:52 (1)	05:27		
	17:03			17:45	6	07:30 (3)	18:20	25	07:12 (2)	19:58			20:32	33	07:25 (1)	20:54		
22	07:36			07:00		07:22 (3)	06:12		06:46 (2)	06:17		07:05 (1)	05:38		06:53 (1)	05:27		
	17:04			17:46	10	07:32 (3)	18:22	26	07:12 (2)	19:59	13	07:18 (1)	20:33	32	07:25 (1)	20:54		
23	07:36			06:58		07:21 (3)	06:10		06:45 (2)	06:16		07:02 (1)	05:38		06:54 (1)	05:27		
	17:05			17:47	13	07:34 (3)	18:23	28	07:13 (2)	20:00	20	07:22 (1)	20:34	30	07:24 (1)	20:54		
24	07:35			06:57		07:19 (3)	06:08		06:45 (2)	06:14		06:59 (1)	05:37		06:55 (1)	05:27		
	17:07			17:49	15	07:34 (3)	18:24	29	07:14 (2)	20:01	24	07:23 (1)	20:35	28	07:23 (1)	20:55		
25	07:34			06:55		07:17 (3)	06:06		06:44 (2)	06:13		06:58 (1)	05:36		06:55 (1)	05:28		
	17:08			17:50	18	07:35 (3)	18:25	29	07:13 (2)	20:02	27	07:25 (1)	20:36	27	07:22 (1)	20:55		
26	07:33			06:53		07:16 (3)	07:04		07:43 (2)	06:11		06:55 (1)	05:35		06:57 (1)	05:28		
	17:09			17:51	20	07:36 (3)	19:26	30	08:13 (2)	20:04	31	07:26 (1)	20:37	25	07:22 (1)	20:55		
27	07:32			06:52		07:14 (3)	07:03		07:43 (2)	06:10		06:55 (1)	05:34		06:58 (1)	05:28		
	17:11			17:53	21	07:35 (3)	19:28	29	08:12 (2)	20:05	33	07:28 (1)	20:38	23	07:21 (1)	20:55		
28	07:31			06:50		07:12 (3)	07:01		07:43 (2)	06:08		06:53 (1)	05:34		06:59 (1)	05:29		
	17:12			17:54	23	07:35 (3)	19:29	28	08:11 (2)	20:06	35	07:28 (1)	20:39	20	07:19 (1)	20:55		
29	07:31						06:59		07:42 (2)	06:07		06:52 (1)	05:33		07:01 (1)	05:29		
	17:13						19:30	28	08:10 (2)	20:07	37	07:29 (1)	20:40	18	07:19 (1)	20:55		
30	07:30						06:57		07:44 (2)	06:05		06:51 (1)	05:32		07:02 (1)	05:30		
	17:15						19:31	26	08:10 (2)	20:08	38	07:29 (1)	20:41	15	07:17 (1)	20:55		
31	07:29						06:55		07:44 (2)				05:32		07:05 (1)			
	17:16						19:32	25	08:09 (2)				20:42	10	07:15 (1)			
Potential sun hours	289			292			368			401			455			462		
Total, worst case		123			126			481			327			1072			4	
Sun reduction		0.27			0.32			0.38			0.43			0.49			0.54	
Oper. time red.		1.00			1.00			1.00			1.00			1.00			1.00	
Wind dir. red.		1.00			1.00			1.00			1.00			1.00			1.00	
Total reduction		0.27			0.32			0.38			0.43			0.49			0.54	
Total, real		33			40			182			140			522			2	

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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: D - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (4)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	July			August			September			October			November			December		
1	05:30			05:56		06:59 (1)	06:30			07:04			06:43			07:21		07:48 (4)
	20:55			20:34	41	07:40 (1)	19:48			18:53			17:02			16:34	9	07:57 (4)
2	05:30			05:57		06:59 (1)	06:32			07:06			06:44			07:22		07:50 (4)
	20:55			20:33	42	07:41 (1)	19:46			18:51			17:01			16:33	8	07:58 (4)
3	05:31			05:58		06:59 (1)	06:33			07:07			06:45			07:23		07:51 (4)
	20:54			20:32	42	07:41 (1)	19:44			18:49			16:59			16:33	8	07:59 (4)
4	05:32			05:59		06:58 (1)	06:34			07:08			06:46			07:24		07:52 (4)
	20:54			20:30	43	07:41 (1)	19:42			18:48			16:58			16:33	8	08:00 (4)
5	05:32			06:00		06:58 (1)	06:35			07:09			06:48			07:25		07:53 (4)
	20:54			20:29	43	07:41 (1)	19:41			18:46			16:57			16:32	7	08:00 (4)
6	05:33			06:01		06:58 (1)	06:36			07:10			06:49			07:26		07:54 (4)
	20:54			20:28	43	07:41 (1)	19:39			18:44			16:55			16:32	7	08:01 (4)
7	05:33			06:02		06:58 (1)	06:37			07:11			06:50			07:27		07:55 (4)
	20:53			20:27	43	07:41 (1)	19:37			18:42			16:54			16:32	6	08:01 (4)
8	05:34			06:03		06:58 (1)	06:38			07:13		07:56 (3)	06:52			07:28		07:56 (4)
	20:53			20:25	43	07:41 (1)	19:35			18:41	4	08:00 (3)	16:53			16:32	6	08:02 (4)
9	05:35			06:05		06:58 (1)	06:39			07:14		07:52 (3)	06:53			07:29		07:57 (4)
	20:53			20:24	42	07:40 (1)	19:33			18:39	12	08:04 (3)	16:52			16:32	5	08:02 (4)
10	05:35			06:06		06:58 (1)	06:41		07:42 (2)	07:15		07:49 (3)	06:54			07:30		07:58 (4)
	20:52			20:23	42	07:40 (1)	19:32	13	07:55 (2)	18:37	16	08:05 (3)	16:50			16:32	5	08:03 (4)
11	05:36			06:07		06:58 (1)	06:42		07:39 (2)	07:16		07:48 (3)	06:56			07:31		07:59 (4)
	20:52			20:21	42	07:40 (1)	19:30	18	07:57 (2)	18:35	19	08:07 (3)	16:49			16:32	4	08:03 (4)
12	05:37			06:08		06:58 (1)	06:43		07:37 (2)	07:17		07:47 (3)	06:57			07:32		08:00 (4)
	20:51			20:20	41	07:39 (1)	19:28	21	07:58 (2)	18:34	20	08:07 (3)	16:48			16:32	4	08:04 (4)
13	05:38		07:16 (1)	06:09		06:59 (1)	06:44		07:36 (2)	07:19		07:46 (3)	06:58			07:33		08:01 (4)
	20:51	4	07:20 (1)	20:18	39	07:38 (1)	19:26	23	07:59 (2)	18:32	21	08:07 (3)	16:47			16:32	3	08:04 (4)
14	05:39		07:13 (1)	06:10		06:59 (1)	06:45		07:34 (2)	07:20		07:45 (3)	07:00			07:34		08:02 (4)
	20:50	10	07:23 (1)	20:17	39	07:38 (1)	19:24	26	08:00 (2)	18:30	22	08:07 (3)	16:46			16:32	3	08:05 (4)
15	05:39		07:11 (1)	06:11		06:59 (1)	06:46		07:33 (2)	07:21		07:45 (3)	07:01			07:34		08:02 (4)
	20:50	15	07:26 (1)	20:15	38	07:37 (1)	19:22	27	08:00 (2)	18:28	23	08:08 (3)	16:45			16:32	3	08:05 (4)
16	05:40		07:10 (1)	06:12		07:00 (1)	06:47		07:33 (2)	07:22		07:46 (3)	07:02			07:35		08:03 (4)
	20:49	18	07:28 (1)	20:14	36	07:36 (1)	19:21	28	08:01 (2)	18:27	22	08:08 (3)	16:44			16:32	2	08:05 (4)
17	05:41		07:08 (1)	06:14		07:01 (1)	06:48		07:32 (2)	07:23		07:47 (3)	07:04			07:36		08:04 (4)
	20:48	20	07:28 (1)	20:12	33	07:34 (1)	19:19	29	08:01 (2)	18:25	20	08:07 (3)	16:43			16:32	2	08:06 (4)
18	05:42		07:07 (1)	06:15		07:01 (1)	06:50		07:31 (2)	07:25		07:49 (3)	07:05			07:37		08:04 (4)
	20:48	23	07:30 (1)	20:11	32	07:33 (1)	19:17	30	08:01 (2)	18:23	18	08:07 (3)	16:42			16:33	2	08:06 (4)
19	05:43		07:06 (1)	06:16		07:03 (1)	06:51		07:31 (2)	07:26		07:50 (3)	07:06			07:37		08:05 (4)
	20:47	25	07:31 (1)	20:09	28	07:31 (1)	19:15	29	08:00 (2)	18:22	16	08:06 (3)	16:41			16:33	2	08:07 (4)
20	05:44		07:05 (1)	06:17		07:05 (1)	06:52		07:31 (2)	07:27		07:51 (3)	07:07			07:38		08:06 (4)
	20:46	27	07:32 (1)	20:08	25	07:30 (1)	19:13	29	08:00 (2)	18:20	13	08:04 (3)	16:41			16:33	1	08:07 (4)
21	05:45		07:05 (1)	06:18		07:07 (1)	06:53		07:30 (2)	07:28		07:52 (3)	07:09			07:39		08:06 (4)
	20:45	28	07:33 (1)	20:06	21	07:28 (1)	19:11	29	07:59 (2)	18:19	11	08:03 (3)	16:40			16:34	1	08:07 (4)
22	05:46		07:04 (1)	06:19		07:09 (1)	06:54		07:30 (2)	07:30		07:54 (3)	07:10			07:39		08:07 (4)
	20:44	30	07:34 (1)	20:04	16	07:25 (1)	19:10	28	07:58 (2)	18:17	7	08:01 (3)	16:39			16:34	1	08:08 (4)
23	05:47		07:03 (1)	06:20		07:14 (1)	06:55		07:31 (2)	07:31		07:55 (3)	07:11			07:40		08:07 (4)
	20:43	32	07:35 (1)	20:03	5	07:19 (1)	19:08	26	07:57 (2)	18:15	2	07:57 (3)	16:38			16:35	1	08:08 (4)
24	05:48		07:03 (1)	06:21			06:56		07:31 (2)	07:32			07:12			07:40		08:08 (4)
	20:43	33	07:36 (1)	20:01			19:06	25	07:56 (2)	18:14			16:37			16:35	1	08:09 (4)
25	05:49		07:02 (1)	06:23			06:57		07:33 (2)	07:34			07:14			07:41		08:08 (4)
	20:42	35	07:37 (1)	19:59			19:04	22	07:55 (2)	18:12			16:37			16:36	1	08:09 (4)
26	05:50		07:02 (1)	06:24			06:59		07:34 (2)	07:35			07:15		07:43 (4)	07:41		08:08 (4)
	20:41	36	07:38 (1)	19:58			19:02	19	07:53 (2)	18:11			16:36	7	07:50 (4)	16:36	2	08:10 (4)
27	05:51		07:01 (1)	06:25			07:00		07:36 (2)	07:36			07:16		07:44 (4)	07:41		08:09 (4)
	20:40	37	07:38 (1)	19:56			19:00	14	07:50 (2)	18:09			16:36	9	07:53 (4)	16:37	2	08:11 (4)
28	05:52		07:01 (1)	06:26			07:01		07:39 (2)	07:37			07:17		07:45 (4)	07:42		08:09 (4)
	20:39	38	07:39 (1)	19:54			18:59	6	07:45 (2)	18:08			16:35	9	07:54 (4)	16:38	2	08:11 (4)
29	05:53		06:59 (1)	06:27			07:02			06:39			07:18		07:46 (4)	07:42		08:09 (4)
	20:37	39	07:38 (1)	19:53			18:57			17:06			16:35	9	07:55 (4)	16:38	2	08:11 (4)
30	05:54		06:59 (1)	06:28			07:03			06:40			07:20		07:47 (4)	07:42		08:09 (4)
	20:36	40	07:39 (1)	19:51			18:55			17:05			16:34	9	07:56 (4)	16:39	3	08:12 (4)
31	05:55		06:59 (1)	06:29						06:41						07:42		08:09 (4)
	20:35	40	07:39 (1)	19:49						17:03						16:40	3	08:12 (4)
Potential sun hours	468			434			377			343			292			279		
Total, worst case		530			819			442			246			43			114	
Sun reduction		0.62			0.60			0.53			0.44			0.30			0.28	
Oper. time red.		1.00			1.00			1.00			1.00			1.00			1.00	
Wind dir. red.		1.00			1.00			1.00			1.00			1.00			1.00	
Total reduction		0.62			0.60			0.53			0.44			0.30			0.28	
Total, real		329			491			235			108			13			32	

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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: E - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (5)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January		February		March		April		May	June
1	07:43	14:42 (3)	07:27	14:51 (3)	06:48	16:08 (2)	06:54	17:57 (1)	06:04	05:31
	16:41 20	15:02 (3)	17:17 26	15:17 (3)	17:55 19	16:27 (2)	19:34 25	18:22 (1)	20:09	20:42
2	07:43	14:42 (3)	07:26	14:52 (3)	06:47	16:07 (2)	06:52	17:57 (1)	06:02	05:30
	16:42 21	15:03 (3)	17:19 24	15:16 (3)	17:56 22	16:29 (2)	19:35 25	18:22 (1)	20:11	20:43
3	07:43	14:42 (3)	07:25	14:54 (3)	06:45	16:05 (2)	06:50	17:57 (1)	06:01	05:30
	16:43 22	15:04 (3)	17:20 21	15:15 (3)	17:58 25	16:30 (2)	19:36 24	18:21 (1)	20:12	20:44
4	07:43	14:42 (3)	07:24	14:56 (3)	06:43	16:04 (2)	06:48	17:57 (1)	05:59	05:29
	16:44 23	15:05 (3)	17:21 18	15:14 (3)	17:59 27	16:31 (2)	19:37 24	18:21 (1)	20:13	20:45
5	07:43	14:42 (3)	07:23	14:58 (3)	06:42	16:04 (2)	06:46	17:58 (1)	05:58	05:29
	16:45 24	15:06 (3)	17:23 13	15:11 (3)	18:00 28	16:32 (2)	19:38 22	18:20 (1)	20:14	20:46
6	07:43	14:43 (3)	07:22		06:40	16:03 (2)	06:45	17:58 (1)	05:57	05:28
	16:45 24	15:07 (3)	17:24		18:02 29	16:32 (2)	19:40 21	18:19 (1)	20:15	20:46
7	07:43	14:43 (3)	07:21		06:38	16:02 (2)	06:43	17:59 (1)	05:55	05:28
	16:46 26	15:09 (3)	17:26		18:03 30	16:32 (2)	19:41 18	18:17 (1)	20:16	20:47
8	07:42	14:43 (3)	07:19		06:37	16:02 (2)	06:41	18:01 (1)	05:54	05:28
	16:47 27	15:10 (3)	17:27		18:04 30	16:32 (2)	19:42 15	18:16 (1)	20:18	20:48
9	07:42	14:42 (3)	07:18		06:35	16:02 (2)	06:39	18:03 (1)	05:53	05:27
	16:49 28	15:10 (3)	17:28		18:05 30	16:32 (2)	19:43 10	18:13 (1)	20:19	20:48
10	07:42	14:43 (3)	07:17		06:33	16:02 (2)	06:38		05:51	05:27
	16:50 28	15:11 (3)	17:30		18:07 30	16:32 (2)	19:44		20:20	20:49
11	07:42	14:43 (3)	07:16		06:31	16:02 (2)	06:36		05:50	05:27
	16:51 29	15:12 (3)	17:31		18:08 29	16:31 (2)	19:46		20:21	20:50
12	07:41	14:42 (3)	07:14		06:30	16:02 (2)	06:34		05:49	05:27
	16:52 30	15:12 (3)	17:32		18:09 28	16:30 (2)	19:47		20:22	20:50
13	07:41	14:43 (3)	07:13		06:28	16:03 (2)	06:32		05:48	05:27
	16:53 31	15:14 (3)	17:34		18:10 26	16:29 (2)	19:48		20:23	20:51
14	07:41	14:42 (3)	07:11		06:26	16:04 (2)	06:31		05:47	05:26
	16:54 32	15:14 (3)	17:35		18:12 25	16:29 (2)	19:49		20:24	20:51
15	07:40	14:43 (3)	07:10		06:24	16:05 (2)	06:29		05:45	05:26
	16:55 32	15:15 (3)	17:37		18:13 22	16:27 (2)	19:50		20:26	20:52
16	07:40	14:43 (3)	07:09		06:22	16:07 (2)	06:27		05:44	05:26
	16:57 32	15:15 (3)	17:38		18:14 18	16:25 (2)	19:51		20:27	20:52
17	07:39	14:43 (3)	07:07		06:21	16:09 (2)	06:26		05:43	05:26
	16:58 33	15:16 (3)	17:39		18:15 13	16:22 (2)	19:53		20:28	20:53
18	07:39	14:43 (3)	07:06		06:19	16:14 (2)	06:24		05:42	05:26
	16:59 34	15:17 (3)	17:41		18:17 2	16:16 (2)	19:54		20:29	20:53
19	07:38	14:43 (3)	07:04		06:17		06:22		05:41	05:26
	17:00 34	15:17 (3)	17:42		18:18		19:55		20:30	20:53
20	07:38	14:44 (3)	07:03		06:15		06:21		05:40	05:26
	17:01 34	15:18 (3)	17:43		18:19		19:56		20:31	20:54
21	07:37	14:44 (3)	07:01		06:13		06:19		05:39	05:27
	17:03 34	15:18 (3)	17:45		18:20		19:57		20:32	20:54
22	07:36	14:44 (3)	07:00		06:12		06:17		05:38	05:27
	17:04 34	15:18 (3)	17:46		18:21		19:59		20:33	20:54
23	07:36	14:44 (3)	06:58		06:10		06:16		05:37	05:27
	17:05 34	15:18 (3)	17:47		18:23		20:00		20:34	20:54
24	07:35	14:44 (3)	06:56		06:08		06:14		05:37	05:27
	17:07 35	15:19 (3)	17:49		18:24		20:01		20:35	20:54
25	07:34	14:45 (3)	06:55		06:06	17:07 (1)	06:13		05:36	05:28
	17:08 34	15:19 (3)	17:50		18:25 7	17:14 (1)	20:02		20:36	20:55
26	07:33	14:45 (3)	06:53		07:04	18:04 (1)	06:11		05:35	05:28
	17:09 34	15:19 (3)	17:51		19:26 12	18:16 (1)	20:03		20:37	20:55
27	07:32	14:46 (3)	06:52	16:15 (2)	07:03	18:02 (1)	06:10		05:34	05:28
	17:11 32	15:18 (3)	17:53 7	16:22 (2)	19:28 16	18:18 (1)	20:05		20:38	20:55
28	07:31	14:46 (3)	06:50	16:11 (2)	07:01	18:00 (1)	06:08		05:33	05:29
	17:12 32	15:18 (3)	17:54 14	16:25 (2)	19:29 19	18:19 (1)	20:06		20:39	20:55
29	07:30	14:47 (3)			06:59	17:59 (1)	06:07		05:33	05:29
	17:13 31	15:18 (3)			19:30 21	18:20 (1)	20:07		20:40	20:55
30	07:29	14:48 (3)			06:57	17:59 (1)	06:05		05:32	05:29
	17:15 30	15:18 (3)			19:31 22	18:21 (1)	20:08		20:41	20:55
31	07:28	14:49 (3)			06:55	17:58 (1)			05:31	
	17:16 28	15:17 (3)			19:32 24	18:22 (1)			20:42	
Potential sun hours	289		292		368		401		455	462
Total, worst case	922		123		554		184			
Sun reduction	0.27		0.32		0.38		0.43			
Oper. time red.	1.00		1.00		1.00		1.00			
Wind dir. red.	1.00		1.00		1.00		1.00			
Total reduction	0.27		0.32		0.38		0.43			
Total, real	245		39		210		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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: E - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (5)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	July		August		September			October			November			December		
1	05:30		05:56		06:30			07:04		16:43 (2)	06:42			07:21		14:24 (3)
	20:55		20:34		19:47			18:53	25	17:08 (2)	17:02			16:34	30	14:54 (3)
2	05:30		05:57		06:31			07:05		16:42 (2)	06:44			07:22		14:25 (3)
	20:55		20:33		19:46			18:51	27	17:09 (2)	17:00			16:33	30	14:55 (3)
3	05:31		05:58		06:33			07:07		16:41 (2)	06:45			07:23		14:26 (3)
	20:54		20:32		19:44			18:49	28	17:09 (2)	16:59			16:33	29	14:55 (3)
4	05:31		05:59		06:34		18:02 (1)	07:08		16:40 (2)	06:46			07:24		14:26 (3)
	20:54		20:30		19:42	5	18:07 (1)	18:48	29	17:09 (2)	16:58			16:32	29	14:55 (3)
5	05:32		06:00		06:35		17:59 (1)	07:09		16:39 (2)	06:48			07:25		14:27 (3)
	20:54		20:29		19:40	13	18:12 (1)	18:46	30	17:09 (2)	16:56			16:32	27	14:54 (3)
6	05:33		06:01		06:36		17:57 (1)	07:10		16:38 (2)	06:49			07:26		14:28 (3)
	20:54		20:28		19:39	16	18:13 (1)	18:44	30	17:08 (2)	16:55			16:32	26	14:54 (3)
7	05:33		06:02		06:37		17:55 (1)	07:11		16:39 (2)	06:50		14:31 (3)	07:27		14:29 (3)
	20:53		20:27		19:37	19	18:14 (1)	18:42	30	17:09 (2)	16:54	9	14:40 (3)	16:32	25	14:54 (3)
8	05:34		06:03		06:38		17:53 (1)	07:12		16:38 (2)	06:52		14:27 (3)	07:28		14:30 (3)
	20:53		20:25		19:35	22	18:15 (1)	18:40	30	17:08 (2)	16:53	15	14:42 (3)	16:32	24	14:54 (3)
9	05:35		06:04		06:39		17:52 (1)	07:14		16:38 (2)	06:53		14:25 (3)	07:29		14:30 (3)
	20:53		20:24		19:33	23	18:15 (1)	18:39	29	17:07 (2)	16:52	20	14:45 (3)	16:32	24	14:54 (3)
10	05:35		06:06		06:40		17:51 (1)	07:15		16:38 (2)	06:54		14:23 (3)	07:30		14:31 (3)
	20:52		20:22		19:31	24	18:15 (1)	18:37	28	17:06 (2)	16:50	23	14:46 (3)	16:32	23	14:54 (3)
11	05:36		06:07		06:42		17:50 (1)	07:16		16:38 (2)	06:56		14:23 (3)	07:31		14:32 (3)
	20:52		20:21		19:30	25	18:15 (1)	18:35	27	17:05 (2)	16:49	25	14:48 (3)	16:31	22	14:54 (3)
12	05:37		06:08		06:43		17:49 (1)	07:17		16:39 (2)	06:57		14:21 (3)	07:32		14:33 (3)
	20:51		20:20		19:28	25	18:14 (1)	18:33	26	17:05 (2)	16:48	28	14:49 (3)	16:32	21	14:54 (3)
13	05:38		06:09		06:44		17:49 (1)	07:18		16:40 (2)	06:58		14:20 (3)	07:33		14:34 (3)
	20:51		20:18		19:26	24	18:13 (1)	18:32	23	17:03 (2)	16:47	29	14:49 (3)	16:32	20	14:54 (3)
14	05:38		06:10		06:45		17:48 (1)	07:20		16:41 (2)	06:59		14:20 (3)	07:34		14:35 (3)
	20:50		20:17		19:24	24	18:12 (1)	18:30	20	17:01 (2)	16:46	30	14:50 (3)	16:32	18	14:53 (3)
15	05:39		06:11		06:46		17:48 (1)	07:21		16:43 (2)	07:01		14:19 (3)	07:34		14:36 (3)
	20:49		20:15		19:22	22	18:10 (1)	18:28	16	16:59 (2)	16:45	32	14:51 (3)	16:32	18	14:54 (3)
16	05:40		06:12		06:47		17:49 (1)	07:22		16:46 (2)	07:02		14:20 (3)	07:35		14:37 (3)
	20:49		20:14		19:20	20	18:09 (1)	18:27	9	16:55 (2)	16:44	32	14:52 (3)	16:32	17	14:54 (3)
17	05:41		06:13		06:48		17:50 (1)	07:23			07:03		14:19 (3)	07:36		14:38 (3)
	20:48		20:12		19:19	18	18:08 (1)	18:25			16:43	33	14:52 (3)	16:32	16	14:54 (3)
18	05:42		06:15		06:49		17:51 (1)	07:25			07:05		14:19 (3)	07:37		14:38 (3)
	20:47		20:11		19:17	15	18:06 (1)	18:23			16:42	33	14:52 (3)	16:33	16	14:54 (3)
19	05:43		06:16		06:51		17:52 (1)	07:26			07:06		14:19 (3)	07:37		14:39 (3)
	20:47		20:09		19:15	11	18:03 (1)	18:22			16:41	34	14:53 (3)	16:33	15	14:54 (3)
20	05:44		06:17		06:52		17:55 (1)	07:27			07:07		14:19 (3)	07:38		14:40 (3)
	20:46		20:08		19:13	6	18:01 (1)	18:20			16:40	34	14:53 (3)	16:33	15	14:55 (3)
21	05:45		06:18		06:53			07:28			07:09		14:20 (3)	07:38		14:40 (3)
	20:45		20:06		19:11			18:18			16:40	34	14:54 (3)	16:34	15	14:55 (3)
22	05:46		06:19		06:54			07:30			07:10		14:19 (3)	07:39		14:41 (3)
	20:44		20:04		19:09			18:17			16:39	35	14:54 (3)	16:34	15	14:56 (3)
23	05:47		06:20		06:55			07:31			07:11		14:19 (3)	07:40		14:41 (3)
	20:43		20:03		19:08			18:15			16:38	35	14:54 (3)	16:35	15	14:56 (3)
24	05:48		06:21		06:56			07:32			07:12		14:20 (3)	07:40		14:42 (3)
	20:42		20:01		19:06			18:14			16:37	35	14:55 (3)	16:35	15	14:57 (3)
25	05:49		06:22		06:57			07:33			07:14		14:21 (3)	07:40		14:42 (3)
	20:41		19:59		19:04			18:12			16:37	33	14:54 (3)	16:36	15	14:57 (3)
26	05:50		06:24		06:59			07:35			07:15		14:21 (3)	07:41		14:42 (3)
	20:40		19:58		19:02			18:11			16:36	33	14:54 (3)	16:36	15	14:57 (3)
27	05:51		06:25		07:00		16:55 (2)	07:36			07:16		14:21 (3)	07:41		14:43 (3)
	20:39		19:56		19:00	5	17:00 (2)	18:09			16:35	33	14:54 (3)	16:37	16	14:59 (3)
28	05:52		06:26		07:01		16:50 (2)	07:37			07:17		14:22 (3)	07:42		14:43 (3)
	20:38		19:54		18:58	14	17:04 (2)	18:08			16:35	33	14:55 (3)	16:38	16	14:59 (3)
29	05:53		06:27		07:02		16:47 (2)	06:39			07:18		14:23 (3)	07:42		14:43 (3)
	20:37		19:53		18:57	19	17:06 (2)	17:06			16:34	32	14:55 (3)	16:38	17	15:00 (3)
30	05:54		06:28		07:03		16:45 (2)	06:40			07:19		14:23 (3)	07:42		14:43 (3)
	20:36		19:51		18:55	22	17:07 (2)	17:05			16:34	31	14:54 (3)	16:39	18	15:01 (3)
31	05:55		06:29					06:41						07:42		14:43 (3)
	20:35		19:49					17:03						16:40	18	15:01 (3)
Potential sun hours	468		434		377			343			292			279		
Total, worst case						372			407			711			620	
Sun reduction						0.53			0.44			0.30			0.28	
Oper. time red.						1.00			1.00			1.00			1.00	
Wind dir. red.						1.00			1.00			1.00			1.00	
Total reduction						0.53			0.44			0.30			0.28	
Total, real						198			179			215			176	

