

AUTORIZZAZIONE UNICA Ex D. LGS. N. 387/2003



PROGETTO DEFINITIVO PARCO EOLICO EMILIA

Titolo elaborato:

STUDIO SUGLI EFFETTI DELLO SHADOW FLICKERING

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1. PREMESSA

Nella presente trattazione si descrive l'evoluzione giornaliera delle ombre generate dalle pale eoliche facenti parte dell'impianto eolico denominato "Parco Eolico Emilia" al fine di verificare che l'alternanza ciclica dell'ombra non arrechi danni alla salute su un possibile ricettore.

2. DESCRIZIONE DEL PROGETTO

L'impianto eolico presenta una potenza nominale totale pari a 79 MWp ed è costituito da n. 9 aerogeneratori di potenza pari a 6.0 MWp, altezza torre pari a 135 m e rotore pari a 170 m, collegati tra loro mediante un sistema di cavidotti interrati da 36 kV, opportunamente dimensionato, che si collega, in parallelo con il BESS di potenza pari a 25 MWp, alla stazione elettrica di trasformazione (SE) della RTN 132/36 kV Castel San Pietro di futura realizzazione.

L'impianto si colloca in Emilia-Romagna, provincia di Bologna, all'interno di un'area di circa 2.000 ettari ed interessa prevalentemente il Comune di Monterenzio, ove ricadono 3 aerogeneratori, il Comune di Casalfiumanese, ove ricadono 4 aerogeneratori, il Comune di Castel del Rio, dove ricadono 2 aerogeneratori e il Comune di Castel San Pietro dove ricadono la linea di collegamento elettrica tra il parco eolico e la SE RTN 132/36 kV, tale sottostazione elettrica e il BESS.

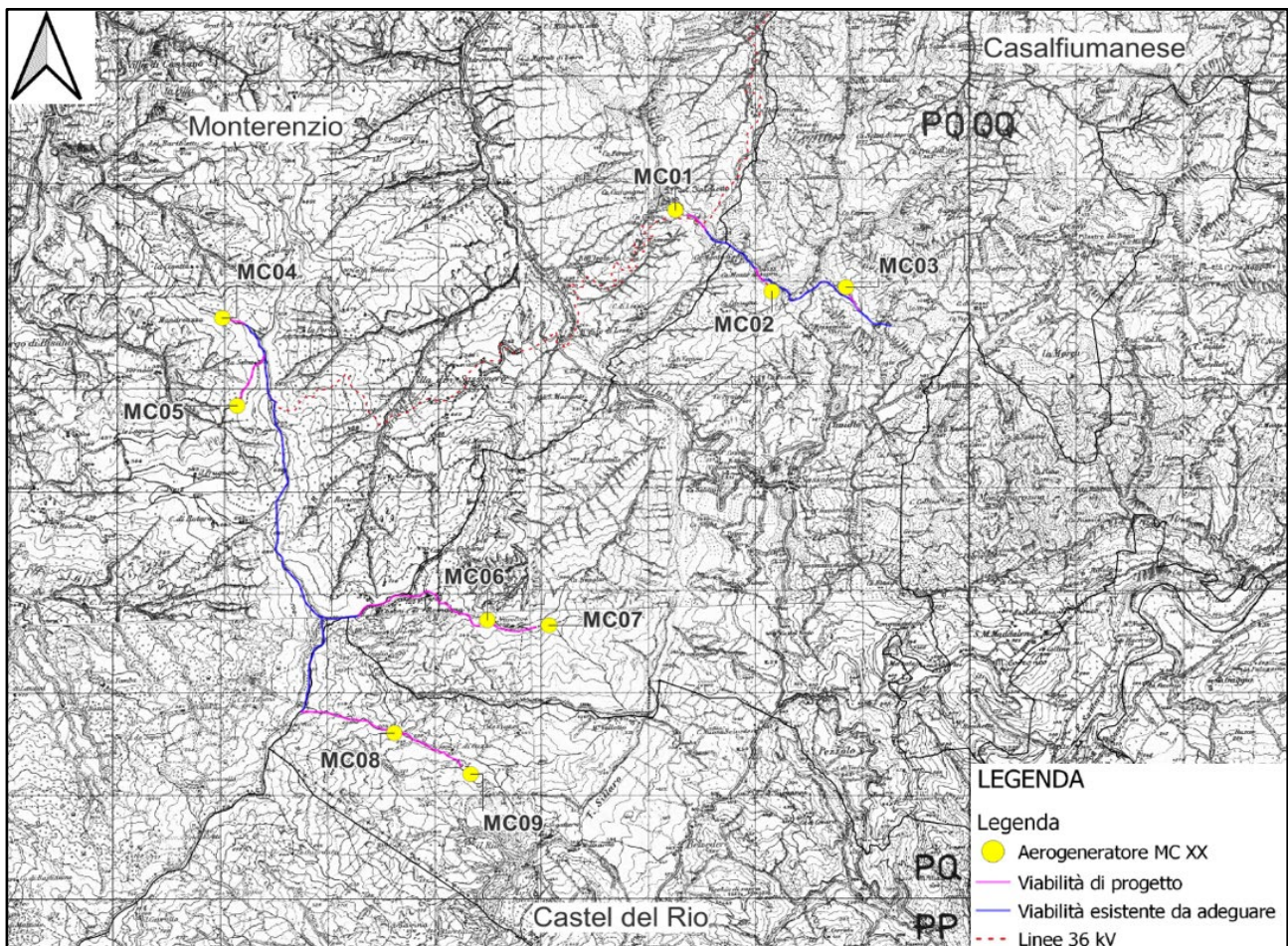


Figura 2.1: Layout d'impianto su carta IGM

Il Parco eolico si può intendere suddiviso in due parti, quella ricadente a Sud del centro abitato del Comune di Monterenzio, in prossimità della frazione di Sassonero e verso i confini con la Regione Toscana (Zona 1 – rettangolo rosso), costituita da 5 aerogeneratori, e quella ricadente ad Est di Monterenzio con riferimento alla suddetta frazione (Zona 2 – rettangolo blu), costituito da 3 aerogeneratori (**Figura 2.2**).

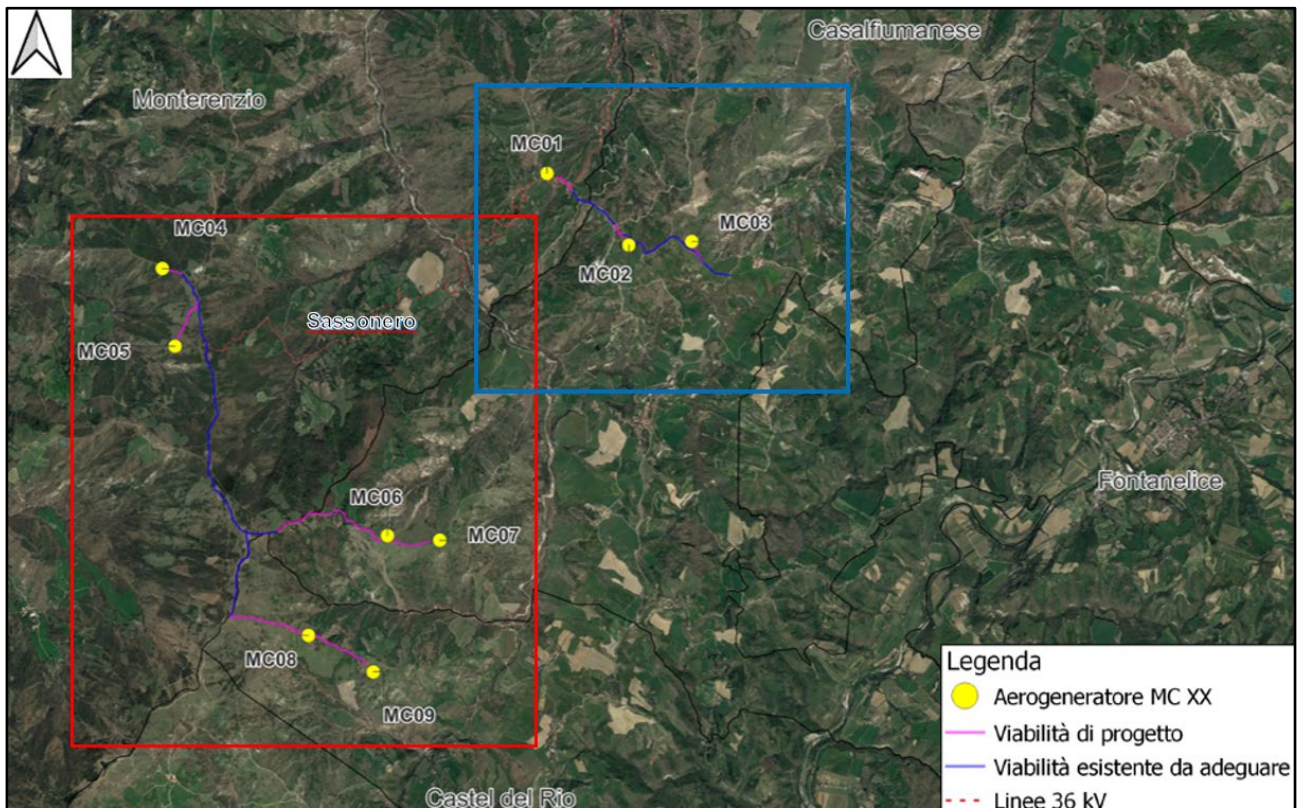


Figura 2.2: Layout d’impianto su ortofoto

Lo schema di allacciamento alla RTN prevede che l’impianto eolico venga collegato in antenna a 36 kV con la futura Stazione Elettrica (SE) della RTN da inserire in entra-esce alla linea RTN a 132 kV “Castel S. Pietro – Imola CP” in accordo alla STMG (Soluzione Tecnica Minima Generale) CP 202102219.

Ai sensi dell’art. 21 dell’allegato A alla deliberazione Arg/elt/99/08 e s.m.i. dell’Autorità di Regolazione per Energia Reti e Ambiente, il nuovo elettrodotto in antenna a 36 kV per il collegamento dell’impianto eolico sulla Stazione Elettrica della RTN costituisce impianto di utenza per la connessione, mentre lo stallo arrivo produttore a 36 kV nella suddetta stazione costituisce impianto di rete per la connessione.

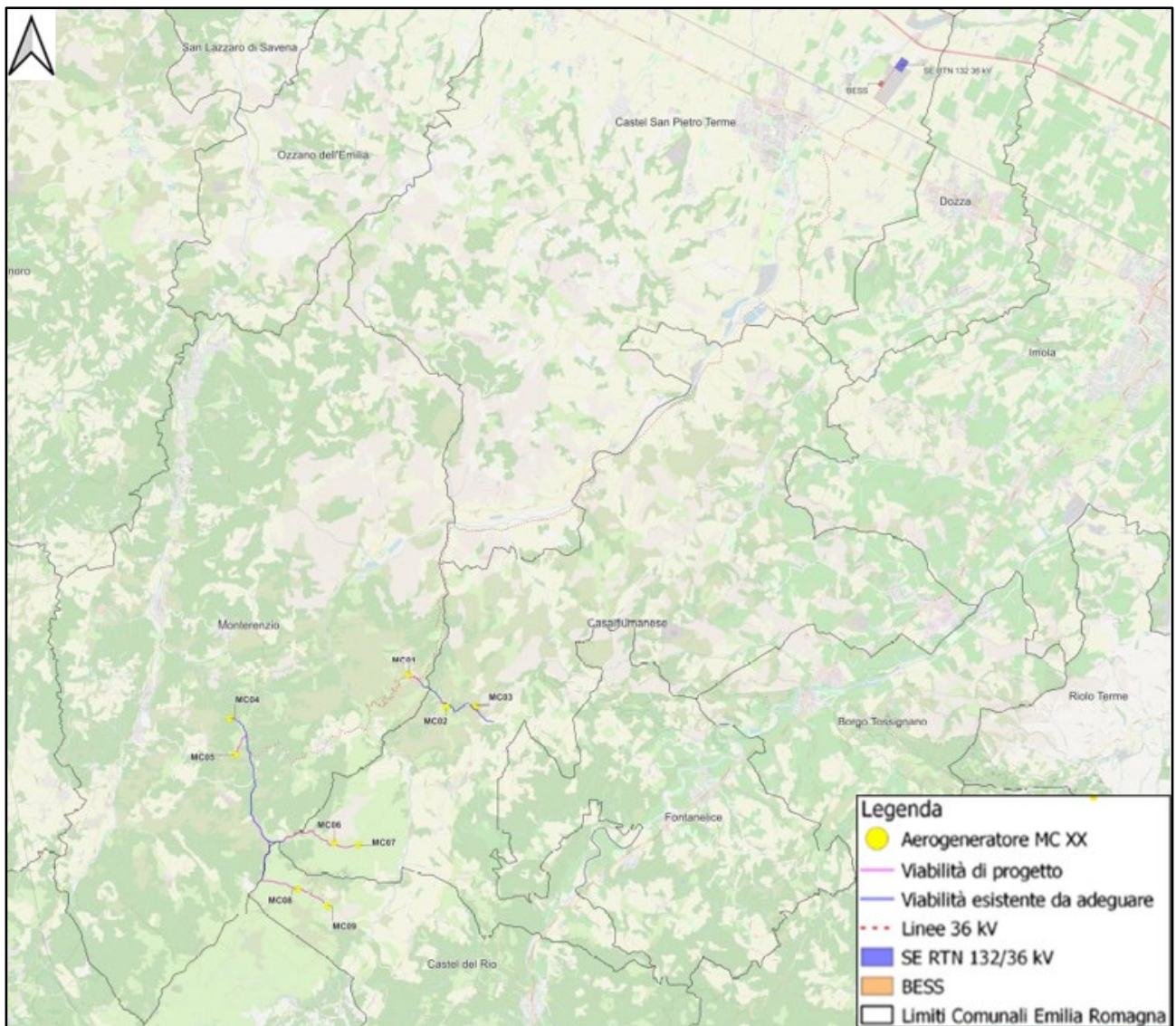


Figura 2.3: Inquadramento territoriale su “Open Street Map” - Limiti amministrativi comuni interessati

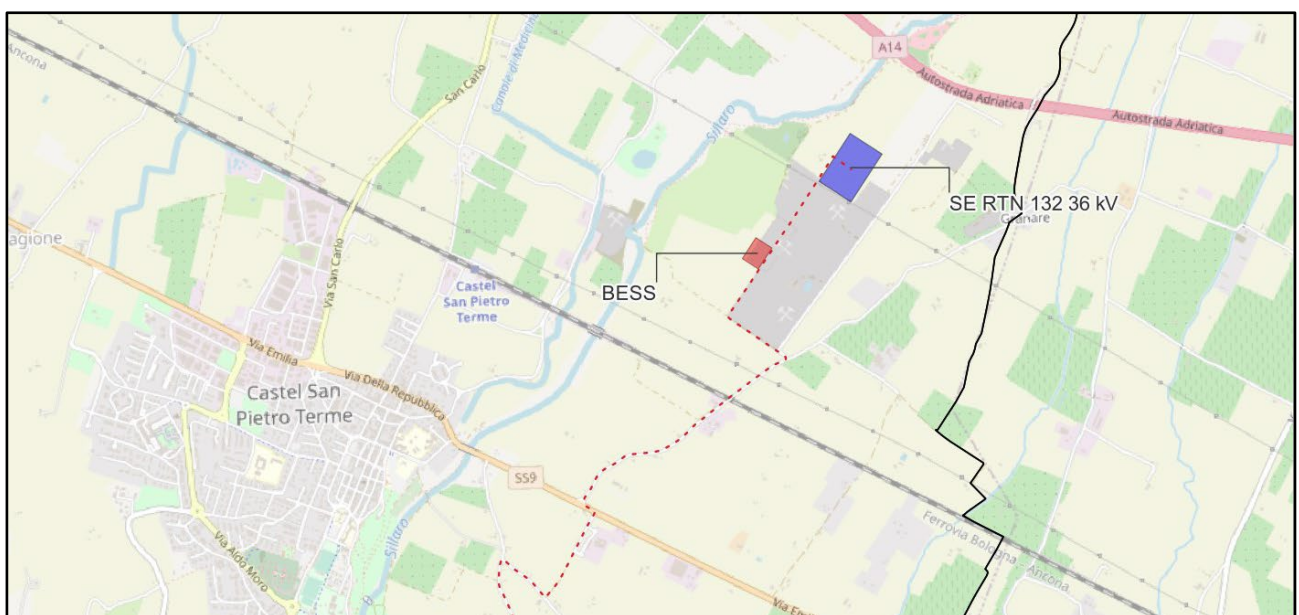


Figura 2.4: Inquadramento SE RTN di nuova realizzazione in Entra-Esci su linea RTN a 132 kV “Castel S. Pietro – Imola CP”.

Le turbine eoliche verranno collegate alla suddetta SE di trasformazione della RTN attraverso un sistema di linee elettriche interrate a 36 kV allocate prevalentemente in corrispondenza del sistema di viabilità interna che servirà per la costruzione e la gestione futura dell'impianto. Tale sistema di viabilità verrà realizzato prevalentemente adeguando il sistema viario esistente e realizzando nuovi tratti di viabilità in terra battuta.

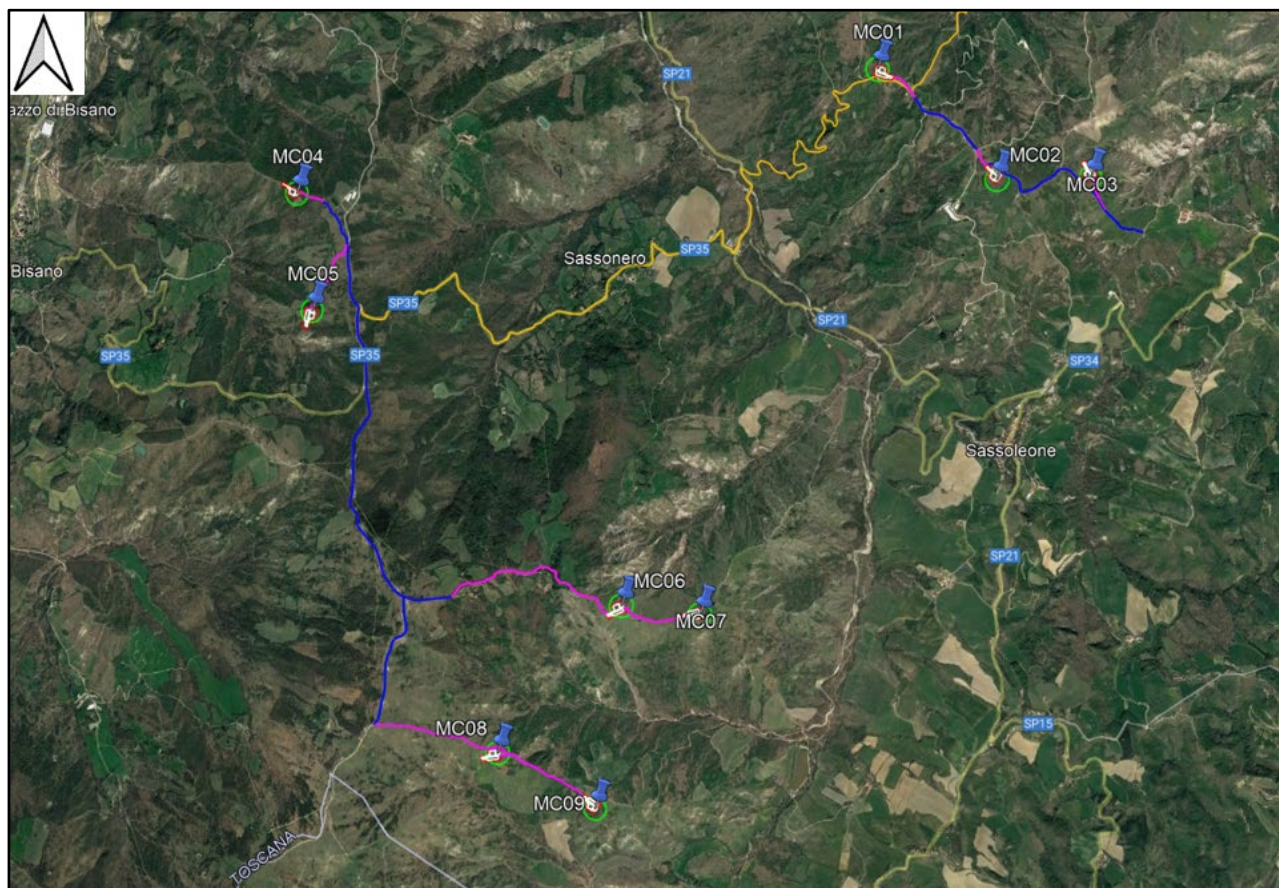


Figura 2.5: Layout d'impianto con sistema di viabilità esistente (linee blu) e di progetto (linee magenta) su immagine satellitare

La consegna in sito dei componenti degli aerogeneratori avverrà mediante l'utilizzo di mezzi di trasporto eccezionale che partendo dal Porto di Ravenna (**Figura 2.6**) arriverà passando per la SS67, la SP01, la SS309, la E45 e la SP19 presso l'area di trasbordo (Transshipment Area) in località San Pietro Terme da cui si seguirà un percorso per la consegna degli aerogeneratori della Zona 1 ed un percorso per quelli della Zona 2.

Nello specifico, dall'area di Trasbordo in San Pietro Terme percorrendo la SS09 direzione Est, la Via Sellustra direzione Sud e la SP34 direzione Ovest e la Via Gesso, si arriverà alle turbine MC01 – MC02 – MC03 e, sempre con partenza dalla suddetta area di trasbordo, i restanti aerogeneratori MC04 – MC05 – MC06 MC07 – MC08 – MC09 verranno raggiunti percorrendo la SS09 direzione Ovest, la SP07 direzione Sud, la SP35 direzione Est ed infine in direzione Sud la Via Casoni di Romagna.



Figura 2.6: Layout d’impianto con viabilità di accesso dal Porto di Ravenna (linee rosse) su immagine satellitare

2.1. Caratteristiche tecniche dell’aerogeneratore

L’aerogeneratore è una macchina rotante che trasforma l’energia cinetica del vento in energia elettrica ed è essenzialmente costituito da una torre (suddivisa in più parti), dalla navicella, dal Drive Train, dall’Hub e tre pale che costituiscono il rotore.

Per il presente progetto una delle possibili macchine che verrà installata è il modello Siemens Gamesa SG 170 di potenza nominale pari a 6.0 MW, altezza torre all’hub pari a 135 m e diametro del rotore 170 m (**Figura 2.1.1**).

Oltre ai componenti su elencati, vi è un sistema di controllo che esegue, il controllo della potenza ruotando le pale intorno al loro asse principale, ed il controllo dell’orientamento della navicella, detto controllo dell’imbardata, che permette l’allineamento della macchina rispetto alla direzione del vento.

Il rotore è a passo variabile in resina epossidica rinforzata con fibra di vetro di diametro pari a 170 metri, posto sopravvento al sostegno, con mozzo rigido in acciaio. Altre caratteristiche salienti sono riassunte nella **Tabella 2.1.1**.

Le caratteristiche dell’aerogeneratore su descritto sono quelle ritenute idonee in base a quanto disponibile oggi sul mercato, in futuro potrà essere possibile cambiare il modello dell’aerogeneratore senza modificare in maniera sostanziale l’impatto ambientale e i limiti di sicurezza previsti.