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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sse / s.screnci@tauw.com
Calculated:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: F - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (6)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January		February		March			April			May			June	
1	07:43		07:27		06:48			06:54		07:15 (5)	06:04		06:47 (4)	05:31	
	16:41		17:18		17:55			19:34	23	07:38 (5)	20:09	37	07:24 (4)	20:42	
2	07:43		07:26		06:47			06:52		07:13 (5)	06:02		06:47 (4)	05:30	
	16:42		17:19		17:57			19:35	25	07:38 (5)	20:11	37	07:24 (4)	20:43	
3	07:43		07:25		06:45			06:50		07:12 (5)	06:01		06:46 (4)	05:30	
	16:43		17:20		17:58			19:36	25	07:37 (5)	20:12	37	07:23 (4)	20:44	
4	07:43		07:24		06:43			06:48		07:12 (5)	05:59		06:47 (4)	05:29	
	16:44		17:22		17:59			19:37	26	07:38 (5)	20:13	36	07:23 (4)	20:45	
5	07:43		07:23		06:42			06:46		07:12 (5)	05:58		06:47 (4)	05:29	
	16:45		17:23		18:00			19:38	25	07:37 (5)	20:14	36	07:23 (4)	20:46	
6	07:43		07:22		06:40			06:45		07:12 (5)	05:57		06:47 (4)	05:29	
	16:46		17:24		18:02			19:40	24	07:36 (5)	20:15	34	07:21 (4)	20:46	
7	07:43		07:21		06:38			06:43		07:12 (5)	05:55		06:48 (4)	05:28	
	16:47		17:26		18:03			19:41	23	07:35 (5)	20:16	33	07:21 (4)	20:47	
8	07:42		07:19		06:37			06:41		07:13 (5)	05:54		06:48 (4)	05:28	
	16:48		17:27		18:04			19:42	22	07:35 (5)	20:18	32	07:20 (4)	20:48	
9	07:42		07:18		06:35			06:39		07:13 (5)	05:53		06:49 (4)	05:28	
	16:49		17:28		18:05			19:43	20	07:33 (5)	20:19	31	07:20 (4)	20:48	
10	07:42		07:17		06:33			06:38		07:14 (5)	05:51		06:50 (4)	05:27	
	16:50		17:30		18:07			19:44	17	07:31 (5)	20:20	29	07:19 (4)	20:49	
11	07:42		07:16		06:31			06:36		07:16 (5)	05:50		06:50 (4)	05:27	
	16:51		17:31		18:08			19:46	12	07:28 (5)	20:21	27	07:17 (4)	20:50	
12	07:42		07:14		06:30			06:34		07:21 (5)	05:49		06:51 (4)	05:27	
	16:52		17:33		18:09			19:47	3	07:24 (5)	20:22	25	07:16 (4)	20:50	
13	07:41		07:13		06:28		06:50 (6)	06:32			05:48		06:53 (4)	05:27	
	16:53		17:34		18:10	4	06:54 (6)	19:48			20:23	22	07:15 (4)	20:51	
14	07:41		07:11		06:26		06:48 (6)	06:31			05:47		06:54 (4)	05:27	
	16:54		17:35		18:12	8	06:56 (6)	19:49			20:24	20	07:14 (4)	20:51	
15	07:40		07:10		06:24		06:46 (6)	06:29			05:46		06:56 (4)	05:26	
	16:55		17:37		18:13	10	06:56 (6)	19:50			20:26	16	07:12 (4)	20:52	
16	07:40		07:09		06:22		06:44 (6)	06:27			05:44		06:58 (4)	05:26	
	16:57		17:38		18:14	12	06:56 (6)	19:52			20:27	12	07:10 (4)	20:52	
17	07:39		07:07		06:21		06:42 (6)	06:26		07:04 (4)	05:43			05:26	
	16:58		17:39		18:15	14	06:56 (6)	19:53	7	07:11 (4)	20:28			20:53	
18	07:39		07:06		06:19		06:40 (6)	06:24		07:00 (4)	05:42			05:26	
	16:59		17:41		18:17	16	06:56 (6)	19:54	16	07:16 (4)	20:29			20:53	
19	07:38		07:04		06:17		06:39 (6)	06:22		06:57 (4)	05:41			05:27	
	17:00		17:42		18:18	17	06:56 (6)	19:55	21	07:18 (4)	20:30			20:53	
20	07:38		07:03		06:15		06:37 (6)	06:21		06:55 (4)	05:40			05:27	
	17:02		17:43		18:19	18	06:55 (6)	19:56	24	07:19 (4)	20:31			20:54	
21	07:37		07:01		06:13		06:37 (6)	06:19		06:54 (4)	05:39			05:27	
	17:03		17:45		18:20	17	06:54 (6)	19:58	27	07:21 (4)	20:32			20:54	
22	07:36		07:00		06:12		06:38 (6)	06:17		06:52 (4)	05:38			05:27	
	17:04		17:46		18:22	14	06:52 (6)	19:59	30	07:22 (4)	20:33			20:54	
23	07:36		06:58		06:10		06:39 (6)	06:16		06:51 (4)	05:38			05:27	
	17:05		17:47		18:23	11	06:50 (6)	20:00	32	07:23 (4)	20:34			20:54	
24	07:35		06:57		06:08		06:44 (6)	06:14		06:50 (4)	05:37			05:27	
	17:07		17:49		18:24	2	06:46 (6)	20:01	33	07:23 (4)	20:35			20:55	
25	07:34		06:55		06:06			06:13		06:49 (4)	05:36			05:28	
	17:08		17:50		18:25			20:02	35	07:24 (4)	20:36			20:55	
26	07:33		06:53		07:04			06:11		06:48 (4)	05:35			05:28	
	17:09		17:51		19:26			20:04	36	07:24 (4)	20:37			20:55	
27	07:32		06:52		07:03		07:24 (5)	06:10		06:48 (4)	05:34			05:28	
	17:11		17:53		19:28	8	07:32 (5)	20:05	36	07:24 (4)	20:38			20:55	
28	07:31		06:50		07:01		07:22 (5)	06:08		06:47 (4)	05:34			05:29	
	17:12		17:54		19:29	12	07:34 (5)	20:06	37	07:24 (4)	20:39			20:55	
29	07:30				06:59		07:20 (5)	06:07		06:47 (4)	05:33			05:29	
	17:13				19:30	15	07:35 (5)	20:07	37	07:24 (4)	20:40			20:55	
30	07:30				06:57		07:19 (5)	06:05		06:46 (4)	05:32			05:30	
	17:15				19:31	18	07:37 (5)	20:08	38	07:24 (4)	20:41			20:55	
31	07:29				06:55		07:17 (5)				05:32				
	17:16				19:32	21	07:38 (5)				20:42				
Potential sun hours	289		292		368			401			455			461	
Total, worst case						217			654			464			
Sun reduction						0.38			0.43			0.49			
Oper. time red.						1.00			1.00			1.00			
Wind dir. red.						1.00			1.00			1.00			
Total reduction						0.38			0.43			0.49			
Total, real						82			280			226			

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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: F - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (6)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	July			August			September			October			November	December
1	05:30			05:56		07:04 (4)	06:30			07:04		07:27 (6)	06:42	07:21
	20:55			20:34	22	07:26 (4)	19:48			18:53	7	07:34 (6)	17:02	16:34
2	05:31			05:57		07:03 (4)	06:32		07:16 (5)	07:05		07:29 (6)	06:44	07:22
	20:55			20:33	24	07:27 (4)	19:46	9	07:25 (5)	18:51	4	07:33 (6)	17:01	16:33
3	05:31			05:58		07:01 (4)	06:33		07:13 (5)	07:07			06:45	07:23
	20:54			20:32	27	07:28 (4)	19:44	15	07:28 (5)	18:49			16:59	16:33
4	05:32			05:59		07:00 (4)	06:34		07:12 (5)	07:08			06:46	07:24
	20:54			20:30	29	07:29 (4)	19:42	18	07:30 (5)	18:48			16:58	16:33
5	05:32			06:00		06:59 (4)	06:35		07:10 (5)	07:09			06:48	07:25
	20:54			20:29	31	07:30 (4)	19:40	21	07:31 (5)	18:46			16:57	16:32
6	05:33			06:01		06:59 (4)	06:36		07:09 (5)	07:10			06:49	07:26
	20:54			20:28	32	07:31 (4)	19:39	22	07:31 (5)	18:44			16:55	16:32
7	05:33			06:02		06:58 (4)	06:37		07:08 (5)	07:11			06:50	07:27
	20:53			20:27	33	07:31 (4)	19:37	24	07:32 (5)	18:42			16:54	16:32
8	05:34			06:03		06:57 (4)	06:38		07:07 (5)	07:13			06:52	07:28
	20:53			20:25	34	07:31 (4)	19:35	25	07:32 (5)	18:40			16:53	16:32
9	05:35			06:05		06:57 (4)	06:39		07:06 (5)	07:14			06:53	07:29
	20:53			20:24	35	07:32 (4)	19:33	26	07:32 (5)	18:39			16:52	16:32
10	05:35			06:06		06:56 (4)	06:41		07:06 (5)	07:15			06:54	07:30
	20:52			20:22	36	07:32 (4)	19:31	25	07:31 (5)	18:37			16:50	16:32
11	05:36			06:07		06:56 (4)	06:42		07:05 (5)	07:16			06:56	07:31
	20:52			20:21	36	07:32 (4)	19:30	26	07:31 (5)	18:35			16:49	16:32
12	05:37			06:08		06:55 (4)	06:43		07:06 (5)	07:17			06:57	07:32
	20:51			20:20	37	07:32 (4)	19:28	24	07:30 (5)	18:33			16:48	16:32
13	05:38			06:09		06:55 (4)	06:44		07:07 (5)	07:19			06:58	07:33
	20:51			20:18	37	07:32 (4)	19:26	22	07:29 (5)	18:32			16:47	16:32
14	05:39			06:10		06:55 (4)	06:45		07:08 (5)	07:20			07:00	07:34
	20:50			20:17	37	07:32 (4)	19:24	20	07:28 (5)	18:30			16:46	16:32
15	05:39			06:11		06:54 (4)	06:46		07:09 (5)	07:21			07:01	07:34
	20:49			20:15	38	07:32 (4)	19:22	17	07:26 (5)	18:28			16:45	16:32
16	05:40			06:12		06:54 (4)	06:47		07:11 (5)	07:22			07:02	07:35
	20:49			20:14	37	07:31 (4)	19:21	15	07:26 (5)	18:27			16:44	16:32
17	05:41			06:14		06:54 (4)	06:48		07:12 (5)	07:23			07:03	07:36
	20:48			20:12	37	07:31 (4)	19:19	11	07:23 (5)	18:25			16:43	16:32
18	05:42			06:15		06:54 (4)	06:50		07:13 (5)	07:25			07:05	07:37
	20:47			20:11	36	07:30 (4)	19:17	6	07:19 (5)	18:23			16:42	16:33
19	05:43			06:16		06:55 (4)	06:51			07:26			07:06	07:37
	20:47			20:09	34	07:29 (4)	19:15			18:22			16:41	16:33
20	05:44			06:17		06:56 (4)	06:52			07:27			07:07	07:38
	20:46			20:08	34	07:30 (4)	19:13			18:20			16:41	16:33
21	05:45			06:18		06:56 (4)	06:53		07:28 (6)	07:28			07:09	07:38
	20:45			20:06	33	07:29 (4)	19:11	5	07:33 (6)	18:18			16:40	16:34
22	05:46			06:19		06:57 (4)	06:54		07:24 (6)	07:30			07:10	07:39
	20:44			20:04	30	07:27 (4)	19:10	12	07:36 (6)	18:17			16:39	16:34
23	05:47			06:20		06:58 (4)	06:55		07:22 (6)	07:31			07:11	07:40
	20:43			20:03	28	07:26 (4)	19:08	15	07:37 (6)	18:15			16:38	16:35
24	05:48			06:21		06:59 (4)	06:56		07:21 (6)	07:32			07:12	07:40
	20:42			20:01	25	07:24 (4)	19:06	17	07:38 (6)	18:14			16:37	16:35
25	05:49			06:23		07:00 (4)	06:57		07:21 (6)	07:33			07:14	07:40
	20:42			19:59	22	07:22 (4)	19:04	18	07:39 (6)	18:12			16:37	16:36
26	05:50			06:24		07:02 (4)	06:59		07:22 (6)	07:35			07:15	07:41
	20:41			19:58	18	07:20 (4)	19:02	17	07:39 (6)	18:11			16:36	16:36
27	05:51			06:25		07:05 (4)	07:00		07:23 (6)	07:36			07:16	07:41
	20:40			19:56	11	07:16 (4)	19:00	16	07:39 (6)	18:09			16:36	16:37
28	05:52			06:26			07:01		07:24 (6)	07:37			07:17	07:42
	20:38			19:54			18:58	14	07:38 (6)	18:08			16:35	16:38
29	05:53		07:09 (4)	06:27			07:02		07:25 (6)	06:39			07:18	07:42
	20:37	10	07:19 (4)	19:53			18:57	12	07:37 (6)	17:06			16:35	16:38
30	05:54		07:06 (4)	06:28			07:03		07:26 (6)	06:40			07:20	07:42
	20:36	16	07:22 (4)	19:51			18:55	10	07:36 (6)	17:05			16:34	16:39
31	05:55		07:04 (4)	06:29						06:41				07:42
	20:35	20	07:24 (4)	19:49						17:03				16:40
Potential sun hours	468			434			377			343			292	279
Total, worst case		46			833			462			11			
Sun reduction		0.62			0.60			0.53			0.44			
Oper. time red.		1.00			1.00			1.00			1.00			
Wind dir. red.		1.00			1.00			1.00			1.00			
Total reduction		0.62			0.60			0.53			0.44			
Total, real		29			499			246			5			

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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: G - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (7)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January		February		March		April			May			June		
1	07:43		07:27		06:48		06:54			06:04		06:43 (4)	05:31		06:41 (4)
	16:41		17:18		17:55		19:34			20:09	20	07:03 (4)	20:42	24	07:05 (4)
2	07:43		07:26		06:47		06:52			06:02		06:42 (4)	05:30		06:43 (4)
	16:42		17:19		17:57		19:35			20:11	23	07:05 (4)	20:43	22	07:05 (4)
3	07:43		07:25		06:45		06:50		07:14 (5)	06:01		06:40 (4)	05:30		06:43 (4)
	16:43		17:20		17:58		19:36	5	07:19 (5)	20:12	26	07:06 (4)	20:44	21	07:04 (4)
4	07:43		07:24		06:43		06:48		07:10 (5)	05:59		06:39 (4)	05:29		06:44 (4)
	16:44		17:22		17:59		19:37	13	07:23 (5)	20:13	28	07:07 (4)	20:45	20	07:04 (4)
5	07:43		07:23		06:42		06:46		07:08 (5)	05:58		06:38 (4)	05:29		06:45 (4)
	16:45		17:23		18:00		19:38	17	07:25 (5)	20:14	30	07:08 (4)	20:46	17	07:02 (4)
6	07:43		07:22		06:40		06:45		07:06 (5)	05:57		06:36 (4)	05:29		06:46 (4)
	16:46		17:24		18:02		19:40	20	07:26 (5)	20:15	32	07:08 (4)	20:46	16	07:02 (4)
7	07:43		07:21		06:38		06:43		07:04 (5)	05:55		06:36 (4)	05:28		06:48 (4)
	16:47		17:26		18:03		19:41	22	07:26 (5)	20:16	33	07:09 (4)	20:47	13	07:01 (4)
8	07:42		07:19		06:37		06:41		07:04 (5)	05:54		06:35 (4)	05:28		06:48 (4)
	16:48		17:27		18:04		19:42	23	07:27 (5)	20:18	35	07:10 (4)	20:48	12	07:00 (4)
9	07:42		07:18		06:35		06:39		07:03 (5)	05:53		06:35 (4)	05:28		06:50 (4)
	16:49		17:28		18:05		19:43	24	07:27 (5)	20:19	35	07:10 (4)	20:48	9	06:59 (4)
10	07:42		07:17		06:33		06:38		07:02 (5)	05:51		06:35 (4)	05:27		06:53 (4)
	16:50		17:30		18:07		19:44	25	07:27 (5)	20:20	36	07:11 (4)	20:49	4	06:57 (4)
11	07:42		07:16		06:31		06:36		07:01 (5)	05:50		06:34 (4)	05:27		
	16:51		17:31		18:08		19:46	26	07:27 (5)	20:21	36	07:10 (4)	20:50		
12	07:42		07:14		06:30		06:34		07:02 (5)	05:49		06:34 (4)	05:27		
	16:52		17:33		18:09		19:47	25	07:27 (5)	20:22	37	07:11 (4)	20:50		
13	07:41		07:13		06:28		06:32		07:01 (5)	05:48		06:34 (4)	05:27		
	16:53		17:34		18:10		19:48	25	07:26 (5)	20:23	37	07:11 (4)	20:51		
14	07:41		07:11		06:26		06:31		07:01 (5)	05:47		06:34 (4)	05:27		
	16:54		17:35		18:12		19:49	24	07:25 (5)	20:24	37	07:11 (4)	20:51		
15	07:40		07:10		06:24		06:29		07:02 (5)	05:46		06:34 (4)	05:26		
	16:55		17:37		18:13		19:50	23	07:25 (5)	20:26	37	07:11 (4)	20:52		
16	07:40		07:09		06:22		06:27		07:02 (5)	05:44		06:34 (4)	05:26		
	16:57		17:38		18:14		19:52	22	07:24 (5)	20:27	37	07:11 (4)	20:52		
17	07:39		07:07		06:21		06:26		07:03 (5)	05:43		06:34 (4)	05:26		
	16:58		17:39		18:15		19:53	19	07:22 (5)	20:28	37	07:11 (4)	20:53		
18	07:39		07:06		06:19	06:40 (6)	06:24		07:05 (5)	05:42		06:34 (4)	05:26		
	16:59		17:41		18:17	4 06:44 (6)	19:54	16	07:21 (5)	20:29	36	07:10 (4)	20:53		
19	07:38		07:04		06:17	06:39 (6)	06:22		07:06 (5)	05:41		06:34 (4)	05:27		
	17:00		17:42		18:18	8 06:47 (6)	19:55	12	07:18 (5)	20:30	36	07:10 (4)	20:53		
20	07:38		07:03		06:15	06:37 (6)	06:21		07:09 (5)	05:40		06:34 (4)	05:27		
	17:02		17:43		18:19	11 06:48 (6)	19:56	5	07:14 (5)	20:31	36	07:10 (4)	20:54		
21	07:37		07:01		06:13	06:35 (6)	06:19			05:39		06:34 (4)	05:27		
	17:03		17:45		18:20	13 06:48 (6)	19:58			20:32	35	07:09 (4)	20:54		
22	07:36		07:00		06:12	06:33 (6)	06:17			05:38		06:36 (4)	05:27		
	17:04		17:46		18:22	15 06:48 (6)	19:59			20:33	34	07:10 (4)	20:54		
23	07:36		06:58		06:10	06:31 (6)	06:16			05:38		06:36 (4)	05:27		
	17:05		17:47		18:23	17 06:48 (6)	20:00			20:34	33	07:09 (4)	20:54		
24	07:35		06:57		06:08	06:30 (6)	06:14			05:37		06:36 (4)	05:27		
	17:07		17:49		18:24	19 06:49 (6)	20:01			20:35	33	07:09 (4)	20:55		
25	07:34		06:55		06:06	06:29 (6)	06:13			05:36		06:36 (4)	05:28		
	17:08		17:50		18:25	19 06:48 (6)	20:02			20:36	32	07:08 (4)	20:55		
26	07:33		06:53		07:04	07:29 (6)	06:11			05:35		06:38 (4)	05:28		
	17:09		17:51		19:26	18 07:47 (6)	20:04			20:37	31	07:09 (4)	20:55		
27	07:32		06:52		07:03	07:29 (6)	06:10			05:34		06:38 (4)	05:28		
	17:11		17:53		19:28	16 07:45 (6)	20:05			20:38	30	07:08 (4)	20:55		
28	07:31		06:50		07:01	07:30 (6)	06:08			05:34		06:38 (4)	05:29		
	17:12		17:54		19:29	13 07:43 (6)	20:06			20:39	29	07:07 (4)	20:55		
29	07:30				06:59	07:32 (6)	06:07		06:50 (4)	05:33		06:39 (4)	05:29		
	17:13				19:30	9 07:41 (6)	20:07	8	06:58 (4)	20:40	28	07:07 (4)	20:55		
30	07:30				06:57		06:05		06:45 (4)	05:32		06:40 (4)	05:30		
	17:15				19:31		20:08	16	07:01 (4)	20:41	26	07:06 (4)	20:55		
31	07:29				06:55					05:32		06:41 (4)			
	17:16				19:32					20:42	25	07:06 (4)			
Potential sun hours	289		292		368		401			455			461		
Total, worst case						162			370			1000			158
Sun reduction						0.38			0.43			0.49			0.54
Oper. time red.						1.00			1.00			1.00			1.00
Wind dir. red.						1.00			1.00			1.00			1.00
Total reduction						0.38			0.43			0.49			0.54
Total, real						61			158			487			86

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

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

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05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: G - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (7)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	July			August			September			October	November	December
1	05:30			05:56		06:45 (4)	06:30		07:00 (5)	07:04	06:42	07:21
	20:55			20:34	37	07:22 (4)	19:48	26	07:26 (5)	18:53	17:02	16:34
2	05:31			05:57		06:45 (4)	06:32		07:00 (5)	07:05	06:44	07:22
	20:55			20:33	37	07:22 (4)	19:46	25	07:25 (5)	18:51	17:01	16:33
3	05:31			05:58		06:45 (4)	06:33		07:00 (5)	07:07	06:45	07:23
	20:54			20:32	36	07:21 (4)	19:44	25	07:25 (5)	18:49	16:59	16:33
4	05:32		06:57 (4)	05:59		06:45 (4)	06:34		07:00 (5)	07:08	06:46	07:24
	20:54	5	07:02 (4)	20:30	36	07:21 (4)	19:42	25	07:25 (5)	18:48	16:58	16:33
5	05:32		06:56 (4)	06:00		06:45 (4)	06:35		07:00 (5)	07:09	06:48	07:25
	20:54	9	07:05 (4)	20:29	36	07:21 (4)	19:40	25	07:25 (5)	18:46	16:57	16:32
6	05:33		06:54 (4)	06:01		06:46 (4)	06:36		07:01 (5)	07:10	06:49	07:26
	20:54	12	07:06 (4)	20:28	34	07:20 (4)	19:39	23	07:24 (5)	18:44	16:55	16:32
7	05:33		06:54 (4)	06:02		06:46 (4)	06:37		07:01 (5)	07:11	06:50	07:27
	20:53	13	07:07 (4)	20:27	34	07:20 (4)	19:37	21	07:22 (5)	18:42	16:54	16:32
8	05:34		06:53 (4)	06:03		06:46 (4)	06:38		07:02 (5)	07:13	06:52	07:28
	20:53	16	07:09 (4)	20:25	33	07:19 (4)	19:35	19	07:21 (5)	18:40	16:53	16:32
9	05:35		06:52 (4)	06:05		06:47 (4)	06:39		07:03 (5)	07:14	06:53	07:29
	20:53	17	07:09 (4)	20:24	31	07:18 (4)	19:33	16	07:19 (5)	18:39	16:52	16:32
10	05:35		06:51 (4)	06:06		06:48 (4)	06:41		07:05 (5)	07:15	06:54	07:30
	20:52	20	07:11 (4)	20:22	29	07:17 (4)	19:31	11	07:16 (5)	18:37	16:50	16:32
11	05:36		06:51 (4)	06:07		06:49 (4)	06:42			07:16	06:56	07:31
	20:52	21	07:12 (4)	20:21	26	07:15 (4)	19:30			18:35	16:49	16:32
12	05:37		06:50 (4)	06:08		06:50 (4)	06:43			07:17	06:57	07:32
	20:51	22	07:12 (4)	20:20	24	07:14 (4)	19:28			18:33	16:48	16:32
13	05:38		06:49 (4)	06:09		06:51 (4)	06:44			07:19	06:58	07:33
	20:51	24	07:13 (4)	20:18	21	07:12 (4)	19:26			18:32	16:47	16:32
14	05:39		06:49 (4)	06:10		06:53 (4)	06:45			07:20	07:00	07:34
	20:50	25	07:14 (4)	20:17	17	07:10 (4)	19:24			18:30	16:46	16:32
15	05:39		06:49 (4)	06:11		06:56 (4)	06:46		07:25 (6)	07:21	07:01	07:34
	20:49	26	07:15 (4)	20:15	10	07:06 (4)	19:22	2	07:27 (6)	18:28	16:45	16:32
16	05:40		06:48 (4)	06:12			06:47		07:21 (6)	07:22	07:02	07:35
	20:49	28	07:16 (4)	20:14			19:21	11	07:32 (6)	18:27	16:44	16:32
17	05:41		06:47 (4)	06:14			06:48		07:19 (6)	07:23	07:03	07:36
	20:48	29	07:16 (4)	20:12			19:19	14	07:33 (6)	18:25	16:43	16:32
18	05:42		06:47 (4)	06:15			06:50		07:17 (6)	07:25	07:05	07:37
	20:47	30	07:17 (4)	20:11			19:17	17	07:34 (6)	18:23	16:42	16:33
19	05:43		06:47 (4)	06:16			06:51		07:16 (6)	07:26	07:06	07:37
	20:47	31	07:18 (4)	20:09			19:15	19	07:35 (6)	18:22	16:41	16:33
20	05:44		06:46 (4)	06:17			06:52		07:15 (6)	07:27	07:07	07:38
	20:46	32	07:18 (4)	20:08			19:13	20	07:35 (6)	18:20	16:41	16:33
21	05:45		06:46 (4)	06:18			06:53		07:16 (6)	07:28	07:09	07:38
	20:45	33	07:19 (4)	20:06			19:11	18	07:34 (6)	18:18	16:40	16:34
22	05:46		06:46 (4)	06:19			06:54		07:17 (6)	07:30	07:10	07:39
	20:44	33	07:19 (4)	20:04			19:10	17	07:34 (6)	18:17	16:39	16:34
23	05:47		06:46 (4)	06:20			06:55		07:18 (6)	07:31	07:11	07:40
	20:43	34	07:20 (4)	20:03			19:08	15	07:33 (6)	18:15	16:38	16:35
24	05:48		06:45 (4)	06:21			06:56		07:19 (6)	07:32	07:12	07:40
	20:42	35	07:20 (4)	20:01			19:06	13	07:32 (6)	18:14	16:37	16:35
25	05:49		06:45 (4)	06:23		07:11 (5)	06:57		07:21 (6)	07:33	07:14	07:40
	20:42	36	07:21 (4)	19:59	10	07:21 (5)	19:04	11	07:32 (6)	18:12	16:37	16:36
26	05:50		06:45 (4)	06:24		07:08 (5)	06:59		07:22 (6)	07:35	07:15	07:41
	20:41	36	07:21 (4)	19:58	15	07:23 (5)	19:02	8	07:30 (6)	18:11	16:36	16:36
27	05:51		06:45 (4)	06:25		07:06 (5)	07:00		07:23 (6)	07:36	07:16	07:41
	20:40	37	07:22 (4)	19:56	18	07:24 (5)	19:00	4	07:27 (6)	18:09	16:36	16:37
28	05:52		06:45 (4)	06:26		07:04 (5)	07:01			07:37	07:17	07:42
	20:38	37	07:22 (4)	19:54	21	07:25 (5)	18:58			18:08	16:35	16:38
29	05:53		06:44 (4)	06:27		07:03 (5)	07:02			06:39	07:18	07:42
	20:37	37	07:21 (4)	19:53	22	07:25 (5)	18:57			17:06	16:35	16:38
30	05:54		06:44 (4)	06:28		07:02 (5)	07:03			06:40	07:20	07:42
	20:36	37	07:21 (4)	19:51	24	07:26 (5)	18:55			17:05	16:34	16:39
31	05:55		06:45 (4)	06:29		07:01 (5)				06:41		07:42
	20:35	37	07:22 (4)	19:49	25	07:26 (5)				17:03		16:40
Potential sun hours	468			434			377			343	292	279
Total, worst case		752			576			385				
Sun reduction		0.62			0.60			0.53				
Oper. time red.		1.00			1.00			1.00				
Wind dir. red.		1.00			1.00			1.00				
Total reduction		0.62			0.60			0.53				
Total, real		467			345			205				

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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: H - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (8)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:43	07:27	06:48	06:54	06:04	05:31	05:30	05:56	06:30	07:04	06:42	07:21
	16:41	17:18	17:55	19:34	20:09	20:42	20:55	20:34	19:48	18:53	17:02	16:34
2	07:43	07:26	06:47	06:52	06:02	05:30	05:31	05:57	06:32	07:05	06:44	07:22
	16:42	17:19	17:57	19:35	20:11	20:43	20:55	20:33	19:46	18:51	17:01	16:33
3	07:43	07:25	06:45	06:50	06:01	05:30	05:31	05:58	06:33	07:07	06:45	07:23
	16:43	17:20	17:58	19:36	20:12	20:44	20:54	20:32	19:44	18:49	16:59	16:33
4	07:43	07:24	06:43	06:48	05:59	05:29	05:32	05:59	06:34	07:08	06:46	07:24
	16:44	17:22	17:59	19:37	20:13	20:45	20:54	20:30	19:42	18:48	16:58	16:33
5	07:43	07:23	06:42	06:46	05:58	05:29	05:32	06:00	06:35	07:09	06:48	07:25
	16:45	17:23	18:00	19:38	20:14	20:46	20:54	20:29	19:40	18:46	16:57	16:32
6	07:43	07:22	06:40	06:45	05:57	05:29	05:33	06:01	06:36	07:10	06:49	07:26
	16:46	17:24	18:02	19:40	20:15	20:46	20:54	20:28	19:39	18:44	16:55	16:32
7	07:43	07:21	06:38	06:43	05:55	05:28	05:33	06:02	06:37	07:11	06:50	07:27
	16:47	17:26	18:03	19:41	20:16	20:47	20:53	20:27	19:37	18:42	16:54	16:32
8	07:42	07:19	06:37	06:41	05:54	05:28	05:34	06:03	06:38	07:13	06:52	07:28
	16:48	17:27	18:04	19:42	20:18	20:48	20:53	20:25	19:35	18:40	16:53	16:32
9	07:42	07:18	06:35	06:39	05:53	05:28	05:35	06:05	06:39	07:14	06:53	07:29
	16:49	17:28	18:05	19:43	20:19	20:48	20:53	20:24	19:33	18:39	16:52	16:32
10	07:42	07:17	06:33	06:38	05:51	05:27	05:35	06:06	06:41	07:15	06:54	07:30
	16:50	17:30	18:07	19:44	20:20	20:49	20:52	20:22	19:31	18:37	16:50	16:32
11	07:42	07:16	06:31	06:36	05:50	05:27	05:36	06:07	06:42	07:16	06:56	07:31
	16:51	17:31	18:08	19:46	20:21	20:50	20:52	20:21	19:30	18:35	16:49	16:32
12	07:41	07:14	06:30	06:34	05:49	05:27	05:37	06:08	06:43	07:17	06:57	07:32
	16:52	17:33	18:09	19:47	20:22	20:50	20:51	20:20	19:28	18:33	16:48	16:32
13	07:41	07:13	06:28	06:32	05:48	05:27	05:38	06:09	06:44	07:19	06:58	07:33
	16:53	17:34	18:10	19:48	20:23	20:51	20:51	20:18	19:26	18:32	16:47	16:32
14	07:41	07:11	06:26	06:31	05:47	05:27	05:39	06:10	06:45	07:20	07:00	07:34
	16:54	17:35	18:12	19:49	20:24	20:51	20:50	20:17	19:24	18:30	16:46	16:32
15	07:40	07:10	06:24	06:29	05:46	05:26	05:39	06:11	06:46	07:21	07:01	07:34
	16:55	17:37	18:13	19:50	20:26	20:52	20:49	20:15	19:22	18:28	16:45	16:32
16	07:40	07:09	06:22	06:27	05:44	05:26	05:40	06:12	06:47	07:22	07:02	07:35
	16:57	17:38	18:14	19:52	20:27	20:52	20:49	20:14	19:21	18:27	16:44	16:32
17	07:39	07:07	06:21	06:26	05:43	05:26	05:41	06:14	06:48	07:23	07:03	07:36
	16:58	17:39	18:15	19:53	20:28	20:53	20:48	20:12	19:19	18:25	16:43	16:32
18	07:39	07:06	06:19	06:24	05:42	05:26	05:42	06:15	06:50	07:25	07:05	07:37
	16:59	17:41	18:17	19:54	20:29	20:53	20:47	20:11	19:17	18:23	16:42	16:33
19	07:38	07:04	06:17	06:22	05:41	05:27	05:43	06:16	06:51	07:26	07:06	07:37
	17:00	17:42	18:18	19:55	20:30	20:53	20:47	20:09	19:15	18:22	16:41	16:33
20	07:38	07:03	06:15	06:21	05:40	05:27	05:44	06:17	06:52	07:27	07:07	07:38
	17:02	17:43	18:19	19:56	20:31	20:54	20:46	20:08	19:13	18:20	16:41	16:33
21	07:37	07:01	06:13	06:19	05:39	05:27	05:45	06:18	06:53	07:28	07:09	07:38
	17:03	17:45	18:20	19:58	20:32	20:54	20:45	20:06	19:11	18:18	16:40	16:34
22	07:36	07:00	06:12	06:17	05:38	05:27	05:46	06:19	06:54	07:30	07:10	07:39
	17:04	17:46	18:22	19:59	20:33	20:54	20:44	20:04	19:09	18:17	16:39	16:34
23	07:36	06:58	06:10	06:16	05:38	05:27	05:47	06:20	06:55	07:31	07:11	07:40
	17:05	17:47	18:23	20:00	20:34	20:54	20:43	20:03	19:08	18:15	16:38	16:35
24	07:35	06:57	06:08	06:14	05:37	05:27	05:48	06:21	06:56	07:32	07:12	07:40
	17:07	17:49	18:24	20:01	20:35	20:54	20:42	20:01	19:06	18:14	16:37	16:35
25	07:34	06:55	06:06	06:13	05:36	05:28	05:49	06:23	06:57	07:33	07:14	07:40
	17:08	17:50	18:25	20:02	20:36	20:55	20:41	19:59	19:04	18:12	16:37	16:36
26	07:33	06:53	07:04	06:11	05:35	05:28	05:50	06:24	06:59	07:35	07:15	07:41
	17:09	17:51	19:26	20:04	20:37	20:55	20:41	19:58	19:02	18:11	16:36	16:36
27	07:32	06:52	07:03	06:10	05:34	05:28	05:51	06:25	07:00	07:36	07:16	07:41
	17:11	17:53	19:28	20:05	20:38	20:55	20:40	19:56	19:00	18:09	16:36	16:37
28	07:31	06:50	07:01	06:08	05:34	05:29	05:52	06:26	07:01	07:37	07:17	07:42
	17:12	17:54	19:29	20:06	20:39	20:55	20:38	19:54	18:58	18:08	16:35	16:38
29	07:30		06:59	06:07	05:33	05:29	05:53	06:27	07:02	06:39	07:18	07:42
	17:13		19:30	20:07	20:40	20:55	20:37	19:53	18:57	17:06	16:35	16:38
30	07:30		06:57	06:05	05:32	05:30	05:54	06:28	07:03	06:40	07:20	07:42
	17:15		19:31	20:08	20:41	20:55	20:36	19:51	18:55	17:05	16:34	16:39
31	07:29		06:55		05:32		05:55	06:29		06:41		07:42
	17:16		19:32		20:42		20:35	19:49		17:03		16:40
Potential sun hours	289	292	368	401	455	461	468	434	377	343	292	279
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

Day in month	Sun rise (hh:mm) 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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: I - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (9)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:43	07:27	06:48	06:54	06:04	05:31	06:19 (5)	05:30	06:21 (5)	05:56	06:30	07:04	06:42	07:21
	16:41	17:18	17:55	19:34	20:09	20:42	21 06:40 (5)	20:55	26 06:47 (5)	20:34	19:47	18:53	17:02	16:34
2	07:43	07:26	06:47	06:52	06:02	05:30	06:19 (5)	05:31	06:21 (5)	05:57	06:32	07:05	06:44	07:22
	16:42	17:19	17:57	19:35	20:11	20:43	22 06:41 (5)	20:55	27 06:48 (5)	20:33	19:46	18:51	17:01	16:33
3	07:43	07:25	06:45	06:50	06:01	05:30	06:19 (5)	05:31	06:21 (5)	05:58	06:33	07:07	06:45	07:23
	16:43	17:20	17:58	19:36	20:12	20:44	22 06:41 (5)	20:54	26 06:47 (5)	20:32	19:44	18:49	16:59	16:33
4	07:43	07:24	06:43	06:48	05:59	05:29	06:19 (5)	05:32	06:22 (5)	05:59	06:34	07:08	06:46	07:24
	16:44	17:22	17:59	19:37	20:13	20:45	23 06:42 (5)	20:54	26 06:48 (5)	20:30	19:42	18:48	16:58	16:33
5	07:43	07:23	06:42	06:46	05:58	05:29	06:18 (5)	05:32	06:23 (5)	06:00	06:35	07:09	06:48	07:25
	16:45	17:23	18:00	19:38	20:14	20:46	23 06:41 (5)	20:54	25 06:48 (5)	20:29	19:40	18:46	16:57	16:32
6	07:43	07:22	06:40	06:45	05:57	05:29	06:18 (5)	05:33	06:23 (5)	06:01	06:36	07:10	06:49	07:26
	16:46	17:24	18:02	19:40	20:15	20:46	24 06:42 (5)	20:54	25 06:48 (5)	20:28	19:39	18:44	16:55	16:32
7	07:43	07:21	06:38	06:43	05:55	05:28	06:18 (5)	05:33	06:24 (5)	06:02	06:37	07:11	06:50	07:27
	16:47	17:26	18:03	19:41	20:16	20:47	24 06:42 (5)	20:53	24 06:48 (5)	20:27	19:37	18:42	16:54	16:32
8	07:42	07:19	06:37	06:41	05:54	05:28	06:17 (5)	05:34	06:25 (5)	06:03	06:38	07:13	06:52	07:28
	16:48	17:27	18:04	19:42	20:18	20:48	25 06:42 (5)	20:53	24 06:49 (5)	20:25	19:35	18:40	16:53	16:32
9	07:42	07:18	06:35	06:39	05:53	05:28	06:17 (5)	05:35	06:25 (5)	06:05	06:39	07:14	06:53	07:29
	16:49	17:28	18:05	19:43	20:19	20:48	25 06:42 (5)	20:53	23 06:48 (5)	20:24	19:33	18:39	16:52	16:32
10	07:42	07:17	06:33	06:38	05:51	05:27	06:17 (5)	05:35	06:26 (5)	06:06	06:41	07:15	06:54	07:30
	16:50	17:30	18:07	19:44	20:20	20:49	26 06:43 (5)	20:52	23 06:49 (5)	20:22	19:31	18:37	16:50	16:32
11	07:42	07:16	06:31	06:36	05:50	05:27	06:17 (5)	05:36	06:27 (5)	06:07	06:42	07:16	06:56	07:31
	16:51	17:31	18:08	19:46	20:21	20:50	26 06:43 (5)	20:52	22 06:49 (5)	20:21	19:30	18:35	16:49	16:32
12	07:41	07:14	06:30	06:34	05:49	05:27	06:17 (5)	05:37	06:26 (5)	06:08	06:43	07:17	06:57	07:32
	16:52	17:33	18:09	19:47	20:22	20:50	27 06:44 (5)	20:51	22 06:48 (5)	20:20	19:28	18:33	16:48	16:32
13	07:41	07:13	06:28	06:32	05:48	05:27	06:18 (5)	05:38	06:27 (5)	06:09	06:44	07:19	06:58	07:33
	16:53	17:34	18:10	19:48	20:23	20:51	26 06:44 (5)	20:51	21 06:48 (5)	20:18	19:26	18:32	16:47	16:32
14	07:41	07:11	06:26	06:31	07:00 (6) 05:47	05:27	06:18 (5)	05:39	06:28 (5)	06:10	07:04 (6)	06:45	07:20	07:00	07:34
	16:54	17:35	18:12	19:49	7 07:07 (6) 20:24	20:51	26 06:44 (5)	20:50	20 06:48 (5)	20:17	5 07:09 (6)	19:24	18:30	16:46	16:32
15	07:40	07:10	06:24	06:29	07:00 (6) 05:46	05:26	06:17 (5)	05:39	06:29 (5)	06:11	07:01 (6)	06:46	07:21	07:01	07:34
	16:55	17:37	18:13	19:50	10 07:10 (6) 20:26	20:52	27 06:44 (5)	20:49	19 06:48 (5)	20:15	11 07:12 (6)	19:22	18:28	16:45	16:32
16	07:40	07:09	06:22	06:27	06:58 (6) 05:44	05:26	06:18 (5)	05:40	06:30 (5)	06:12	06:59 (6)	06:47	07:22	07:02	07:35
	16:57	17:38	18:14	19:52	12 07:10 (6) 20:27	20:52	27 06:45 (5)	20:49	18 06:48 (5)	20:14	15 07:14 (6)	19:21	18:27	16:44	16:32
17	07:39	07:07	06:21	06:26	06:56 (6) 05:43	05:26	06:18 (5)	05:41	06:30 (5)	06:14	06:57 (6)	06:48	07:23	07:03	07:36
	16:58	17:39	18:15	19:53	15 07:11 (6) 20:28	20:53	27 06:45 (5)	20:48	17 06:47 (5)	20:12	18 07:15 (6)	19:19	18:25	16:43	16:32
18	07:39	07:06	06:19	06:24	06:56 (6) 05:42	05:26	06:18 (5)	05:42	06:30 (5)	06:15	06:56 (6)	06:50	07:25	07:05	07:37
	16:59	17:41	18:17	19:54	16 07:12 (6) 20:29	20:53	27 06:45 (5)	20:47	17 06:47 (5)	20:11	19 07:15 (6)	19:17	18:23	16:42	16:33
19	07:38	07:04	06:17	06:22	06:54 (6) 05:41	05:27	06:18 (5)	05:43	06:31 (5)	06:16	06:55 (6)	06:51	07:26	07:06	07:37
	17:00	17:42	18:18	19:55	18 07:12 (6) 20:30	20:53	27 06:45 (5)	20:47	15 06:46 (5)	20:09	21 07:16 (6)	19:15	18:22	16:41	16:33
20	07:38	07:03	06:15	06:21	06:53 (6) 05:40	06:25 (5) 05:27	06:18 (5)	05:44	06:32 (5)	06:17	06:54 (6)	06:52	07:27	07:07	07:38
	17:02	17:43	18:19	19:56	19 07:12 (6) 20:31	2 06:27 (5) 20:54	27 06:45 (5)	20:46	14 06:46 (5)	20:08	22 07:16 (6)	19:13	18:20	16:41	16:33
21	07:37	07:01	06:13	06:19	06:52 (6) 05:39	06:24 (5) 05:27	06:18 (5)	05:45	06:33 (5)	06:18	06:55 (6)	06:53	07:28	07:09	07:38
	17:03	17:45	18:20	19:58	20 07:12 (6) 20:32	6 06:30 (5) 20:54	27 06:45 (5)	20:45	12 06:45 (5)	20:06	22 07:17 (6)	19:11	18:18	16:40	16:34
22	07:36	07:00	06:12	06:17	06:50 (6) 05:38	06:24 (5) 05:27	06:18 (5)	05:46	06:34 (5)	06:19	06:55 (6)	06:54	07:30	07:10	07:39
	17:04	17:46	18:22	19:59	22 07:12 (6) 20:33	9 06:33 (5) 20:54	27 06:45 (5)	20:44	10 06:44 (5)	20:04	22 07:17 (6)	19:09	18:17	16:39	16:34
23	07:36	06:58	06:10	06:16	06:50 (6) 05:38	06:24 (5) 05:27	06:18 (5)	05:47	06:34 (5)	06:20	06:56 (6)	06:55	07:31	07:11	07:40
	17:05	17:47	18:23	20:00	22 07:12 (6) 20:34	10 06:34 (5) 20:54	27 06:45 (5)	20:43	9 06:43 (5)	20:03	21 07:17 (6)	19:08	18:15	16:38	16:35
24	07:35	06:57	06:08	06:14	06:48 (6) 05:37	06:23 (5) 05:27	06:19 (5)	05:48	06:35 (5)	06:21	06:57 (6)	06:56	07:32	07:12	07:40
	17:07	17:49	18:24	20:01	23 07:11 (6) 20:35	12 06:35 (5) 20:54	27 06:46 (5)	20:42	6 06:41 (5)	20:01	19 07:16 (6)	19:06	18:14	16:37	16:35
25	07:34	06:55	06:06	06:13	06:49 (6) 05:36	06:22 (5) 05:28	06:19 (5)	05:49	06:36 (5)	06:23	06:57 (6)	06:57	07:33	07:14	07:40
	17:08	17:50	18:25	20:02	22 07:11 (6) 20:36	14 06:36 (5) 20:55	27 06:46 (5)	20:41	2 06:38 (5)	19:59	19 07:16 (6)	19:04	18:12	16:37	16:36
26	07:33	06:53	07:04	06:11	06:49 (6) 05:35	06:22 (5) 05:28	06:19 (5)	05:50		06:24	06:58 (6)	06:59	07:35	07:15	07:41
	17:09	17:51	19:26	20:03	20 07:09 (6) 20:37	15 06:37 (5) 20:55	27 06:46 (5)	20:41		19:58	17 07:15 (6)	19:02	18:11	16:36	16:36
27	07:32	06:52	07:03	06:10	06:50 (6) 05:34	06:21 (5) 05:28	06:20 (5)	05:51		06:25	06:59 (6)	07:00	07:36	07:16	07:41
	17:11	17:53	19:28	20:05	19 07:09 (6) 20:38	17 06:38 (5) 20:55	27 06:47 (5)	20:39		19:56	15 07:14 (6)	19:00	18:09	16:36	16:37
28	07:31	06:50	07:01	06:08	06:51 (6) 05:34	06:21 (5) 05:29	06:20 (5)	05:52		06:26	06:59 (6)	07:01	07:37	07:17	07:42
	17:12	17:54	19:29	20:06	16 07:07 (6) 20:39	17 06:38 (5) 20:55	27 06:47 (5)	20:38		19:54	14 07:13 (6)	18:58	18:08	16:35	16:38
29	07:30		06:59	06:07	06:53 (6) 05:33	06:21 (5) 05:29	06:21 (5)	05:53		06:27	07:00 (6)	07:02	06:39	07:18	07:42
	17:13		19:30	20:07	12 07:05 (6) 20:40	18 06:39 (5) 20:55	26 06:47 (5)	20:37		19:53	11 07:11 (6)	18:57	17:06	16:35	16:38
30	07:29		06:57	06:05	06:55 (6) 05:32	06:20 (5) 05:30	06:21 (5)	05:54		06:28	07:00 (6)	07:03	06:40	07:19	07:42
	17:15		19:31	20:08	7 07:02 (6) 20:41	19 06:39 (5) 20:55	26 06:47 (5)	20:36		19:51	9 07:09 (6)	18:55	17:05	16:34	16:39
31	07:28		06:55		05:32	06:20 (5)		05:55		06:29	07:01 (6)		06:41		07:42
	17:16		19:32		20:42	20 06:40 (5)		20:35		19:49	3 07:04 (6)		17:03		16:40
Potential sun hours	289	292	368	401	455	461		468		434	377	343	292		279
Total, worst case				280	159	770		473		283					
Sun reduction				0.43	0.49	0.54		0.62		0.60					
Oper. time red.				1.00	1.00	1.00		1.00		1.00					
Wind dir. red.				1.00	1.00	1.00		1.00		1.00					
Total reduction				0.43	0.49	0.54		0.62		0.60					
Total, real				120	77	418		294		170					