In accordo alle disposizioni dell'ENAC (Ente Nazionale per l'Aviazione Civile), ognuna delle macchine è dotata di un sistema di segnalazione notturna per la segnalazione aerea, che prevede l'utilizzo di una luce rossa sull'estradosso della navicella.

Una segnalazione diurna, consistente nella verniciatura della parte estrema della pala con tre bande di colore rosso ciascuna di 6 m per un totale di 18 m, è prevista per gli aerogeneratori di inizio e fine tratto.

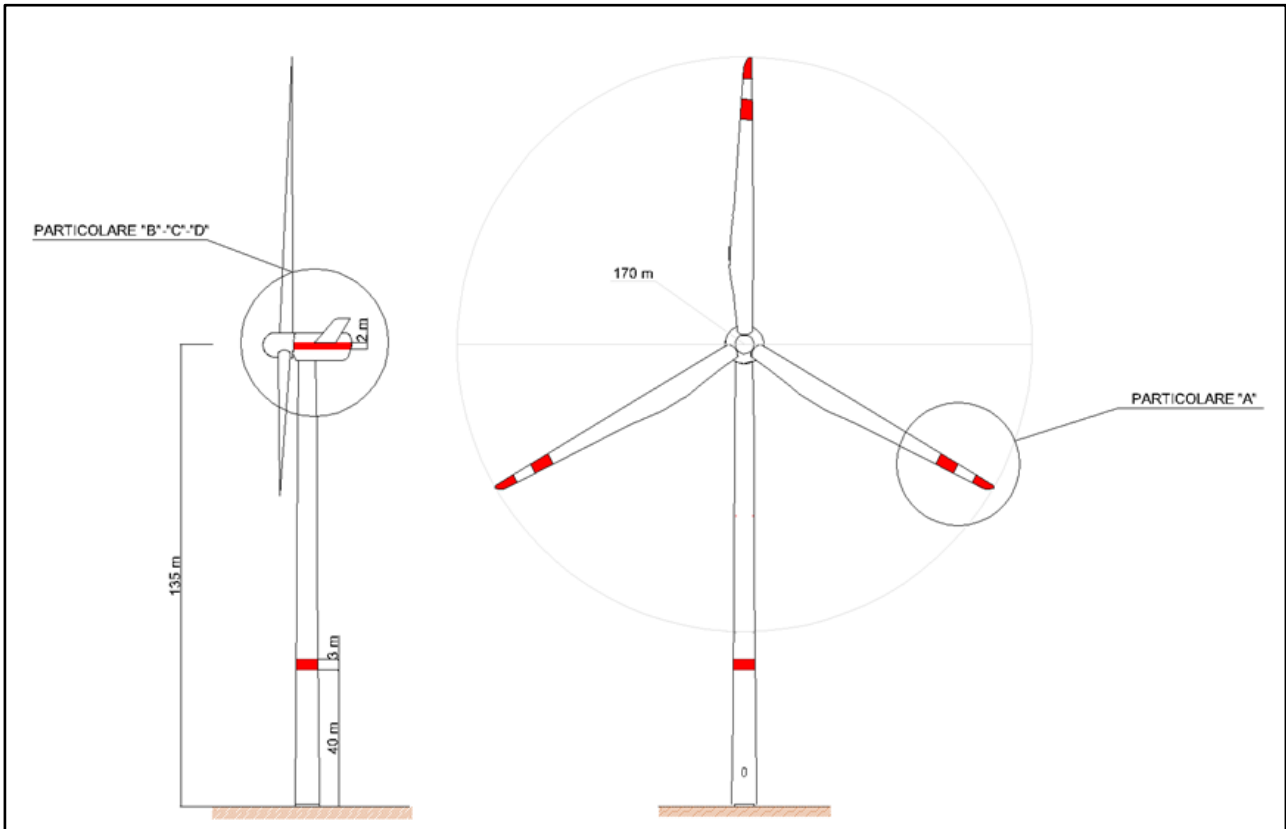


Figura 2.1.1: Profilo aerogeneratore SG170 – 6.0 MW

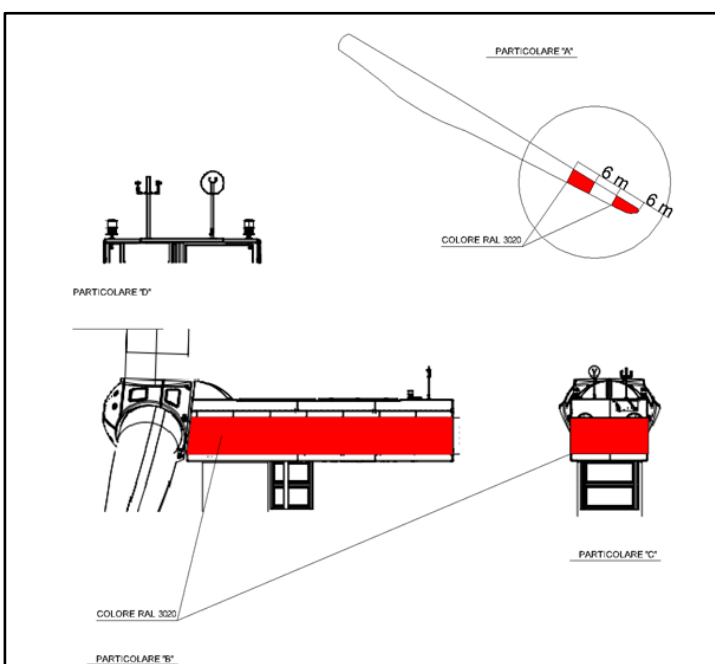


Figura 2.1.2: Particolari aerogeneratore SG170 – 6.0 MW di cui alla Figura 2.1.1

Rotor		Grid Terminals (LV)	
Type	3-bladed, horizontal axis	Baseline nominal power	6.0MW/6.2 MW
Position	Upwind	Voltage	690 V
Diameter	170 m	Frequency	50 Hz or 60 Hz
Swept area	22,698 m ²	Yaw System	
Power regulation	Pitch & torque regulation with variable speed	Type	Active
Rotor tilt	6 degrees	Yaw bearing	Externally geared
Blade		Yaw drive	Electric gear motors
Type	Self-supporting	Yaw brake	Active friction brake
Single piece blade length	83,3 m	Controller	
Segmented blade length:		Type	Siemens Integrated Control System (SICS)
Inboard module	68,33 m	SCADA system	Consolidated SCADA (CSSS)
Outboard module	15,04 m	Tower	
Max chord	4.5 m	Type	Tubular steel / Hybrid
Aerodynamic profile	Siemens Gamesa proprietary airfoils	Hub height	100m to 165 m and site- specific
Material	G (Glassfiber) – CRP (Carbon Reinforced Plastic)	Corrosion protection	
Surface gloss	Semi-gloss, < 30 / ISO2813	Surface gloss	Painted
Surface color	Light grey, RAL 7035 or White, RAL 9018	Color	Semi-gloss, <30 / ISO-2813 Light grey, RAL 7035 or White, RAL 9018
Aerodynamic Brake		Operational Data	
Type	Full span pitching	Cut-in wind speed	3 m/s
Activation	Active, hydraulic	Rated wind speed	11.0 m/s (steady wind without turbulence, as defined by IEC61400-1)
Load-Supporting Parts		Cut-out wind speed	25 m/s
Hub	Nodular cast iron	Restart wind speed	22 m/s
Main shaft	Nodular cast iron	Weight	
Nacelle bed frame	Nodular cast iron	Modular approach	Different modules depending on restriction
Mechanical Brake		Generator	
Type	Hydraulic disc brake	Type	Asynchronous, DFIG
Position	Gearbox rear end		
Nacelle Cover			
Type	Totally enclosed		
Surface gloss	Semi-gloss, <30 / ISO2813		
Color	Light Grey, RAL 7035 or White, RAL 9018		

Tabella 2.1.1: Specifiche tecniche aerogeneratore

2.2. Viabilità e piazzole

La viabilità e le piazzole del parco eolico sono elementi progettati considerando la fase di costruzione e la fase di esercizio dell'impianto eolico.

In merito alla viabilità, come anticipato sopra, si è cercato di utilizzare il sistema viario esistente adeguandolo al passaggio dei mezzi eccezionali. Tale indirizzo progettuale ha consentito di minimizzare l'impatto sul territorio e di ripristinare tratti di viabilità comunale che si trovano in stato di dissesto migliorando l'accessibilità dei luoghi anche alla popolazione locale.

Nel caso questo non sia stato possibile, sono stati progettati tratti di nuova viabilità seguendo il profilo naturale del terreno senza interferire con il reticolo idrografico presente in sito.

Nella **Figura 2.2.1** è riportata una sezione stradale tipo di riferimento per i tratti di viabilità da adeguare e quelli di nuova realizzazione.

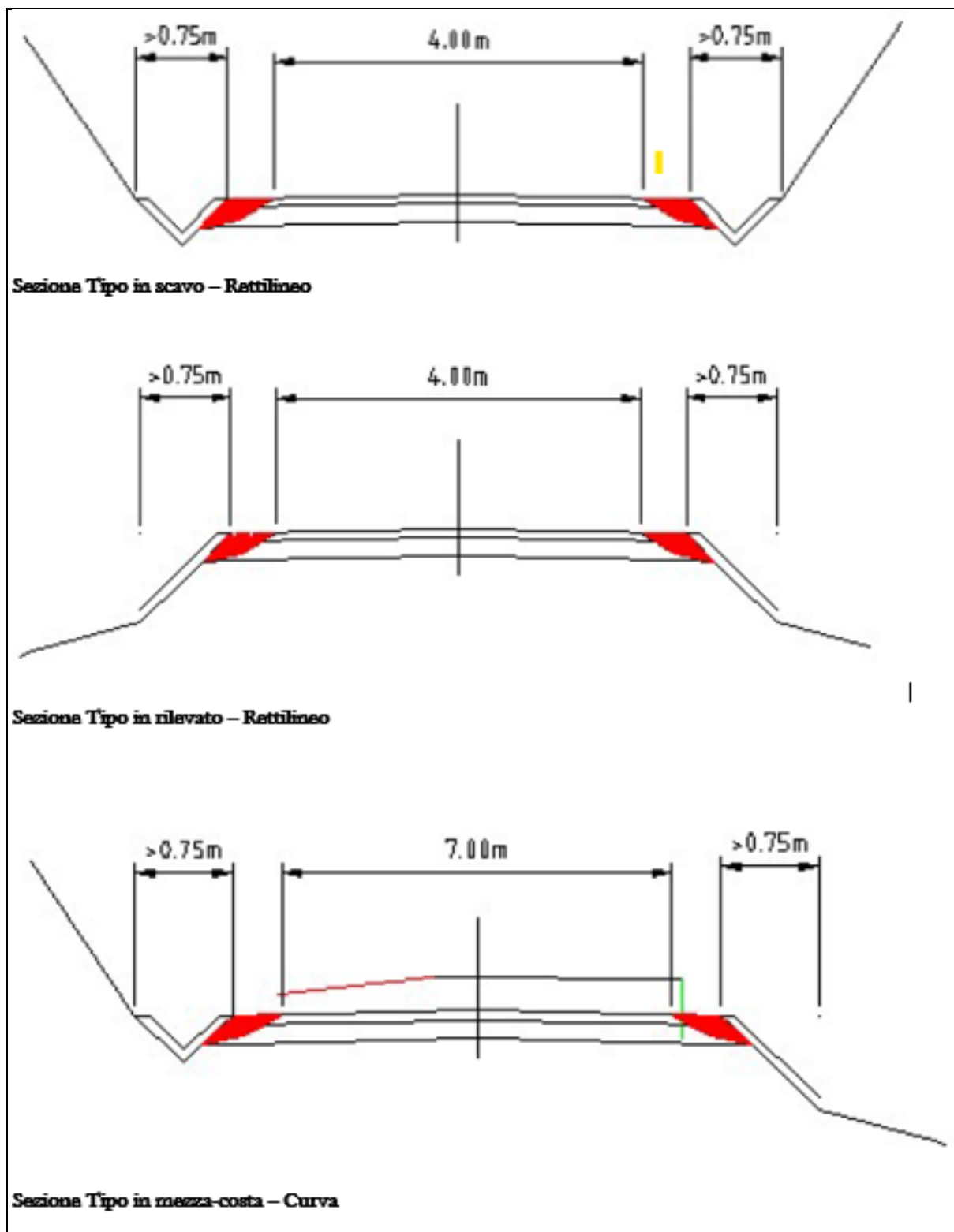


Figura 2.2.1: Sezioni tipo viabilità parco eolico

La progettazione delle piazzole da realizzare per l'installazione di ogni aerogeneratore prevede due configurazioni, la prima necessaria all'installazione dell'aerogeneratore e la seconda, a seguito di opere di dismissione parziale, per la fase di esercizio e manutenzione dell'impianto (**Figura 2.2.2**).

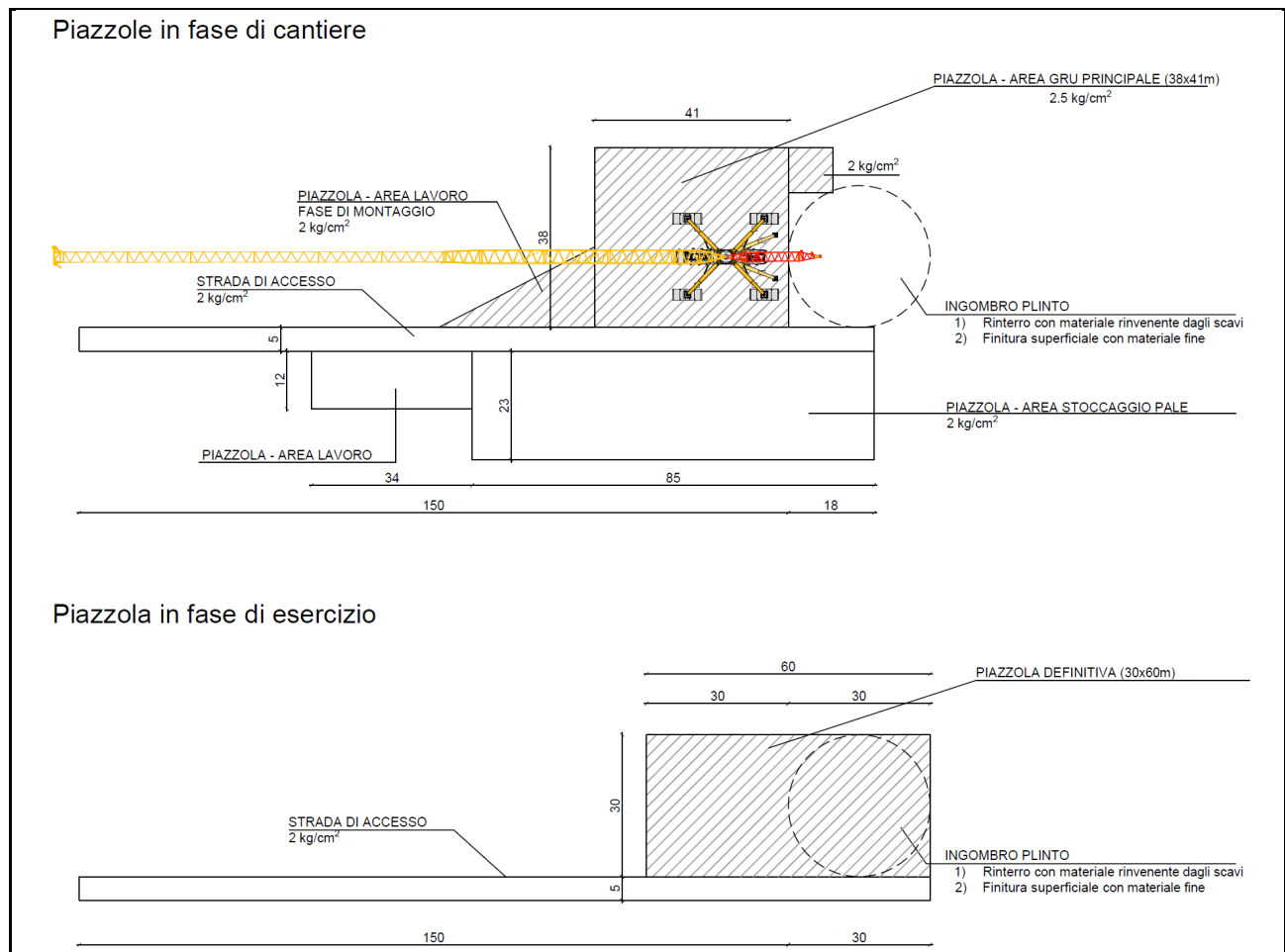


Figura 2.2.2: Planimetria piazzola tipo per la fase di installazione e fase di esercizio e manutenzione

2.3. Descrizione opere elettriche

2.3.1. Aerogeneratori

L'impianto eolico è composto da 9 aerogeneratori di potenza nominale pari a 6,0 MWp, opportunamente disposti, collegati in relazione alla disposizione dell'impianto e dotati di generatori asincroni trifasi. Ogni generatore è topograficamente, strutturalmente ed elettricamente indipendente dagli altri anche dal punto di vista delle funzioni di controllo e protezione.

Gli aerogeneratori sono collegati fra loro e a loro volta si connettono alla Stazione Elettrica di trasformazione della RTN 132/36 kV, prevista nel Comune di Castel San Pietro e ancora da realizzare.

All'interno della torre saranno installati:

- l'arrivo cavo BT (690 V) dal generatore eolico al trasformatore;
- il trasformatore MT-BT (0,69/36 kV);

- il sistema di rifasamento del trasformatore;
- la cella a 36 kV di arrivo linea e di protezione del trasformatore;
- il quadro di BT (690 V) di alimentazione dei servizi ausiliari;
- quadro di controllo locale.

2.3.2 Linee elettriche di collegamento a 36 KV

Il parco eolico avrà una potenza complessiva di 79 MWp, data dalla somma delle potenze elettriche di 9 aerogeneratori da 6 MWp ciascuno e dalla potenza del BESS di 25 MWp. Dal punto di vista elettrico gli aerogeneratori sono collegati fra loro in n. 4 gruppi (sottocampi) da 2 o 3 aerogeneratori ciascuno, come riportato nella tabella sottostante.

Sottocampo o Circuito	Aerogeneratori	Potenza totale [MWp]
CIRCUITO A	MC08 – MC09	12
CIRCUITO B	MC06 – MC07	12
CIRCUITO C	MC01 – MC02 – MC03	18
CIRCUITO D	MC04 – MC05	12

Tabella 2.3.2.1: Sottocampi degli aerogeneratori

Coerentemente con la suddivisione in sottocampi di cui sopra, l'intero sistema di distribuzione dell'energia dagli aerogeneratori verso la nuova stazione elettrica di trasformazione 132/36 kV nel Comune di Castel San Pietro è articolato in 4 distinte linee elettriche, una per ciascun sottocampo, con un livello di tensione pari a 36 kV e che confluiscono sui quadri generali dell'edificio a 36 kV in prossimità della stazione di cui sopra.

Dall'aerogeneratore capofila di ciascun sottocampo, infatti, si diparte una linea elettrica di vettoriamento in cavo interrato a 36 kV di sezione pari a 630 mm². Analogamente, gli aerogeneratori di ciascun sottocampo sono collegati fra loro in entra-esce o fine linea mediante una linea elettrica in cavo interrato a 36 kV di sezione 185 o 300 mm². Tutti i cavi di cui si farà utilizzo, sia per il collegamento interno dei sottocampi che per la relativa connessione alla stazione elettrica di trasformazione della RTN 132/36 kV, sono del tipo schermato mediante filo di rame rosso, con conduttore a corda rotonda compatta di rame rosso, semiconduttore esterno elastomerico estruso e guaina in PVC.

In generale, per tutte le linee elettriche, si prevede la posa a trifoglio direttamente interrata dei cavi, ad una profondità di 1,50 m dal piano del suolo e l'utilizzo di una lastra protettiva che ne assicuri la protezione meccanica. In caso di particolari attraversamenti o di risoluzione puntuale di interferenze, le modalità di posa potranno essere modificate in conformità a quanto previsto dalla norma CEI 11-17 e dagli eventuali regolamenti vigenti relativi alle opere interferite, mantenendo comunque un grado di

protezione delle linee non inferiore a quanto garantito dalle normali condizioni di posa.

La figura seguente, nella quale le misure sono espresse in mm, mostra la modalità di posa sopra indicate.