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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+31622792352
sse / s.screnci@tauw.com
Calculated:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: J - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (10)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January		February		March		April		May		June	
1	07:43		07:27		06:48		06:54		07:15 (5)	06:04	06:46 (4)	05:31
	16:41		17:18		17:55		19:34	23	07:38 (5)	20:09	38 07:24 (4)	20:42
2	07:43		07:26		06:47		06:52		07:13 (5)	06:02	06:47 (4)	05:30
	16:42		17:19		17:57		19:35	25	07:38 (5)	20:11	37 07:24 (4)	20:43
3	07:43		07:25		06:45		06:50		07:12 (5)	06:01	06:46 (4)	05:30
	16:43		17:20		17:58		19:36	26	07:38 (5)	20:12	37 07:23 (4)	20:44
4	07:43		07:24		06:43		06:48		07:12 (5)	05:59	06:47 (4)	05:29
	16:44		17:22		17:59		19:37	26	07:38 (5)	20:13	36 07:23 (4)	20:45
5	07:43		07:23		06:42		06:46		07:12 (5)	05:58	06:47 (4)	05:29
	16:45		17:23		18:00		19:38	25	07:37 (5)	20:14	36 07:23 (4)	20:46
6	07:43		07:22		06:40		06:45		07:12 (5)	05:57	06:47 (4)	05:29
	16:46		17:24		18:02		19:40	24	07:36 (5)	20:15	35 07:22 (4)	20:46
7	07:43		07:21		06:38		06:43		07:12 (5)	05:55	06:47 (4)	05:28
	16:47		17:26		18:03		19:41	23	07:35 (5)	20:16	35 07:22 (4)	20:47
8	07:42		07:19		06:37		06:41		07:13 (5)	05:54	06:48 (4)	05:28
	16:48		17:27		18:04		19:42	22	07:35 (5)	20:18	33 07:21 (4)	20:48
9	07:42		07:18		06:35		06:39		07:14 (5)	05:53	06:49 (4)	05:28
	16:49		17:28		18:05		19:43	19	07:33 (5)	20:19	32 07:21 (4)	20:48
10	07:42		07:17		06:33		06:38		07:15 (5)	05:51	06:50 (4)	05:27
	16:50		17:30		18:07		19:44	16	07:31 (5)	20:20	30 07:20 (4)	20:49
11	07:42		07:16		06:31		06:36		07:16 (5)	05:50	06:50 (4)	05:27
	16:51		17:31		18:08		19:46	12	07:28 (5)	20:21	28 07:18 (4)	20:50
12	07:42		07:14		06:30	06:51 (6)	06:34		07:22 (5)	05:49	06:51 (4)	05:27
	16:52		17:33		18:09	2 06:53 (6)	19:47	1	07:23 (5)	20:22	26 07:17 (4)	20:50
13	07:41		07:13		06:28	06:50 (6)	06:32			05:48	06:52 (4)	05:27
	16:53		17:34		18:10	5 06:55 (6)	19:48			20:23	24 07:16 (4)	20:51
14	07:41		07:11		06:26	06:48 (6)	06:31			05:47	06:53 (4)	05:27
	16:54		17:35		18:12	8 06:56 (6)	19:49			20:24	22 07:15 (4)	20:51
15	07:40		07:10		06:24	06:46 (6)	06:29			05:46	06:55 (4)	05:26
	16:55		17:37		18:13	11 06:57 (6)	19:50			20:26	18 07:13 (4)	20:52
16	07:40		07:09		06:22	06:44 (6)	06:27			05:44	06:57 (4)	05:26
	16:57		17:38		18:14	13 06:57 (6)	19:52			20:27	14 07:11 (4)	20:52
17	07:39		07:07		06:21	06:42 (6)	06:26		07:04 (4)	05:43	07:00 (4)	05:26
	16:58		17:39		18:15	15 06:57 (6)	19:53	8	07:12 (4)	20:28	8 07:08 (4)	20:53
18	07:39		07:06		06:19	06:40 (6)	06:24		07:00 (4)	05:42		05:26
	16:59		17:41		18:17	16 06:56 (6)	19:54	16	07:16 (4)	20:29		20:53
19	07:38		07:04		06:17	06:39 (6)	06:22		06:57 (4)	05:41		05:27
	17:00		17:42		18:18	17 06:56 (6)	19:55	21	07:18 (4)	20:30		20:53
20	07:38		07:03		06:15	06:37 (6)	06:21		06:55 (4)	05:40		05:27
	17:02		17:43		18:19	18 06:55 (6)	19:56	25	07:20 (4)	20:31		20:54
21	07:37		07:01		06:13	06:37 (6)	06:19		06:54 (4)	05:39		05:27
	17:03		17:45		18:20	17 06:54 (6)	19:58	27	07:21 (4)	20:32		20:54
22	07:36		07:00		06:12	06:38 (6)	06:17		06:52 (4)	05:38		05:27
	17:04		17:46		18:22	14 06:52 (6)	19:59	30	07:22 (4)	20:33		20:54
23	07:36		06:58		06:10	06:40 (6)	06:16		06:51 (4)	05:38		05:27
	17:05		17:47		18:23	10 06:50 (6)	20:00	32	07:23 (4)	20:34		20:54
24	07:35		06:57		06:08		06:14		06:50 (4)	05:37		05:27
	17:07		17:49		18:24		20:01	33	07:23 (4)	20:35		20:55
25	07:34		06:55		06:06		06:13		06:49 (4)	05:36		05:28
	17:08		17:50		18:25		20:02	35	07:24 (4)	20:36		20:55
26	07:33		06:53		07:04		06:11		06:48 (4)	05:35		05:28
	17:09		17:51		19:26		20:04	36	07:24 (4)	20:37		20:55
27	07:32		06:52		07:03	07:24 (5)	06:10		06:48 (4)	05:34		05:28
	17:11		17:53		19:28	9 07:33 (5)	20:05	37	07:25 (4)	20:38		20:55
28	07:31		06:50		07:01	07:22 (5)	06:08		06:47 (4)	05:34		05:29
	17:12		17:54		19:29	13 07:35 (5)	20:06	37	07:24 (4)	20:39		20:55
29	07:30				06:59	07:20 (5)	06:07		06:47 (4)	05:33		05:29
	17:13				19:30	16 07:36 (5)	20:07	38	07:25 (4)	20:40		20:55
30	07:30				06:57	07:19 (5)	06:05		06:46 (4)	05:32		05:30
	17:15				19:31	19 07:38 (5)	20:08	38	07:24 (4)	20:41		20:55
31	07:29				06:55	07:17 (5)				05:32		
	17:16				19:32	21 07:38 (5)				20:42		
Potential sun hours	289		292		368		401			455		461
Total, worst case						224		655			489	
Sun reduction						0.38		0.43			0.49	
Oper. time red.						1.00		1.00			1.00	
Wind dir. red.						1.00		1.00			1.00	
Total reduction						0.38		0.43			0.49	
Total, real						85		280			238	

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

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

Licensed user:
TAUW Group bv
Handelskade 37
NL-7417 DE DEVENTER
+31622792352
sse / s.screnci@tauw.com
Calculated:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: J - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (10)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	July			August			September			October			November	December
1	05:30			05:56		07:03 (4)	06:30			07:04		07:27 (6)	06:42	07:21
	20:55			20:34	24	07:27 (4)	19:48			18:53	8	07:35 (6)	17:02	16:34
2	05:31			05:57		07:02 (4)	06:32		07:17 (5)	07:05		07:29 (6)	06:44	07:22
	20:55			20:33	26	07:28 (4)	19:46	8	07:25 (5)	18:51	5	07:34 (6)	17:01	16:33
3	05:31			05:58		07:01 (4)	06:33		07:13 (5)	07:07		07:30 (6)	06:45	07:23
	20:54			20:32	28	07:29 (4)	19:44	15	07:28 (5)	18:49	2	07:32 (6)	16:59	16:33
4	05:32			05:59		07:00 (4)	06:34		07:12 (5)	07:08			06:46	07:24
	20:54			20:30	30	07:30 (4)	19:42	18	07:30 (5)	18:48			16:58	16:33
5	05:32			06:00		06:59 (4)	06:35		07:11 (5)	07:09			06:48	07:25
	20:54			20:29	32	07:31 (4)	19:40	20	07:31 (5)	18:46			16:57	16:32
6	05:33			06:01		06:58 (4)	06:36		07:09 (5)	07:10			06:49	07:26
	20:54			20:28	33	07:31 (4)	19:39	23	07:32 (5)	18:44			16:55	16:32
7	05:33			06:02		06:58 (4)	06:37		07:08 (5)	07:11			06:50	07:27
	20:53			20:27	34	07:32 (4)	19:37	24	07:32 (5)	18:42			16:54	16:32
8	05:34			06:03		06:57 (4)	06:38		07:07 (5)	07:13			06:52	07:28
	20:53			20:25	35	07:32 (4)	19:35	25	07:32 (5)	18:40			16:53	16:32
9	05:35			06:05		06:56 (4)	06:39		07:06 (5)	07:14			06:53	07:29
	20:53			20:24	36	07:32 (4)	19:33	26	07:32 (5)	18:39			16:52	16:32
10	05:35			06:06		06:56 (4)	06:41		07:06 (5)	07:15			06:54	07:30
	20:52			20:22	37	07:33 (4)	19:31	26	07:32 (5)	18:37			16:50	16:32
11	05:36			06:07		06:55 (4)	06:42		07:05 (5)	07:16			06:56	07:31
	20:52			20:21	38	07:33 (4)	19:30	26	07:31 (5)	18:35			16:49	16:32
12	05:37			06:08		06:55 (4)	06:43		07:06 (5)	07:17			06:57	07:32
	20:51			20:20	38	07:33 (4)	19:28	24	07:30 (5)	18:33			16:48	16:32
13	05:38			06:09		06:55 (4)	06:44		07:07 (5)	07:19			06:58	07:33
	20:51			20:18	38	07:33 (4)	19:26	22	07:29 (5)	18:32			16:47	16:32
14	05:39			06:10		06:55 (4)	06:45		07:08 (5)	07:20			07:00	07:34
	20:50			20:17	37	07:32 (4)	19:24	20	07:28 (5)	18:30			16:46	16:32
15	05:39			06:11		06:54 (4)	06:46		07:09 (5)	07:21			07:01	07:34
	20:49			20:15	38	07:32 (4)	19:22	18	07:27 (5)	18:28			16:45	16:32
16	05:40			06:12		06:54 (4)	06:47		07:11 (5)	07:22			07:02	07:35
	20:49			20:14	38	07:32 (4)	19:21	15	07:26 (5)	18:27			16:44	16:32
17	05:41			06:14		06:54 (4)	06:48		07:12 (5)	07:23			07:03	07:36
	20:48			20:12	37	07:31 (4)	19:19	12	07:24 (5)	18:25			16:43	16:32
18	05:42			06:15		06:54 (4)	06:50		07:13 (5)	07:25			07:05	07:37
	20:47			20:11	37	07:31 (4)	19:17	8	07:21 (5)	18:23			16:42	16:33
19	05:43			06:16		06:55 (4)	06:51			07:26			07:06	07:37
	20:47			20:09	35	07:30 (4)	19:15			18:22			16:41	16:33
20	05:44			06:17		06:56 (4)	06:52			07:27			07:07	07:38
	20:46			20:08	34	07:30 (4)	19:13			18:20			16:41	16:33
21	05:45			06:18		06:56 (4)	06:53		07:30 (6)	07:28			07:09	07:38
	20:45			20:06	33	07:29 (4)	19:11	2	07:32 (6)	18:18			16:40	16:34
22	05:46			06:19		06:57 (4)	06:54		07:25 (6)	07:30			07:10	07:39
	20:44			20:04	31	07:28 (4)	19:10	11	07:36 (6)	18:17			16:39	16:34
23	05:47			06:20		06:58 (4)	06:55		07:23 (6)	07:31			07:11	07:40
	20:43			20:03	28	07:26 (4)	19:08	14	07:37 (6)	18:15			16:38	16:35
24	05:48			06:21		06:59 (4)	06:56		07:21 (6)	07:32			07:12	07:40
	20:42			20:01	26	07:25 (4)	19:06	17	07:38 (6)	18:14			16:37	16:35
25	05:49			06:23		07:00 (4)	06:57		07:21 (6)	07:33			07:14	07:40
	20:42			19:59	23	07:23 (4)	19:04	18	07:39 (6)	18:12			16:37	16:36
26	05:50			06:24		07:02 (4)	06:59		07:22 (6)	07:35			07:15	07:41
	20:41			19:58	18	07:20 (4)	19:02	17	07:39 (6)	18:11			16:36	16:36
27	05:51			06:25		07:05 (4)	07:00		07:23 (6)	07:36			07:16	07:41
	20:40			19:56	12	07:17 (4)	19:00	16	07:39 (6)	18:09			16:36	16:37
28	05:52		07:11 (4)	06:26			07:01		07:24 (6)	07:37			07:17	07:42
	20:38	8	07:19 (4)	19:54			18:58	14	07:38 (6)	18:08			16:35	16:38
29	05:53		07:07 (4)	06:27			07:02		07:25 (6)	06:39			07:18	07:42
	20:37	14	07:21 (4)	19:53			18:57	13	07:38 (6)	17:06			16:35	16:38
30	05:54		07:05 (4)	06:28			07:03		07:26 (6)	06:40			07:20	07:42
	20:36	18	07:23 (4)	19:51			18:55	10	07:36 (6)	17:05			16:34	16:39
31	05:55		07:04 (4)	06:29						06:41				07:42
	20:35	21	07:25 (4)	19:49						17:03				16:40
Potential sun hours	468			434			377			343			292	279
Total, worst case		61			856			462			15			
Sun reduction		0.62			0.60			0.53			0.44			
Oper. time red.		1.00			1.00			1.00			1.00			
Wind dir. red.		1.00			1.00			1.00			1.00			
Total reduction		0.62			0.60			0.53			0.44			
Total, real		38			513			246			7			

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

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

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Calculated:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: K - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (11)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January		February		March		April		May		June	
1	07:43		07:27		06:48		06:54		07:20 (5)	06:04	06:44 (4)	05:31	06:48 (4)
	16:41		17:18		17:55		19:34	1	07:21 (5)	20:09	27	07:11 (4)	20:42	19	07:07 (4)
2	07:43		07:26		06:47		06:52		07:14 (5)	06:02	06:43 (4)	05:30	06:49 (4)
	16:42		17:19		17:57		19:35	12	07:26 (5)	20:11	30	07:13 (4)	20:43	17	07:06 (4)
3	07:43		07:25		06:45		06:50		07:11 (5)	06:01	06:41 (4)	05:30	06:50 (4)
	16:43		17:20		17:58		19:36	17	07:28 (5)	20:12	32	07:13 (4)	20:44	15	07:05 (4)
4	07:43		07:24		06:43		06:48		07:10 (5)	05:59	06:40 (4)	05:29	06:52 (4)
	16:44		17:22		17:59		19:37	20	07:30 (5)	20:13	34	07:14 (4)	20:45	12	07:04 (4)
5	07:43		07:23		06:42		06:46		07:09 (5)	05:58	06:40 (4)	05:29	06:53 (4)
	16:45		17:23		18:00		19:38	21	07:30 (5)	20:14	35	07:15 (4)	20:46	9	07:02 (4)
6	07:43		07:22		06:40		06:45		07:07 (5)	05:57	06:39 (4)	05:29	
	16:46		17:24		18:02		19:40	24	07:31 (5)	20:15	35	07:14 (4)	20:46		
7	07:43		07:21		06:38		06:43		07:06 (5)	05:55	06:38 (4)	05:28	
	16:47		17:26		18:03		19:41	25	07:31 (5)	20:16	37	07:15 (4)	20:47		
8	07:42		07:19		06:37		06:41		07:06 (5)	05:54	06:38 (4)	05:28	
	16:48		17:27		18:04		19:42	26	07:32 (5)	20:18	37	07:15 (4)	20:48		
9	07:42		07:18		06:35		06:39		07:05 (5)	05:53	06:38 (4)	05:28	
	16:49		17:28		18:05		19:43	26	07:31 (5)	20:19	38	07:16 (4)	20:48		
10	07:42		07:17		06:33		06:38		07:05 (5)	05:51	06:38 (4)	05:27	
	16:50		17:30		18:07		19:44	26	07:31 (5)	20:20	38	07:16 (4)	20:49		
11	07:42		07:16		06:31		06:36		07:04 (5)	05:50	06:37 (4)	05:27	
	16:51		17:31		18:08		19:46	26	07:30 (5)	20:21	38	07:15 (4)	20:50		
12	07:42		07:14		06:30		06:34		07:05 (5)	05:49	06:37 (4)	05:27	
	16:52		17:33		18:09		19:47	25	07:30 (5)	20:22	38	07:15 (4)	20:50		
13	07:41		07:13		06:28		06:32		07:05 (5)	05:48	06:37 (4)	05:27	
	16:53		17:34		18:10		19:48	24	07:29 (5)	20:23	38	07:15 (4)	20:51		
14	07:41		07:11		06:26		06:31		07:05 (5)	05:47	06:37 (4)	05:27	
	16:54		17:35		18:12		19:49	22	07:27 (5)	20:24	38	07:15 (4)	20:51		
15	07:40		07:10		06:24		06:29		07:06 (5)	05:46	06:37 (4)	05:26	
	16:55		17:37		18:13		19:50	21	07:27 (5)	20:26	38	07:15 (4)	20:52		
16	07:40		07:09		06:22	06:44 (6)	06:27		07:07 (5)	05:44	06:37 (4)	05:26	
	16:57		17:38		18:14	3	06:47 (6)	19:52	18	07:25 (5)	20:27	38	07:15 (4)	20:52	
17	07:39		07:07		06:21	06:42 (6)	06:26		07:08 (5)	05:43	06:38 (4)	05:26	
	16:58		17:39		18:15	7	06:49 (6)	19:53	14	07:22 (5)	20:28	37	07:15 (4)	20:53	
18	07:39		07:06		06:19	06:40 (6)	06:24		07:12 (5)	05:42	06:38 (4)	05:26	
	16:59		17:41		18:17	10	06:50 (6)	19:54	8	07:20 (5)	20:29	36	07:14 (4)	20:53	
19	07:38		07:04		06:17	06:39 (6)	06:22				05:41	06:38 (4)	05:27	
	17:00		17:42		18:18	13	06:52 (6)	19:55			20:30	36	07:14 (4)	20:53	
20	07:38		07:03		06:15	06:37 (6)	06:21				05:40	06:38 (4)	05:27	
	17:02		17:43		18:19	15	06:52 (6)	19:56			20:31	36	07:14 (4)	20:54	
21	07:37		07:01		06:13	06:35 (6)	06:19				05:39	06:39 (4)	05:27	
	17:03		17:45		18:20	17	06:52 (6)	19:58			20:32	34	07:13 (4)	20:54	
22	07:36		07:00		06:12	06:33 (6)	06:17				05:38	06:40 (4)	05:27	
	17:04		17:46		18:22	18	06:51 (6)	19:59			20:33	33	07:13 (4)	20:54	
23	07:36		06:58		06:10	06:31 (6)	06:16				05:38	06:40 (4)	05:27	
	17:05		17:47		18:23	20	06:51 (6)	20:00			20:34	33	07:13 (4)	20:54	
24	07:35		06:57		06:08	06:32 (6)	06:14				05:37	06:41 (4)	05:27	
	17:07		17:49		18:24	19	06:51 (6)	20:01			20:35	31	07:12 (4)	20:55	
25	07:34		06:55		06:06	06:32 (6)	06:13				05:36	06:41 (4)	05:28	
	17:08		17:50		18:25	18	06:50 (6)	20:02			20:36	30	07:11 (4)	20:55	
26	07:33		06:53		07:04	07:33 (6)	06:11				05:35	06:43 (4)	05:28	
	17:09		17:51		19:26	15	07:48 (6)	20:04			20:37	28	07:11 (4)	20:55	
27	07:32		06:52		07:03	07:34 (6)	06:10		06:53 (4)		05:34	06:43 (4)	05:28	
	17:11		17:53		19:28	12	07:46 (6)	20:05	10	07:03 (4)	20:38	28	07:11 (4)	20:55	
28	07:31		06:50		07:01	07:37 (6)	06:08		06:49 (4)		05:34	06:44 (4)	05:29	
	17:12		17:54		19:29	5	07:42 (6)	20:06	17	07:06 (4)	20:39	26	07:10 (4)	20:55	
29	07:30				06:59		06:07		06:47 (4)		05:33	06:45 (4)	05:29	
	17:13				19:30		20:07	22	07:09 (4)		20:40	24	07:09 (4)	20:55	
30	07:30				06:57		06:05		06:45 (4)		05:32	06:45 (4)	05:30	
	17:15				19:31		20:08	25	07:10 (4)		20:41	23	07:08 (4)	20:55	
31	07:29				06:55						05:32	06:47 (4)		
	17:16				19:32						20:42	21	07:08 (4)		
Potential sun hours	289		292		368		401			455			461		
Total, worst case						172		430			1027			72	
Sun reduction						0.38		0.43			0.49			0.54	
Oper. time red.						1.00		1.00			1.00			1.00	
Wind dir. red.						1.00		1.00			1.00			1.00	
Total reduction						0.38		0.43			0.49			0.54	
Total, real						65		184			500			39	