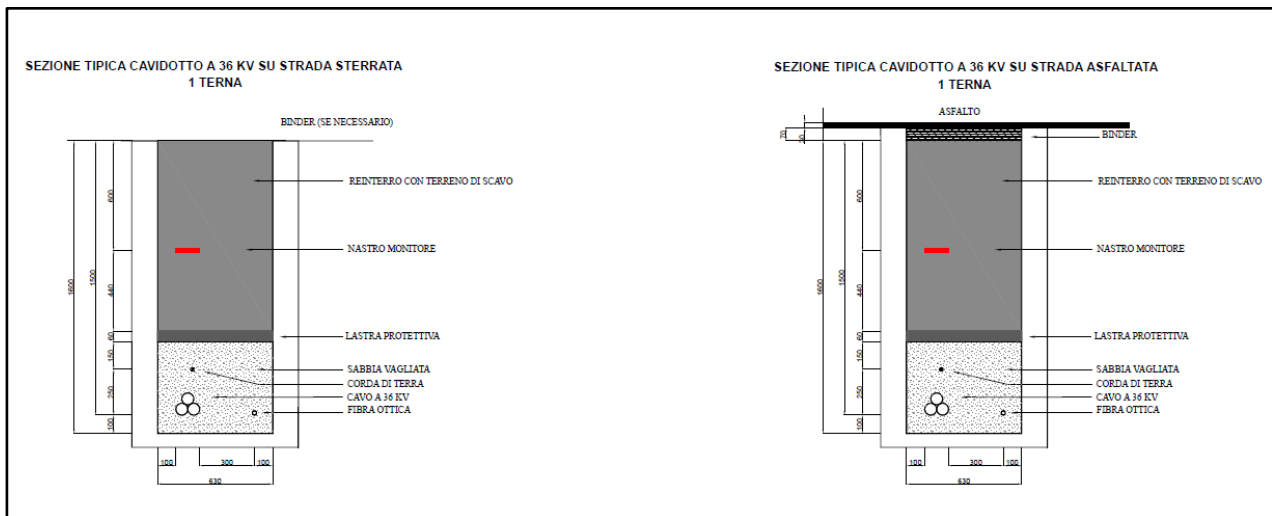


Figura 2.3.2.1: Sezioni tipiche delle trincee caavidotto per una terna di cavi in parallelo

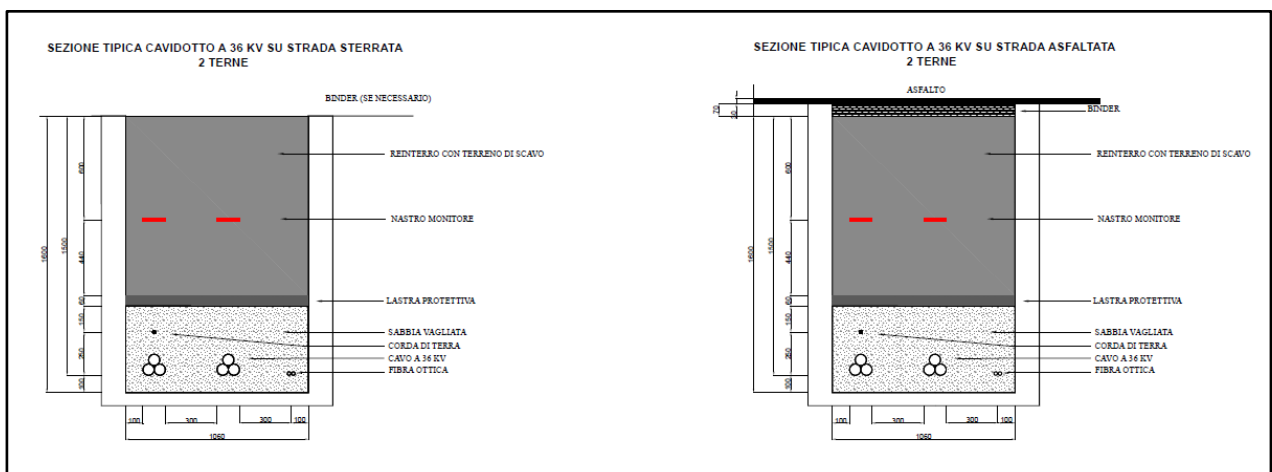


Figura 2.3.2.2: Sezioni tipiche delle trincee caavidotto per due terne di cavi in parallelo

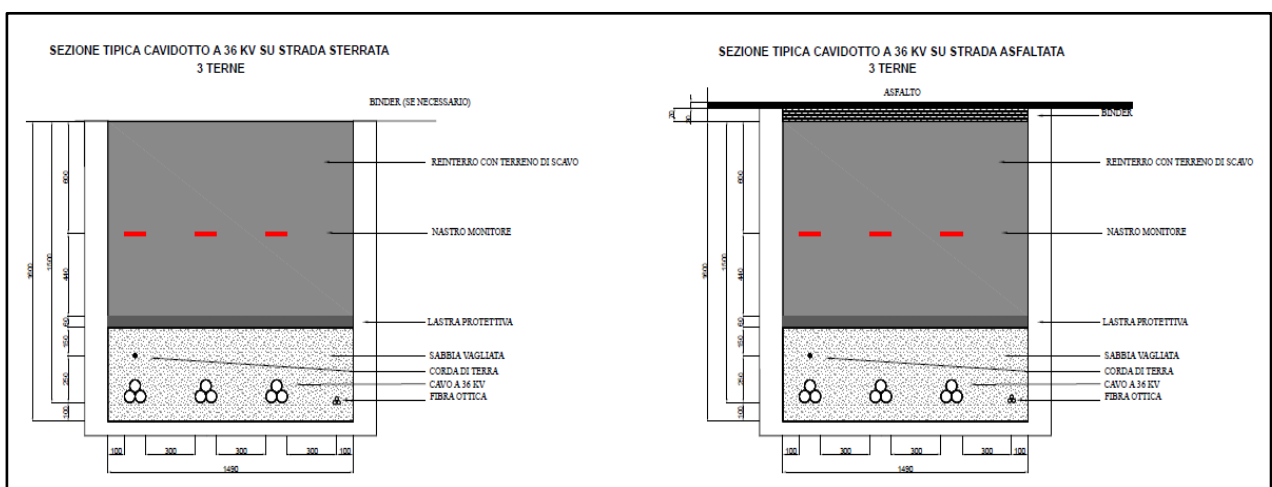


Figura 2.3.2.3: Sezioni tipiche delle trincee caavidotto per tre terne di cavi in parallelo

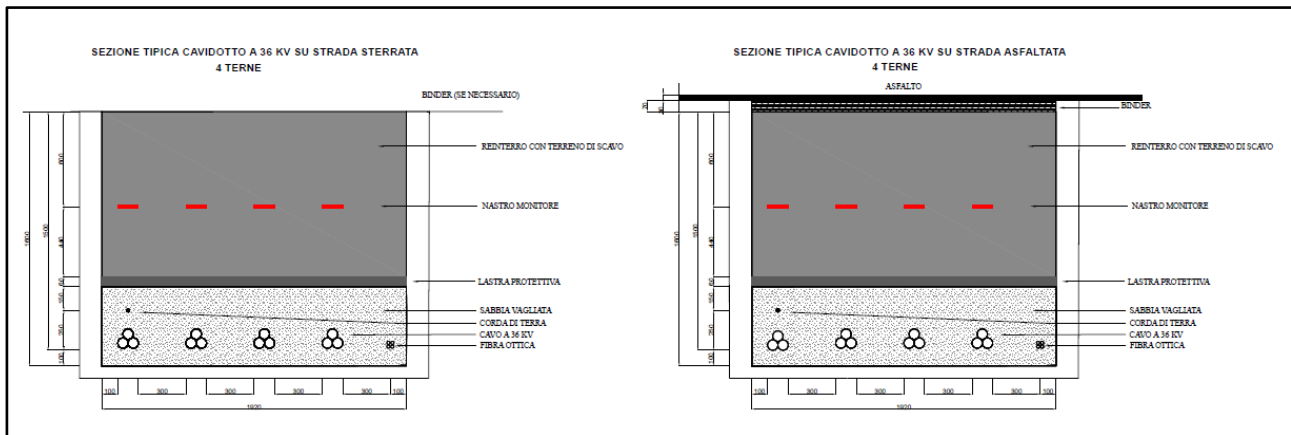


Figura 2.3.2.4: Sezioni tipiche delle trincee caavidotto per quattro terne di cavi in parallelo

2.3.3. BESS

L'impianto eolico è connesso ad un sistema di accumulo di energia BESS (Battery Energy Storage System) di potenza pari a 25 MWp localizzato nelle immediate vicinanze della Stazione Elettrica della RTN 132/36 kV, come rappresentato nella **Figura 2.5**.

Il BESS è un sistema costituito da apparecchiature e dispositivi in grado di immagazzinare a livello elettrochimico l'energia al fine di convertirla in energia elettrica a 36 kV.

In particolare, il sistema BESS è costituito da un insieme di celle elettrochimiche connesse elettricamente tra loro in serie e parallelo in modo da formare i singoli moduli batterie, i quali, a loro volta, sono connessi elettricamente tra loro in serie e parallelo e assemblati in un unico sistema (armadio batteria).

Le batterie adoperate sono agli ioni di litio e presentano un'aspettativa di vita pari alla vita di impianto prevista in condizioni operative standard all'aperto.

Un sistema di controllo batterie (BMS, Battery Management System) assicura la gestione, il controllo e il monitoraggio locale degli assemblati-batterie, mentre il PCS (Power Conversion System) assicura la conversione bidirezionale della corrente da AC/DC.

La gestione e il controllo locale dell'impianto è assicurato dal Sistema di Controllo Integrato (SCI).

I componenti e le apparecchiature principali del sistema di accumulo sono di seguito elencati:

- celle elettrochimiche;
- moduli batterie;
- sistema di gestione, controllo e monitoraggio locale delle batterie (BMS);
- sistema di conversione di corrente AC/DC (PCS);
- sistema di gestione e controllo dell'impianto (SCI);
- trasformatori di potenza 36 kV/BT;
- quadri elettrici a 36 kV;

- sistema di misurazione;
- servizi ausiliari;
- sistema SCADA in grado di garantire la supervisione, il controllo e la raccolta dei dati relativi all'impianto;
- container batterie.

La configurazione del BESS (**Figura 2.3.3.1**) è costituita da 1 gruppo ottenuto replicando 8 blocchi da 3,125 MWp ciascuno, per una potenza totale di 25 MW e collegati tra loro in entra – esci in modo che l'impianto occuperà complessivamente un'area di 138 m x 109 m.

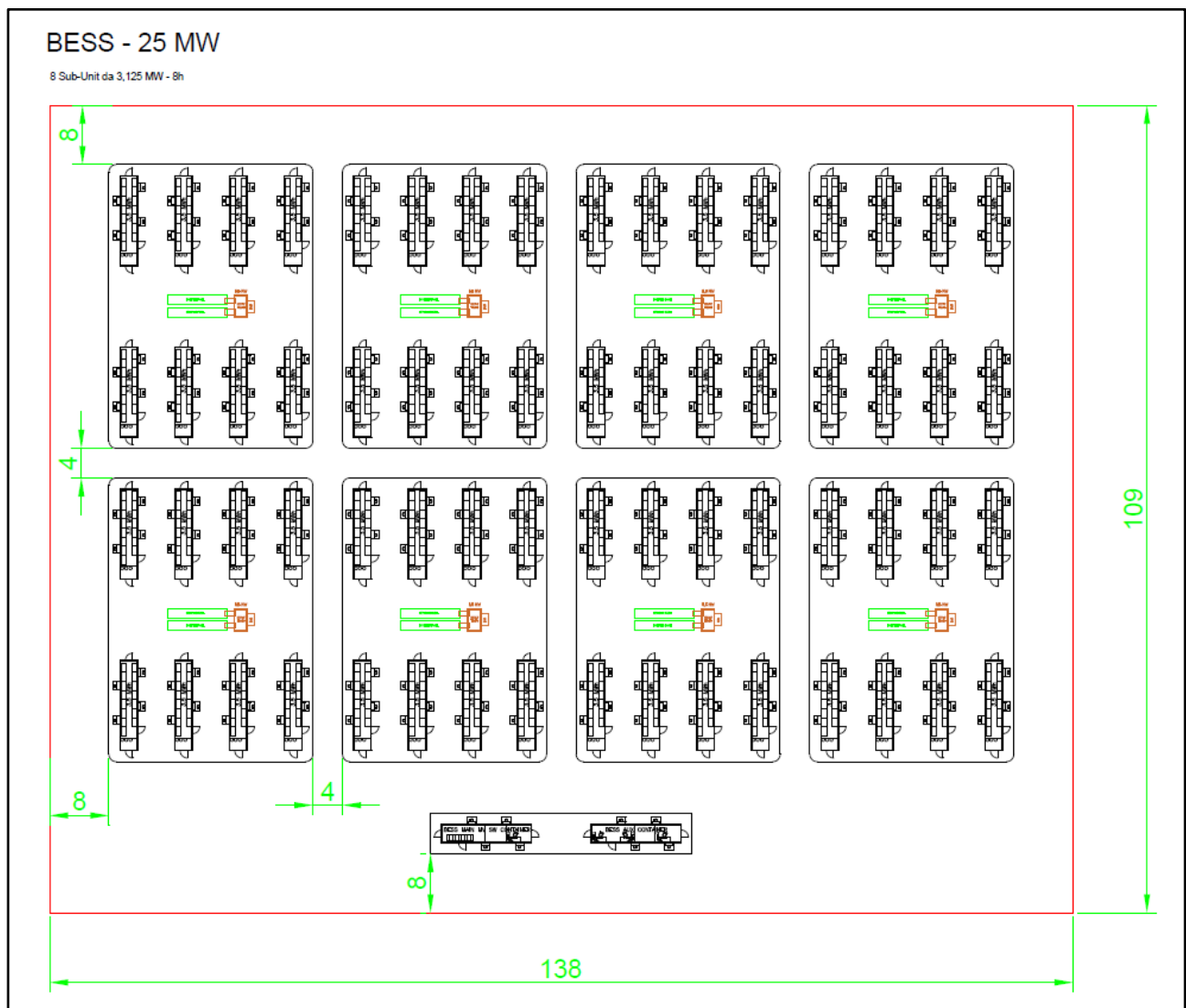


Figura 2.3.3.1: Configurazione BESS di potenza 25 MWp

2.3.4. Opere di connessione alla RTN

Lo schema di allacciamento alla RTN prevede che la centrale eolica venga collegata in antenna a 36 kV con la futura Stazione Elettrica (SE) di trasformazione della RTN 132/36 kV di Castel San Pietro, da inserire in entra-esce alla linea elettrica aerea RTN a 132 kV “Castel San Pietro – Imola CP”.

Il progetto prevede la realizzazione dell'edificio per i servizi ausiliari, del locale magazzino e dei chioschi per apparecchiature elettriche, dell'edificio per i punti di consegna, dell'edificio comandi e di un edificio quadri di attestazione cavi a 36 kV dei produttori e da cui si dipartono le linee a 36 kV verso i 3 trasformatori 132/36 kV.

2.3.5. Sistema di terra

Il sistema di terra del parco eolico è costituito da una maglia di terra formata dai sistemi di dispersori dei singoli aerogeneratori e dal conduttore di corda nuda che li collega. La maglia complessiva che si viene così a creare consente di ottenere un valore di resistenza di terra tale da garantire un sufficiente margine di sicurezza, adeguato alla normativa vigente. Il sistema di terra di ciascun aerogeneratore consisterà in più anelli dispersori concentrici, collegati radialmente fra loro, e collegati in più punti anche all'armatura del plinto di fondazione.

3. CARATTERISTICHE PRINCIPALI DEL PARCO EOLICO

L'impianto eolico sarà costituito essenzialmente da 9 aerogeneratori la cui posizione è stata stabilita a seguito di valutazioni che riguardano diversi aspetti quali l'esposizione a tutti i settori della rosa dei venti, la morfologia del territorio, la distanza da fabbricati e strade esistenti ed utilizzate da un elevato numero di veicoli, distanza dal centro abitato e da beni monumentali presenti nell'area oltre agli aspetti legati alla sicurezza e volti a minimizzare l'impatto sull'ambiente:

- ottemperare alle previsioni della normativa vigente e delle linee guida sia nazionali che regionali;
- minimizzare l'impatto visivo;
- migliorare in sistema viario esistente al fine di migliorare l'accessibilità ai terreni per lo sviluppo dell'agricoltura e dell'allevamento di animali;
- disposizione delle macchine ad una distanza reciproca minima pari ad almeno 530 m, atta a minimizzare l'effetto scia, l'effetto selva e l'impatto sull'avifauna;
- condizioni di massima sicurezza, sia in fase di installazione che di esercizio.

La disposizione finale del parco è stata verificata e confermata a seguito di uno studio di fattibilità condotto sulla base delle informazioni sugli aspetti vincolistici dal punto di vista ambientale e paesaggistico e sulla base dei sopralluoghi svolti sul posto per verificare le interferenze presenti in sito e la fattibilità di realizzazione delle opere.

Si riportano di seguito le coordinate delle posizioni scelte per l'installazione degli aerogeneratori con il relativo inquadramento catastale.

ID	Comune	Lat. [°]	Long. [°]	Foglio	Particella	D rotore [m]	H _{hub} [m]	H _{tot} [m]
MC01	Monterenzio	44°17'7.15"N	11°28'14.23"E	70	8	170	135	220
MC02	Casalfiumanese	44°16'40.69"N	11°28'53.76"E	47	155	170	135	220
MC03	Casalfiumanese	44°16'41.30"N	11°29'25.07"E	68	1	170	135	220
MC04	Monterenzio	44°16'37.27"N	11°25'1.86"E	79	14	170	135	220
MC05	Monterenzio	44°16'9.45"N	11°25'6.99"E	79	187	170	135	220
MC06	Casalfiumanese	44°14'59.72"N	11°26'49.64"E	82	20	170	135	220
MC07	Casalfiumanese	44°14'57.51"N	11°27'15.52"E	85	7	170	135	220
MC08	Castel del Rio	44°14'24.94"N	11°26'8.93"E	2	7	170	135	220
MC09	Castel del Rio	44°14'11.27"N	11°26'40.61"E	3	36	170	135	220

Tabella 3.1: Localizzazione planimetrica e catastale degli aerogeneratori di progetto

Il progetto prevede l'adeguamento di tratti di strada esistenti, in particolare strade comunali, e la realizzazione di una nuova viabilità a servizio degli aerogeneratori di progetto, ossia di una rete viaria interna al parco che si snoderà seguendo lo sviluppo degli esistenti tratturi non vincolati dalla Soprintendenza.

La disponibilità delle aree, necessaria per l'installazione degli aerogeneratori e le relative opere connesse, è garantita grazie alla Dichiarazione di Pubblica utilità ai sensi degli artt. 52-quater "Disposizioni generali in materia di conformità urbanistica, apposizione del vincolo preordinato all'esproprio e pubblica utilità" e 52-quinquies "Disposizioni particolari per le infrastrutture lineari energetiche facenti parte delle reti energetiche nazionali" D.P.R. 327/2001 a conclusione del procedimento autorizzatorio di cui all'art.12, d.lgs. 387/2003 e gli effetti dell'Autorizzazione Unica ottenuta dopo opportuna conferenza di servizi.

Tutte le aree oggetto interessate dal progetto sono riportate nello specifico elaborato di progetto "MCEG011 Piano Particellare di esproprio descrittivo".

4. FENOMENO DI SHADOW FLICKERING

La presenza delle turbine eoliche provoca la proiezione dell'ombra sulle aree ad esse adiacenti in presenza di luce solare diretta.

Il fenomeno causa effetti quasi statici dovuti alla presenza della torre fissa ed effetti dinamici legati alla rotazione del rotore delle tre pale della turbina.

Gli effetti statici possono aumentare, nelle prime ed ultime ore del giorno, la probabilità di formazione di ghiaccio su eventuali strade asfaltate soggette a traffico.

Gli effetti dinamici si traducono in una variazione alternata di intensità luminosa che, a lungo andare, può provocare fastidio agli occupanti le abitazioni le cui finestre risultano esposte al fenomeno stesso.

Lo "**shadow flickering**" descrive appunto l'effetto stroboscopico delle ombre proiettate dalle pale rotanti degli aerogeneratori allorquando il sole si trova alle loro spalle, come si evince dalla **Figura 4.1**.



Figura 4.1: Ombre proiettate dalle pale in rotazione di una turbina

Il conseguente effetto sugli individui è simile a quello che si sperimenterebbe in seguito alle variazioni di intensità luminosa di una lampada ad incandescenza a causa di continui sbalzi della tensione della rete di alimentazione elettrica.

Lo shadow flickering risulta assente nei casi di presenza di nuvole e nebbia che oscurano il sole e nei casi in cui le pale dell'aerogeneratore sono a riposo (per esempio in assenza del vento).

Per effettuare l'analisi del fenomeno vengono considerati alcuni parametri che ne influenzano la rilevanza.

Il primo di essi da tenere in conto è la frequenza di rotazione delle pale; in particolare, le frequenze che possono provocare un senso di fastidio sono comprese tra i 2,5 ed i 20 Hz.

Solitamente gli aerogeneratori tripala operano ad una velocità di rotazione inferiore ai 35 giri al minuto, corrispondente ad una frequenza di passaggio delle pale sulla verticale inferiore a 1,75 Hz, minore, quindi, della frequenza critica di 2,5 Hz.

Inoltre, i generatori di grande potenza (dal MW in su) raramente superano la velocità di rotazione di 20 giri al minuto, corrispondente a frequenze di passaggio delle pale ampiamente minori di quelle ritenute fastidiose per la maggioranza degli individui.

Un ulteriore aspetto da considerare per l'analisi della durata del fenomeno è la relazione spaziale tra un aerogeneratore ed un ricettore (abitazione), così come la direzione del vento.

Per distanze dell'ordine dei 300 m il fenomeno è più rilevante all'alba oppure al tramonto, ovvero in quelle ore in cui le ombre risultano molto lunghe per effetto della piccola elevazione solare. Al di là di

una certa distanza l'effetto delle ombre è meno consistente perché il diametro del sole risulta essere di gran lunga superiore rispetto allo spessore della singola pala.

In questo scenario la condizione più penalizzante corrisponde al caso in cui il piano del rotore risulta essere ortogonale alla congiungente tra sole e ricettore; infatti, in tali condizioni, l'ombra proiettata darà origine ad un cerchio di diametro pari al rotore dell'aerogeneratore.

L'effetto dello shadow flickering risulta evidente e fastidioso in quegli ambienti con finestrate rivolte verso le ombre.

In linea di massima, si può ritenere che l'area soggetta al fenomeno in questione non si estenda oltre i $500 \div 1000$ m dall'aerogeneratore e le zone a maggiore impatto ricadono entro i 300 m di distanza dalle turbine.

Al fine di analizzare qualitativamente e quantitativamente il fenomeno, risulta necessario individuare la posizione occupata dal sole in maniera univoca tramite due coordinate angolari, azimuth ed altezza.

L'azimut per convenzione è l'angolo valutato sul piano orizzontale ed in senso orario, a partire dal nord geografico fino alla proiezione della congiungente (origine del sistema) - sole sul piano orizzontale stesso, ovvero il punto direttamente sotto al sole.

L'altezza o elevazione è misurata sul piano verticale, partendo da tale punto sino ad arrivare in corrispondenza del sole.

Tali coordinate variano con continuità grazie al moto della Terra intorno al sole e la traiettoria descritta nel cielo dal sole è assimilabile ad un arco; ogni giorno si caratterizza per un proprio arco, il quale si discosta, se pur di poco, da quello del giorno immediatamente precedente e successivo.

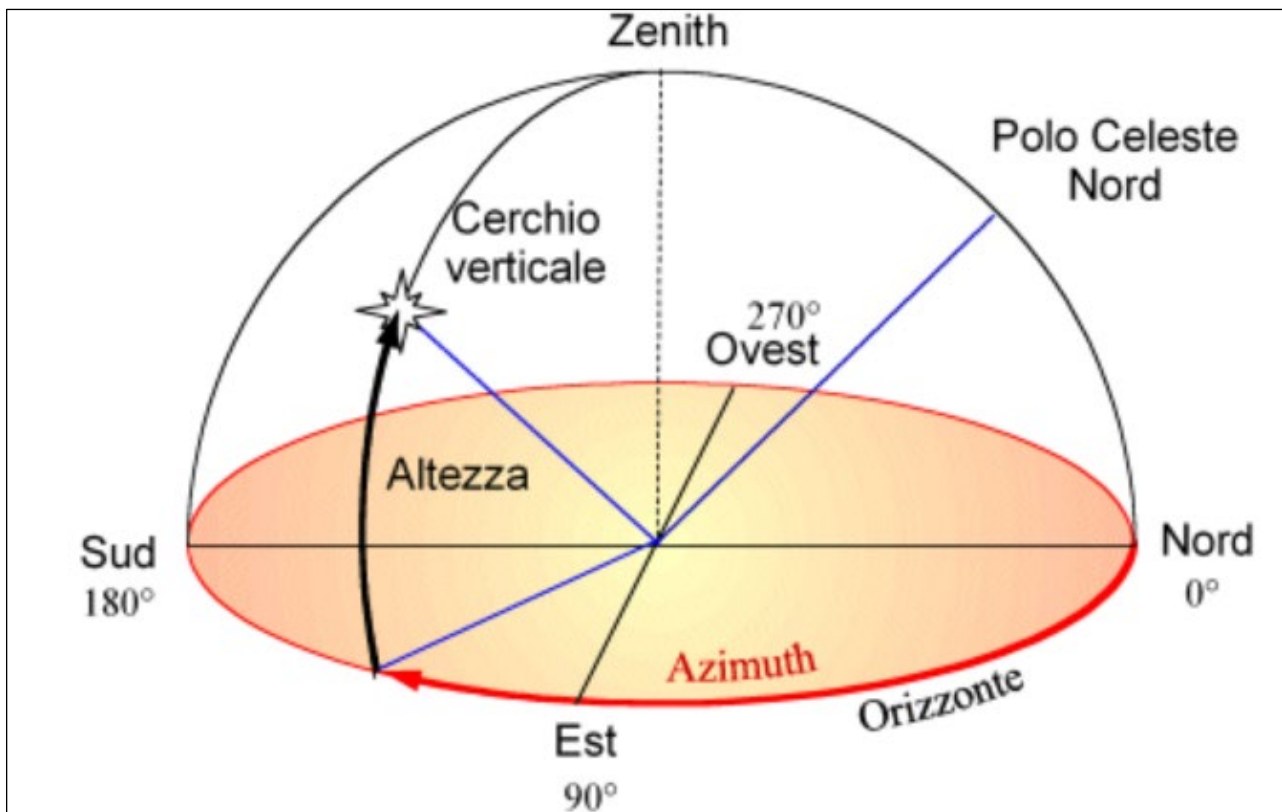


Figura 4.2: Coordinate azimuth ed altezza per identificare la posizione del sole

La durata del giorno non coincide con la durata della luce naturale in quanto prima dell'alba e dopo il tramonto sono individuabili due periodi, detti crepuscolo (rispettivamente crepuscolo mattutino e crepuscolo serale o serotino), durante i quali giunge a terra una luce diffusa naturale fornita dai livelli più esterni dell'atmosfera, i quali, trovandosi a quote più elevate, ricevono luce solare diretta per un tempo più lungo riflettendola in parte verso la terra.