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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: K - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (11)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	July			August			September			October	November	December
1	05:30			05:56		06:48 (4)	06:30		07:04 (5)	07:04	06:42	07:21
	20:55			20:34	38	07:26 (4)	19:48	24	07:28 (5)	18:53	17:02	16:34
2	05:31			05:57		06:48 (4)	06:32		07:03 (5)	07:05	06:44	07:22
	20:55			20:33	38	07:26 (4)	19:46	25	07:28 (5)	18:51	17:01	16:33
3	05:31			05:58		06:48 (4)	06:33		07:02 (5)	07:07	06:45	07:23
	20:54			20:32	38	07:26 (4)	19:44	26	07:28 (5)	18:49	16:59	16:33
4	05:32			05:59		06:48 (4)	06:34		07:03 (5)	07:08	06:46	07:24
	20:54			20:30	38	07:26 (4)	19:42	26	07:29 (5)	18:48	16:58	16:33
5	05:32			06:00		06:48 (4)	06:35		07:03 (5)	07:09	06:48	07:25
	20:54			20:29	38	07:26 (4)	19:40	26	07:29 (5)	18:46	16:57	16:32
6	05:33			06:01		06:48 (4)	06:36		07:02 (5)	07:10	06:49	07:26
	20:54			20:28	38	07:26 (4)	19:39	26	07:28 (5)	18:44	16:55	16:32
7	05:33			06:02		06:48 (4)	06:37		07:02 (5)	07:11	06:50	07:27
	20:53			20:27	37	07:25 (4)	19:37	25	07:27 (5)	18:42	16:54	16:32
8	05:34		07:04 (4)	06:03		06:49 (4)	06:38		07:03 (5)	07:13	06:52	07:28
	20:53	2	07:06 (4)	20:25	36	07:25 (4)	19:35	23	07:26 (5)	18:40	16:53	16:32
9	05:35		07:00 (4)	06:05		06:49 (4)	06:39		07:04 (5)	07:14	06:53	07:29
	20:53	9	07:09 (4)	20:24	35	07:24 (4)	19:33	21	07:25 (5)	18:39	16:52	16:32
10	05:35		06:59 (4)	06:06		06:49 (4)	06:41		07:04 (5)	07:15	06:54	07:30
	20:52	12	07:11 (4)	20:22	34	07:23 (4)	19:31	19	07:23 (5)	18:37	16:50	16:32
11	05:36		06:58 (4)	06:07		06:50 (4)	06:42		07:05 (5)	07:16	06:56	07:31
	20:52	15	07:13 (4)	20:21	32	07:22 (4)	19:30	16	07:21 (5)	18:35	16:49	16:32
12	05:37		06:56 (4)	06:08		06:51 (4)	06:43		07:07 (5)	07:17	06:57	07:32
	20:51	17	07:13 (4)	20:20	30	07:21 (4)	19:28	11	07:18 (5)	18:33	16:48	16:32
13	05:38		06:56 (4)	06:09		06:52 (4)	06:44			07:19	06:58	07:33
	20:51	19	07:15 (4)	20:18	28	07:20 (4)	19:26			18:32	16:47	16:32
14	05:39		06:55 (4)	06:10		06:53 (4)	06:45			07:20	07:00	07:34
	20:50	21	07:16 (4)	20:17	25	07:18 (4)	19:24			18:30	16:46	16:32
15	05:39		06:54 (4)	06:11		06:54 (4)	06:46			07:21	07:01	07:34
	20:49	23	07:17 (4)	20:15	22	07:16 (4)	19:22			18:28	16:45	16:32
16	05:40		06:54 (4)	06:12		06:56 (4)	06:47			07:22	07:02	07:35
	20:49	24	07:18 (4)	20:14	18	07:14 (4)	19:21			18:27	16:44	16:32
17	05:41		06:53 (4)	06:14		06:58 (4)	06:48		07:25 (6)	07:23	07:03	07:36
	20:48	26	07:19 (4)	20:12	13	07:11 (4)	19:19	8	07:33 (6)	18:25	16:43	16:32
18	05:42		06:52 (4)	06:15			06:50		07:22 (6)	07:25	07:05	07:37
	20:47	28	07:20 (4)	20:11			19:17	13	07:35 (6)	18:23	16:42	16:33
19	05:43		06:52 (4)	06:16			06:51		07:20 (6)	07:26	07:06	07:37
	20:47	28	07:20 (4)	20:09			19:15	16	07:36 (6)	18:22	16:41	16:33
20	05:44		06:51 (4)	06:17			06:52		07:19 (6)	07:27	07:07	07:38
	20:46	30	07:21 (4)	20:08			19:13	17	07:36 (6)	18:20	16:41	16:33
21	05:45		06:51 (4)	06:18			06:53		07:17 (6)	07:28	07:09	07:38
	20:45	31	07:22 (4)	20:06			19:11	20	07:37 (6)	18:18	16:40	16:34
22	05:46		06:50 (4)	06:19			06:54		07:17 (6)	07:30	07:10	07:39
	20:44	33	07:23 (4)	20:04			19:10	19	07:36 (6)	18:17	16:39	16:34
23	05:47		06:50 (4)	06:20			06:55		07:18 (6)	07:31	07:11	07:40
	20:43	33	07:23 (4)	20:03			19:08	18	07:36 (6)	18:15	16:38	16:35
24	05:48		06:50 (4)	06:21			06:56		07:19 (6)	07:32	07:12	07:40
	20:42	34	07:24 (4)	20:01			19:06	16	07:35 (6)	18:14	16:37	16:35
25	05:49		06:49 (4)	06:23			06:57		07:21 (6)	07:33	07:14	07:40
	20:42	36	07:25 (4)	19:59			19:04	15	07:36 (6)	18:12	16:37	16:36
26	05:50		06:49 (4)	06:24		07:17 (5)	06:59		07:22 (6)	07:35	07:15	07:41
	20:41	36	07:25 (4)	19:58	3	07:20 (5)	19:02	12	07:34 (6)	18:11	16:36	16:36
27	05:51		06:49 (4)	06:25		07:12 (5)	07:00		07:23 (6)	07:36	07:16	07:41
	20:40	36	07:25 (4)	19:56	12	07:24 (5)	19:00	10	07:33 (6)	18:09	16:36	16:37
28	05:52		06:49 (4)	06:26		07:09 (5)	07:01		07:24 (6)	07:37	07:17	07:42
	20:38	37	07:26 (4)	19:54	17	07:26 (5)	18:58	7	07:31 (6)	18:08	16:35	16:38
29	05:53		06:47 (4)	06:27		07:08 (5)	07:02		07:25 (6)	06:39	07:18	07:42
	20:37	38	07:25 (4)	19:53	19	07:27 (5)	18:57	3	07:28 (6)	17:06	16:35	16:38
30	05:54		06:47 (4)	06:28		07:06 (5)	07:03			06:40	07:20	07:42
	20:36	38	07:25 (4)	19:51	22	07:28 (5)	18:55			17:05	16:34	16:39
31	05:55		06:47 (4)	06:29		07:05 (5)				06:41		07:42
	20:35	38	07:25 (4)	19:49	23	07:28 (5)				17:03		16:40
Potential sun hours	468			434			377			343	292	279
Total, worst case		644			634			442				
Sun reduction		0.62			0.60			0.53				
Oper. time red.		1.00			1.00			1.00				
Wind dir. red.		1.00			1.00			1.00				
Total reduction		0.62			0.60			0.53				
Total, real		400			380			235				

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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: L - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (12)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January	February	March			April			May			June
1	07:43	07:27	06:48			06:54		07:15 (5)	06:04		06:43 (4)	05:31
	16:41	17:18	17:55			19:34	13	07:28 (5)	20:09	32	07:15 (4)	20:42
2	07:43	07:26	06:47			06:52		07:13 (5)	06:02		06:42 (4)	05:30
	16:42	17:19	17:57			19:35	16	07:29 (5)	20:11	34	07:16 (4)	20:43
3	07:43	07:25	06:45			06:50		07:11 (5)	06:01		06:41 (4)	05:30
	16:43	17:20	17:58			19:36	19	07:30 (5)	20:12	35	07:16 (4)	20:44
4	07:43	07:24	06:43			06:48		07:10 (5)	05:59		06:41 (4)	05:29
	16:44	17:22	17:59			19:37	22	07:32 (5)	20:13	35	07:16 (4)	20:45
5	07:43	07:23	06:42			06:46		07:08 (5)	05:58		06:40 (4)	05:29
	16:45	17:23	18:00			19:38	24	07:32 (5)	20:14	37	07:17 (4)	20:46
6	07:43	07:22	06:40			06:45		07:07 (5)	05:57		06:39 (4)	05:29
	16:46	17:24	18:02			19:40	25	07:32 (5)	20:15	37	07:16 (4)	20:46
7	07:43	07:21	06:38			06:43		07:06 (5)	05:55		06:39 (4)	05:28
	16:47	17:26	18:03			19:41	26	07:32 (5)	20:16	38	07:17 (4)	20:47
8	07:42	07:19	06:37			06:41		07:07 (5)	05:54		06:39 (4)	05:28
	16:48	17:27	18:04			19:42	25	07:32 (5)	20:18	38	07:17 (4)	20:48
9	07:42	07:18	06:35			06:39		07:06 (5)	05:53		06:39 (4)	05:28
	16:49	17:28	18:05			19:43	26	07:32 (5)	20:19	38	07:17 (4)	20:48
10	07:42	07:17	06:33			06:38		07:06 (5)	05:51		06:40 (4)	05:27
	16:50	17:30	18:07			19:44	25	07:31 (5)	20:20	37	07:17 (4)	20:49
11	07:42	07:16	06:31			06:36		07:06 (5)	05:50		06:39 (4)	05:27
	16:51	17:31	18:08			19:46	24	07:30 (5)	20:21	37	07:16 (4)	20:50
12	07:42	07:14	06:30			06:34		07:07 (5)	05:49		06:39 (4)	05:27
	16:52	17:33	18:09			19:47	23	07:30 (5)	20:22	37	07:16 (4)	20:50
13	07:41	07:13	06:28			06:32		07:07 (5)	05:48		06:39 (4)	05:27
	16:53	17:34	18:10			19:48	21	07:28 (5)	20:23	37	07:16 (4)	20:51
14	07:41	07:11	06:26			06:31		07:08 (5)	05:47		06:40 (4)	05:27
	16:54	17:35	18:12			19:49	19	07:27 (5)	20:24	36	07:16 (4)	20:51
15	07:40	07:10	06:24			06:29		07:09 (5)	05:46		06:40 (4)	05:26
	16:55	17:37	18:13			19:50	16	07:25 (5)	20:26	35	07:15 (4)	20:52
16	07:40	07:09	06:22		06:44 (6)	06:27		07:11 (5)	05:44		06:40 (4)	05:26
	16:57	17:38	18:14	5	06:49 (6)	19:52	12	07:23 (5)	20:27	35	07:15 (4)	20:52
17	07:39	07:07	06:21		06:42 (6)	06:26			05:43		06:41 (4)	05:26
	16:58	17:39	18:15	9	06:51 (6)	19:53			20:28	33	07:14 (4)	20:53
18	07:39	07:06	06:19		06:40 (6)	06:24			05:42		06:41 (4)	05:26
	16:59	17:41	18:17	11	06:51 (6)	19:54			20:29	33	07:14 (4)	20:53
19	07:38	07:04	06:17		06:39 (6)	06:22			05:41		06:42 (4)	05:27
	17:00	17:42	18:18	14	06:53 (6)	19:55			20:30	31	07:13 (4)	20:53
20	07:38	07:03	06:15		06:37 (6)	06:21			05:40		06:42 (4)	05:27
	17:02	17:43	18:19	16	06:53 (6)	19:56			20:31	31	07:13 (4)	20:54
21	07:37	07:01	06:13		06:35 (6)	06:19			05:39		06:43 (4)	05:27
	17:03	17:45	18:20	17	06:52 (6)	19:58			20:32	29	07:12 (4)	20:54
22	07:36	07:00	06:12		06:33 (6)	06:17			05:38		06:45 (4)	05:27
	17:04	17:46	18:22	19	06:52 (6)	19:59			20:33	27	07:12 (4)	20:54
23	07:36	06:58	06:10		06:32 (6)	06:16			05:38		06:45 (4)	05:27
	17:05	17:47	18:23	19	06:51 (6)	20:00			20:34	26	07:11 (4)	20:54
24	07:35	06:57	06:08		06:33 (6)	06:14			05:37		06:46 (4)	05:27
	17:07	17:49	18:24	18	06:51 (6)	20:01			20:35	24	07:10 (4)	20:55
25	07:34	06:55	06:06		06:34 (6)	06:13		06:54 (4)	05:36		06:47 (4)	05:28
	17:08	17:50	18:25	15	06:49 (6)	20:02	13	07:07 (4)	20:36	22	07:09 (4)	20:55
26	07:33	06:53	07:04		07:35 (6)	06:11		06:50 (4)	05:35		06:49 (4)	05:28
	17:09	17:51	19:26	12	07:47 (6)	20:04	19	07:09 (4)	20:37	19	07:08 (4)	20:55
27	07:32	06:52	07:03		07:37 (6)	06:10		06:48 (4)	05:34		06:50 (4)	05:28
	17:11	17:53	19:28	7	07:44 (6)	20:05	23	07:11 (4)	20:38	17	07:07 (4)	20:55
28	07:31	06:50	07:01			06:08		06:46 (4)	05:34		06:51 (4)	05:29
	17:12	17:54	19:29			20:06	26	07:12 (4)	20:39	14	07:05 (4)	20:55
29	07:30		06:59			06:07		06:45 (4)	05:33		06:54 (4)	05:29
	17:13		19:30			20:07	29	07:14 (4)	20:40	10	07:04 (4)	20:55
30	07:30		06:57			06:05		06:43 (4)	05:32		06:58 (4)	05:30
	17:15		19:31			20:08	31	07:14 (4)	20:41	1	06:59 (4)	20:55
31	07:29		06:55		07:20 (5)				05:32			
	17:16		19:32	4	07:24 (5)				20:42			
Potential sun hours	289	292	368			401			455			461
Total, worst case				166			477			895		
Sun reduction				0.38			0.43			0.49		
Oper. time red.				1.00			1.00			1.00		
Wind dir. red.				1.00			1.00			1.00		
Total reduction				0.38			0.43			0.49		
Total, real				63			204			436		

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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: L - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (12)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	July			August			September			October		November	December
1	05:30			05:56		06:50 (4)	06:30		07:06 (5)	07:04		06:42	07:21
	20:55			20:34	37	07:27 (4)	19:48	22	07:28 (5)	18:53		17:02	16:34
2	05:31			05:57		06:50 (4)	06:32		07:05 (5)	07:05		06:44	07:22
	20:55			20:33	37	07:27 (4)	19:46	23	07:28 (5)	18:51		17:01	16:33
3	05:31			05:58		06:50 (4)	06:33		07:04 (5)	07:07		06:45	07:23
	20:54			20:32	37	07:27 (4)	19:44	25	07:29 (5)	18:49		16:59	16:33
4	05:32			05:59		06:50 (4)	06:34		07:04 (5)	07:08		06:46	07:24
	20:54			20:30	37	07:27 (4)	19:42	26	07:30 (5)	18:48		16:58	16:33
5	05:32			06:00		06:50 (4)	06:35		07:03 (5)	07:09		06:48	07:25
	20:54			20:29	37	07:27 (4)	19:40	26	07:29 (5)	18:46		16:57	16:32
6	05:33			06:01		06:50 (4)	06:36		07:03 (5)	07:10		06:49	07:26
	20:54			20:28	37	07:27 (4)	19:39	26	07:29 (5)	18:44		16:55	16:32
7	05:33			06:02		06:50 (4)	06:37		07:03 (5)	07:11		06:50	07:27
	20:53			20:27	37	07:27 (4)	19:37	25	07:28 (5)	18:42		16:54	16:32
8	05:34			06:03		06:50 (4)	06:38		07:03 (5)	07:13		06:52	07:28
	20:53			20:25	37	07:27 (4)	19:35	24	07:27 (5)	18:40		16:53	16:32
9	05:35			06:05		06:50 (4)	06:39		07:03 (5)	07:14		06:53	07:29
	20:53			20:24	36	07:26 (4)	19:33	23	07:26 (5)	18:39		16:52	16:32
10	05:35			06:06		06:50 (4)	06:41		07:04 (5)	07:15		06:54	07:30
	20:52			20:22	36	07:26 (4)	19:31	21	07:25 (5)	18:37		16:50	16:32
11	05:36			06:07		06:50 (4)	06:42		07:05 (5)	07:16		06:56	07:31
	20:52			20:21	35	07:25 (4)	19:30	18	07:23 (5)	18:35		16:49	16:32
12	05:37			06:08		06:50 (4)	06:43		07:06 (5)	07:17		06:57	07:32
	20:51			20:20	34	07:24 (4)	19:28	15	07:21 (5)	18:33		16:48	16:32
13	05:38			06:09		06:51 (4)	06:44		07:07 (5)	07:19		06:58	07:33
	20:51			20:18	33	07:24 (4)	19:26	11	07:18 (5)	18:32		16:47	16:32
14	05:39			06:10		06:51 (4)	06:45			07:20		07:00	07:34
	20:50			20:17	32	07:23 (4)	19:24			18:30		16:46	16:32
15	05:39		07:06 (4)	06:11		06:52 (4)	06:46			07:21		07:01	07:34
	20:49	2	07:08 (4)	20:15	29	07:21 (4)	19:22			18:28		16:45	16:32
16	05:40		07:03 (4)	06:12		06:53 (4)	06:47			07:22		07:02	07:35
	20:49	10	07:13 (4)	20:14	27	07:20 (4)	19:21			18:27		16:44	16:32
17	05:41		07:00 (4)	06:14		06:54 (4)	06:48			07:23		07:03	07:36
	20:48	14	07:14 (4)	20:12	24	07:18 (4)	19:19			18:25		16:43	16:32
18	05:42		06:59 (4)	06:15		06:56 (4)	06:50		07:24 (6)	07:25		07:05	07:37
	20:47	17	07:16 (4)	20:11	20	07:16 (4)	19:17	9	07:33 (6)	18:23		16:42	16:33
19	05:43		06:58 (4)	06:16		06:58 (4)	06:51		07:22 (6)	07:26		07:06	07:37
	20:47	19	07:17 (4)	20:09	15	07:13 (4)	19:15	13	07:35 (6)	18:22		16:41	16:33
20	05:44		06:57 (4)	06:17		07:03 (4)	06:52		07:20 (6)	07:27		07:07	07:38
	20:46	22	07:19 (4)	20:08	7	07:10 (4)	19:13	16	07:36 (6)	18:20		16:41	16:33
21	05:45		06:56 (4)	06:18			06:53		07:19 (6)	07:28		07:09	07:38
	20:45	24	07:20 (4)	20:06			19:11	17	07:36 (6)	18:18		16:40	16:34
22	05:46		06:55 (4)	06:19			06:54		07:17 (6)	07:30		07:10	07:39
	20:44	26	07:21 (4)	20:04			19:10	20	07:37 (6)	18:17		16:39	16:34
23	05:47		06:55 (4)	06:20			06:55		07:18 (6)	07:31		07:11	07:40
	20:43	27	07:22 (4)	20:03			19:08	18	07:36 (6)	18:15		16:38	16:35
24	05:48		06:54 (4)	06:21			06:56		07:19 (6)	07:32		07:12	07:40
	20:42	29	07:23 (4)	20:01			19:06	17	07:36 (6)	18:14		16:37	16:35
25	05:49		06:53 (4)	06:23			06:57		07:21 (6)	07:33		07:14	07:40
	20:42	31	07:24 (4)	19:59			19:04	15	07:36 (6)	18:12		16:37	16:36
26	05:50		06:53 (4)	06:24			06:59		07:22 (6)	07:35		07:15	07:41
	20:41	31	07:24 (4)	19:58			19:02	13	07:35 (6)	18:11		16:36	16:36
27	05:51		06:52 (4)	06:25			07:00		07:23 (6)	07:36		07:16	07:41
	20:40	33	07:25 (4)	19:56			19:00	11	07:34 (6)	18:09		16:36	16:37
28	05:52		06:52 (4)	06:26		07:14 (5)	07:01		07:24 (6)	07:37		07:17	07:42
	20:38	34	07:26 (4)	19:54	9	07:23 (5)	18:58	8	07:32 (6)	18:08		16:35	16:38
29	05:53		06:50 (4)	06:27		07:11 (5)	07:02		07:25 (6)	06:39		07:18	07:42
	20:37	35	07:25 (4)	19:53	14	07:25 (5)	18:57	5	07:30 (6)	17:06		16:35	16:38
30	05:54		06:50 (4)	06:28		07:09 (5)	07:03			06:40		07:20	07:42
	20:36	35	07:25 (4)	19:51	18	07:27 (5)	18:55			17:05		16:34	16:39
31	05:55		06:50 (4)	06:29		07:07 (5)				06:41			07:42
	20:35	36	07:26 (4)	19:49	21	07:28 (5)				17:03			16:40
Potential sun hours	468			434			377			343		292	279
Total, worst case		425			686			447					
Sun reduction		0.62			0.60			0.53					
Oper. time red.		1.00			1.00			1.00					
Wind dir. red.		1.00			1.00			1.00					
Total reduction		0.62			0.60			0.53					
Total, real		264			411			238					