Pertanto, la durata dell'illuminazione del sole è pari alla somma della durata del giorno e della durata del crepuscolo mattutino e serale.

5. RIFERIMENTI NORMATIVI

L'effetto Shadow – Flickering è più pronunciato alle latitudini settentrionali durante i mesi invernali; infatti, soprattutto nel Nord Europa, l'effetto della minore altezza del sole all'orizzonte è più rilevante. Pertanto, alcuni paesi hanno adottato dei limiti di legge relativi all'esposizione all'effetto in questione. In Italia non esistono specifiche norme o linee guida che regolamentino il fenomeno e definiscano i limiti di esposizione in termini di ore o giorni all'anno.

Tuttavia, al fine di fornire una valutazione dell'impatto del fenomeno anche in termini quantitativi, si è cercato di mantenere l'esposizione allo shadow – flickering di ogni ricettore al di sotto delle 30 ore annue, parametro considerato di qualità a livello internazionale.

In particolare, la seguente trattazione fa riferimento alle norme e linee guida tedesche, in base alle quali il fenomeno in questione deve essere valutato nei casi seguenti:

- Fino alle distanze in corrispondenza delle quali il rotore dell'aerogeneratore copre il 20 % del disco solare (per distanze superiori a quella menzionata lo shadow-flickering arreca danni considerati trascurabili);
- per angoli del sole sull'orizzonte superiori a 3° ;
- ad un'altezza di 2 m dal suolo.

Inoltre, come anticipato, le linee guida tedesche stabiliscono i limiti di esposizione al fenomeno di:

- 30 ore all'anno;
- 30 minuti al giorno.

6. IPOTESI E METODO DI CALCOLO

L'obiettivo della trattazione è la stima quantitativa dell'effetto shadow flickering prodotto dall'impianto eolico, fenomeno per cui si genera una intermittenza dell'ombra a seguito del movimento del rotore dell'aerogeneratore quando in esercizio (in particolare quando il piano del rotore risulta perpendicolare alla congiungente tra l'osservatore e il sole) e che potrebbe risultare fastidioso per un osservatore.

Nell'analisi condotta sono stati considerati 9 aerogeneratori di nuova realizzazione e relativi al progetto del Parco Eolico Emilia e 16 aerogeneratori esistenti.

Gli aerogeneratori di progetto hanno un'altezza al mozzo di 135 m, diametro del rotore di 170 m, potenza nominale di 6,0 MWp e una frequenza di rotazione nominale del rotore di 8,8 giri al minuto (RPM nominale).

Nel file **ALLEGATO 1** alla relazione sono esplicitati anche i modelli delle 16 turbine eoliche esistenti e le relative coordinate, in quanto contribuiscono agli effetti provocati dal fenomeno shadow flickering così come quelle di nuova installazione, essendo prossime alle stesse.

La verifica è stata effettuata in corrispondenza di 20 ricettori, rappresentativi di fabbricati di "civile abitazione", riportati nella **Tabella 6.1** e sui quali l'effetto trattato potrebbe avere una certa rilevanza:

Ricettore	Coordinate UTM WGS 84, 33°		Comune	WTG più vicina	Distanza WTG più vicina	Foglio	Particella	Stato accatastamento
	Latitudine	Longitudine						
R01	44,250726°	11,433907°	Casalfumane	MC06	1083	83	98	A/3
R02	44,252088°	11,432953°	Monterenzio	MC06	1150	87	202	A/3
R03	44,253657°	11,435098°	Monterenzio	MC06	1061	88	121	A/4
R04	44,252135°	11,440042°	Casalfumane	MC06	626	82	59	A/3

Ricettore	Coordinate UTM WGS 84, 33°		Comune	WTG più vicina	Distanza WTG più vicina	Foglio	Particella	Stato accatastamento
	Latitudine	Longitudine						
R05	44,257508°	11,448213°	Casalfumane	MC06	845	75	32	A/3
R09	44,263375°	11,413069°	Monterenzio	MC05	780	78	98	A/3
R10	44,264475°	11,424736°	Monterenzio	MC05	715	80	221	A/3
R14	44,281813°	11,477495°	Casalfumane	MC02	535	47	52	A/3
R15	44,290074°	11,462588°	Monterenzio	MC01	826	68	6	A/4
R16	44,286110°	11,465136°	Monterenzio	MC01	447	68	27	A/4
R18	44,273727°	11,486381°	Casalfumane	MC03	581	68	16	A/3
R19	44,273865°	11,493017°	Casalfumane	MC03	514	68	14	A/4
R20	44,275819°	11,500122°	Casalfumane	MC03	810	69	216	A/4
R21	44,269318°	11,482316°	Casalfumane	MC02	955	67	51	A/3
R22	44,270420°	11,492287°	Casalfumane	MC03	866	68	162	A/3
R23	44,270391°	11,489627°	Casalfumane	MC03	861	68	158	A/4
R24	44,268166°	11,498943°	Casalfumane	MC03	1280	69	67	A/4
R26	44,283763°	11,490558°	Casalfumane	MC03	611	48	30	A/4
R27	44,275280°	11,506065°	Casalfumane	MC03	1285	70	150	A/5
R28	44,230405°	11,444171°	Castel del Rio	MC09	675	6	64	A/3

Tabella 6.1: Ricettori oggetto di verifica

La distribuzione dei suddetti ricettori rispetto agli aerogeneratori è riportata nella figura seguente:

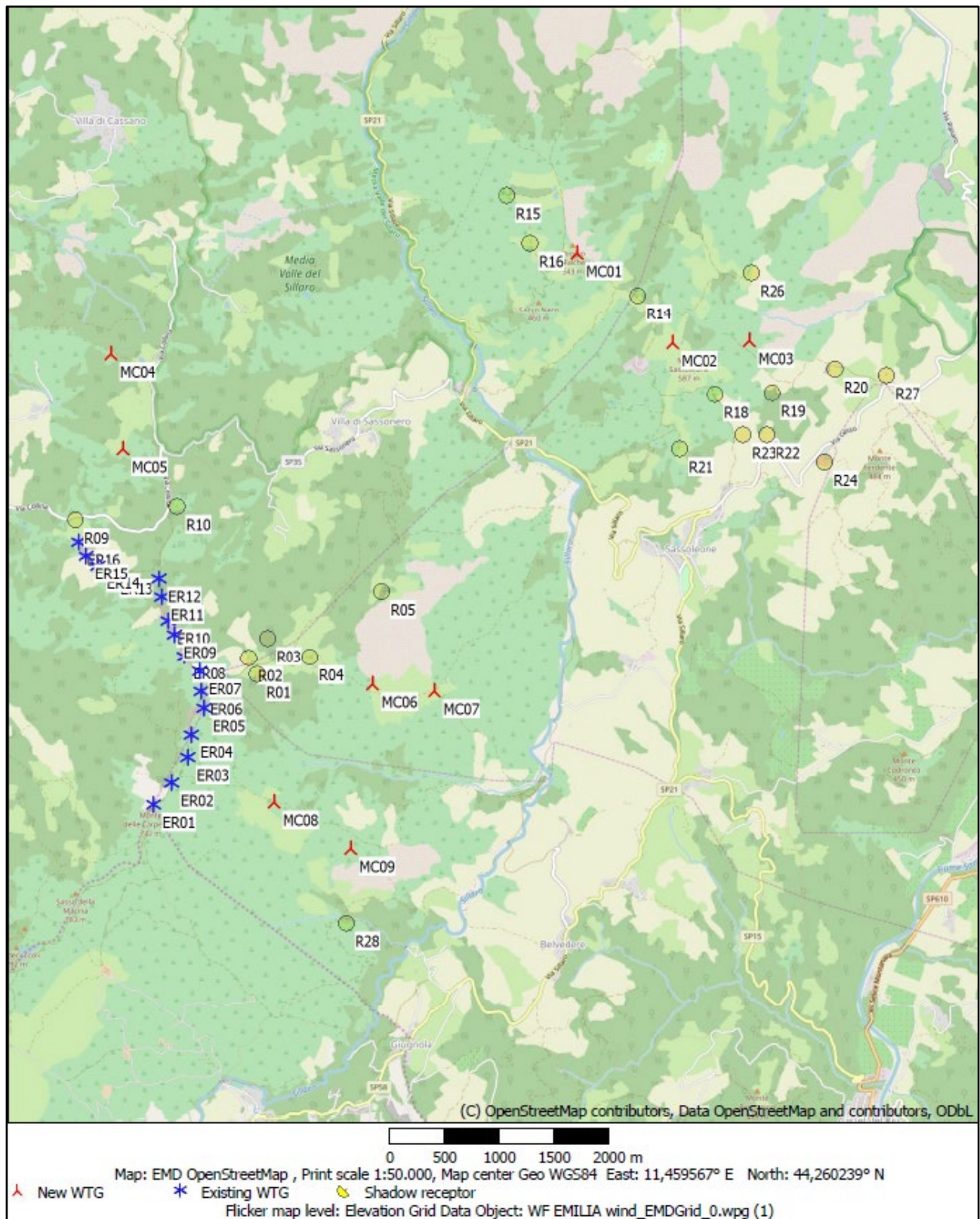


Figura 6.1: Localizzazione dei ricettori rispetto agli aerogeneratori di progetto e quelli esistenti

Il software impiegato per effettuare la verifica di sicurezza all'effetto shadow flickering è il WindPRO versione 3.4.

Tale software esegue la valutazione di zone di influenza degli aerogeneratori (ZVI), considerando l'orografia del terreno e altezza dell'osservatore (nel caso specifico altezza della finestra di un'abitazione)

pari a 2 m, prima di effettuare il calcolo flicker in modo da escludere il contributo di quegli aerogeneratori che non sono visibili dal ricettore.

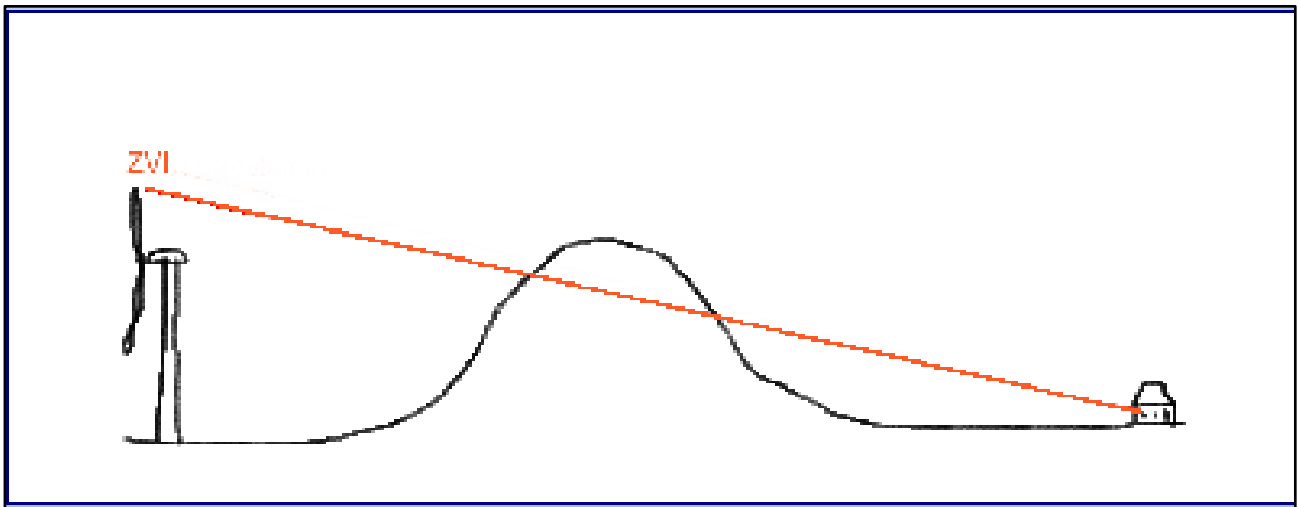


Figura 6.2: Impatto della ZVI, l'orografia del territorio può rendere non visibile l'aerogeneratore al ricettore

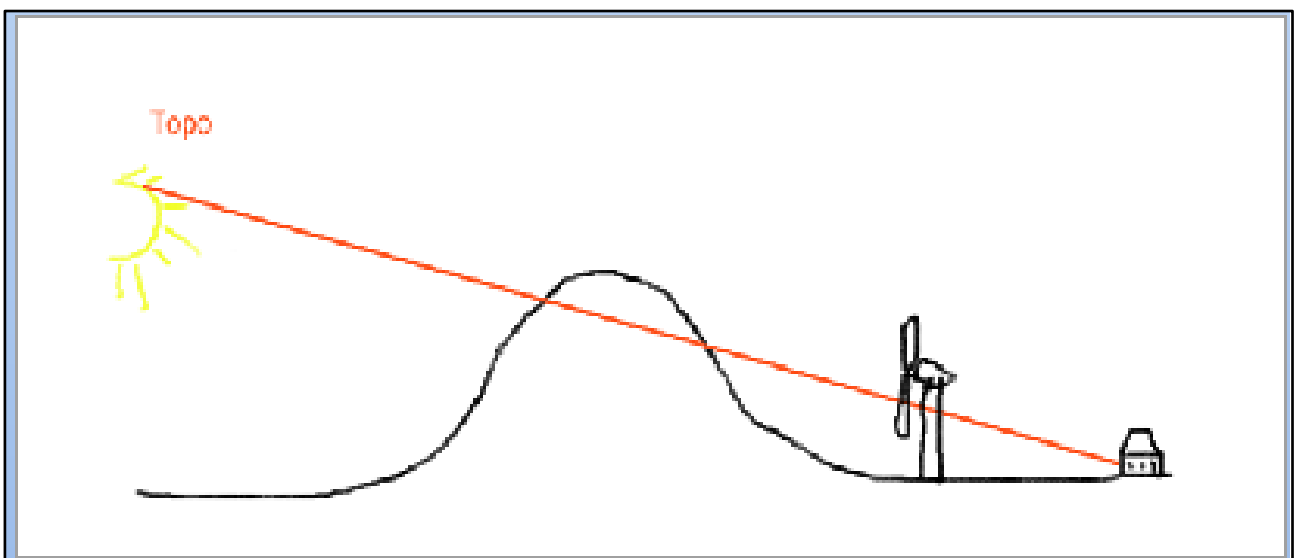


Figura 6.3: Impatto dell'orografia del territorio sull'ombreggiamento

Nella prima stima effettuata (**worst case**) si assumono le seguenti ipotesi restrittive:

- l'impianto eolico sempre in funzione durante le ore di sole;
- altezza minima del sole sull'orizzonte pari a 3° ;
- piano del rotore sempre ortogonale alla congiungente tra l'osservatore e il sole;
- totale assenza di ostacoli o schermi vegetazionali presenti negli spazi circostanti i possibili ricettori e che potrebbero inficiare il fenomeno;
- ricettori in modalità "green house", ovvero le finestre delle abitazioni attenzionate non orientate in una particolare direzione ma omnidirezionali.

Inoltre, in una seconda stima, allo scopo di pervenire a valori più realistici di impatto (**expected values**), si è impiegato il valore di eliofania, che tiene in conto del numero medio di ore di cielo libero da nubi durante il giorno, e le ore di funzionamento degli aerogeneratori in presenza del sole.

Per l'area in esame, con riferimento all'anno 2021 ed alla zona di Bologna, i valori delle probabilità medie di eliofania per ognuno dei mesi e le ore di funzionamento degli aerogeneratori in presenza del sole in funzione della direzione del vento sono riportati nelle tabelle seguenti:

MESE	gen	feb	mar	apr	mag	giu	lug	ago	set	ott	nov	dic
GIORNI	31	28	31	30	31	30	31	31	30	31	30	31
PROB. MEDIA ELIOFANIA	2,48	3,33	4,51	5,74	7,16	8,35	9,37	8,38	6,67	4,87	2,94	2,55

Tabella 6.2: Probabilità medie di eliofania e ore di funzionamento aerogeneratori in presenza del sole

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Somma
446	588	709	537	307	224	366	1786	992	318	487	496	7256

Tabella 6.3: Ore di funzionamento degli aerogeneratori in presenza del sole in funzione della direzione del vento (ipotesi di funzionamento dell'impianto per circa l'83% del tempo in un anno)

Il modello numerico utilizzato, al pari degli altri presenti sul mercato, produce statisticamente un output relativo al valore atteso delle ore d'ombra per anno relativo ai ricettori.

7. CONCLUSIONI

Nella **Figura 7.1** sono rappresentati i ricettori attenzionati rispetto alle posizioni degli aerogeneratori di progetto e già esistenti e gli intervalli delle ore d'ombra per anno ottenute dalla simulazione effettuata nell'area d'impianto.

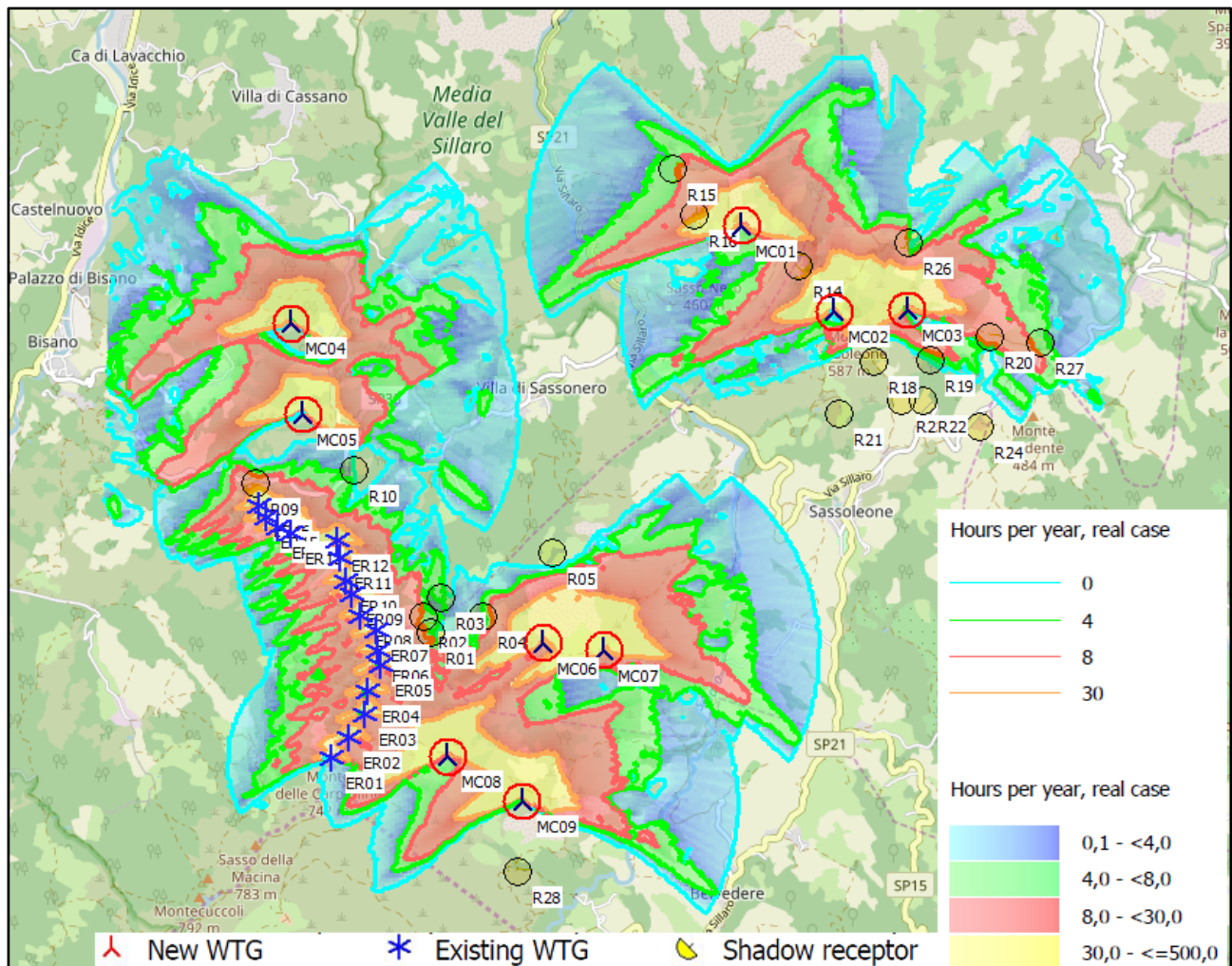


Figura 7.1: Localizzazione dei ricettori attenzionati rispetto agli aerogeneratori di progetto ed esistenti e ore d'ombra per anno

Nella **Tabella 7.1** si riportano i valori attesi delle ore d'ombra intermittente per anno relativamente ai ricettori considerati nelle ipotesi precedentemente indicate:

Ricettore	ORE/ANNO – WORST CASE	ORE/ANNO – REAL CASE (EXPECTED VALUES)
R01	24:26	4:55
R02	33:41	6:44
R03	27:36	5:20
R04	26:07	3:47
R05	0:00	0:00
R09	130:38	20:27
R10	0:00	0:00
R14	120:12	16:19
R15	52:59	7:17
R16	112:16	23:49
R18	0:00	0:00
R19	0:00	0:00
R20	63:37	14:04

Ricettore	ORE/ANNO – WORST CASE	ORE/ANNO – REAL CASE (EXPECTED VALUES)
R21	0:00	0:00
R22	0:00	0:00
R23	0:00	0:00
R24	0:00	0:00
R26	67:21	12:23
R27	30:01	6:38
R28	0:00	0:00

Tabella 7.1: Ore d'ombra intermittente per anno sui ricettori nel worst case e real case

Dai risultati riportati nella **Tabella 7.1**, si evince che, nelle ipotesi precedentemente elencate, le ore d'ombra intermittente per anno, pur essendo superiori rispetto al parametro di 30 ore/anno in alcuni casi nel worst case, risultano essere inferiori a 30 ore/anno, parametro considerato di qualità a livello internazionale, nel caso più realistico (“expected values”) per ognuno dei ricettori attenzionati.