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

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

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Calculated:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: M - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (13)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:42	07:27	06:48	06:54	06:04	05:31	05:30	05:56	06:30	07:04	06:42	07:21
	16:41	17:17	17:55	19:34	20:09	20:42	20:55	20:34	19:47	18:53	17:02	16:34
2	07:43	07:26	06:47	06:52	06:02	05:30	05:30	05:57	06:31	07:05	06:44	07:22
	16:42	17:19	17:56	19:35	20:11	20:43	20:54	20:33	19:46	18:51	17:01	16:33
3	07:43	07:25	06:45	06:50	06:01	05:30	05:31	05:58	06:33	07:07	06:45	07:23
	16:43	17:20	17:58	19:36	20:12	20:44	20:54	20:32	19:44	18:49	16:59	16:33
4	07:43	07:24	06:43	06:48	05:59	05:29	05:32	05:59	06:34	07:08	06:46	07:24
	16:44	17:22	17:59	19:37	20:13	20:45	20:54	20:30	19:42	18:48	16:58	16:33
5	07:43	07:23	06:42	06:46	05:58	05:29	05:32	06:00	06:35	07:09	06:48	07:25
	16:45	17:23	18:00	19:38	20:14	20:45	20:54	20:29	19:40	18:46	16:57	16:32
6	07:43	07:22	06:40	06:45	05:57	05:28	05:33	06:01	06:36	07:10	06:49	07:26
	16:46	17:24	18:02	19:40	20:15	20:46	20:54	20:28	19:39	18:44	16:55	16:32
7	07:43	07:21	06:38	06:43	05:55	05:28	05:33	06:02	06:37	07:11	06:50	07:27
	16:47	17:26	18:03	19:41	20:16	20:47	20:53	20:26	19:37	18:42	16:54	16:32
8	07:42	07:19	06:36	06:41	05:54	05:28	05:34	06:03	06:38	07:12	06:52	07:28
	16:48	17:27	18:04	19:42	20:18	20:48	20:53	20:25	19:35	18:40	16:53	16:32
9	07:42	07:18	06:35	06:39	05:53	05:27	05:35	06:05	06:39	07:14	06:53	07:29
	16:49	17:28	18:05	19:43	20:19	20:48	20:52	20:24	19:33	18:39	16:52	16:32
10	07:42	07:17	06:33	06:38	05:51	05:27	05:35	06:06	06:40	07:15	06:54	07:30
	16:50	17:30	18:07	19:44	20:20	20:49	20:52	20:22	19:31	18:37	16:50	16:32
11	07:42	07:15	06:31	06:36	05:50	05:27	05:36	06:07	06:42	07:16	06:55	07:31
	16:51	17:31	18:08	19:45	20:21	20:50	20:52	20:21	19:30	18:35	16:49	16:32
12	07:41	07:14	06:29	06:34	05:49	05:27	05:37	06:08	06:43	07:17	06:57	07:32
	16:52	17:32	18:09	19:47	20:22	20:50	20:51	20:20	19:28	18:33	16:48	16:32
13	07:41	07:13	06:28	06:32	05:48	05:27	05:38	06:09	06:44	07:18	06:58	07:33
	16:53	17:34	18:10	19:48	20:23	20:51	20:51	20:18	19:26	18:32	16:47	16:32
14	07:41	07:11	06:26	06:31	05:47	05:27	05:39	06:10	06:45	07:20	06:59	07:33
	16:54	17:35	18:12	19:49	20:24	20:51	20:50	20:17	19:24	18:30	16:46	16:32
15	07:40	07:10	06:24	06:29	05:45	05:26	05:39	06:11	06:46	07:21	07:01	07:34
	16:55	17:37	18:13	19:50	20:25	20:52	20:49	20:15	19:22	18:28	16:45	16:32
16	07:40	07:09	06:22	06:27	05:44	05:26	05:40	06:12	06:47	07:22	07:02	07:35
	16:57	17:38	18:14	19:51	20:27	20:52	20:49	20:14	19:20	18:27	16:44	16:32
17	07:39	07:07	06:21	06:26	05:43	05:26	05:41	06:13	06:48	07:23	07:03	07:36
	16:58	17:39	18:15	19:53	20:28	20:52	20:48	20:12	19:19	18:25	16:43	16:32
18	07:39	07:06	06:19	06:24	05:42	05:26	05:42	06:15	06:49	07:25	07:05	07:36
	16:59	17:41	18:17	19:54	20:29	20:53	20:47	20:11	19:17	18:23	16:42	16:33
19	07:38	07:04	06:17	06:22	05:41	05:26	05:43	06:16	06:51	07:26	07:06	07:37
	17:00	17:42	18:18	19:55	20:30	20:53	20:47	20:09	19:15	18:22	16:41	16:33
20	07:38	07:03	06:15	06:21	05:40	05:27	05:44	06:17	06:52	07:27	07:07	07:38
	17:02	17:43	18:19	19:56	20:31	20:54	20:46	20:07	19:13	18:20	16:40	16:33
21	07:37	07:01	06:13	06:19	05:39	05:27	05:45	06:18	06:53	07:28	07:08	07:38
	17:03	17:45	18:20	19:57	20:32	20:54	20:45	20:06	19:11	18:18	16:40	16:34
22	07:36	07:00	06:12	06:17	05:38	05:27	05:46	06:19	06:54	07:30	07:10	07:39
	17:04	17:46	18:21	19:59	20:33	20:54	20:44	20:04	19:09	18:17	16:39	16:34
23	07:35	06:58	06:10	06:16	05:37	05:27	05:47	06:20	06:55	07:31	07:11	07:39
	17:05	17:47	18:23	20:00	20:34	20:54	20:43	20:03	19:08	18:15	16:38	16:35
24	07:35	06:56	06:08	06:14	05:37	05:27	05:48	06:21	06:56	07:32	07:12	07:40
	17:07	17:49	18:24	20:01	20:35	20:54	20:42	20:01	19:06	18:14	16:37	16:35
25	07:34	06:55	06:06	06:13	05:36	05:28	05:49	06:22	06:57	07:33	07:13	07:40
	17:08	17:50	18:25	20:02	20:36	20:55	20:41	19:59	19:04	18:12	16:37	16:36
26	07:33	06:53	07:04	06:11	05:35	05:28	05:50	06:24	06:59	07:35	07:15	07:41
	17:09	17:51	19:26	20:03	20:37	20:55	20:40	19:58	19:02	18:11	16:36	16:36
27	07:32	06:52	07:03	06:10	05:34	05:28	05:51	06:25	07:00	07:36	07:16	07:41
	17:11	17:53	19:28	20:05	20:38	20:55	20:39	19:56	19:00	18:09	16:36	16:37
28	07:31	06:50	07:01	06:08	05:33	05:29	05:52	06:26	07:01	07:37	07:17	07:41
	17:12	17:54	19:29	20:06	20:39	20:55	20:38	19:54	18:58	18:08	16:35	16:38
29	07:30		06:59	06:07	05:33	05:29	05:53	06:27	07:02	06:38	07:18	07:42
	17:13		19:30	20:07	20:40	20:55	20:37	19:53	18:57	17:06	16:34	16:38
30	07:29		06:57	06:05	05:32	05:29	05:54	06:28	07:03	06:40	07:19	07:42
	17:15		19:31	20:08	20:41	20:55	20:36	19:51	18:55	17:05	16:34	16:39
31	07:28		06:55		05:32		05:55	06:29		06:41		07:42
	17:16		19:32		20:41		20:35	19:49		17:03		16:40
Potential sun hours	289	292	368	401	455	461	468	434	377	343	292	279
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

Day in month	Sun rise (hh:mm) 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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: N - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (14)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January			February			March			April			May			June		
1	07:42		14:26 (5)	07:27		15:50 (4)	06:48			06:54		17:36 (3)	06:04		18:17 (2)	05:31		
	16:41	23	14:49 (5)	17:17	9	15:59 (4)	17:55			19:34	27	18:03 (3)	20:09	24	18:41 (2)	20:42		
2	07:43		14:27 (5)	07:26		15:49 (4)	06:47			06:52		17:35 (3)	06:02		18:18 (2)	05:30		
	16:42	23	14:50 (5)	17:19	15	16:04 (4)	17:56			19:35	28	18:03 (3)	20:11	23	18:41 (2)	20:43		
3	07:43		14:28 (5)	07:25		15:49 (4)	06:45			06:50		17:35 (3)	06:01		18:17 (2)	05:30		
	16:43	23	14:51 (5)	17:20	17	16:06 (4)	17:58			19:36	28	18:03 (3)	20:12	23	18:40 (2)	20:44		
4	07:43		14:28 (5)	07:24		15:48 (4)	06:43			06:48		17:35 (3)	05:59		18:18 (2)	05:29		
	16:44	24	14:52 (5)	17:21	19	16:07 (4)	17:59			19:37	29	18:04 (3)	20:13	22	18:40 (2)	20:45		
5	07:43		14:29 (5)	07:23		15:47 (4)	06:42			06:46		17:34 (3)	05:58		18:18 (2)	05:29		
	16:45	24	14:53 (5)	17:23	20	16:07 (4)	18:00			19:38	29	18:03 (3)	20:14	22	18:40 (2)	20:46		
6	07:43		14:30 (5)	07:22		15:47 (4)	06:40			06:45		17:34 (3)	05:57		18:18 (2)	05:28		
	16:45	24	14:54 (5)	17:24	21	16:08 (4)	18:02			19:40	29	18:03 (3)	20:15	21	18:39 (2)	20:46		
7	07:43		14:31 (5)	07:21		15:48 (4)	06:38			06:43		17:34 (3)	05:55		18:19 (2)	05:28		
	16:46	24	14:55 (5)	17:26	21	16:09 (4)	18:03			19:41	28	18:02 (3)	20:16	19	18:38 (2)	20:47		
8	07:42		14:32 (5)	07:19		15:48 (4)	06:36			06:41		17:34 (3)	05:54		18:20 (2)	05:28		
	16:47	25	14:57 (5)	17:27	21	16:09 (4)	18:04			19:42	27	18:01 (3)	20:18	22	18:58 (1)	20:48		
9	07:42		14:32 (5)	07:18		15:47 (4)	06:35			06:39		17:35 (3)	05:53		18:22 (2)	05:27		
	16:49	26	14:58 (5)	17:28	22	16:09 (4)	18:05			19:43	26	18:01 (3)	20:19	20	18:59 (1)	20:48		
10	07:42		14:33 (5)	07:17		15:48 (4)	06:33			06:38		17:36 (3)	05:51		18:22 (2)	05:27		
	16:50	26	14:59 (5)	17:30	22	16:10 (4)	18:07			19:44	24	18:00 (3)	20:20	19	18:59 (1)	20:49		
11	07:42		14:34 (5)	07:15		15:49 (4)	06:31			06:36		17:36 (3)	05:50		18:25 (2)	05:27		
	16:51	25	14:59 (5)	17:31	22	16:11 (4)	18:08			19:45	22	17:58 (3)	20:21	15	19:00 (1)	20:50		
12	07:41		14:35 (5)	07:14		15:49 (4)	06:29			06:34		17:38 (3)	05:49		18:52 (1)	05:27		
	16:52	24	14:59 (5)	17:32	22	16:11 (4)	18:09			19:47	19	17:57 (3)	20:22	10	19:02 (1)	20:50		
13	07:41		14:36 (5)	07:13		15:50 (4)	06:28			06:32		17:40 (3)	05:48		18:52 (1)	05:27		
	16:53	23	14:59 (5)	17:34	22	16:12 (4)	18:10			19:48	15	17:55 (3)	20:23	11	19:03 (1)	20:51		
14	07:41		14:37 (5)	07:11		15:51 (4)	06:26			06:31		17:42 (3)	05:47		18:52 (1)	05:26		
	16:54	21	14:58 (5)	17:35	19	16:10 (4)	18:12			19:49	10	17:52 (3)	20:24	12	19:04 (1)	20:51		
15	07:40		14:39 (5)	07:10		15:53 (4)	06:24			06:29			05:45		18:52 (1)	05:26		
	16:55	19	14:58 (5)	17:37	17	16:10 (4)	18:13			19:50			20:25	14	19:06 (1)	20:52		
16	07:40		14:40 (5)	07:09		15:54 (4)	06:22			06:27			05:44		18:52 (1)	05:26		
	16:57	17	14:57 (5)	17:38	13	16:07 (4)	18:14			19:51			20:27	16	19:08 (1)	20:52		
17	07:39		14:43 (5)	07:07		15:58 (4)	06:21			06:26			05:43		18:53 (1)	05:26		
	16:58	13	14:56 (5)	17:39	6	16:04 (4)	18:15			19:53			20:28	16	19:09 (1)	20:53		
18	07:39		14:45 (5)	07:06			06:19			06:24			05:42		18:53 (1)	05:26		
	16:59	9	14:54 (5)	17:41			18:17			19:54			20:29	17	19:10 (1)	20:53		
19	07:38			07:04			06:17			06:22			05:41		18:53 (1)	05:26		
	17:00			17:42			18:18			19:55			20:30	17	19:10 (1)	20:53		
20	07:38			07:03			06:15			06:21			05:40		18:54 (1)	05:26		
	17:01			17:43			18:19			19:56			20:31	15	19:09 (1)	20:54		
21	07:37			07:01			06:13			06:19			05:39		18:55 (1)	05:27		
	17:03			17:45			18:20			19:57			20:32	14	19:09 (1)	20:54		
22	07:36			07:00			06:12			06:17			05:38		18:56 (1)	05:27		
	17:04			17:46			18:21			19:59			20:33	12	19:08 (1)	20:54		
23	07:36			06:58			06:10			06:16		18:26 (2)	05:37		18:58 (1)	05:27		
	17:05			17:47			18:23			20:00	6	18:32 (2)	20:34	9	19:07 (1)	20:54		
24	07:35			06:56			06:08			06:14		18:23 (2)	05:37		19:00 (1)	05:27		
	17:07			17:49			18:24			20:01	9	18:32 (2)	20:35	5	19:05 (1)	20:54		
25	07:34			06:55			06:06			06:13		18:22 (2)	05:36			05:28		
	17:08			17:50			18:25			20:02	12	18:34 (2)	20:36			20:55		
26	07:33			06:53			07:04			06:11		18:20 (2)	05:35			05:28		
	17:09			17:51			19:26			20:03	16	18:36 (2)	20:37			20:55		
27	07:32			06:52			07:03		17:46 (3)	06:10		18:19 (2)	05:34			05:28		
	17:11			17:53			19:28	10	17:56 (3)	20:05	19	18:38 (2)	20:38			20:55		
28	07:31			06:50			07:01		17:43 (3)	06:08		18:18 (2)	05:33			05:29		
	17:12			17:54			19:29	15	17:58 (3)	20:06	22	18:40 (2)	20:39			20:55		
29	07:30						06:59		17:40 (3)	06:07		18:18 (2)	05:33			05:29		
	17:13						19:30	20	18:00 (3)	20:07	23	18:41 (2)	20:40			20:55		
30	07:29						06:57		17:39 (3)	06:05		18:17 (2)	05:32			05:29		
	17:15						19:31	23	18:02 (3)	20:08	24	18:41 (2)	20:41			20:55		
31	07:28		15:51 (4)				06:55		17:38 (3)				05:31					
	17:16	4	15:55 (4)				19:32	25	18:03 (3)				20:42					
Potential sun hours	289			292			368			401			455			461		
Total, worst case		397			308			93			472			398				
Sun reduction		0.27			0.32			0.38			0.43			0.49				
Oper. time red.		1.00			1.00			1.00			1.00			1.00				
Wind dir. red.		1.00			1.00			1.00			1.00			1.00				
Total reduction		0.27			0.32			0.38			0.43			0.49				
Total, real		105			98			35			202			194				

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

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

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05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: N - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (14)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	July			August			September			October			November			December		
1	05:30			05:56		19:02 (1)	06:30		17:38 (3)	07:04			06:42		15:18 (4)	07:21		14:17 (5)
	20:55			20:34	11	19:13 (1)	19:47	17	17:55 (3)	18:53			17:02	22	15:40 (4)	16:34	23	14:40 (5)
2	05:30			05:57		19:02 (1)	06:31		17:36 (3)	07:05			06:44		15:18 (4)	07:22		14:16 (5)
	20:54			20:33	10	19:12 (1)	19:46	20	17:56 (3)	18:51			17:00	22	15:40 (4)	16:33	25	14:41 (5)
3	05:31			05:58		18:36 (2)	06:33		17:34 (3)	07:07			06:45		15:17 (4)	07:23		14:17 (5)
	20:54			20:32	15	19:11 (1)	19:44	23	17:57 (3)	18:49			16:59	22	15:39 (4)	16:33	25	14:42 (5)
4	05:31			05:59		18:33 (2)	06:34		17:32 (3)	07:08			06:46		15:18 (4)	07:24		14:17 (5)
	20:54			20:30	18	19:09 (1)	19:42	26	17:58 (3)	18:48			16:58	21	15:39 (4)	16:32	26	14:43 (5)
5	05:32			06:00		18:31 (2)	06:35		17:32 (3)	07:09			06:48		15:17 (4)	07:25		14:17 (5)
	20:54			20:29	20	19:08 (1)	19:40	27	17:59 (3)	18:46			16:56	21	15:38 (4)	16:32	25	14:42 (5)
6	05:33			06:01		18:31 (2)	06:36		17:31 (3)	07:10			06:49		15:17 (4)	07:26		14:16 (5)
	20:54			20:28	20	19:08 (1)	19:39	28	17:59 (3)	18:44			16:55	21	15:38 (4)	16:32	25	14:41 (5)
7	05:33			06:02		18:30 (2)	06:37		17:30 (3)	07:11			06:50		15:18 (4)	07:27		14:17 (5)
	20:53			20:26	21	19:07 (1)	19:37	29	17:59 (3)	18:42			16:54	20	15:38 (4)	16:32	24	14:41 (5)
8	05:34			06:03		18:29 (2)	06:38		17:29 (3)	07:12			06:52		15:18 (4)	07:28		14:17 (5)
	20:53			20:25	20	18:49 (2)	19:35	29	17:58 (3)	18:40			16:53	19	15:37 (4)	16:32	24	14:41 (5)
9	05:35			06:04		18:28 (2)	06:39		17:29 (3)	07:14			06:53		15:19 (4)	07:29		14:17 (5)
	20:53			20:24	21	18:49 (2)	19:33	29	17:58 (3)	18:39			16:52	18	15:37 (4)	16:32	24	14:41 (5)
10	05:35			06:06		18:27 (2)	06:40		17:28 (3)	07:15			06:54		15:19 (4)	07:30		14:17 (5)
	20:52			20:22	23	18:50 (2)	19:31	29	17:57 (3)	18:37			16:50	17	15:36 (4)	16:32	24	14:41 (5)
11	05:36			06:07		18:26 (2)	06:42		17:28 (3)	07:16			06:56		15:21 (4)	07:31		14:17 (5)
	20:52			20:21	24	18:50 (2)	19:30	28	17:56 (3)	18:35			16:49	13	15:34 (4)	16:31	24	14:41 (5)
12	05:37			06:08		18:26 (2)	06:43		17:28 (3)	07:17			06:57		15:22 (4)	07:32		14:18 (5)
	20:51			20:20	24	18:50 (2)	19:28	27	17:55 (3)	18:33			16:48	6	15:28 (4)	16:32	23	14:41 (5)
13	05:38			06:09		18:26 (2)	06:44		17:28 (3)	07:18			06:58		15:23 (4)	07:33		14:18 (5)
	20:51			20:18	23	18:49 (2)	19:26	26	17:54 (3)	18:32			16:47	2	15:25 (4)	16:32	23	14:41 (5)
14	05:38			06:10		18:25 (2)	06:45		17:29 (3)	07:20			06:59			07:33		14:18 (5)
	20:50			20:17	24	18:49 (2)	19:24	24	17:53 (3)	18:30			16:46			16:32	23	14:41 (5)
15	05:39			06:11		18:25 (2)	06:46		17:29 (3)	07:21			07:01			07:34		14:18 (5)
	20:49			20:15	24	18:49 (2)	19:22	22	17:51 (3)	18:28			16:45			16:32	23	14:41 (5)
16	05:40			06:12		18:25 (2)	06:47		17:30 (3)	07:22			07:02			07:35		14:19 (5)
	20:49			20:14	23	18:48 (2)	19:20	19	17:49 (3)	18:27			16:44			16:32	22	14:41 (5)
17	05:41			06:13		18:26 (2)	06:48		17:33 (3)	07:23			07:03			07:36		14:20 (5)
	20:48			20:12	20	18:46 (2)	19:19	14	17:47 (3)	18:25			16:43			16:32	22	14:42 (5)
18	05:42			06:15		18:26 (2)	06:49		17:37 (3)	07:25			07:05			07:36		14:19 (5)
	20:47			20:11	17	18:43 (2)	19:17	6	17:43 (3)	18:23			16:42			16:33	23	14:42 (5)
19	05:43			06:16		18:27 (2)	06:51			07:26			07:06			07:37		14:20 (5)
	20:47			20:09	13	18:40 (2)	19:15			18:22			16:41			16:33	22	14:42 (5)
20	05:44			06:17		18:28 (2)	06:52			07:27			07:07			07:38		14:21 (5)
	20:46			20:07	10	18:38 (2)	19:13			18:20			16:40			16:33	22	14:43 (5)
21	05:45		19:10 (1)	06:18		18:29 (2)	06:53			07:28			07:09			07:38		14:21 (5)
	20:45	5	19:15 (1)	20:06	8	18:37 (2)	19:11			18:18			16:40			16:34	22	14:43 (5)
22	05:46		19:08 (1)	06:19		18:34 (2)	06:54			07:30			07:10			07:39		14:22 (5)
	20:44	9	19:17 (1)	20:04	2	18:36 (2)	19:09			18:17			16:39			16:34	22	14:44 (5)
23	05:47		19:07 (1)	06:20			06:55			07:31			07:11			07:39		14:22 (5)
	20:43	12	19:19 (1)	20:03			19:08			18:15			16:38			16:35	22	14:44 (5)
24	05:48		19:06 (1)	06:21			06:56			07:32			07:12			07:40		14:22 (5)
	20:42	14	19:20 (1)	20:01			19:06			18:14			16:37			16:35	22	14:44 (5)
25	05:49		19:04 (1)	06:22			06:57			07:33			07:13		14:25 (5)	07:40		14:23 (5)
	20:41	15	19:19 (1)	19:59			19:04			18:12			16:37	5	14:30 (5)	16:36	22	14:45 (5)
26	05:50		19:04 (1)	06:24			06:58			07:35			07:15		14:21 (5)	07:41		14:23 (5)
	20:40	16	19:20 (1)	19:58			19:02			18:11			16:36	12	14:33 (5)	16:36	22	14:45 (5)
27	05:51		19:03 (1)	06:25			07:00			07:36		16:24 (4)	07:16		14:20 (5)	07:41		14:23 (5)
	20:39	18	19:21 (1)	19:56			19:00			18:09	12	16:36 (4)	16:35	15	14:35 (5)	16:37	23	14:46 (5)
28	05:52		19:03 (1)	06:26			07:01			07:37		16:23 (4)	07:17		14:19 (5)	07:41		14:25 (5)
	20:38	17	19:20 (1)	19:54			18:58			18:08	16	16:39 (4)	16:35	18	14:37 (5)	16:38	22	14:47 (5)
29	05:53		19:02 (1)	06:27			07:02			06:39		15:21 (4)	07:18		14:18 (5)	07:42		14:25 (5)
	20:37	16	19:18 (1)	19:53			18:57			17:06	19	15:40 (4)	16:34	20	14:38 (5)	16:38	23	14:48 (5)
30	05:54		19:02 (1)	06:28		17:45 (3)	07:03			06:40		15:20 (4)	07:19		14:17 (5)	07:42		14:25 (5)
	20:36	14	19:16 (1)	19:51	5	17:50 (3)	18:55			17:05	21	15:41 (4)	16:34	22	14:39 (5)	16:39	23	14:48 (5)
31	05:55		19:02 (1)	06:29		17:41 (3)				06:41		15:19 (4)				07:42		14:26 (5)
	20:35	12	19:14 (1)	19:49	13	17:54 (3)				17:03	22	15:41 (4)				16:40	23	14:49 (5)
Potential sun hours	468			434			377			343			292			279		
Total, worst case		148			409			423			90			316			718	
Sun reduction		0.62			0.60			0.53			0.44			0.30			0.28	
Oper. time red.		1.00			1.00			1.00			1.00			1.00			1.00	
Wind dir. red.		1.00			1.00			1.00			1.00			1.00			1.00	
Total reduction		0.62			0.60			0.53			0.44			0.30			0.28	
Total, real		92			245			225			40			96			204	

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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: O - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (15)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January			February			March			April			May	June
1	07:43			07:27		14:55 (3)	06:48			06:54		18:08 (1)	06:04	05:31
	16:41			17:17	35	15:30 (3)	17:55			19:34	12	18:20 (1)	20:09	20:42
2	07:43			07:26		14:56 (3)	06:47			06:52		18:06 (1)	06:02	05:30
	16:42			17:19	34	15:30 (3)	17:56			19:35	16	18:22 (1)	20:11	20:43
3	07:43			07:25		14:57 (3)	06:45			06:50		18:05 (1)	06:01	05:30
	16:43			17:20	33	15:30 (3)	17:58			19:36	19	18:24 (1)	20:12	20:44
4	07:43			07:24		14:57 (3)	06:43			06:48		18:05 (1)	05:59	05:29
	16:44			17:21	33	15:30 (3)	17:59			19:37	22	18:27 (1)	20:13	20:45
5	07:43			07:23		14:57 (3)	06:42		16:21 (2)	06:46		18:04 (1)	05:58	05:29
	16:45			17:23	32	15:29 (3)	18:00	11	16:32 (2)	19:38	25	18:29 (1)	20:14	20:46
6	07:43			07:22		14:59 (3)	06:40		16:18 (2)	06:45		18:03 (1)	05:57	05:28
	16:45			17:24	29	15:28 (3)	18:02	17	16:35 (2)	19:40	25	18:28 (1)	20:15	20:46
7	07:43			07:21		15:00 (3)	06:38		16:15 (2)	06:43		18:03 (1)	05:55	05:28
	16:46			17:26	28	15:28 (3)	18:03	21	16:36 (2)	19:41	25	18:28 (1)	20:16	20:47
8	07:42			07:19		15:02 (3)	06:37		16:14 (2)	06:41		18:04 (1)	05:54	05:28
	16:47			17:27	25	15:27 (3)	18:04	23	16:37 (2)	19:42	24	18:28 (1)	20:18	20:48
9	07:42			07:18		15:03 (3)	06:35		16:13 (2)	06:39		18:04 (1)	05:53	05:27
	16:49			17:28	22	15:25 (3)	18:05	26	16:39 (2)	19:43	23	18:27 (1)	20:19	20:48
10	07:42		15:03 (3)	07:17		15:05 (3)	06:33		16:12 (2)	06:38		18:04 (1)	05:51	05:27
	16:50	5	15:08 (3)	17:30	19	15:24 (3)	18:07	28	16:40 (2)	19:44	22	18:26 (1)	20:20	20:49
11	07:42		15:01 (3)	07:16		15:08 (3)	06:31		16:11 (2)	06:36		18:04 (1)	05:50	05:27
	16:51	11	15:12 (3)	17:31	14	15:22 (3)	18:08	29	16:40 (2)	19:46	20	18:24 (1)	20:21	20:50
12	07:41		14:59 (3)	07:14		15:13 (3)	06:30		16:10 (2)	06:34		18:06 (1)	05:49	05:27
	16:52	14	15:13 (3)	17:32	4	15:17 (3)	18:09	30	16:40 (2)	19:47	18	18:24 (1)	20:22	20:50
13	07:41		14:59 (3)	07:13			06:28		16:09 (2)	06:32		18:07 (1)	05:48	05:27
	16:53	17	15:16 (3)	17:34			18:10	31	16:40 (2)	19:48	14	18:21 (1)	20:23	20:51
14	07:41		14:57 (3)	07:11			06:26		16:10 (2)	06:31		18:09 (1)	05:47	05:26
	16:54	20	15:17 (3)	17:35			18:12	30	16:40 (2)	19:49	9	18:18 (1)	20:24	20:51
15	07:40		14:57 (3)	07:10			06:24		16:10 (2)	06:29			05:45	05:26
	16:55	22	15:19 (3)	17:37			18:13	30	16:40 (2)	19:50			20:26	20:52
16	07:40		14:56 (3)	07:09			06:22		16:09 (2)	06:27			05:44	05:26
	16:57	24	15:20 (3)	17:38			18:14	30	16:39 (2)	19:51			20:27	20:52
17	07:39		14:56 (3)	07:07			06:21		16:10 (2)	06:26			05:43	05:26
	16:58	25	15:21 (3)	17:39			18:15	28	16:38 (2)	19:53			20:28	20:53
18	07:39		14:55 (3)	07:06			06:19		16:10 (2)	06:24			05:42	05:26
	16:59	27	15:22 (3)	17:41			18:17	27	16:37 (2)	19:54			20:29	20:53
19	07:38		14:55 (3)	07:04			06:17		16:11 (2)	06:22			05:41	05:26
	17:00	28	15:23 (3)	17:42			18:18	26	16:37 (2)	19:55			20:30	20:53
20	07:38		14:55 (3)	07:03			06:15		16:12 (2)	06:21			05:40	05:26
	17:01	30	15:25 (3)	17:43			18:19	24	16:36 (2)	19:56			20:31	20:54
21	07:37		14:55 (3)	07:01			06:13		16:13 (2)	06:19			05:39	05:27
	17:03	30	15:25 (3)	17:45			18:20	21	16:34 (2)	19:57			20:32	20:54
22	07:36		14:54 (3)	07:00			06:12		16:15 (2)	06:17			05:38	05:27
	17:04	32	15:26 (3)	17:46			18:21	16	16:31 (2)	19:59			20:33	20:54
23	07:36		14:54 (3)	06:58			06:10		16:17 (2)	06:16			05:37	05:27
	17:05	32	15:26 (3)	17:47			18:23	11	16:28 (2)	20:00			20:34	20:54
24	07:35		14:54 (3)	06:56			06:08			06:14			05:37	05:27
	17:07	33	15:27 (3)	17:49			18:24			20:01			20:35	20:54
25	07:34		14:54 (3)	06:55			06:06			06:13			05:36	05:28
	17:08	33	15:27 (3)	17:50			18:25			20:02			20:36	20:55
26	07:33		14:53 (3)	06:53			07:04			06:11			05:35	05:28
	17:09	35	15:28 (3)	17:51			19:26			20:03			20:37	20:55
27	07:32		14:54 (3)	06:52			07:03			06:10			05:34	05:28
	17:11	34	15:28 (3)	17:53			19:28			20:05			20:38	20:55
28	07:31		14:54 (3)	06:50			07:01			06:08			05:33	05:29
	17:12	35	15:29 (3)	17:54			19:29			20:06			20:39	20:55
29	07:30		14:54 (3)				06:59			06:07			05:33	05:29
	17:13	35	15:29 (3)				19:30			20:07			20:40	20:55
30	07:29		14:54 (3)				06:57		18:12 (1)	06:05			05:32	05:29
	17:15	35	15:29 (3)				19:31	5	18:17 (1)	20:08			20:41	20:55
31	07:28		14:55 (3)				06:55		18:10 (1)				05:31	
	17:16	35	15:30 (3)				19:32	9	18:19 (1)				20:42	
Potential sun hours	289			292			368			401			455	462
Total, worst case		592			308			473			274			
Sun reduction		0.27			0.32			0.38			0.43			
Oper. time red.		1.00			1.00			1.00			1.00			
Wind dir. red.		1.00			1.00			1.00			1.00			
Total reduction		0.27			0.32			0.38			0.43			
Total, real		157			98			179			117			

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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: O - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (15)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	July		August			September			October			November			December		
1	05:30		05:56			06:30		18:06 (1)	07:04		16:49 (2)	06:42		14:38 (3)	07:21		14:40 (3)
	20:55		20:34			19:47	16	18:22 (1)	18:53	30	17:19 (2)	17:02	11	14:49 (3)	16:34	16	14:56 (3)
2	05:30		05:57			06:31		18:04 (1)	07:05		16:49 (2)	06:44		14:35 (3)	07:22		14:42 (3)
	20:55		20:33			19:46	19	18:23 (1)	18:51	31	17:20 (2)	17:00	18	14:53 (3)	16:33	13	14:55 (3)
3	05:31		05:58			06:33		18:02 (1)	07:07		16:49 (2)	06:45		14:33 (3)	07:23		14:45 (3)
	20:54		20:32			19:44	21	18:23 (1)	18:49	30	17:19 (2)	16:59	21	14:54 (3)	16:33	9	14:54 (3)
4	05:31		05:59			06:34		18:01 (1)	07:08		16:49 (2)	06:46		14:32 (3)	07:24		
	20:54		20:30			19:42	22	18:23 (1)	18:48	29	17:18 (2)	16:58	24	14:56 (3)	16:32		
5	05:32		06:00			06:35		18:01 (1)	07:09		16:49 (2)	06:48		14:30 (3)	07:25		
	20:54		20:29			19:40	24	18:25 (1)	18:46	28	17:17 (2)	16:56	27	14:57 (3)	16:32		
6	05:33		06:01			06:36		18:00 (1)	07:10		16:49 (2)	06:49		14:30 (3)	07:26		
	20:54		20:28			19:39	24	18:24 (1)	18:44	26	17:15 (2)	16:55	28	14:58 (3)	16:32		
7	05:33		06:02			06:37		17:59 (1)	07:11		16:51 (2)	06:50		14:28 (3)	07:27		
	20:53		20:27			19:37	25	18:24 (1)	18:42	24	17:15 (2)	16:54	31	14:59 (3)	16:32		
8	05:34		06:03			06:38		17:59 (1)	07:12		16:51 (2)	06:52		14:27 (3)	07:28		
	20:53		20:25			19:35	25	18:24 (1)	18:40	22	17:13 (2)	16:53	32	14:59 (3)	16:32		
9	05:35		06:04			06:39		17:58 (1)	07:14		16:53 (2)	06:53		14:27 (3)	07:29		
	20:53		20:24			19:33	25	18:23 (1)	18:39	17	17:10 (2)	16:52	33	15:00 (3)	16:32		
10	05:35		06:06			06:40		17:58 (1)	07:15		16:55 (2)	06:54		14:27 (3)	07:30		
	20:52		20:22			19:31	22	18:20 (1)	18:37	12	17:07 (2)	16:50	33	15:00 (3)	16:32		
11	05:36		06:07			06:42		17:58 (1)	07:16			06:56		14:27 (3)	07:31		
	20:52		20:21			19:30	19	18:17 (1)	18:35			16:49	34	15:01 (3)	16:31		
12	05:37		06:08			06:43		17:59 (1)	07:17			06:57		14:26 (3)	07:32		
	20:51		20:20			19:28	15	18:14 (1)	18:33			16:48	35	15:01 (3)	16:32		
13	05:38		06:09			06:44		18:00 (1)	07:18			06:58		14:26 (3)	07:33		
	20:51		20:18			19:26	11	18:11 (1)	18:32			16:47	35	15:01 (3)	16:32		
14	05:38		06:10			06:45		18:01 (1)	07:20			06:59		14:27 (3)	07:34		
	20:50		20:17			19:24	7	18:08 (1)	18:30			16:46	35	15:02 (3)	16:32		
15	05:39		06:11			06:46		18:03 (1)	07:21			07:01		14:26 (3)	07:34		
	20:49		20:15			19:22	3	18:06 (1)	18:28			16:45	35	15:01 (3)	16:32		
16	05:40		06:12			06:47			07:22			07:02		14:27 (3)	07:35		
	20:49		20:14			19:20			18:27			16:44	35	15:02 (3)	16:32		
17	05:41		06:13			06:48			07:23			07:03		14:27 (3)	07:36		
	20:48		20:12			19:19			18:25			16:43	35	15:02 (3)	16:32		
18	05:42		06:15			06:49			07:25			07:05		14:27 (3)	07:37		
	20:47		20:11			19:17			18:23			16:42	34	15:01 (3)	16:33		
19	05:43		06:16			06:51			07:26			07:06		14:28 (3)	07:37		
	20:47		20:09			19:15			18:22			16:41	34	15:02 (3)	16:33		
20	05:44		06:17			06:52			07:27			07:07		14:28 (3)	07:38		
	20:46		20:08			19:13			18:20			16:40	33	15:01 (3)	16:33		
21	05:45		06:18			06:53			07:28			07:09		14:30 (3)	07:38		
	20:45		20:06			19:11			18:18			16:40	32	15:02 (3)	16:34		
22	05:46		06:19			06:54		17:02 (2)	07:30			07:10		14:30 (3)	07:39		
	20:44		20:04			19:09	13	17:15 (2)	18:17			16:39	31	15:01 (3)	16:34		
23	05:47		06:20			06:55		16:59 (2)	07:31			07:11		14:30 (3)	07:40		
	20:43		20:03			19:08	18	17:17 (2)	18:15			16:38	31	15:01 (3)	16:35		
24	05:48		06:21			06:56		16:57 (2)	07:32			07:12		14:32 (3)	07:40		
	20:42		20:01			19:06	21	17:18 (2)	18:14			16:37	29	15:01 (3)	16:35		
25	05:49		06:22			06:57		16:55 (2)	07:33			07:14		14:33 (3)	07:40		
	20:41		19:59			19:04	24	17:19 (2)	18:12			16:37	27	15:00 (3)	16:36		
26	05:50		06:24			06:59		16:54 (2)	07:35			07:15		14:33 (3)	07:41		
	20:40		19:58			19:02	26	17:20 (2)	18:11			16:36	26	14:59 (3)	16:36		
27	05:51		06:25			07:00		16:53 (2)	07:36			07:16		14:34 (3)	07:41		
	20:39		19:56			19:00	27	17:20 (2)	18:09			16:35	25	14:59 (3)	16:37		
28	05:52		06:26			07:01		16:51 (2)	07:37			07:17		14:36 (3)	07:42		
	20:38		19:54			18:58	29	17:20 (2)	18:08			16:35	23	14:59 (3)	16:38		
29	05:53		06:27			07:02		16:50 (2)	06:39			07:18		14:37 (3)	07:42		
	20:37		19:53			18:57	30	17:20 (2)	17:06			16:34	21	14:58 (3)	16:38		
30	05:54		06:28		18:13 (1)	07:03		16:49 (2)	06:40			07:19		14:38 (3)	07:42		
	20:36		19:51	3	18:16 (1)	18:55	31	17:20 (2)	17:05			16:34	19	14:57 (3)	16:39		
31	05:55		06:29		18:08 (1)				06:41						07:42		
	20:35		19:49	12	18:20 (1)				17:03						16:40		
Potential sun hours	468		434			377			343			292			279		
Total, worst case				15			497			249			867			38	
Sun reduction				0.60			0.53			0.44			0.30			0.28	
Oper. time red.				1.00			1.00			1.00			1.00			1.00	
Wind dir. red.				1.00			1.00			1.00			1.00			1.00	
Total reduction				0.60			0.53			0.44			0.30			0.28	
Total, real				9			264			110			262			11	

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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: P - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (16)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January		February		March		April			May			June		
1	07:43		07:27		06:48		06:54			06:04		06:42 (4)	05:31		06:48 (4)
	16:41		17:18		17:55		19:34			20:09	26	07:08 (4)	20:42	15	07:03 (4)
2	07:43		07:26		06:47		06:52		07:16 (5)	06:02		06:41 (4)	05:30		06:50 (4)
	16:42		17:19		17:57		19:35	5	07:21 (5)	20:11	29	07:10 (4)	20:43	12	07:02 (4)
3	07:43		07:25		06:45		06:50		07:11 (5)	06:01		06:40 (4)	05:30		06:51 (4)
	16:43		17:20		17:58		19:36	13	07:24 (5)	20:12	30	07:10 (4)	20:44	8	06:59 (4)
4	07:43		07:24		06:43		06:48		07:10 (5)	05:59		06:39 (4)	05:29		
	16:44		17:22		17:59		19:37	17	07:27 (5)	20:13	32	07:11 (4)	20:45		
5	07:43		07:23		06:42		06:46		07:08 (5)	05:58		06:39 (4)	05:29		
	16:45		17:23		18:00		19:38	20	07:28 (5)	20:14	33	07:12 (4)	20:46		
6	07:43		07:22		06:40		06:45		07:06 (5)	05:57		06:37 (4)	05:29		
	16:46		17:24		18:02		19:40	22	07:28 (5)	20:15	35	07:12 (4)	20:46		
7	07:43		07:21		06:38		06:43		07:05 (5)	05:55		06:37 (4)	05:28		
	16:47		17:26		18:03		19:41	23	07:28 (5)	20:16	35	07:12 (4)	20:47		
8	07:42		07:19		06:37		06:41		07:05 (5)	05:54		06:37 (4)	05:28		
	16:48		17:27		18:04		19:42	24	07:29 (5)	20:18	36	07:13 (4)	20:48		
9	07:42		07:18		06:35		06:39		07:04 (5)	05:53		06:37 (4)	05:28		
	16:49		17:28		18:05		19:43	25	07:29 (5)	20:19	36	07:13 (4)	20:48		
10	07:42		07:17		06:33		06:38		07:03 (5)	05:51		06:37 (4)	05:27		
	16:50		17:30		18:07		19:44	26	07:29 (5)	20:20	36	07:13 (4)	20:49		
11	07:42		07:16		06:31		06:36		07:03 (5)	05:50		06:36 (4)	05:27		
	16:51		17:31		18:08		19:46	25	07:28 (5)	20:21	36	07:12 (4)	20:50		
12	07:42		07:14		06:30		06:34		07:03 (5)	05:49		06:36 (4)	05:27		
	16:52		17:33		18:09		19:47	25	07:28 (5)	20:22	37	07:13 (4)	20:50		
13	07:41		07:13		06:28		06:32		07:03 (5)	05:48		06:36 (4)	05:27		
	16:53		17:34		18:10		19:48	24	07:27 (5)	20:23	37	07:13 (4)	20:51		
14	07:41		07:11		06:26		06:31		07:03 (5)	05:47		06:36 (4)	05:27		
	16:54		17:35		18:12		19:49	23	07:26 (5)	20:24	37	07:13 (4)	20:51		
15	07:40		07:10		06:24		06:29		07:04 (5)	05:46		06:36 (4)	05:26		
	16:55		17:37		18:13		19:50	21	07:25 (5)	20:26	36	07:12 (4)	20:52		
16	07:40		07:09		06:22		06:27		07:05 (5)	05:44		06:36 (4)	05:26		
	16:57		17:38		18:14		19:52	19	07:24 (5)	20:27	36	07:12 (4)	20:52		
17	07:39		07:07		06:21		06:26		07:06 (5)	05:43		06:36 (4)	05:26		
	16:58		17:39		18:15	3	06:45 (6)	19:53	15	07:21 (5)	20:28	36	07:12 (4)	20:53	
18	07:39		07:06		06:19		06:40 (6)	06:24		07:09 (5)	05:42		06:37 (4)	05:26	
	16:59		17:41		18:17	7	06:47 (6)	19:54	10	07:19 (5)	20:29	35	07:12 (4)	20:53	
19	07:38		07:04		06:17		06:39 (6)	06:22			05:41		06:37 (4)	05:27	
	17:00		17:42		18:18	10	06:49 (6)	19:55			20:30	34	07:11 (4)	20:53	
20	07:38		07:03		06:15		06:37 (6)	06:21			05:40		06:37 (4)	05:27	
	17:02		17:43		18:19	12	06:49 (6)	19:56			20:31	34	07:11 (4)	20:54	
21	07:37		07:01		06:13		06:35 (6)	06:19			05:39		06:38 (4)	05:27	
	17:03		17:45		18:20	15	06:50 (6)	19:58			20:32	32	07:10 (4)	20:54	
22	07:36		07:00		06:12		06:33 (6)	06:17			05:38		06:39 (4)	05:27	
	17:04		17:46		18:22	16	06:49 (6)	19:59			20:33	31	07:10 (4)	20:54	
23	07:36		06:58		06:10		06:31 (6)	06:16			05:38		06:39 (4)	05:27	
	17:05		17:47		18:23	18	06:49 (6)	20:00			20:34	31	07:10 (4)	20:54	
24	07:35		06:57		06:08		06:30 (6)	06:14			05:37		06:40 (4)	05:27	
	17:07		17:49		18:24	19	06:49 (6)	20:01			20:35	29	07:09 (4)	20:55	
25	07:34		06:55		06:06		06:30 (6)	06:13			05:36		06:40 (4)	05:28	
	17:08		17:50		18:25	18	06:48 (6)	20:02			20:36	28	07:08 (4)	20:55	
26	07:33		06:53		07:04		07:30 (6)	06:11			05:35		06:42 (4)	05:28	
	17:09		17:51		19:26	17	07:47 (6)	20:04			20:37	26	07:08 (4)	20:55	
27	07:32		06:52		07:03		07:31 (6)	06:10		06:53 (4)	05:34		06:42 (4)	05:28	
	17:11		17:53		19:28	14	07:45 (6)	20:05	7	07:00 (4)	20:38	25	07:07 (4)	20:55	
28	07:31		06:50		07:01		07:32 (6)	06:08		06:48 (4)	05:34		06:43 (4)	05:29	
	17:12		17:54		19:29	11	07:43 (6)	20:06	15	07:03 (4)	20:39	23	07:06 (4)	20:55	
29	07:30				06:59			06:07		06:46 (4)	05:33		06:45 (4)	05:29	
	17:13				19:30			20:07	20	07:06 (4)	20:40	21	07:06 (4)	20:55	
30	07:30				06:57			06:05		06:43 (4)	05:32		06:45 (4)	05:30	
	17:15				19:31			20:08	24	07:07 (4)	20:41	20	07:05 (4)	20:55	
31	07:29				06:55						05:32		06:47 (4)		
	17:16				19:32						20:42	17	07:04 (4)		
Potential sun hours	289		292		368			401			455			461	
Total, worst case						160			403			969			35
Sun reduction						0.38			0.43			0.49			0.54
Oper. time red.						1.00			1.00			1.00			1.00
Wind dir. red.						1.00			1.00			1.00			1.00
Total reduction						0.38			0.43			0.49			0.54
Total, real						61			173			472			19

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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: P - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (16)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	July			August			September			October		November	December
1	05:30			05:56		06:47 (4)	06:30		07:02 (5)	07:04		06:42	07:21
	20:55			20:34	37	07:24 (4)	19:48	25	07:27 (5)	18:53		17:02	16:34
2	05:31			05:57		06:47 (4)	06:32		07:01 (5)	07:05		06:44	07:22
	20:55			20:33	37	07:24 (4)	19:46	26	07:27 (5)	18:51		17:01	16:33
3	05:31			05:58		06:47 (4)	06:33		07:01 (5)	07:07		06:45	07:23
	20:54			20:32	37	07:24 (4)	19:44	25	07:26 (5)	18:49		16:59	16:33
4	05:32			05:59		06:47 (4)	06:34		07:01 (5)	07:08		06:46	07:24
	20:54			20:30	36	07:23 (4)	19:42	26	07:27 (5)	18:48		16:58	16:33
5	05:32			06:00		06:47 (4)	06:35		07:01 (5)	07:09		06:48	07:25
	20:54			20:29	36	07:23 (4)	19:40	25	07:26 (5)	18:46		16:57	16:32
6	05:33			06:01		06:47 (4)	06:36		07:01 (5)	07:10		06:49	07:26
	20:54			20:28	36	07:23 (4)	19:39	24	07:25 (5)	18:44		16:55	16:32
7	05:33			06:02		06:47 (4)	06:37		07:01 (5)	07:11		06:50	07:27
	20:53			20:27	35	07:22 (4)	19:37	23	07:24 (5)	18:42		16:54	16:32
8	05:34			06:03		06:47 (4)	06:38		07:02 (5)	07:13		06:52	07:28
	20:53			20:25	35	07:22 (4)	19:35	21	07:23 (5)	18:40		16:53	16:32
9	05:35			06:05		06:48 (4)	06:39		07:03 (5)	07:14		06:53	07:29
	20:53			20:24	33	07:21 (4)	19:33	19	07:22 (5)	18:39		16:52	16:32
10	05:35			06:06		06:48 (4)	06:41		07:04 (5)	07:15		06:54	07:30
	20:52			20:22	32	07:20 (4)	19:31	16	07:20 (5)	18:37		16:50	16:32
11	05:36		06:59 (4)	06:07		06:49 (4)	06:42		07:06 (5)	07:16		06:56	07:31
	20:52	8	07:07 (4)	20:21	31	07:20 (4)	19:30	11	07:17 (5)	18:35		16:49	16:32
12	05:37		06:57 (4)	06:08		06:49 (4)	06:43			07:17		06:57	07:32
	20:51	12	07:09 (4)	20:20	29	07:18 (4)	19:28			18:33		16:48	16:32
13	05:38		06:56 (4)	06:09		06:50 (4)	06:44			07:19		06:58	07:33
	20:51	15	07:11 (4)	20:18	27	07:17 (4)	19:26			18:32		16:47	16:32
14	05:39		06:55 (4)	06:10		06:51 (4)	06:45			07:20		07:00	07:34
	20:50	17	07:12 (4)	20:17	25	07:16 (4)	19:24			18:30		16:46	16:32
15	05:39		06:54 (4)	06:11		06:53 (4)	06:46			07:21		07:01	07:34
	20:49	20	07:14 (4)	20:15	21	07:14 (4)	19:22			18:28		16:45	16:32
16	05:40		06:54 (4)	06:12		06:55 (4)	06:47		07:25 (6)	07:22		07:02	07:35
	20:49	21	07:15 (4)	20:14	16	07:11 (4)	19:21	5	07:30 (6)	18:27		16:44	16:32
17	05:41		06:52 (4)	06:14		06:58 (4)	06:48		07:21 (6)	07:23		07:03	07:36
	20:48	23	07:15 (4)	20:12	10	07:08 (4)	19:19	12	07:33 (6)	18:25		16:43	16:32
18	05:42		06:51 (4)	06:15			06:50		07:19 (6)	07:25		07:05	07:37
	20:47	25	07:16 (4)	20:11			19:17	15	07:34 (6)	18:23		16:42	16:33
19	05:43		06:51 (4)	06:16			06:51		07:18 (6)	07:26		07:06	07:37
	20:47	26	07:17 (4)	20:09			19:15	17	07:35 (6)	18:22		16:41	16:33
20	05:44		06:50 (4)	06:17			06:52		07:17 (6)	07:27		07:07	07:38
	20:46	28	07:18 (4)	20:08			19:13	18	07:35 (6)	18:20		16:41	16:33
21	05:45		06:50 (4)	06:18			06:53		07:16 (6)	07:28		07:09	07:38
	20:45	29	07:19 (4)	20:06			19:11	19	07:35 (6)	18:18		16:40	16:34
22	05:46		06:50 (4)	06:19			06:54		07:17 (6)	07:30		07:10	07:39
	20:44	30	07:20 (4)	20:04			19:10	18	07:35 (6)	18:17		16:39	16:34
23	05:47		06:49 (4)	06:20			06:55		07:18 (6)	07:31		07:11	07:40
	20:43	31	07:20 (4)	20:03			19:08	16	07:34 (6)	18:15		16:38	16:35
24	05:48		06:49 (4)	06:21			06:56		07:19 (6)	07:32		07:12	07:40
	20:42	32	07:21 (4)	20:01			19:06	14	07:33 (6)	18:14		16:37	16:35
25	05:49		06:48 (4)	06:23			06:57		07:21 (6)	07:33		07:14	07:40
	20:42	34	07:22 (4)	19:59			19:04	12	07:33 (6)	18:12		16:37	16:36
26	05:50		06:48 (4)	06:24		07:13 (5)	06:59		07:22 (6)	07:35		07:15	07:41
	20:41	34	07:22 (4)	19:58	8	07:21 (5)	19:02	10	07:32 (6)	18:11		16:36	16:36
27	05:51		06:48 (4)	06:25		07:09 (5)	07:00		07:23 (6)	07:36		07:16	07:41
	20:40	35	07:23 (4)	19:56	14	07:23 (5)	19:00	7	07:30 (6)	18:09		16:36	16:37
28	05:52		06:48 (4)	06:26		07:07 (5)	07:01		07:24 (6)	07:37		07:17	07:42
	20:38	35	07:23 (4)	19:54	18	07:25 (5)	18:58	2	07:26 (6)	18:08		16:35	16:38
29	05:53		06:46 (4)	06:27		07:05 (5)	07:02			06:39		07:18	07:42
	20:37	36	07:22 (4)	19:53	20	07:25 (5)	18:57			17:06		16:35	16:38
30	05:54		06:46 (4)	06:28		07:04 (5)	07:03			06:40		07:20	07:42
	20:36	36	07:22 (4)	19:51	22	07:26 (5)	18:55			17:05		16:34	16:39
31	05:55		06:47 (4)	06:29		07:03 (5)				06:41			07:42
	20:35	37	07:24 (4)	19:49	23	07:26 (5)				17:03			16:40
Potential sun hours	468			434			377			343		292	279
Total, worst case		564			618			406					
Sun reduction		0.62			0.60			0.53					
Oper. time red.		1.00			1.00			1.00					
Wind dir. red.		1.00			1.00			1.00					
Total reduction		0.62			0.60			0.53					
Total, real		350			371			216					