In particolare, per i ricettori R05, R10, R18, R19, R21, R22, R23, R24, R28 la stima delle ore d'ombra intermittente per anno è nulla, mentre per i ricettori R01, R02, R03, R04, R15, R27 essa risulta essere largamente inferiore a 30 ore/anno.

Come detto, nell'analisi condotta sono state adottate ipotesi molto restrittive, tra le quali quella secondo cui l'impianto sia sempre in funzione durante le ore di sole, il piano del rotore sempre ortogonale alla congiungente tra l'osservatore e il sole e ci sia totale assenza di ostacoli o schermi vegetazionali presenti negli spazi circostanti i possibili ricettori e che potrebbero attenuare il fenomeno.

Nella stima effettuata è stata considerata l'ulteriore ipotesi conservativa secondo la quale i ricettori siano in modalità “green house”, ovvero le finestre delle abitazioni attenzionate siano omnidirezionali, situazione non sempre verificata nella realtà.

Nello scenario reale ci si aspetta che il fenomeno, quindi, risulti ulteriormente meno rilevante di quello a cui ha condotto la stima effettuata.

Pertanto, si può ragionevolmente affermare che l'effetto shadow flickering non abbia un impatto negativo sul territorio circostante, in particolare sui fabbricati adibiti a “civile abitazione”.

8. ALLEGATO 1: SHADOW – MAIN RESULT – ELABORAZIONE MEDIANTE IL SOFTWARE WINDPRO 3.4

SHADOW - Main Result

Calculation: Parco Eolico Emilia: Shadow flickering

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

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
446	588	709	537	307	224	366	1.786	992	318	487	496	7.256

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: WF EMILIA wind_EMDGrid

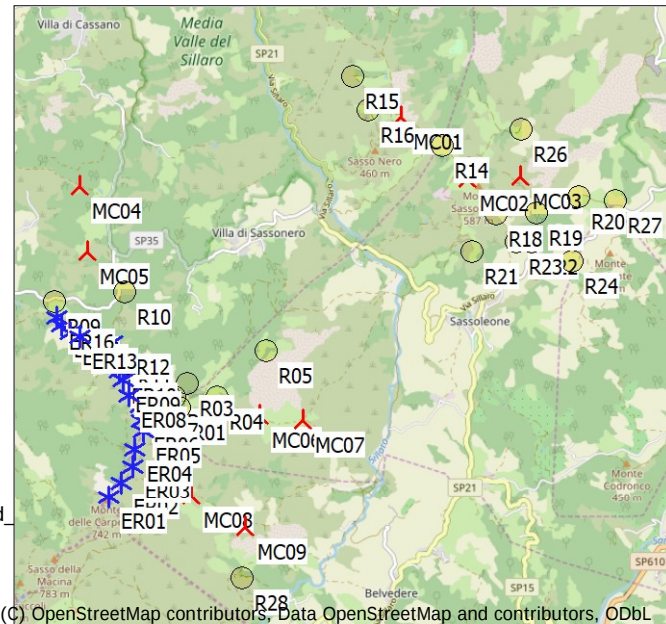
Obstacles used in calculation

Receptor grid resolution: 1,0 m

Topographic shadow included in calculation

All coordinates are in

Geo [deg]-WGS84



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

Scale 1:100.000

▲ New WTG
★ Shadow receptor

WTGs

	Longitude	Latitude	Z	Row data/Description	WTG type		Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
					Valid	Manufact.					Calculation distance [m]	RPM [RPM]
			[m]									
ER01	11,422042° E	44,240097° N	741,3	ENERCON E-53 800 5...	Yes	ENERCON	E-53-800	800	53,0	60,0	996	29,0
ER02	11,424120° E	44,241877° N	736,6	ENERCON E-53 800 5...	Yes	ENERCON	E-53-800	800	53,0	60,0	996	29,0
ER03	11,425993° E	44,243877° N	740,9	ENERCON E-53 800 5...	Yes	ENERCON	E-53-800	800	53,0	60,0	996	29,0
ER04	11,426341° E	44,245795° N	748,3	ENERCON E-53 800 5...	Yes	ENERCON	E-53-800	800	53,0	60,0	996	29,0
ER05	11,427791° E	44,247989° N	734,4	ENERCON E-53 800 5...	Yes	ENERCON	E-53-800	800	53,0	60,0	996	29,0
ER06	11,427530° E	44,249290° N	744,8	ENERCON E-53 800 5...	Yes	ENERCON	E-53-800	800	53,0	60,0	996	29,0
ER07	11,427333° E	44,250997° N	720,5	ENERCON E-53 800 5...	Yes	ENERCON	E-53-800	800	53,0	60,0	996	29,0
ER08	11,425482° E	44,252266° N	716,2	ENERCON E-53 800 5...	Yes	ENERCON	E-53-800	800	53,0	60,0	996	29,0
ER09	11,424407° E	44,254053° N	702,5	ENERCON E-53 800 5...	Yes	ENERCON	E-53-800	800	53,0	60,0	996	29,0
ER10	11,423731° E	44,255180° N	697,9	ENERCON E-53 800 5...	Yes	ENERCON	E-53-800	800	53,0	60,0	996	29,0
ER11	11,423016° E	44,257149° N	675,6	ENERCON E-53 800 5...	Yes	ENERCON	E-53-800	800	53,0	60,0	996	29,0
ER12	11,422658° E	44,258604° N	672,5	ENERCON E-53 800 5...	Yes	ENERCON	E-53-800	800	53,0	60,0	996	29,0
ER13	11,417231° E	44,259236° N	654,9	ENERCON E-53 800 5...	Yes	ENERCON	E-53-800	800	53,0	60,0	996	29,0
ER14	11,415688° E	44,259726° N	650,4	ENERCON E-53 800 5...	Yes	ENERCON	E-53-800	800	53,0	60,0	996	29,0
ER15	11,414246° E	44,260513° N	630,5	ENERCON E-53 800 5...	Yes	ENERCON	E-53-800	800	53,0	60,0	996	29,0
ER16	11,413456° E	44,261591° N	623,4	ENERCON E-53 800 5...	Yes	ENERCON	E-53-800	800	53,0	60,0	996	29,0
MC01	11,470619° E	44,285319° N	536,6	Siemens Gamesa SG 6...	Yes	Siemens Gamesa	SG 6.6-170-6.600	6.600	170,0	135,0	2.040	8,8
MC02	11,481599° E	44,277971° N	548,0	Siemens Gamesa SG 6...	Yes	Siemens Gamesa	SG 6.6-170-6.600	6.600	170,0	135,0	2.040	8,8
MC03	11,490298° E	44,278140° N	538,1	Siemens Gamesa SG 6...	Yes	Siemens Gamesa	SG 6.6-170-6.600	6.600	170,0	135,0	2.040	8,8
MC04	11,417182° E	44,277020° N	557,1	Siemens Gamesa SG 6...	Yes	Siemens Gamesa	SG 6.6-170-6.600	6.600	170,0	135,0	2.040	8,8
MC05	11,418607° E	44,269292° N	556,1	Siemens Gamesa SG 6...	Yes	Siemens Gamesa	SG 6.6-170-6.600	6.600	170,0	135,0	2.040	8,8
MC06	11,447122° E	44,249922° N	572,6	Siemens Gamesa SG 6...	Yes	Siemens Gamesa	SG 6.6-170-6.600	6.600	170,0	135,0	2.040	8,8
MC07	11,454311° E	44,249309° N	539,6	Siemens Gamesa SG 6...	Yes	Siemens Gamesa	SG 6.6-170-6.600	6.600	170,0	135,0	2.040	8,8
MC08	11,435813° E	44,240261° N	598,9	Siemens Gamesa SG 6...	Yes	Siemens Gamesa	SG 6.6-170-6.600	6.600	170,0	135,0	2.040	8,8
MC09	11,444613° E	44,236464° N	515,8	Siemens Gamesa SG 6...	Yes	Siemens Gamesa	SG 6.6-170-6.600	6.600	170,0	135,0	2.040	8,8

Shadow receptor-Input

No.	Longitude	Latitude	Z	Width	Height	Elevation	Slope of	Direction mode	Eye height
						a.g.l.	window		(ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
R01	11,433907° E	44,250726° N	751,5	1,0	1,0	1,0	90,0	"Green house mode"	2,0
R02	11,432953° E	44,252088° N	734,9	1,0	1,0	1,0	90,0	"Green house mode"	2,0
R03	11,435098° E	44,253657° N	708,0	1,0	1,0	1,0	90,0	"Green house mode"	2,0
R04	11,440042° E	44,252135° N	698,0	1,0	1,0	1,0	90,0	"Green house mode"	2,0
R05	11,448213° E	44,257508° N	553,3	1,0	1,0	1,0	90,0	"Green house mode"	2,0

To be continued on next page...

SHADOW - Main Result

Calculation: Parco Eolico Emilia: Shadow flickering

...continued from previous page

No.	Longitude	Latitude	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
R09	11,413069° E	44,263375° N	582,9	1,0	1,0	1,0	90,0	"Green house mode"	2,0
R10	11,424736° E	44,264475° N	616,9	1,0	1,0	1,0	90,0	"Green house mode"	2,0
R14	11,477495° E	44,281813° N	515,4	1,0	1,0	1,0	90,0	"Green house mode"	2,0
R15	11,462588° E	44,290074° N	444,5	1,0	1,0	1,0	90,0	"Green house mode"	2,0
R16	11,465136° E	44,286110° N	459,8	1,0	1,0	1,0	90,0	"Green house mode"	2,0
R18	11,486381° E	44,273727° N	496,1	1,0	1,0	1,0	90,0	"Green house mode"	2,0
R19	11,493017° E	44,273865° N	442,7	1,0	1,0	1,0	90,0	"Green house mode"	2,0
R20	11,500122° E	44,275819° N	425,2	1,0	1,0	1,0	90,0	"Green house mode"	2,0
R21	11,482316° E	44,269318° N	429,3	1,0	1,0	1,0	90,0	"Green house mode"	2,0
R22	11,492287° E	44,270420° N	391,3	1,0	1,0	1,0	90,0	"Green house mode"	2,0
R23	11,489627° E	44,270391° N	453,0	1,0	1,0	1,0	90,0	"Green house mode"	2,0
R24	11,498943° E	44,268166° N	407,8	1,0	1,0	1,0	90,0	"Green house mode"	2,0
R26	11,490558° E	44,283763° N	518,1	1,0	1,0	1,0	90,0	"Green house mode"	2,0
R27	11,506065° E	44,275280° N	448,2	1,0	1,0	1,0	90,0	"Green house mode"	2,0
R28	11,444171° E	44,230405° N	392,6	1,0	1,0	1,0	90,0	"Green house mode"	2,0

Calculation Results

Shadow receptor

No.	Shadow, worst case		Shadow, expected values	
	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
R01	24:26	115	0:24	4:55
R02	33:41	143	0:27	6:44
R03	27:36	132	0:28	5:20
R04	26:07	71	0:34	3:47
R05	0:00	0	0:00	0:00
R09	130:38	108	2:00	20:27
R10	0:00	0	0:00	0:00
R14	120:12	131	1:14	16:19
R15	52:59	128	0:47	7:17
R16	112:16	115	1:17	23:49
R18	0:00	0	0:00	0:00
R19	0:00	0	0:00	0:00
R20	63:37	115	0:49	14:04
R21	0:00	0	0:00	0:00
R22	0:00	0	0:00	0:00
R23	0:00	0	0:00	0:00
R24	0:00	0	0:00	0:00
R26	67:21	126	0:43	12:23
R27	30:01	84	0:31	6:38
R28	0:00	0	0:00	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
ER01	ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (1)	0:00	0:00
ER02	ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (2)	0:00	0:00
ER03	ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (3)	0:00	0:00
ER04	ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (4)	0:00	0:00
ER05	ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (5)	9:33	1:37
ER06	ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (6)	31:42	5:49
ER07	ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (7)	22:12	4:43
ER08	ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (8)	10:23	2:14
ER09	ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (9)	3:50	0:49
ER10	ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (10)	1:57	0:25
ER11	ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (11)	0:00	0:00
ER12	ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (12)	0:24	0:03
ER13	ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (13)	13:38	1:47
ER14	ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (14)	11:10	1:35
ER15	ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (15)	15:11	2:17
ER16	ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (16)	90:15	14:45

To be continued on next page...

SHADOW - Main Result

Calculation: Parco Eolico Emilia: Shadow flickering

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
MC01	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (1)	167:15	32:23
MC02	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (2)	202:36	31:02
MC03	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (3)	71:05	15:38
MC04	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (4)	0:00	0:00
MC05	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (5)	0:00	0:00
MC06	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (6)	26:07	3:47
MC07	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (7)	0:00	0:00
MC08	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (8)	0:00	0:00
MC09	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (9)	0:00	0:00

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.

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R01 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (1)
Assumptions for shadow calculations 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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June
1	07:50 16:46	07:34 17:23	16:34 (ER05) 16:49 (ER05)	06:54 18:02	17:11 (ER06) 17:33 (ER06)	06:58 19:41
2	07:51 16:47	07:33 17:25	16:36 (ER05) 16:47 (ER05)	06:52 18:03	17:11 (ER06) 17:32 (ER06)	06:56 19:42
3	07:51 16:48	07:32 17:26	16:39 (ER05) 16:45 (ER05)	06:50 18:04	17:11 (ER06) 17:31 (ER06)	06:54 19:43
4	07:51 16:49	07:31 17:27	06:49 18:06	17:12 (ER06) 17:29 (ER06)	06:52 19:45	19:07 (ER07) 20:21
5	07:51 16:50	07:29 17:29	06:47 18:07	17:14 (ER06) 17:28 (ER06)	06:51 19:46	19:08 (ER07) 20:22
6	07:50 16:51	07:28 17:30	06:45 18:08	17:17 (ER06) 17:25 (ER06)	06:49 19:47	19:08 (ER07) 20:23
7	07:50 16:52	07:27 17:32	06:43 18:10	06:47 19:48	19:10 (ER07) 19:23 (ER07)	05:59 20:25
8	07:50 16:53	07:26 17:33	06:42 18:11	06:45 19:49	19:13 (ER07) 19:21 (ER07)	05:58 20:26
9	07:50 16:54	07:24 17:34	06:40 18:12	06:43 19:51	05:56 20:27	05:31 20:57
10	07:50 16:55	07:23 17:36	06:38 18:13	06:42 19:52	05:55 20:28	05:31 20:57
11	07:49 16:56	07:22 17:37	06:36 18:15	06:40 19:53	05:54 20:29	05:31 20:58
12	07:49 16:57	07:20 17:39	06:34 18:16	06:38 19:54	05:53 20:30	05:31 20:59
13	07:49 16:58	07:19 17:40	06:33 18:17	06:36 19:56	05:51 20:32	05:30 20:59
14	07:48 17:00	07:17 16:32 (ER05)	06:31 18:19	06:35 19:57	05:50 20:33	05:30 21:00
15	07:48 17:01	07:16 16:30 (ER05)	06:29 18:20	06:33 19:58	05:49 20:34	05:30 21:00
16	07:47 17:02	07:14 16:29 (ER05)	06:27 18:21	06:31 19:59	05:48 20:35	05:30 21:00
17	07:47 17:03	07:13 16:28 (ER05)	06:25 18:22	06:30 20:00	05:47 20:36	05:30 21:01
18	07:46 17:04	07:11 16:29 (ER05)	06:24 18:24	06:28 20:02	05:46 20:37	05:30 21:01
19	07:45 17:06	07:10 16:28 (ER05)	06:22 18:25	06:26 20:03	19:39 (ER08) 19:40 (ER08)	05:45 20:38
20	07:45 17:07	07:08 16:28 (ER05)	06:20 17:17 (ER06)	06:25 20:04	19:40 (ER08) 19:38 (ER08)	20:38 05:44
21	07:44 17:08	07:07 16:40 (ER05)	06:18 17:15 (ER06)	06:23 20:05	19:39 (ER08) 19:42 (ER08)	05:43 20:40
22	07:43 17:10	07:05 16:29 (ER05)	06:16 17:13 (ER06)	06:21 20:07	19:38 (ER08) 19:43 (ER08)	05:42 20:41
23	07:42 17:11	07:04 16:44 (ER05)	06:14 17:10 (ER06)	06:20 20:08	19:39 (ER08) 19:45 (ER08)	05:41 20:42
24	07:42 17:12	07:02 16:45 (ER05)	06:13 17:11 (ER06)	06:18 20:09	19:39 (ER08) 19:45 (ER08)	05:40 20:43
25	07:41 17:14	07:00 16:29 (ER05)	06:11 17:10 (ER06)	06:16 20:10	19:41 (ER08) 19:47 (ER08)	05:39 20:44
26	07:40 17:15	06:59 16:49 (ER05)	06:09 17:11 (ER06)	06:15 20:11	19:42 (ER08) 19:48 (ER08)	05:39 20:45
27	07:39 17:16	06:57 16:30 (ER05)	06:07 17:10 (ER06)	06:13 18:11 (ER07)	05:38 20:46	05:32 21:03
28	07:38 17:18	06:55 16:51 (ER05)	06:05 17:34 (ER06)	06:12 18:10 (ER07)	05:37 20:47	05:33 21:03
29	07:37 17:19	06:53 16:31 (ER05)	06:03 17:33 (ER06)	06:10 18:14 (ER07)	05:36 19:09 (ER07)	05:33 20:48
30	07:36 17:21	06:51 16:51 (ER05)	06:01 17:38	06:09 19:15 (ER07)	05:36 19:08 (ER07)	05:34 20:49
31	07:35 17:22	06:50 16:33 (ER05)	06:00 17:40	06:07 19:16 (ER07)	05:35 19:07 (ER07)	05:33 20:50
Potential sun hours	288	292	369	403	457	464
Total, worst case	253	203	131	140		
Sun reduction	0,27	0,32	0,38	0,43		
Oper. time red.	0,83	0,83	0,83	0,83		
Wind dir. red.	0,71	0,66	0,63	0,54		
Total reduction	0,16	0,18	0,20	0,20		
Total, real	41	36	27	27		

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R01 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (1)
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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	July	August	September	October	November	December			
1	05:34 21:02	06:01 20:41	06:37 19:53	07:11 18:57	06:50 17:06	07:29 16:38			
2	05:35 21:02	06:02 20:39	06:38 19:51	07:13 18:56	06:52 17:04	07:30 16:37			
3	05:35 21:02	06:03 20:38	06:39 19:49	07:14 18:54	06:53 17:03	07:31 16:37			
4	05:36 21:02	06:04 20:37	06:40 19:47	19:10 (ER07) 19:18 (ER07)	07:15 18:52	06:54 17:02	07:33 16:37		
5	05:37 21:02	06:06 20:35	06:41 19:46	19:07 (ER07) 19:20 (ER07)	07:16 18:50	06:56 17:00	07:34 16:36		
6	05:37 21:01	06:07 20:34	06:42 19:44	19:05 (ER07) 19:20 (ER07)	07:17 18:48	06:57 16:59	07:35 16:36		
7	05:38 21:01	06:08 20:33	06:43 19:42	19:03 (ER07) 19:18 (ER07)	07:19 18:46	06:58 16:58	07:36 16:36		
8	05:39 21:01	06:09 20:31	06:45 19:40	19:01 (ER07) 19:16 (ER07)	07:20 18:45	17:50 (ER06) 18:02 (ER06)	07:00 16:15 (ER05)	16:08 (ER05) 16:36	
9	05:39 21:00	06:10 20:30	06:46 19:38	19:00 (ER07) 19:15 (ER07)	07:21 18:43	17:48 (ER06) 18:03 (ER06)	07:01 16:19 (ER05)	16:07 (ER05) 16:36	
10	05:40 21:00	06:11 20:29	06:47 19:36	19:00 (ER07) 19:14 (ER07)	07:22 18:41	17:47 (ER06) 18:05 (ER06)	07:03 16:54	16:05 (ER05) 16:20 (ER05)	07:39 16:36
11	05:41 20:59	06:12 20:27	06:48 19:35	19:00 (ER07) 19:12 (ER07)	07:23 18:39	17:45 (ER06) 18:06 (ER06)	07:04 16:53	16:04 (ER05) 16:22 (ER05)	07:39 16:36
12	05:42 20:59	06:13 20:26	06:49 19:33	18:59 (ER07) 19:10 (ER07)	07:25 18:38	17:44 (ER06) 18:06 (ER06)	07:05 16:52	16:03 (ER05) 16:22 (ER05)	07:40 16:36
13	05:42 20:58	06:15 20:24	06:50 19:31	18:59 (ER07) 19:08 (ER07)	07:26 18:36	17:44 (ER06) 18:07 (ER06)	07:07 16:51	16:03 (ER05) 16:23 (ER05)	07:41 16:36
14	05:43 20:57	06:16 20:23	06:51 19:29	18:59 (ER07) 19:06 (ER07)	07:27 18:34	17:43 (ER06) 18:06 (ER06)	07:08 16:50	16:02 (ER05) 16:24 (ER05)	07:42 16:36
15	05:44 20:57	06:17 20:21	06:53 19:27	18:59 (ER07) 19:04 (ER07)	07:28 18:32	17:43 (ER06) 18:06 (ER06)	07:09 16:49	16:03 (ER05) 16:24 (ER05)	07:43 16:36
16	05:45 20:56	06:18 20:20	19:52 (ER08) 19:54 (ER08)	06:54 19:00 (ER07)	07:30 18:31	17:42 (ER06) 18:05 (ER06)	07:11 16:48	16:02 (ER05) 16:22 (ER05)	07:44 16:36
17	05:46 20:55	06:19 20:18	19:48 (ER08) 19:54 (ER08)	06:55 19:23	07:31 18:29	17:43 (ER06) 18:05 (ER06)	07:12 16:47	16:02 (ER05) 16:21 (ER05)	07:44 16:37
18	05:47 20:55	06:20 20:16	19:46 (ER08) 19:52 (ER08)	06:56 19:22	07:32 18:27	17:43 (ER06) 18:03 (ER06)	07:13 16:46	16:03 (ER05) 16:20 (ER05)	07:45 16:37
19	05:48 20:54	06:21 20:15	19:45 (ER08) 19:51 (ER08)	06:57 19:20	07:33 18:26	17:43 (ER06) 18:01 (ER06)	07:14 16:45	16:03 (ER05) 16:19 (ER05)	07:46 16:37
20	05:49 20:53	06:23 20:13	19:44 (ER08) 19:49 (ER08)	06:58 19:18	07:35 18:24	17:45 (ER06) 18:00 (ER06)	07:16 16:44	16:03 (ER05) 16:18 (ER05)	07:46 16:38
21	05:50 20:52	06:24 20:12	19:43 (ER08) 19:47 (ER08)	07:00 19:16	07:36 18:22	17:46 (ER06) 17:58 (ER06)	07:17 16:44	16:04 (ER05) 16:18 (ER05)	07:47 16:38
22	05:51 20:51	06:25 20:10	19:43 (ER08) 19:47 (ER08)	07:01 19:14	07:37 18:21	17:48 (ER06) 17:56 (ER06)	07:18 16:43	16:04 (ER05) 16:16 (ER05)	07:47 16:39
23	05:52 20:50	06:26 20:08	19:43 (ER08) 19:45 (ER08)	07:02 19:12	07:39 18:19	17:56 (ER06) 16:42	07:20 16:42	16:05 (ER05) 16:16 (ER05)	07:48 16:39
24	05:53 20:49	06:27 20:07	19:45 (ER08) 19:10	07:03 19:07	07:40 18:18	16:21 16:41	07:21 16:41	16:06 (ER05) 16:15 (ER05)	07:48 16:40
25	05:54 20:48	06:28 20:05	19:04 19:08	07:04 17:16	06:41 17:16	16:22 16:41	07:22 16:41	16:06 (ER05) 16:14 (ER05)	07:49 16:40
26	05:55 20:47	06:30 20:03	07:05 19:07	06:43 17:15	06:43 17:15	16:07 (ER05) 16:40	07:23 16:40	16:07 (ER05) 16:13 (ER05)	07:49 16:41
27	05:56 20:46	06:31 20:01	07:07 19:05	06:44 17:13	06:44 17:13	16:09 (ER05) 16:39	07:25 16:39	16:09 (ER05) 16:13 (ER05)	07:49 16:42
28	05:57 20:45	06:32 20:00	07:08 19:03	06:45 17:12	06:45 17:12	16:10 (ER05) 16:39	07:26 16:39	16:10 (ER05) 16:12 (ER05)	07:50 16:42
29	05:58 20:44	06:33 19:58	07:09 19:01	06:46 17:10	06:46 17:10	16:11 (ER05) 16:38	07:27 16:38	16:11 (ER05) 16:12 (ER05)	07:50 16:43
30	05:59 20:43	06:34 19:56	07:10 18:59	06:48 17:09	06:48 17:09	16:12 (ER05) 16:38	07:28 16:38	16:12 (ER05) 16:13 (ER05)	07:50 16:44
31	06:00 20:42	06:35 19:55		06:49 17:07	06:49 17:07				07:50 16:45
Potential sun hours	470	434	376	342	290				277
Total, worst case		35	141	275	288				
Sun reduction		0,60	0,53	0,44	0,30				
Oper. time red.		0,83	0,83	0,83	0,83				
Wind dir. red.		0,49	0,56	0,65	0,71				
Total reduction		0,25	0,25	0,24	0,18				
Total, real		9	36	67	53				