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

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

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Calculated:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: Q - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (17)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	January			February			March			April			May			June		
1	07:42		14:22 (5)	07:27		15:38 (4)	06:48			06:54		17:26 (3)	06:04		18:12 (2)	05:31		
	16:41	19	14:41 (5)	17:17	18	15:56 (4)	17:55			19:34	29	17:55 (3)	20:09	21	18:33 (2)	20:42		
2	07:43		14:23 (5)	07:26		15:38 (4)	06:47			06:52		17:26 (3)	06:02		18:13 (2)	05:30		
	16:42	18	14:41 (5)	17:19	19	15:57 (4)	17:56			19:35	28	17:54 (3)	20:11	19	18:32 (2)	20:43		
3	07:43		14:24 (5)	07:25		15:39 (4)	06:45			06:50		17:26 (3)	06:01		18:13 (2)	05:30		
	16:43	17	14:41 (5)	17:20	19	15:58 (4)	17:58			19:36	27	17:53 (3)	20:12	17	18:30 (2)	20:44		
4	07:43		14:26 (5)	07:24		15:39 (4)	06:43			06:48		17:28 (3)	05:59		18:15 (2)	05:29		
	16:44	15	14:41 (5)	17:21	20	15:59 (4)	17:59			19:37	25	17:53 (3)	20:13	17	18:52 (1)	20:45		
5	07:43		14:27 (5)	07:23		15:39 (4)	06:42			06:46		17:29 (3)	05:58		18:17 (2)	05:29		
	16:44	14	14:41 (5)	17:23	20	15:59 (4)	18:00			19:38	22	17:51 (3)	20:14	15	18:53 (1)	20:46		
6	07:43		14:29 (5)	07:22		15:40 (4)	06:40			06:45		17:30 (3)	05:57		18:20 (2)	05:28		
	16:45	11	14:40 (5)	17:24	21	16:01 (4)	18:02			19:40	19	17:49 (3)	20:15	10	18:54 (1)	20:46		
7	07:43		14:31 (5)	07:21		15:41 (4)	06:38			06:43		17:31 (3)	05:55		18:47 (1)	05:28		
	16:46	8	14:39 (5)	17:26	22	16:03 (4)	18:03			19:41	16	17:47 (3)	20:16	9	18:56 (1)	20:47		
8	07:42			07:19		15:42 (4)	06:36			06:41		17:33 (3)	05:54		18:47 (1)	05:28		
	16:47			17:27	20	16:02 (4)	18:04			19:42	11	17:44 (3)	20:18	11	18:58 (1)	20:48		
9	07:42			07:18		15:43 (4)	06:35			06:39			05:53		18:47 (1)	05:27		
	16:49			17:28	18	16:01 (4)	18:05			19:43			20:19	13	19:00 (1)	20:48		
10	07:42			07:17		15:45 (4)	06:33			06:38			05:51		18:46 (1)	05:27		
	16:50			17:30	15	16:00 (4)	18:07			19:44			20:20	14	19:00 (1)	20:49		
11	07:42			07:15		15:48 (4)	06:31			06:36			05:50		18:46 (1)	05:27		
	16:51			17:31	10	15:58 (4)	18:08			19:45			20:21	16	19:02 (1)	20:50		
12	07:41			07:14			06:29			06:34			05:49		18:47 (1)	05:27		
	16:52			17:32			18:09			19:47			20:22	16	19:03 (1)	20:50		
13	07:41			07:13			06:28			06:32			05:48		18:47 (1)	05:27		
	16:53			17:34			18:10			19:48			20:23	17	19:04 (1)	20:51		
14	07:41			07:11			06:26			06:31			05:47		18:48 (1)	05:26		
	16:54			17:35			18:12			19:49			20:24	17	19:05 (1)	20:51		
15	07:40			07:10			06:24			06:29			05:45		18:48 (1)	05:26		
	16:55			17:37			18:13			19:50			20:25	16	19:04 (1)	20:52		
16	07:40			07:09			06:22			06:27			05:44		18:49 (1)	05:26		
	16:57			17:38			18:14			19:51			20:27	15	19:04 (1)	20:52		
17	07:39			07:07			06:21			06:26			05:43		18:50 (1)	05:26		
	16:58			17:39			18:15			19:53			20:28	13	19:03 (1)	20:53		
18	07:39			07:06			06:19			06:24		18:21 (2)	05:42		18:52 (1)	05:26		
	16:59			17:41			18:17			19:54	5	18:26 (2)	20:29	9	19:01 (1)	20:53		
19	07:38			07:04			06:17			06:22		18:17 (2)	05:41		18:54 (1)	05:26		
	17:00			17:42			18:18			19:55	11	18:28 (2)	20:30	5	18:59 (1)	20:53		
20	07:38			07:03			06:15			06:21		18:15 (2)	05:40			05:26		
	17:01			17:43			18:19			19:56	15	18:30 (2)	20:31			20:54		
21	07:37		15:45 (4)	07:01			06:13		16:40 (3)	06:19		18:14 (2)	05:39			05:27		
	17:03	1	15:46 (4)	17:45			18:20	7	16:47 (3)	19:57	18	18:32 (2)	20:32			20:54		
22	07:36		15:43 (4)	07:00			06:12		16:35 (3)	06:17		18:12 (2)	05:38			05:27		
	17:04	5	15:48 (4)	17:46			18:21	15	16:50 (3)	19:59	20	18:32 (2)	20:33			20:54		
23	07:36		15:41 (4)	06:58			06:10		16:33 (3)	06:16		18:12 (2)	05:37			05:27		
	17:05	8	15:49 (4)	17:47			18:23	19	16:52 (3)	20:00	22	18:34 (2)	20:34			20:54		
24	07:35		15:40 (4)	06:56			06:08		16:31 (3)	06:14		18:11 (2)	05:37			05:27		
	17:07	10	15:50 (4)	17:49			18:24	22	16:53 (3)	20:01	23	18:34 (2)	20:35			20:54		
25	07:34		15:39 (4)	06:55			06:06		16:30 (3)	06:13		18:11 (2)	05:36			05:28		
	17:08	12	15:51 (4)	17:50			18:25	25	16:55 (3)	20:02	24	18:35 (2)	20:36			20:55		
26	07:33		15:39 (4)	06:53			07:04		17:29 (3)	06:11		18:10 (2)	05:35			05:28		
	17:09	12	15:51 (4)	17:51			19:26	26	17:55 (3)	20:03	25	18:35 (2)	20:37			20:55		
27	07:32		15:38 (4)	06:52			07:03		17:28 (3)	06:10		18:11 (2)	05:34			05:28		
	17:11	14	15:52 (4)	17:53			19:28	28	17:56 (3)	20:05	24	18:35 (2)	20:38			20:55		
28	07:31		15:38 (4)	06:50			07:01		17:27 (3)	06:08		18:10 (2)	05:33			05:29		
	17:12	15	15:53 (4)	17:54			19:29	29	17:56 (3)	20:06	24	18:34 (2)	20:39			20:55		
29	07:30		15:38 (4)				06:59		17:26 (3)	06:07		18:11 (2)	05:33			05:29		
	17:13	15	15:53 (4)				19:30	29	17:55 (3)	20:07	23	18:34 (2)	20:40			20:55		
30	07:29		15:38 (4)				06:57		17:27 (3)	06:05		18:11 (2)	05:32			05:29		
	17:15	16	15:54 (4)				19:31	29	17:56 (3)	20:08	22	18:33 (2)	20:41			20:55		
31	07:28		15:38 (4)				06:55		17:26 (3)				05:31					
	17:16	17	15:55 (4)				19:32	30	17:56 (3)				20:42					
Potential sun hours	289			292			368			401			455			461		
Total, worst case		227			202			259			433			270				
Sun reduction		0.27			0.32			0.38			0.43			0.49				
Oper. time red.		1.00			1.00			1.00			1.00			1.00				
Wind dir. red.		1.00			1.00			1.00			1.00			1.00				
Total reduction		0.27			0.32			0.38			0.43			0.49				
Total, real		60			64			98			185			131				

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:
05/12/2023 17:21/3.6.366

SHADOW - Calendar

Calculation: Real case_3 Shadow receptor: Q - Shadow Receptor: 1.5 × 1.5 Azimuth: 0.0° Slope: 90.0° (17)

Assumptions for shadow calculations

Reference year for calendar 2023

Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.48	3.33	4.51	5.74	7.16	8.35	9.37	8.38	6.67	4.87	2.94	2.55

No operational time reduction. It is assumed the WTGs are always running with worst case wind direction.

	July			August			September			October			November			December		
1	05:30			05:56		18:57 (1)	06:30			07:04			06:42		15:18 (4)	07:21		
	20:55			20:34	17	19:14 (1)	19:47			18:53			17:02	7	15:25 (4)	16:34		
2	05:30			05:57		18:57 (1)	06:31			07:05			06:44		15:15 (4)	07:22		
	20:54			20:33	16	19:13 (1)	19:46			18:51			17:00	13	15:28 (4)	16:33		
3	05:31			05:58		18:56 (1)	06:33			07:07			06:45		15:13 (4)	07:23		
	20:54			20:32	16	19:12 (1)	19:44			18:49			16:59	17	15:30 (4)	16:33		
4	05:31			05:59		18:56 (1)	06:34			07:08			06:46		15:12 (4)	07:24		
	20:54			20:30	15	19:11 (1)	19:42			18:48			16:58	20	15:32 (4)	16:32		
5	05:32			06:00		18:56 (1)	06:35		17:34 (3)	07:09			06:48		15:11 (4)	07:25		
	20:54			20:29	13	19:09 (1)	19:40	5	17:39 (3)	18:46			16:56	21	15:32 (4)	16:32		
6	05:33			06:01		18:57 (1)	06:36		17:29 (3)	07:10			06:49		15:10 (4)	07:26		14:19 (5)
	20:54			20:28	12	19:09 (1)	19:39	14	17:43 (3)	18:44			16:55	21	15:31 (4)	16:32	4	14:23 (5)
7	05:33			06:02		18:57 (1)	06:37		17:27 (3)	07:11			06:50		15:10 (4)	07:27		14:16 (5)
	20:53			20:26	9	19:06 (1)	19:37	17	17:44 (3)	18:42			16:54	20	15:30 (4)	16:32	9	14:25 (5)
8	05:34			06:03		18:57 (1)	06:38		17:24 (3)	07:12			06:52		15:09 (4)	07:28		14:15 (5)
	20:53			20:25	7	19:04 (1)	19:35	21	17:45 (3)	18:40			16:53	20	15:29 (4)	16:32	12	14:27 (5)
9	05:35			06:04		18:27 (2)	06:39		17:23 (3)	07:14			06:53		15:09 (4)	07:29		14:15 (5)
	20:53			20:24	14	19:03 (1)	19:33	23	17:46 (3)	18:39			16:52	20	15:29 (4)	16:32	14	14:29 (5)
10	05:35			06:06		18:25 (2)	06:40		17:21 (3)	07:15			06:54		15:09 (4)	07:30		14:14 (5)
	20:52			20:22	16	19:01 (1)	19:31	25	17:46 (3)	18:37			16:50	19	15:28 (4)	16:32	16	14:30 (5)
11	05:36			06:07		18:23 (2)	06:42		17:20 (3)	07:16			06:56		15:09 (4)	07:31		14:14 (5)
	20:52			20:21	17	19:00 (1)	19:30	27	17:47 (3)	18:35			16:49	19	15:28 (4)	16:31	17	14:31 (5)
12	05:37			06:08		18:21 (2)	06:43		17:19 (3)	07:17			06:57		15:09 (4)	07:32		14:14 (5)
	20:51			20:20	19	18:40 (2)	19:28	28	17:47 (3)	18:33			16:48	18	15:27 (4)	16:32	18	14:32 (5)
13	05:38			06:09		18:20 (2)	06:44		17:18 (3)	07:18			06:58		15:09 (4)	07:33		14:14 (5)
	20:51			20:18	21	18:41 (2)	19:26	28	17:46 (3)	18:32			16:47	17	15:26 (4)	16:32	19	14:33 (5)
14	05:38			06:10		18:19 (2)	06:45		17:17 (3)	07:20			06:59		15:10 (4)	07:33		14:13 (5)
	20:50			20:17	22	18:41 (2)	19:24	29	17:46 (3)	18:30			16:46	16	15:26 (4)	16:32	20	14:33 (5)
15	05:39			06:11		18:18 (2)	06:46		17:16 (3)	07:21			07:01		15:10 (4)	07:34		14:14 (5)
	20:49			20:15	23	18:41 (2)	19:22	30	17:46 (3)	18:28			16:45	15	15:25 (4)	16:32	20	14:34 (5)
16	05:40			06:12		18:18 (2)	06:47		17:16 (3)	07:22			07:02		15:11 (4)	07:35		14:14 (5)
	20:49			20:14	23	18:41 (2)	19:20	29	17:45 (3)	18:27			16:44	15	15:26 (4)	16:32	21	14:35 (5)
17	05:41			06:13		18:17 (2)	06:48		17:17 (3)	07:23			07:03		15:12 (4)	07:36		14:14 (5)
	20:48			20:12	24	18:41 (2)	19:19	28	17:45 (3)	18:25			16:43	13	15:25 (4)	16:32	22	14:36 (5)
18	05:42			06:15		18:17 (2)	06:49		17:16 (3)	07:25			07:05		15:12 (4)	07:36		14:14 (5)
	20:47			20:11	24	18:41 (2)	19:17	28	17:44 (3)	18:23			16:42	13	15:25 (4)	16:33	22	14:36 (5)
19	05:43			06:16		18:17 (2)	06:51		17:17 (3)	07:26			07:06		15:14 (4)	07:37		14:15 (5)
	20:47			20:09	24	18:41 (2)	19:15	26	17:43 (3)	18:22			16:41	11	15:25 (4)	16:33	22	14:37 (5)
20	05:44			06:17		18:16 (2)	06:52		17:17 (3)	07:27			07:07		15:15 (4)	07:38		14:16 (5)
	20:46			20:07	24	18:40 (2)	19:13	24	17:41 (3)	18:20			16:40	9	15:24 (4)	16:33	22	14:38 (5)
21	05:45			06:18		18:16 (2)	06:53		17:18 (3)	07:28			07:09		15:17 (4)	07:38		14:15 (5)
	20:45			20:06	23	18:39 (2)	19:11	21	17:39 (3)	18:18			16:40	7	15:24 (4)	16:34	23	14:38 (5)
22	05:46			06:19		18:18 (2)	06:54		17:19 (3)	07:30			07:10		15:19 (4)	07:39		14:16 (5)
	20:44			20:04	20	18:38 (2)	19:09	18	17:37 (3)	18:17			16:39	4	15:23 (4)	16:34	23	14:39 (5)
23	05:47			06:20		18:18 (2)	06:55		17:21 (3)	07:31			07:11			07:39		14:16 (5)
	20:43			20:03	19	18:37 (2)	19:08	13	17:34 (3)	18:15			16:38			16:35	23	14:39 (5)
24	05:48			06:21		18:19 (2)	06:56		17:25 (3)	07:32			07:12			07:40		14:16 (5)
	20:42			20:01	16	18:35 (2)	19:06	4	17:29 (3)	18:14			16:37			16:35	23	14:39 (5)
25	05:49			06:22		18:20 (2)	06:57			07:33			07:13			07:40		14:18 (5)
	20:41			19:59	13	18:33 (2)	19:04			18:12			16:37			16:36	22	14:40 (5)
26	05:50		19:04 (1)	06:24		18:22 (2)	06:58			07:35			07:15			07:41		14:18 (5)
	20:40	5	19:09 (1)	19:58	8	18:30 (2)	19:02			18:11			16:36			16:36	22	14:40 (5)
27	05:51		19:02 (1)	06:25			07:00			07:36			07:16			07:41		14:18 (5)
	20:39	9	19:11 (1)	19:56			19:00			18:09			16:35			16:37	22	14:40 (5)
28	05:52		19:01 (1)	06:26			07:01			07:37			07:17			07:42		14:20 (5)
	20:38	12	19:13 (1)	19:54			18:58			18:08			16:35			16:38	21	14:41 (5)
29	05:53		18:59 (1)	06:27			07:02			06:39			07:18			07:42		14:20 (5)
	20:37	15	19:14 (1)	19:53			18:57			17:06			16:34			16:38	21	14:41 (5)
30	05:54		18:59 (1)	06:28			07:03			06:40			07:19			07:42		14:21 (5)
	20:36	16	19:15 (1)	19:51			18:55			17:05			16:34			16:39	20	14:41 (5)
31	05:55		18:58 (1)	06:29						06:41						07:42		14:21 (5)
	20:35	17	19:15 (1)	19:49						17:03						16:40	20	14:41 (5)
Potential sun hours	468			434			377			343			292			279		
Total, worst case		74			455			438						335			498	
Sun reduction		0.62			0.60			0.53						0.30			0.28	
Oper. time red.		1.00			1.00			1.00						1.00			1.00	
Wind dir. red.		1.00			1.00			1.00						1.00			1.00	
Total reduction		0.62			0.60			0.53						0.30			0.28	
Total, real		46			273			233						101			141	

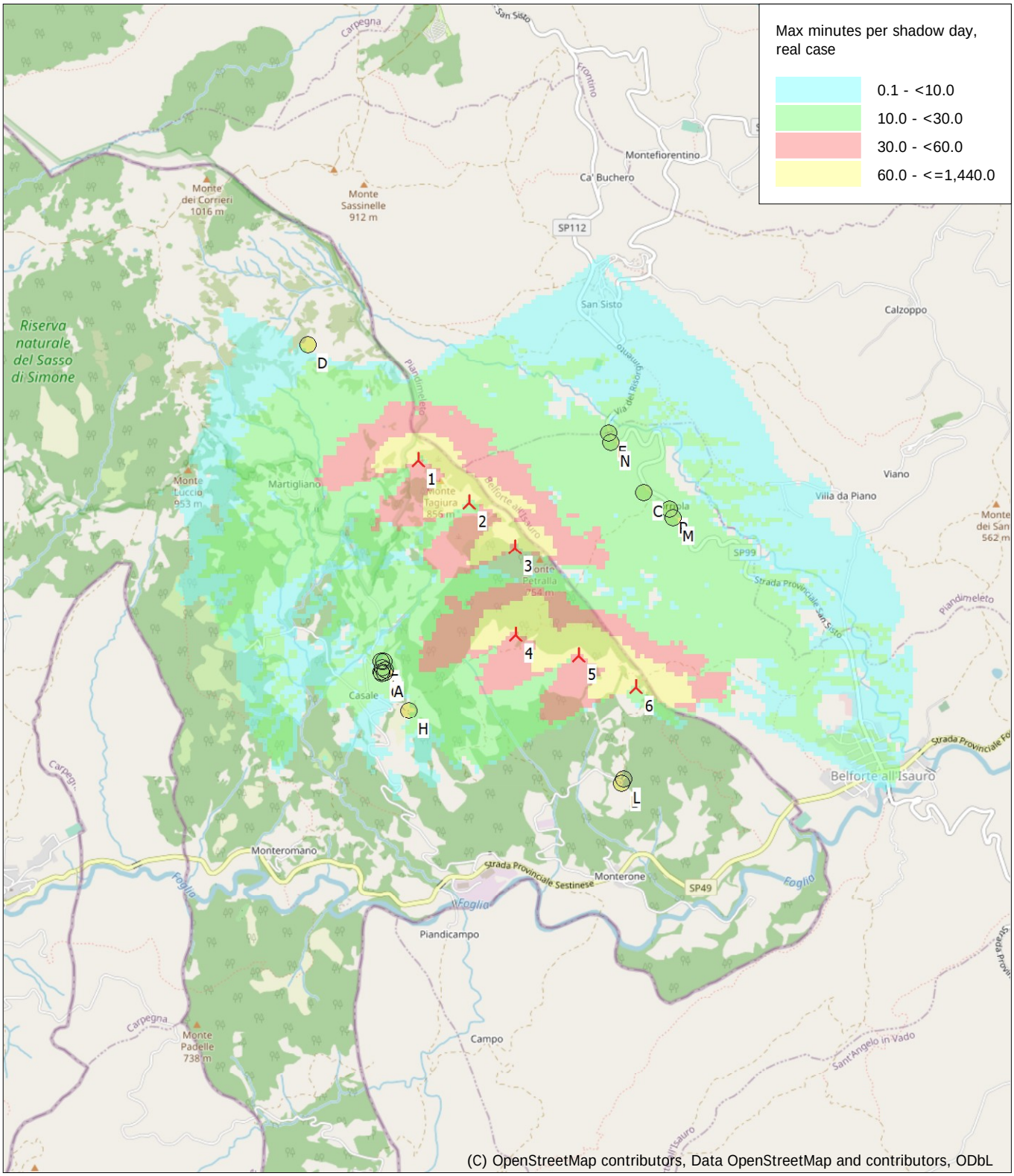
Table layout: For each day in each month the following matrix apply

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

Licensed user:
TAUW Group bv
Handelskade 37
NL-7417 DE DEVENTER
+31622792352
sse / s.screnci@tauw.com
Calculated:
03/12/2023 15:52/3.6.366

SHADOW - Map

Calculation: Minuti_Giorno



0 500 1000 1500 2000 m

Map: EMD OpenStreetMap , Print scale 1:40,000, Map center UTM (north)-WGS84 Zone: 32 East: 769,350.00 North: 4,847,280.00

New WTG Shadow receptor

Flicker map level: Elevation Grid Data Object: Sestino Shadow_EMDGrid_0.wpg (1)