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R02 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (2)
Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June
1	07:50 16:46	07:34 17:23	16:11 (ER06) 18:02	06:54 18:02	17:16 (ER07) 19:41	06:58 19:18 (ER08)
2	07:51 16:47	07:33 17:25	16:13 (ER06) 18:03	06:52 18:03	17:15 (ER07) 19:42	06:56 19:19 (ER08)
3	07:51 16:48	07:32 17:26	16:15 (ER06) 18:04	06:50 18:04	17:15 (ER07) 19:43	06:54 19:21 (ER08)
4	07:51 16:49	07:31 17:27	16:18 (ER06) 18:06	06:49 18:06	17:14 (ER07) 19:45	06:52 19:20 (ER08)
5	07:51 16:50	07:29 17:29	16:25 (ER06) 18:07	06:47 18:07	17:15 (ER07) 19:46	06:51 19:20 (ER08)
6	07:50 16:51	07:28 17:30	18:08	06:45 18:08	17:15 (ER07) 19:47	06:49 19:21 (ER08)
7	07:50 16:52	07:27 17:32	06:43 18:10	17:16 (ER07) 19:48	06:47 19:48	05:59 20:25
8	07:50 16:53	07:26 17:33	06:42 18:11	17:16 (ER07) 19:49	06:45 19:49	05:58 20:26
9	07:50 16:54	07:24 17:34	06:40 18:12	17:18 (ER07) 19:51	06:43 19:51	05:56 20:27
10	07:50 16:55	07:23 17:36	06:38 18:13	17:20 (ER07) 19:52	06:42 19:52	05:55 20:28
11	07:49 16:56	16:12 (ER06) 17:37	06:36 18:15	17:23 (ER07) 19:53	06:40 19:53	05:54 20:29
12	07:49 16:57	16:10 (ER06) 17:39	06:34 18:16	17:31 (ER07) 19:54	06:38 19:54	05:53 20:30
13	07:49 16:58	16:09 (ER06) 17:40	06:33 18:17	19:55	06:36 19:55	05:51 20:32
14	07:48 17:00	16:23 (ER06) 17:41	06:31 18:19	19:57	06:35 19:57	05:50 20:33
15	07:48 17:01	16:08 (ER06) 17:43	06:29 18:20	19:58	06:33 19:58	05:49 20:34
16	07:47 17:02	16:07 (ER06) 17:44	06:27 18:21	19:59	06:31 19:59	05:48 20:35
17	07:47 17:03	16:07 (ER06) 17:46	06:25 18:22	20:00	06:30 20:00	05:47 20:36
18	07:46 17:04	16:07 (ER06) 17:47	06:24 18:24	20:02	06:28 20:02	05:46 20:37
19	07:45 17:06	16:07 (ER06) 17:48	06:22 18:25	20:03	06:26 20:03	05:45 20:38
20	07:45 17:07	16:06 (ER06) 17:50	06:20 18:26	20:04	06:25 20:04	05:44 20:39
21	07:44 17:08	16:06 (ER06) 17:51	06:18 18:27	20:05	06:23 20:05	05:43 20:40
22	07:43 17:10	16:07 (ER06) 17:52	17:27 (ER07) 18:29	06:21 20:07	06:21 20:07	05:42 20:41
23	07:43 17:11	16:07 (ER06) 17:54	17:23 (ER07) 18:30	06:20 20:08	06:20 20:08	05:41 20:42
24	07:42 17:12	16:31 (ER06) 17:55	17:21 (ER07) 18:31	06:18 20:09	06:18 20:09	05:40 20:43
25	07:41 17:14	16:07 (ER06) 17:56	17:20 (ER07) 18:32	06:16 20:10	06:16 20:10	05:39 20:44
26	07:40 17:15	16:07 (ER06) 17:58	17:18 (ER07) 18:33	06:09 20:11	06:15 20:11	05:39 20:45
27	07:39 17:16	16:08 (ER06) 17:59	17:17 (ER07) 18:35	06:07 20:13	06:13 20:13	05:38 20:46
28	07:38 17:18	16:08 (ER06) 18:00	17:16 (ER07) 18:36	06:05 20:14	06:12 20:14	05:37 20:47
29	07:37 17:19	16:32 (ER06) 18:01	17:37 (ER07) 18:37	06:03 20:15	06:10 20:15	05:36 20:48
30	07:36 17:21	16:32 (ER06) 18:02	19:37 19:38	11 13	19:15 (ER08) 19:16 (ER08)	20:15 20:16
31	07:35 17:22	16:11 (ER06) 18:03	07:00 19:40	15	19:02 (ER08) 19:17 (ER08)	05:35 20:50
Potential sun hours	288	292	369	403	457	464
Total, worst case	421	145	298	102	39	
Sun reduction	0,27	0,32	0,38	0,43	0,49	
Oper. time red.	0,83	0,83	0,83	0,83	0,83	
Wind dir. red.	0,72	0,67	0,63	0,55	0,48	
Total reduction	0,16	0,18	0,20	0,20	0,20	
Total, real	69	26	60	20	8	

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R02 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (2)
Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	July	August	September	October	November	December	
1	05:34	06:01	06:37	07:11	06:50	07:29	15:54 (ER06)
	21:02	20:41	19:53	18:57	17:06	16:38	6 16:00 (ER06)
2	05:35	06:02	06:38	07:13	06:52	07:30	
	21:02	20:39	19:51	18:56	17:04	16:37	
3	05:35	06:03	06:39	07:14	06:53	07:31	
	21:02	20:38	19:49	18:54	17:03	16:37	
4	05:36	06:04	06:40	07:15	06:54	07:33	
	21:02	20:37	19:47	18:52	17:02	16:37	
5	05:37	06:06	06:41	07:16	06:56	07:34	
	21:02	20:35	19:46	18:50	17:00	16:36	
6	05:37	06:07	06:42	19:03 (ER08) 07:17	17:53 (ER07) 06:57	07:35	
	21:01	20:34	19:44	19:10 (ER08) 18:48	18:15 (ER07) 16:59	16:36	
7	05:38	06:08	06:43	19:00 (ER08) 07:19	17:52 (ER07) 06:59	07:36	
	21:01	20:33	19:42	19:13 (ER08) 18:46	18:16 (ER07) 16:58	16:36	
8	05:39	06:09	06:45	18:58 (ER08) 07:20	17:50 (ER07) 07:00	07:37	
	21:01	20:31	19:40	19:14 (ER08) 18:45	18:16 (ER07) 16:57	16:36	
9	05:39	06:10	06:46	18:56 (ER08) 07:21	17:49 (ER07) 07:01	07:38	
	21:00	20:30	19:38	19:14 (ER08) 18:43	18:16 (ER07) 16:55	16:36	
10	05:40	06:11	06:47	18:56 (ER08) 07:22	17:50 (ER07) 07:03	07:39	
	21:00	20:29	19:36	19:14 (ER08) 18:41	18:16 (ER07) 16:54	16:36	
11	05:41	06:12	06:48	18:55 (ER08) 07:23	17:49 (ER07) 07:04	07:39	
	20:59	20:27	19:35	19:12 (ER08) 18:39	18:15 (ER07) 16:53	16:36	
12	05:42	06:13	06:49	18:55 (ER08) 07:25	17:49 (ER07) 07:05	07:40	
	20:59	20:26	19:33	19:10 (ER08) 18:38	18:13 (ER07) 16:52	16:36	
13	05:42	06:15	06:50	18:54 (ER08) 07:26	17:49 (ER07) 07:07	07:41	
	20:58	20:24	19:31	19:08 (ER08) 18:36	18:12 (ER07) 16:51	16:36	
14	05:43	06:16	06:51	18:54 (ER08) 07:27	17:49 (ER07) 07:08	07:42	
	20:57	20:23	19:29	19:06 (ER08) 18:34	18:10 (ER07) 16:50	16:36	
15	05:44	06:17	06:53	18:54 (ER08) 07:28	17:49 (ER07) 07:09	07:43	
	20:57	20:21	19:27	19:04 (ER08) 18:32	18:08 (ER07) 16:49	16:36	
16	05:45	06:18	06:54	18:54 (ER08) 07:30	17:50 (ER07) 07:11	07:44	
	20:56	20:20	19:25	19:02 (ER08) 18:31	18:06 (ER07) 16:48	16:36	
17	05:46	06:19	06:55	18:55 (ER08) 07:31	17:52 (ER07) 07:12	07:44	
	20:55	20:18	19:23	19:00 (ER08) 18:29	18:05 (ER07) 16:47	16:37	
18	05:47	06:20	06:56	18:56 (ER08) 07:32	17:53 (ER07) 07:13	07:45	
	20:55	20:16	19:22	18:58 (ER08) 18:27	18:03 (ER07) 16:46	16:37	
19	05:48	06:21	06:57	07:33	17:55 (ER07) 07:14	07:46	
	20:54	20:15	19:20	18:26	18:01 (ER07) 16:45	16:37	
20	05:49	06:23	06:58	07:35	17:16	07:46	
	20:53	20:13	19:18	18:24	16:44	16:38	
21	05:50	20:25 (ER10) 06:24	07:00	07:36	07:17	07:47	
	20:52	1 20:26 (ER10) 20:12	19:16	18:22	16:44	16:38	
22	05:51	20:24 (ER10) 06:25	07:01	07:37	07:18	07:47	
	20:51	2 20:26 (ER10) 20:10	19:14	18:21	16:43	16:39	
23	05:52	20:23 (ER10) 06:26	07:02	07:39	07:20	07:48	
	20:50	2 20:25 (ER10) 20:08	19:12	18:19	16:42	16:39	
24	05:53	20:22 (ER10) 06:27	07:03	07:40	07:21	07:48	
	20:49	2 20:24 (ER10) 20:07	19:10	18:18	16:41	16:40	
25	05:54	20:21 (ER10) 06:28	07:04	06:41	07:22	07:49	
	20:48	2 20:23 (ER10) 20:05	19:08	17:16	16:41	16:40	
26	05:55	20:21 (ER10) 06:30	07:05	06:43	07:23	07:49	
	20:47	1 20:22 (ER10) 20:03	19:07	17:15	16:40	16:41	
27	05:56	06:31	07:07	06:44	07:25	07:49	
	20:46	20:02	19:05	17:13	16:39	16:42	
28	05:57	06:32	07:08	06:45	07:26	07:50	
	20:45	20:00	19:03	17:12	16:39	16:42	
29	05:58	06:33	07:09	06:46	07:27	07:50	
	20:44	19:58	19:01	17:10	16:38	16:43	
30	05:59	06:34	07:10	06:48	07:28	07:50	
	20:43	19:56	18:59	17:09	16:38	16:44	
31	06:00	06:35		06:49		07:50	
	20:42	19:55		17:07		16:45	
Potential sun hours	470	434	376	342	290	277	
Total, worst case	10	45	155	332	468	6	
Sun reduction	0,62	0,60	0,53	0,44	0,30	0,29	
Oper. time red.	0,83	0,83	0,83	0,83	0,83	0,83	
Wind dir. red.	0,50	0,47	0,57	0,64	0,72	0,72	
Total reduction	0,26	0,24	0,26	0,24	0,19	0,18	
Total, real	3	11	40	80	87	1	

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

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R03 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (3)
Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

January		February		March		April		May		June	
1	07:50	15:59 (ER06)	07:34	06:54	06:58	19:09 (ER09)	06:07	05:35			
	16:46	3	16:02 (ER06)	17:23	18:02	19:41	9	20:17	20:51		
2	07:51	15:58 (ER06)	07:33	06:52	06:56	19:08 (ER09)	06:06	05:34			
	16:47	5	16:03 (ER06)	17:25	18:03	19:42	11	20:19	20:52		
3	07:51	15:58 (ER06)	07:32	06:50	06:54	19:09 (ER09)	06:04	05:33			
	16:48	7	16:05 (ER06)	17:26	18:04	19:43	12	20:20	20:52		
4	07:51	15:58 (ER06)	07:31	06:49	06:52	19:10 (ER09)	06:03	05:33			
	16:49	8	16:06 (ER06)	17:27	18:06	19:45	11	20:21	20:53		
5	07:51	15:57 (ER06)	07:29	07:52 (MC06)	06:47	17:35 (ER08)	06:51	19:11 (ER09)	06:02	05:33	
	16:50	9	16:06 (ER06)	17:29	18:07	17:45 (ER08)	19:46	19:19 (ER09)	20:22	20:54	
6	07:50	15:57 (ER06)	07:28	07:50 (MC06)	06:45	17:33 (ER08)	06:49		06:00	05:32	
	16:51	11	16:08 (ER06)	17:30	18:08	17:46 (ER08)	19:47		20:23	20:55	
7	07:50	15:57 (ER06)	07:27	07:49 (MC06)	06:43	17:32 (ER08)	06:47		05:59	05:32	
	16:52	12	16:09 (ER06)	17:32	18:10	17:47 (ER08)	19:48		20:25	20:55	
8	07:50	15:57 (ER06)	07:26	07:47 (MC06)	06:42	17:31 (ER08)	06:45		05:58	05:32	
	16:53	14	16:11 (ER06)	17:33	18:11	17:47 (ER08)	19:49		20:26	20:56	
9	07:50	15:57 (ER06)	07:24	07:46 (MC06)	06:40	17:32 (ER08)	06:43		05:56	05:31	
	16:54	14	16:11 (ER06)	17:34	18:12	17:48 (ER08)	19:51		20:27	20:57	
10	07:50	15:57 (ER06)	07:23	07:45 (MC06)	06:38	17:32 (ER08)	06:42		05:55	05:31	
	16:55	15	16:12 (ER06)	17:36	18:13	17:47 (ER08)	19:52		20:28	20:57	
11	07:49	15:57 (ER06)	07:22	07:42 (MC06)	06:36	17:32 (ER08)	06:40		05:54	05:31	
	16:56	16	16:13 (ER06)	17:37	18:15	17:46 (ER08)	19:53		20:29	20:58	
12	07:49	15:57 (ER06)	07:20	07:41 (MC06)	06:34	17:33 (ER08)	06:38	19:31 (ER10)	05:53	05:31	
	16:57	16	16:13 (ER06)	17:39	18:16	17:44 (ER08)	19:54	1	19:32 (ER10)	20:30	20:59
13	07:49	15:58 (ER06)	07:19	07:39 (MC06)	06:33	17:34 (ER08)	06:36		19:29 (ER10)	05:51	05:30
	16:58	17	16:15 (ER06)	17:40	18:17	17:42 (ER08)	19:56	4	19:33 (ER10)	20:32	20:59
14	07:48	15:58 (ER06)	07:17	07:38 (MC06)	06:31		06:35		19:28 (ER10)	05:50	05:30
	16:59	17	16:15 (ER06)	17:41	18:19		19:57	6	19:34 (ER10)	20:33	21:00
15	07:48	15:58 (ER06)	07:16	07:36 (MC06)	06:29		06:33		19:29 (ER10)	05:49	05:30
	17:01	18	16:16 (ER06)	17:43	18:20		19:58	6	19:35 (ER10)	20:34	21:00
16	07:47	15:58 (ER06)	07:14	07:35 (MC06)	06:27		06:31		19:28 (ER10)	05:48	05:30
	17:02	17	16:15 (ER06)	17:44	18:21		19:59	8	19:36 (ER10)	20:35	21:00
17	07:47	15:59 (ER06)	07:13	07:33 (MC06)	06:25		06:30		19:28 (ER10)	05:47	05:30
	17:03	16	16:15 (ER06)	17:46	18:22		20:00	9	19:37 (ER10)	20:36	21:01
18	07:46	16:00 (ER06)	07:11	16:54 (ER07)	06:24		06:28		19:30 (ER10)	05:46	05:30
	17:04	16	16:16 (ER06)	17:47	18:24		20:02	9	19:39 (ER10)	20:37	21:01
19	07:45	16:00 (ER06)	07:10		06:22		06:26		19:31 (ER10)	05:45	05:30
	17:06	16	16:16 (ER06)	17:48	18:25		20:03	6	19:37 (ER10)	20:38	21:01
20	07:45	16:01 (ER06)	07:08		06:20		06:25			05:44	05:31
	17:07	14	16:15 (ER06)	17:50	18:26		20:04			20:39	21:02
21	07:44	16:02 (ER06)	07:07		06:18		06:23			05:43	05:31
	17:08	13	16:15 (ER06)	17:51	18:27		20:05			20:40	21:02
22	07:43	16:04 (ER06)	07:05		06:16		06:21			05:42	05:31
	17:10	11	16:15 (ER06)	17:52	18:29		20:07			20:41	21:02
23	07:43	16:05 (ER06)	07:04		06:14		06:20			05:41	05:31
	17:11	9	16:14 (ER06)	17:54	18:30		20:08			20:42	21:02
24	07:42	16:07 (ER06)	07:02		06:12		06:18			05:40	05:31
	17:12	5	16:12 (ER06)	17:55	18:31		20:09			20:43	21:03
25	07:41		07:00		06:11		06:16			05:39	05:32
	17:14		17:56		18:32		20:10			20:44	21:03
26	07:40		06:59		06:09		06:15			05:39	05:32
	17:15		17:58		18:33		20:11			20:45	21:03
27	07:39		06:57		06:07		06:13			05:38	05:32
	17:16		17:59		18:35		20:13			20:46	21:03
28	07:38		06:55		06:05		06:12			05:37	05:33
	17:18		18:00		18:36		20:14			20:47	21:03
29	07:37				07:03	19:12 (ER09)	06:10			05:36	05:33
	17:19				19:37	3	19:15 (ER09)	20:15		20:48	21:03
30	07:36				07:01	6	19:10 (ER09)	06:09		05:36	05:34
	17:20				19:38		20:16			20:49	21:03
31	07:35				07:00		19:09 (ER09)			05:35	
	17:22				19:40	8	19:17 (ER09)			20:50	
Potential sun hours	288		292		369		403		457		464
Total, worst case		299		281		142		100			
Sun reduction		0,27		0,32		0,38		0,43			
Oper. time red.		0,83		0,83		0,83		0,83			
Wind dir. red.		0,73		0,63		0,62		0,54			
Total reduction		0,16		0,17		0,20		0,19			
Total, real		49		48		28		19			

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

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R03 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (3)
Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	July	August	September	October	November	December
1	05:34 21:02	06:01 20:41	06:37 19:53	07:11 18:57	18:13 (ER08) 17:06	07:29 16:38
2	05:35 21:02	06:02 20:39	06:38 19:51	07:13 18:56	18:23 (ER08) 17:04	16:35 (ER07) 16:37
3	05:35 21:02	06:03 20:38	06:39 19:49	07:14 18:54	18:24 (ER08) 17:03	16:35 (ER07) 16:37
4	05:36 21:02	06:04 20:37	06:40 19:47	07:15 18:52	18:24 (ER08) 17:02	16:34 (ER07) 16:37
5	05:37 21:02	06:05 20:35	06:41 19:46	07:16 18:50	18:08 (ER08) 17:00	16:33 (ER07) 16:36
6	05:37 21:01	06:07 20:34	06:42 19:44	07:17 18:49	18:09 (ER08) 16:59	16:31 (ER07) 16:36
7	05:38 21:01	06:08 20:33	06:43 19:42	19:06 (ER09) 18:46	18:08 (ER08) 16:58	07:24 (MC06) 16:36
8	05:39 21:01	06:09 20:31	06:45 19:40	19:14 (ER09) 18:45	18:23 (ER08) 16:57	16:36 16:36
9	05:39 21:00	06:10 20:30	06:46 19:38	19:02 (ER09) 18:43	18:21 (ER08) 16:55	07:38 16:36
10	05:40 21:00	06:11 20:29	06:47 19:36	19:15 (ER09) 18:41	18:18 (ER08) 16:54	16:36 16:36
11	05:41 20:59	06:12 20:27	06:48 19:35	19:02 (ER09) 18:39	18:17 (ER08) 16:54	07:39 16:36
12	05:42 20:59	06:13 20:26	06:49 19:33	19:02 (ER09) 18:38	07:25 16:52	07:40 16:36
13	05:42 20:58	06:15 20:24	06:50 19:31	19:10 (ER09) 18:36	07:26 16:51	16:36 16:36
14	05:43 20:57	06:16 20:23	06:51 19:29	19:02 (ER09) 18:34	07:27 16:50	07:42 16:36
15	05:44 20:57	06:17 20:21	06:53 19:27	19:03 (ER09) 18:32	07:28 16:49	07:43 16:36
16	05:45 20:56	06:18 20:20	06:54 19:25	19:04 (ER09) 18:31	07:30 16:48	07:44 16:36
17	05:46 20:55	06:19 20:18	06:55 19:23	18:31 18:29	07:31 16:47	07:44 16:37
18	05:47 20:55	06:20 20:16	06:56 19:22	07:32 18:27	16:46 16:46	16:37 16:37
19	05:48 20:54	06:21 20:15	06:57 19:20	07:33 18:26	16:46 16:45	16:37 16:37
20	05:49 20:53	06:23 20:13	06:58 19:18	07:35 18:24	16:46 16:44	16:38 16:38
21	05:50 20:52	06:24 20:12	07:00 19:16	07:36 18:22	16:44 16:44	16:38 16:38
22	05:51 20:51	06:25 20:10	07:01 19:14	07:37 18:21	16:44 16:43	16:38 16:39
23	05:52 20:50	06:26 20:08	07:02 19:12	07:39 18:19	16:43 16:42	16:39 16:39
24	05:53 20:49	06:27 20:07	19:35 (ER10) 19:10	07:40 18:18	17:26 (ER07) 17:30 (ER07)	07:48 16:42
25	05:54 20:48	06:28 20:05	19:33 (ER10) 19:08	07:41 17:16	17:33 (ER07) 16:41	16:40 16:40
26	05:55 20:47	06:30 20:03	19:31 (ER10) 19:07	07:43 17:15	07:04 (MC06) 16:36 (ER07)	16:40 16:41
27	05:56 20:46	06:31 20:01	19:30 (ER10) 19:05	07:44 17:13	07:05 (MC06) 16:36 (ER07)	16:41 16:42
28	05:57 20:45	06:32 20:00	19:29 (ER10) 19:03	07:45 17:12	07:06 (MC06) 16:37 (ER07)	16:42 16:42
29	05:58 20:44	06:33 19:58	19:29 (ER10) 19:01	07:46 17:10	07:07 (MC06) 16:38 (ER07)	16:43 16:43
30	05:59 20:43	06:34 19:56	19:29 (ER10) 18:59	18:15 (ER08) 18:20 (ER08)	07:11 (MC06) 16:37 (ER07)	16:44 16:44
31	06:00 20:42	06:35 19:55	19:30 (ER10) 19:31 (ER10)	06:49 17:07	07:12 (MC06) 16:36 (ER07)	16:45 16:45
Potential sun hours	470	434	376	342	290	277
Total, worst case		48	78	313	276	119
Sun reduction		0,60	0,53	0,44	0,30	0,29
Oper. time red.		0,83	0,83	0,83	0,83	0,83
Wind dir. red.		0,52	0,57	0,63	0,70	0,73
Total reduction		0,26	0,25	0,23	0,18	0,18
Total, real		12	20	73	49	21

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R04 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (4)
Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1 07:50		07:34	07:55 (MC06)	06:54	06:58	06:07	05:35	05:34	06:01	06:36	07:11	06:50
16:46		17:23	14 08:09 (MC06)	18:02	19:41	20:17	20:51	21:02	20:40	19:53	18:57	17:06
2 07:51		07:33	07:54 (MC06)	06:52	06:56	06:06	05:34	05:35	06:02	06:38	07:12	06:52
16:47		17:25	16 08:10 (MC06)	18:03	19:42	20:19	20:52	21:02	20:39	19:51	18:56	17:04
3 07:51		07:32	07:53 (MC06)	06:50	06:54	06:04	05:33	05:35	06:03	06:39	07:14	06:53
16:48		17:26	17 08:10 (MC06)	18:04	19:43	20:20	20:52	21:02	20:38	19:49	18:54	17:03
4 07:51		07:30	07:52 (MC06)	06:49	06:52	06:03	05:33	05:36	06:04	06:40	07:15	06:54
16:49		17:27	18 08:10 (MC06)	18:06	19:45	20:21	20:53	21:02	20:37	19:47	18:52	17:02
5 07:51		07:29	07:50 (MC06)	06:47	06:51	06:02	05:33	05:37	06:05	06:41	07:16	06:56
16:50		17:29	20 08:10 (MC06)	18:07	19:46	20:22	20:54	21:02	20:35	19:46	18:50	17:00
6 07:50		07:28	07:49 (MC06)	06:45	06:49	06:00	05:32	05:37	06:07	06:42	07:17	06:57
16:51		17:30	21 08:10 (MC06)	18:08	19:47	20:23	20:55	21:01	20:34	19:44	18:48	16:59
7 07:50		07:27	07:48 (MC06)	06:43	06:47	05:59	05:32	05:38	06:08	06:43	07:19	06:58
16:52		17:32	22 08:10 (MC06)	18:10	19:48	20:25	20:55	21:01	20:33	19:42	18:46	16:58
8 07:50		07:26	07:46 (MC06)	06:42	06:45	05:58	05:31	05:39	06:09	06:45	07:20	07:00
16:53		17:33	24 08:10 (MC06)	18:11	19:49	20:26	20:56	21:00	20:31	19:40	18:45	16:57
9 07:50		07:24	07:45 (MC06)	06:40	06:43	05:56	05:31	05:39	06:10	06:46	07:21	07:01
16:54		17:34	25 08:10 (MC06)	18:12	19:51	20:27	20:57	21:00	20:30	19:38	18:43	16:55
10 07:50		07:23	07:44 (MC06)	06:38	06:42	05:55	05:31	05:40	06:11	06:47	07:22	07:02
16:55		17:36	26 08:10 (MC06)	18:13	19:52	20:28	20:57	21:00	20:29	19:36	18:41	16:54
11 07:49		07:22	07:42 (MC06)	06:36	06:40	05:54	05:31	05:41	06:12	06:48	07:23	07:04
16:56		17:37	27 08:09 (MC06)	18:15	19:53	20:29	20:58	20:59	20:27	19:35	18:39	16:53
12 07:49		07:20	07:41 (MC06)	06:34	06:38	05:53	05:31	05:42	06:13	06:49	07:25	07:05
16:57		17:39	28 08:09 (MC06)	18:16	19:54	20:30	20:58	20:59	20:26	19:33	18:38	16:52
13 07:49		07:19	07:39 (MC06)	06:33	06:36	05:51	05:30	05:42	06:15	06:50	07:26	07:07
16:58		17:40	29 08:08 (MC06)	18:17	19:56	20:32	20:59	20:58	20:24	19:31	18:36	16:51
14 07:48		07:17	07:38 (MC06)	06:31	06:35	05:50	05:30	05:43	06:16	06:51	07:27	07:08
16:59		17:41	30 08:08 (MC06)	18:19	19:57	20:33	21:00	20:57	20:23	19:29	18:34	7 08:13 (MC06)
15 07:48		07:16	07:36 (MC06)	06:29	06:33	05:49	05:30	05:44	06:17	06:53	07:28	8 07:40 (MC06)
17:01		17:43	31 08:07 (MC06)	18:20	19:58	20:34	21:00	20:57	20:21	19:27	18:32	7 07:40 (MC06)
16 07:47		07:14	07:35 (MC06)	06:27	06:31	05:48	05:30	05:45	06:18	06:54	07:30	8 07:35 (MC06)
17:02		17:44	32 08:07 (MC06)	18:21	19:59	20:35	21:00	20:56	20:20	19:25	18:31	5 07:40 (MC06)
17 07:47		07:13	07:33 (MC06)	06:25	06:30	05:47	05:30	05:46	06:19	06:55	07:31	28 08:22 (MC06)
17:03		17:46	32 08:05 (MC06)	18:22	20:00	20:36	21:01	20:55	20:18	19:23	18:29	32 08:25 (MC06)
18 07:46		07:11	07:32 (MC06)	06:23	06:28	05:46	05:30	05:47	06:20	06:56	07:32	3 07:39 (MC06)
17:04		17:47	33 08:05 (MC06)	18:24	20:02	20:37	21:01	20:55	20:16	19:22	18:27	33 08:27 (MC06)
19 07:45		07:10	07:30 (MC06)	06:22	06:26	05:45	05:30	05:48	06:21	06:57	07:33	2 07:40 (MC06)
17:06		17:48	33 08:03 (MC06)	18:25	20:03	20:38	21:01	20:54	20:15	19:20	18:26	33 08:28 (MC06)
20 07:45		07:08	07:29 (MC06)	06:20	06:24	05:44	05:31	05:49	06:23	06:58	07:35	7 07:55 (MC06)
17:07		17:50	33 08:02 (MC06)	18:26	20:04	20:39	21:02	20:53	20:13	19:18	18:24	34 08:31 (MC06)
21 07:44		07:07	07:27 (MC06)	06:18	06:23	05:43	05:31	05:50	06:24	07:00	07:36	34 08:32 (MC06)
17:08		17:51	34 08:01 (MC06)	18:27	20:05	20:40	21:02	20:52	20:12	19:16	18:22	34 08:32 (MC06)
22 07:43		07:05	07:25 (MC06)	06:16	06:21	05:42	05:31	05:51	06:25	07:01	07:37	34 08:32 (MC06)
17:10		17:52	34 07:59 (MC06)	18:29	20:07	20:41	21:02	20:51	20:10	19:14	18:21	33 08:32 (MC06)
23 07:42		07:04	07:24 (MC06)	06:14	06:20	05:41	05:31	05:52	06:26	07:02	07:39	33 08:01 (MC06)
17:11		17:54	33 07:57 (MC06)	18:30	20:08	20:42	21:02	20:50	20:08	19:12	18:19	33 08:34 (MC06)
24 07:42		07:02	07:22 (MC06)	06:12	06:18	05:40	05:31	05:53	06:27	07:03	07:40	33 08:02 (MC06)
17:12	2 08:06 (MC06)	07:02	33 07:55 (MC06)	18:31	20:09	20:43	21:03	20:49	20:07	19:10	18:18	33 08:35 (MC06)
25 07:41		07:00	07:20 (MC06)	06:11	06:16	05:39	05:32	05:54	06:28	07:04	06:41	33 07:53 (MC06)
17:14	3 08:06 (MC06)	07:00	32 07:52 (MC06)	18:32	20:10	20:44	21:03	20:48	20:05	19:08	17:16	32 07:36 (MC06)
26 07:40		06:59	07:24 (MC06)	06:09	06:15	05:39	05:32	05:55	06:30	07:05	06:42	32 07:05 (MC06)
17:15	5 08:07 (MC06)	06:59	25 07:49 (MC06)	18:33	20:11	20:45	21:03	20:47	20:03	19:07	17:15	31 07:36 (MC06)
27 07:39		06:57	07:28 (MC06)	06:07	06:13	05:38	05:32	05:56	06:31	07:07	06:44	31 07:06 (MC06)
17:16	7 08:08 (MC06)	06:57	16 07:44 (MC06)	18:35	20:13	20:46	21:03	20:46	20:01	19:05	17:13	31 07:37 (MC06)
28 07:38		06:55		06:05	06:12	05:37	05:33	05:57	06:32	07:08	06:45	31 07:08 (MC06)
17:18	8 08:08 (MC06)	18:00		18:36	20:14	20:47	21:03	20:45	20:00	19:03	17:12	30 07:38 (MC06)
29 07:37		07:59 (MC06)		07:03	06:10	05:36	05:33	05:58	06:33	07:09	06:46	30 07:09 (MC06)
17:19	10 08:09 (MC06)			19:37	20:15	20:48	21:03	20:44	19:58	19:01	17:10	29 07:38 (MC06)
30 07:36		07:58 (MC06)		07:01	06:09	05:36	05:34	05:59	06:34	07:10	06:48	29 07:11 (MC06)
17:20	11 08:09 (MC06)			19:38	20:16	20:49	21:03	20:43	19:56	18:59	17:09	28 07:39 (MC06)
31 07:35		07:56 (MC06)		07:00		05:35		06:00	06:35		06:49	28 07:12 (MC06)
17:22	13 08:09 (MC06)			19:40		20:50		20:42	19:54		17:07	27 07:39 (MC06)
Potential sun hours	288		292	369	403	457	464	470	434		342	290
Total, worst case	59		718								529	261
Sun reduction	0,27		0,32								0,44	0,30
Oper. time red.	0,83		0,83								0,83	0,83
Wind dir. red.	0,49		0,49								0,49	0,49
Total reduction	0,11		0,13								0,18	0,12
Total, real	6		93								95	32

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)

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R05 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (5)
Assumptions for shadow calculations 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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:50 16:46	07:34 17:23	06:54 18:02	06:58 19:41	06:07 20:17	05:34 20:51	05:34 21:02	06:01 20:40	06:36 19:53	07:11 18:57	06:50 17:06	07:29 16:38
2	07:51 16:47	07:33 17:25	06:52 18:03	06:56 19:42	06:06 20:19	05:34 20:52	05:35 21:02	06:02 20:39	06:38 19:51	07:12 18:55	06:52 17:04	07:30 16:37
3	07:51 16:48	07:32 17:26	06:50 18:04	06:54 19:43	06:04 20:20	05:33 20:52	05:35 21:02	06:03 20:38	06:39 19:49	07:14 18:54	06:53 17:03	07:31 16:37
4	07:51 16:49	07:30 17:27	06:48 18:06	06:52 19:44	06:03 20:21	05:33 20:53	05:36 21:02	06:04 20:37	06:40 19:47	07:15 18:52	06:54 17:02	07:33 16:37
5	07:50 16:49	07:29 17:29	06:47 18:07	06:51 19:46	06:02 20:22	05:33 20:54	05:36 21:02	06:05 20:35	06:41 19:46	07:16 18:50	06:56 17:00	07:34 16:36
6	07:50 16:50	07:28 17:30	06:45 18:08	06:49 19:47	06:00 20:23	05:32 20:55	05:37 21:01	06:07 20:34	06:42 19:44	07:17 18:48	06:57 16:59	07:35 16:36
7	07:50 16:52	07:27 17:32	06:43 18:10	06:47 19:48	05:59 20:25	05:32 20:55	05:38 21:01	06:08 20:33	06:43 19:42	07:18 18:46	06:58 16:58	07:36 16:36
8	07:50 16:53	07:25 17:33	06:41 18:11	06:45 19:49	05:58 20:26	05:31 20:56	05:38 21:00	06:09 20:31	06:45 19:40	07:20 18:45	07:00 16:57	07:37 16:36
9	07:50 16:54	07:24 17:34	06:40 18:12	06:43 19:51	05:56 20:27	05:31 20:57	05:39 21:00	06:10 20:30	06:46 19:38	07:21 18:43	07:01 16:55	07:38 16:36
10	07:50 16:55	07:23 17:36	06:38 18:13	06:42 19:52	05:55 20:28	05:31 20:57	05:40 21:00	06:11 20:29	06:47 19:36	07:22 18:41	07:02 16:54	07:39 16:36
11	07:49 16:56	07:22 17:37	06:36 18:15	06:40 19:53	05:54 20:29	05:31 20:58	05:41 20:59	06:12 20:27	06:48 19:35	07:23 18:39	07:04 16:53	07:39 16:36
12	07:49 16:57	07:20 17:39	06:34 18:16	06:38 19:54	05:52 20:30	05:31 20:58	05:42 20:59	06:13 20:26	06:49 19:33	07:25 18:38	07:05 16:52	07:40 16:36
13	07:49 16:58	07:19 17:40	06:33 18:17	06:36 19:55	05:51 20:32	05:30 20:59	05:42 20:58	06:15 20:24	06:50 19:31	07:26 18:36	07:06 16:51	07:41 16:36
14	07:48 16:59	07:17 17:41	06:31 18:18	06:35 19:57	05:50 20:33	05:30 20:59	05:43 20:57	06:16 20:23	06:51 19:29	07:27 18:34	07:08 16:50	07:42 16:36
15	07:48 17:01	07:16 17:43	06:29 18:20	06:33 19:58	05:49 20:34	05:30 21:00	05:44 20:57	06:17 20:21	06:53 19:27	07:28 18:32	07:09 16:49	07:43 16:36
16	07:47 17:02	07:14 17:44	06:27 18:21	06:31 19:59	05:48 20:35	05:30 21:00	05:45 20:56	06:18 20:20	06:54 19:25	07:30 18:31	07:10 16:48	07:43 16:36
17	07:47 17:03	07:13 17:45	06:25 18:22	06:29 20:00	05:47 20:36	05:30 21:01	05:46 20:55	06:19 20:18	06:55 19:23	07:31 18:29	07:12 16:47	07:44 16:37
18	07:46 17:04	07:11 17:47	06:23 18:23	06:28 20:02	05:46 20:37	05:30 21:01	05:47 20:55	06:20 20:16	06:56 19:21	07:32 18:27	07:13 16:46	07:45 16:37
19	07:45 17:06	07:10 17:48	06:22 18:25	06:26 20:03	05:45 20:38	05:30 21:01	05:48 20:54	06:21 20:15	06:57 19:20	07:33 18:26	07:14 16:45	07:46 16:37
20	07:45 17:07	07:08 17:50	06:20 18:26	06:24 20:04	05:44 20:39	05:30 21:02	05:49 20:53	06:23 20:13	06:58 19:18	07:35 18:24	07:16 16:44	07:46 16:38
21	07:44 17:08	07:07 17:51	06:18 18:27	06:23 20:05	05:43 20:40	05:31 21:02	05:50 20:52	06:24 20:12	06:59 19:16	07:36 18:22	07:17 16:43	07:47 16:38
22	07:43 17:10	07:05 17:52	06:16 18:28	06:21 20:06	05:42 20:41	05:31 21:02	05:51 20:51	06:25 20:10	07:01 19:14	07:37 18:21	07:18 16:43	07:47 16:39
23	07:42 17:11	07:04 17:54	06:14 18:30	06:20 20:08	05:41 20:42	05:31 21:02	05:52 20:50	06:26 20:08	07:02 19:12	07:39 18:19	07:20 16:42	07:48 16:39
24	07:42 17:12	07:02 17:55	06:12 18:31	06:18 20:09	05:40 20:43	05:31 21:02	05:53 20:49	06:27 20:07	07:03 19:10	07:40 18:18	07:21 16:41	07:48 16:40
25	07:41 17:14	07:00 17:56	06:11 18:32	06:16 20:10	05:39 20:44	05:32 21:03	05:54 20:48	06:28 20:05	07:04 19:08	06:41 17:16	07:22 16:41	07:49 16:40
26	07:40 17:15	06:59 17:58	06:09 18:33	06:15 20:11	05:39 20:45	05:32 21:03	05:55 20:47	06:30 20:03	07:05 19:07	06:42 17:15	07:23 16:40	07:49 16:41
27	07:39 17:16	06:57 17:59	06:07 18:35	06:13 20:13	05:38 20:46	05:32 21:03	05:56 20:46	06:31 20:01	07:07 19:05	06:44 17:13	07:24 16:39	07:49 16:42
28	07:38 17:18	06:55 18:00	06:05 18:36	06:12 20:14	05:37 20:47	05:33 21:03	05:57 20:45	06:32 20:00	07:08 19:03	06:45 17:12	07:26 16:39	07:50 16:42
29	07:37 17:19		07:03 19:37	06:10 20:15	05:36 20:48	05:33 21:03	05:58 20:44	06:33 19:58	07:09 19:01	06:46 17:10	07:27 16:38	07:50 16:43
30	07:36 17:20		07:01 19:38	06:09 20:16	05:36 20:49	05:34 21:03	05:59 20:43	06:34 19:56	07:10 18:59	06:48 17:09	07:28 16:38	07:50 16:44
31	07:35 17:22		07:00 19:40		05:35 20:50		06:00 20:42	06:35 19:54		06:49 17:07		07:50 16:45
Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R09 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (6)
Assumptions for shadow calculations 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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January		February		March	April	May	June
1	07:51		09:31 (ER13)	07:34	11:25 (ER16)	06:54	06:58	05:35
	16:46	113	12:07 (ER16)	17:23	12:21 (ER16)	18:02	19:41	20:51
2	07:51		09:32 (ER13)	07:33	11:26 (ER16)	06:52	06:56	05:34
	16:47	112	12:08 (ER16)	17:25	12:21 (ER16)	18:03	19:42	20:52
3	07:51		09:33 (ER13)	07:32	08:40 (ER12)	06:50	06:54	05:34
	16:48	110	12:08 (ER16)	17:26	12:20 (ER16)	18:04	19:43	20:53
4	07:51		09:34 (ER13)	07:31	08:38 (ER12)	06:49	06:52	05:33
	16:49	105	12:09 (ER16)	17:28	12:20 (ER16)	18:06	19:45	20:53
5	07:51		09:35 (ER13)	07:29	08:36 (ER12)	06:47	06:51	05:33
	16:50	102	12:10 (ER16)	17:29	12:19 (ER16)	18:07	19:46	20:54
6	07:51		09:35 (ER13)	07:28	08:34 (ER12)	06:45	06:49	05:32
	16:51	97	12:10 (ER16)	17:30	12:18 (ER16)	18:08	19:47	20:55
7	07:50		09:36 (ER13)	07:27	11:30 (ER16)	06:43	06:47	05:32
	16:52	92	12:11 (ER16)	17:32	12:17 (ER16)	18:10	19:48	20:56
8	07:50		09:37 (ER13)	07:26	11:32 (ER16)	06:42	06:45	05:32
	16:53	84	12:12 (ER16)	17:33	12:16 (ER16)	18:11	19:50	20:56
9	07:50		09:38 (ER13)	07:24	11:33 (ER16)	06:40	06:44	05:31
	16:54	73	12:13 (ER16)	17:35	12:14 (ER16)	18:12	19:51	20:57
10	07:50		09:39 (ER13)	07:23	11:35 (ER16)	06:38	06:42	05:31
	16:55	64	12:13 (ER16)	17:36	12:12 (ER16)	18:14	19:52	20:58
11	07:49		09:41 (ER13)	07:22	11:36 (ER16)	06:36	06:40	05:31
	16:56	63	12:14 (ER16)	17:37	12:09 (ER16)	18:15	19:53	20:58
12	07:49		09:43 (ER13)	07:20	11:40 (ER16)	06:34	06:38	05:31
	16:57	60	12:15 (ER16)	17:39	12:07 (ER16)	18:16	19:54	20:59
13	07:49		11:21 (ER16)	07:19	11:44 (ER16)	06:33	06:36	05:31
	16:58	55	12:16 (ER16)	17:40	12:02 (ER16)	18:17	19:56	20:59
14	07:48		11:21 (ER16)	07:17		06:31	06:35	05:30
	17:00	55	12:16 (ER16)	17:41		18:19	19:57	21:00
15	07:48		11:21 (ER16)	07:16		06:29	06:33	05:30
	17:01	56	12:17 (ER16)	17:43		18:20	19:58	21:00
16	07:47		11:21 (ER16)	07:15		06:27	06:31	05:30
	17:02	56	12:17 (ER16)	17:44		18:21	19:59	21:01
17	07:47		11:21 (ER16)	07:13		06:25	06:30	05:30
	17:03	57	12:18 (ER16)	17:46		18:22	20:01	21:01
18	07:46		11:22 (ER16)	07:12		06:24	06:28	05:30
	17:05	57	12:19 (ER16)	17:47		18:24	20:02	21:01
19	07:46		11:22 (ER16)	07:10		06:22	06:26	05:30
	17:06	57	12:19 (ER16)	17:48		18:25	20:03	21:02
20	07:45		11:21 (ER16)	07:08		06:20	06:25	05:31
	17:07	58	12:19 (ER16)	17:50		18:26	20:04	21:02
21	07:44		11:21 (ER16)	07:07		06:18	06:23	05:31
	17:08	59	12:20 (ER16)	17:51		18:27	20:05	21:02
22	07:43		11:22 (ER16)	07:05		06:16	06:21	05:31
	17:10	59	12:21 (ER16)	17:52		18:29	20:07	21:02
23	07:43		11:22 (ER16)	07:04		06:14	06:20	05:31
	17:11	59	12:21 (ER16)	17:54		18:30	20:08	21:03
24	07:42		11:23 (ER16)	07:02		06:13	06:18	05:31
	17:12	58	12:21 (ER16)	17:55		18:31	20:09	21:03
25	07:41		11:23 (ER16)	07:00		06:11	06:16	05:32
	17:14	58	12:21 (ER16)	17:56		18:32	20:10	21:03
26	07:40		11:23 (ER16)	06:59		06:09	06:15	05:32
	17:15	59	12:22 (ER16)	17:58		18:34	20:12	21:03
27	07:39		11:23 (ER16)	06:57		06:07	06:13	05:32
	17:16	59	12:22 (ER16)	17:59		18:35	20:13	21:03
28	07:38		11:24 (ER16)	06:55		06:05	06:12	05:33
	17:18	58	12:22 (ER16)	18:00		18:36	20:14	21:03
29	07:37		11:24 (ER16)			07:03	06:10	05:36
	17:19	58	12:22 (ER16)			19:37	20:15	21:03
30	07:36		11:25 (ER16)			07:02	06:09	05:34
	17:21	57	12:22 (ER16)			19:38	20:16	21:03
31	07:35		11:25 (ER16)			07:00		
	17:22	57	12:22 (ER16)			19:40	20:50	
Potential sun hours	288		292		369	403	457	464
Total, worst case	2167		574					
Sun reduction	0,27		0,32					
Oper. time red.	0,83		0,83					
Wind dir. red.	0,66		0,67					
Total reduction	0,15		0,18					
Total, real	317		102					

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R09 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (6)
Assumptions for shadow calculations 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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	July	August	September	October	November	December		
1	05:34 21:03	06:01 20:41	06:37 19:53	07:11 18:57	06:51 17:06	11:04 (ER16) 16:38	07:29 64	09:23 (ER13) 11:57 (ER16)
2	05:35 21:02	06:02 20:39	06:38 19:51	07:13 18:56	06:52 17:04	11:02 (ER16) 11:44 (ER16)	07:30 64	09:22 (ER13) 11:56 (ER16)
3	05:35 21:02	06:03 20:38	06:39 19:49	07:14 18:54	06:53 17:03	11:00 (ER16) 11:45 (ER16)	07:32 73	09:21 (ER13) 11:56 (ER16)
4	05:36 21:02	06:04 20:37	06:40 19:47	07:15 18:52	06:55 17:02	11:00 (ER16) 11:47 (ER16)	07:33 84	09:21 (ER13) 11:56 (ER16)
5	05:37 21:02	06:06 20:36	06:41 19:46	07:16 18:50	06:56 17:00	08:04 (ER12) 11:48 (ER16)	07:34 90	09:21 (ER13) 11:56 (ER16)
6	05:37 21:01	06:07 20:34	06:42 19:44	07:17 18:48	06:57 16:59	08:06 (ER12) 11:49 (ER16)	07:35 97	09:21 (ER13) 11:56 (ER16)
7	05:38 21:01	06:08 20:33	06:43 19:42	07:19 18:47	06:59 16:58	08:08 (ER12) 11:50 (ER16)	07:36 102	09:21 (ER13) 11:56 (ER16)
8	05:39 21:01	06:09 20:32	06:45 19:40	07:20 18:45	07:00 16:57	08:11 (ER12) 11:51 (ER16)	07:37 105	09:21 (ER13) 11:56 (ER16)
9	05:39 21:00	06:10 20:30	06:46 19:38	07:21 18:43	07:01 16:56	10:57 (ER16) 11:51 (ER16)	07:38 109	09:21 (ER13) 11:57 (ER16)
10	05:40 21:00	06:11 20:29	06:47 19:37	07:22 18:41	07:03 16:54	10:56 (ER16) 11:52 (ER16)	07:39 111	09:21 (ER13) 11:57 (ER16)
11	05:41 20:59	06:12 20:27	06:48 19:35	07:24 18:39	07:04 16:53	10:56 (ER16) 11:53 (ER16)	07:40 112	09:21 (ER13) 11:57 (ER16)
12	05:42 20:59	06:14 20:26	06:49 19:33	07:25 18:38	07:05 16:52	10:56 (ER16) 11:53 (ER16)	07:40 113	09:22 (ER13) 11:57 (ER16)
13	05:42 20:58	06:15 20:24	06:50 19:31	07:26 18:36	07:07 16:51	10:56 (ER16) 11:54 (ER16)	07:41 116	09:22 (ER13) 11:58 (ER16)
14	05:43 20:57	06:16 20:23	06:52 19:29	07:27 18:34	07:08 16:50	10:56 (ER16) 11:54 (ER16)	07:42 115	09:23 (ER13) 11:58 (ER16)
15	05:44 20:57	06:17 20:21	06:53 19:27	07:29 18:33	07:09 16:49	10:56 (ER16) 11:55 (ER16)	07:43 117	09:22 (ER13) 11:58 (ER16)
16	05:45 20:56	06:18 20:20	06:54 19:25	07:30 18:31	07:11 16:48	10:56 (ER16) 11:54 (ER16)	07:44 118	09:23 (ER13) 11:58 (ER16)
17	05:46 20:55	06:19 20:18	06:55 19:24	07:31 18:29	07:12 16:47	10:56 (ER16) 11:54 (ER16)	07:44 119	09:24 (ER13) 11:59 (ER16)
18	05:47 20:55	06:20 20:17	06:56 19:22	07:32 18:27	07:13 16:46	10:57 (ER16) 11:55 (ER16)	07:45 118	09:24 (ER13) 11:58 (ER16)
19	05:48 20:54	06:22 20:15	06:57 19:20	07:34 18:26	07:15 16:45	10:56 (ER16) 11:55 (ER16)	07:46 120	09:24 (ER13) 11:59 (ER16)
20	05:49 20:53	06:23 20:13	06:58 19:18	07:35 18:24	07:16 16:44	10:57 (ER16) 11:56 (ER16)	07:46 120	09:25 (ER13) 12:00 (ER16)
21	05:50 20:52	06:24 20:12	07:00 19:16	07:36 18:23	07:17 16:44	10:57 (ER16) 11:56 (ER16)	07:47 120	09:25 (ER13) 12:00 (ER16)
22	05:51 20:51	06:25 20:10	07:01 19:14	07:37 18:21	07:18 16:43	10:57 (ER16) 11:55 (ER16)	07:47 120	09:26 (ER13) 12:01 (ER16)
23	05:52 20:50	06:26 20:08	07:02 19:12	07:39 18:19	07:20 16:42	10:59 (ER16) 11:56 (ER16)	07:48 120	09:26 (ER13) 12:01 (ER16)
24	05:53 20:49	06:27 20:07	07:03 19:10	07:40 18:18	07:21 16:41	10:59 (ER16) 11:56 (ER16)	07:48 120	09:26 (ER13) 12:01 (ER16)
25	05:54 20:48	06:28 20:05	07:04 19:09	06:41 17:16	07:22 16:41	10:59 (ER16) 11:56 (ER16)	07:49 119	09:28 (ER13) 12:02 (ER16)
26	05:55 20:47	06:30 20:03	07:05 19:07	06:43 17:15	07:23 16:40	11:00 (ER16) 11:56 (ER16)	07:49 119	09:28 (ER13) 12:03 (ER16)
27	05:56 20:46	06:31 20:02	07:07 19:05	06:44 17:13	07:25 16:40	11:00 (ER16) 11:56 (ER16)	07:49 118	09:28 (ER13) 12:03 (ER16)
28	05:57 20:45	06:32 20:00	07:08 19:03	06:45 17:12	07:26 16:39	11:01 (ER16) 11:56 (ER16)	07:50 116	09:29 (ER13) 12:04 (ER16)
29	05:58 20:44	06:33 19:58	07:09 19:01	06:47 17:10	07:27 11:32 (ER16)	11:01 (ER16) 11:56 (ER16)	07:50 116	09:30 (ER13) 12:05 (ER16)
30	05:59 20:43	06:34 19:56	07:10 18:59	06:48 17:09	11:09 (ER16) 11:37 (ER16)	09:25 (ER13) 11:57 (ER16)	07:50 115	09:30 (ER13) 12:05 (ER16)
31	06:00 20:42	06:35 19:55		06:49 17:07	11:06 (ER16) 11:39 (ER16)		07:50 114	09:31 (ER13) 12:06 (ER16)
Potential sun hours	470	434	376	342	290		277	
Total, worst case				81	1652		3364	
Sun reduction				0,44	0,30		0,29	
Oper. time red.				0,83	0,83		0,83	
Wind dir. red.				0,68	0,68		0,64	
Total reduction				0,25	0,17		0,15	
Total, real				20	281		507	

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

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R10 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (7)
Assumptions for shadow calculations 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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:51 16:46	07:34 17:23	06:54 18:02	06:58 19:41	06:07 20:18	05:35 20:51	05:34 21:03	06:01 20:41	06:37 19:53	07:11 18:57	06:51 17:06	07:29 16:38
2	07:51 16:47	07:33 17:25	06:52 18:03	06:56 19:42	06:06 20:19	05:34 20:52	05:35 21:02	06:02 20:39	06:38 19:51	07:13 18:56	06:52 17:04	07:30 16:37
3	07:51 16:48	07:32 17:26	06:50 18:04	06:54 19:43	06:04 20:20	05:33 20:53	05:35 21:02	06:03 20:38	06:39 19:49	07:14 18:54	06:53 17:03	07:32 16:37
4	07:51 16:49	07:31 17:27	06:49 18:06	06:52 19:45	06:03 20:21	05:33 20:53	05:36 21:02	06:04 20:37	06:40 19:47	07:15 18:52	06:55 17:02	07:33 16:37
5	07:51 16:50	07:29 17:29	06:47 18:07	06:51 19:46	06:02 20:22	05:33 20:54	05:37 21:02	06:06 20:36	06:41 19:46	07:16 18:50	06:56 17:00	07:34 16:36
6	07:51 16:51	07:28 17:30	06:45 18:08	06:49 19:47	06:00 20:24	05:32 20:55	05:37 21:01	06:07 20:34	06:42 19:44	07:17 18:48	06:57 16:59	07:35 16:36
7	07:50 16:52	07:27 17:32	06:43 18:10	06:47 19:48	05:59 20:25	05:32 20:56	05:38 21:01	06:08 20:33	06:43 19:42	07:19 18:47	06:59 16:58	07:36 16:36
8	07:50 16:53	07:26 17:33	06:42 18:11	06:45 19:49	05:58 20:26	05:32 20:56	05:39 21:01	06:09 20:31	06:45 19:40	07:20 18:45	07:00 16:57	07:37 16:36
9	07:50 16:54	07:24 17:34	06:40 18:12	06:43 19:51	05:56 20:27	05:31 20:57	05:39 21:00	06:10 20:30	06:46 19:38	07:21 18:43	07:01 16:55	07:38 16:36
10	07:50 16:55	07:23 17:36	06:38 18:13	06:42 19:52	05:55 20:28	05:31 20:57	05:40 21:00	06:11 20:29	06:47 19:36	07:22 18:41	07:03 16:54	07:39 16:36
11	07:49 16:56	07:22 17:37	06:36 18:15	06:40 19:53	05:54 20:29	05:31 20:58	05:41 20:59	06:12 20:27	06:48 19:35	07:23 18:39	07:04 16:53	07:40 16:36
12	07:49 16:57	07:20 17:39	06:34 18:16	06:38 19:54	05:53 20:31	05:31 20:59	05:42 20:59	06:13 20:26	06:49 19:33	07:25 18:38	07:05 16:52	07:40 16:36
13	07:49 16:58	07:19 17:40	06:33 18:17	06:36 19:56	05:51 20:32	05:30 20:59	05:42 20:58	06:15 20:24	06:50 19:31	07:26 18:36	07:07 16:51	07:41 16:36
14	07:48 17:00	07:17 17:41	06:31 18:19	06:35 19:57	05:50 20:33	05:30 21:00	05:43 20:57	06:16 20:23	06:52 19:29	07:27 18:34	07:08 16:50	07:42 16:36
15	07:48 17:01	07:16 17:43	06:29 18:20	06:33 19:58	05:49 20:34	05:30 21:00	05:44 20:57	06:17 20:21	06:53 19:27	07:28 18:32	07:09 16:49	07:43 16:36
16	07:47 17:02	07:14 17:44	06:27 18:21	06:31 19:59	05:48 20:35	05:30 21:00	05:45 20:56	06:18 20:20	06:54 19:25	07:30 18:31	07:11 16:48	07:44 16:36
17	07:47 17:03	07:13 17:46	06:25 18:22	06:30 20:00	05:47 20:36	05:30 21:01	05:46 20:55	06:19 20:18	06:55 19:23	07:31 18:29	07:12 16:47	07:44 16:37
18	07:46 17:04	07:11 17:47	06:24 18:24	06:28 20:02	05:46 20:37	05:30 21:01	05:47 20:55	06:20 20:17	06:56 19:22	07:32 18:27	07:13 16:46	07:45 16:37
19	07:45 17:06	07:10 17:48	06:22 18:25	06:26 20:03	05:45 20:38	05:30 21:02	05:48 20:54	06:22 20:15	06:57 19:20	07:34 18:26	07:15 16:45	07:46 16:37
20	07:45 17:07	07:08 17:50	06:20 18:26	06:25 20:04	05:44 20:39	05:31 21:02	05:49 20:53	06:23 20:13	06:58 19:18	07:35 18:24	07:16 16:44	07:46 16:38
21	07:44 17:08	07:07 17:51	06:18 18:27	06:23 20:05	05:43 20:40	05:31 21:02	05:50 20:52	06:24 20:12	07:00 19:16	07:36 18:22	07:17 16:44	07:47 16:38
22	07:43 17:10	07:05 17:52	06:16 18:29	06:21 20:07	05:42 20:41	05:31 21:02	05:51 20:51	06:25 20:10	07:01 19:14	07:37 18:21	07:18 16:43	07:47 16:39
23	07:43 17:11	07:04 17:54	06:14 18:30	06:20 20:08	05:41 20:43	05:31 21:02	05:52 20:50	06:26 20:08	07:02 19:12	07:39 18:19	07:20 16:42	07:48 16:39
24	07:42 17:12	07:02 17:55	06:13 18:31	06:18 20:09	05:40 20:44	05:31 21:03	05:53 20:49	06:27 20:07	07:03 19:10	07:40 18:18	07:21 16:41	07:48 16:40
25	07:41 17:14	07:00 17:56	06:11 18:32	06:16 20:10	05:39 20:44	05:32 21:03	05:54 20:48	06:28 20:05	07:04 19:09	06:41 17:16	07:22 16:41	07:49 16:40
26	07:40 17:15	06:59 17:58	06:09 18:34	06:15 20:11	05:39 20:45	05:32 21:03	05:55 20:47	06:30 20:03	07:05 19:07	06:43 17:15	07:23 16:40	07:49 16:41
27	07:39 17:16	06:57 17:59	06:07 18:35	06:13 20:13	05:38 20:46	05:32 21:03	05:56 20:46	06:31 20:02	07:07 19:05	06:44 17:13	07:25 16:39	07:49 16:42
28	07:38 17:18	06:55 18:00	06:05 18:36	06:12 20:14	05:37 20:47	05:33 21:03	05:57 20:45	06:32 20:00	07:08 19:03	06:45 17:12	07:26 16:39	07:50 16:42
29	07:37 17:19		07:03 19:37	06:10 20:15	05:36 20:48	05:33 21:03	05:58 20:44	06:33 19:58	07:09 19:01	06:47 17:10	07:27 16:38	07:50 16:43
30	07:36 17:21		07:02 19:38	06:09 20:16	05:36 20:49	05:34 21:03	05:59 20:43	06:34 19:56	07:10 18:59	06:48 17:09	07:28 16:38	07:50 16:44
31	07:35 17:22		07:00 19:40		05:35 20:50		06:00 20:42	06:35 19:55		06:49 17:07		07:50 16:45
Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R14 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (8)
Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

January			February			March			April	May	June
1	07:50	09:21 (MC02)	07:34	09:19 (MC02)	06:54	08:07 (MC03)	06:58	06:07	05:34		
	16:46	58 10:19 (MC02)	17:23	69 10:28 (MC02)	18:02	1 08:08 (MC03)	19:41	20:17	20:51		
2	07:50	09:21 (MC02)	07:33	09:19 (MC02)	06:52	08:05 (MC03)	06:56	06:06	05:34		
	16:46	58 10:19 (MC02)	17:24	68 10:27 (MC02)	18:03	1 08:06 (MC03)	19:42	20:19	20:52		
3	07:51	09:21 (MC02)	07:32	09:20 (MC02)	06:50	08:02 (MC03)	06:54	06:04	05:33		
	16:47	59 10:20 (MC02)	17:26	67 10:27 (MC02)	18:04	3 08:05 (MC03)	19:43	20:20	20:52		
4	07:51	09:21 (MC02)	07:30	09:21 (MC02)	06:48	08:00 (MC03)	06:52	06:03	05:33		
	16:48	60 10:21 (MC02)	17:27	66 10:27 (MC02)	18:05	3 08:03 (MC03)	19:44	20:21	20:53		
5	07:50	09:20 (MC02)	07:29	09:21 (MC02)	06:47	07:59 (MC03)	06:50	06:01	05:32		
	16:49	60 10:20 (MC02)	17:29	64 10:25 (MC02)	18:07	3 08:02 (MC03)	19:46	20:22	20:54		
6	07:50	09:20 (MC02)	07:28	09:22 (MC02)	06:45	07:56 (MC03)	06:49	06:00	05:32		
	16:50	61 10:21 (MC02)	17:30	63 10:25 (MC02)	18:08	3 07:59 (MC03)	19:47	20:23	20:55		
7	07:50	09:20 (MC02)	07:27	09:23 (MC02)	06:43	07:54 (MC03)	06:47	05:59	05:32		
	16:51	62 10:22 (MC02)	17:31	61 10:24 (MC02)	18:09	1 07:55 (MC03)	19:48	20:25	20:55		
8	07:50	09:20 (MC02)	07:25	09:24 (MC02)	06:41		06:45	05:57	05:31		
	16:52	63 10:23 (MC02)	17:33	59 10:23 (MC02)	18:11		19:49	20:26	20:56		
9	07:50	09:19 (MC02)	07:24	09:25 (MC02)	06:40		06:43	05:56	05:31		
	16:53	64 10:23 (MC02)	17:34	57 10:22 (MC02)	18:12		19:51	20:27	20:57		
10	07:50	09:19 (MC02)	07:23	09:26 (MC02)	06:38		06:41	05:55	05:31		
	16:55	65 10:24 (MC02)	17:36	55 10:21 (MC02)	18:13		19:52	20:28	20:57		
11	07:49	09:19 (MC02)	07:21	09:27 (MC02)	06:36		06:40	05:54	05:30		
	16:56	66 10:25 (MC02)	17:37	52 10:19 (MC02)	18:15		19:53	20:29	20:58		
12	07:49	09:17 (MC02)	07:20	09:29 (MC02)	06:34		06:38	05:52	05:30		
	16:57	68 10:25 (MC02)	17:38	48 10:17 (MC02)	18:16		19:54	20:30	20:58		
13	07:49	09:17 (MC02)	07:19	09:30 (MC02)	06:32		06:36	05:51	05:30		
	16:58	69 10:26 (MC02)	17:40	45 10:15 (MC02)	18:17		19:55	20:32	20:59		
14	07:48	09:16 (MC02)	07:17	09:32 (MC02)	06:31		06:34	05:50	05:30		
	16:59	70 10:26 (MC02)	17:41	41 10:13 (MC02)	18:18		19:57	20:33	20:59		
15	07:48	09:16 (MC02)	07:16	09:34 (MC02)	06:29		06:33	05:49	05:30		
	17:00	71 10:27 (MC02)	17:43	36 10:10 (MC02)	18:20		19:58	20:34	21:00		
16	07:47	09:15 (MC02)	07:14	09:37 (MC02)	06:27		06:31	05:48	05:30		
	17:02	72 10:27 (MC02)	17:44	31 10:08 (MC02)	18:21		19:59	20:35	21:00		
17	07:47	09:14 (MC02)	07:13	09:39 (MC02)	06:25		06:29	05:47	05:30		
	17:03	73 10:27 (MC02)	17:45	24 10:03 (MC02)	18:22		20:00	20:36	21:01		
18	07:46	09:14 (MC02)	07:11	09:45 (MC02)	06:23		06:28	05:46	05:30		
	17:04	74 10:28 (MC02)	17:47	13 09:58 (MC02)	18:23		20:02	20:37	21:01		
19	07:45	09:14 (MC02)	07:10		06:22		06:26	05:45	05:30		
	17:05	74 10:28 (MC02)	17:48		18:25		20:03	20:38	21:01		
20	07:45	09:14 (MC02)	07:08		06:20		06:24	05:44	05:30		
	17:07	74 10:28 (MC02)	17:49		18:26		20:04	20:39	21:02		
21	07:44	09:14 (MC02)	07:07		06:18		06:23	05:43	05:30		
	17:08	74 10:28 (MC02)	17:51		18:27		20:05	20:40	21:02		
22	07:43	09:14 (MC02)	07:05		06:16		06:21	05:42	05:31		
	17:09	74 10:28 (MC02)	17:52		18:28		20:06	20:41	21:02		
23	07:42	09:16 (MC02)	07:03		06:14		06:19	05:41	05:31		
	17:11	73 10:29 (MC02)	17:54		18:30		20:08	20:42	21:02		
24	07:42	09:16 (MC02)	07:02		06:12		06:18	05:40	05:31		
	17:12	73 10:29 (MC02)	17:55		18:31		20:09	20:43	21:02		
25	07:41	09:16 (MC02)	07:00		06:10		06:16	05:39	05:31		
	17:13	73 10:29 (MC02)	17:56		18:32		20:10	20:44	21:03		
26	07:40	09:16 (MC02)	06:59		06:09		06:15	05:38	05:32		
	17:15	73 10:29 (MC02)	17:58		18:33		20:11	20:45	21:03		
27	07:39	09:17 (MC02)	06:57		06:07		06:13	05:38	05:32		
	17:16	72 10:29 (MC02)	17:59		18:35		20:13	20:46	21:03		
28	07:38	09:17 (MC02)	06:55		06:05		06:12	05:37	05:33		
	17:17	72 10:29 (MC02)	18:00		18:36		20:14	20:47	21:03		
29	07:37	09:18 (MC02)			07:03		06:10	05:36	05:33		
	17:19	71 10:29 (MC02)			19:37		20:15	20:48	21:03		
30	07:36	09:18 (MC02)			07:01		06:09	05:35	05:33		
	17:20	71 10:29 (MC02)			19:38		20:16	20:49	21:03		
31	07:35	09:18 (MC02)			06:59			05:35			
	17:22	70 10:28 (MC02)			19:39			20:50			
Potential sun hours	288		292		369		403	458	464		
Total, worst case	2117		919		15						
Sun reduction	0,27		0,32		0,38						
Oper. time red.	0,83		0,83		0,83						
Wind dir. red.	0,55		0,55		0,49						
Total reduction	0,12		0,15		0,15						
Total, real	259		134		2						

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

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R14 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (8)
Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	July	August	September	October	November	December
1	05:34 21:02	06:01 20:40	06:36 19:53	07:11 18:57	06:50 17:06	08:55 (MC02) 16:37
2	05:34 21:02	06:02 20:39	06:37 19:51	07:12 18:55	06:52 17:04	08:55 (MC02) 16:37
3	05:35 21:02	06:03 20:38	06:39 19:49	07:14 18:54	06:53 17:03	08:53 (MC02) 16:37
4	05:36 21:02	06:04 20:37	06:40 19:47	07:15 18:52	06:54 17:01	08:53 (MC02) 16:36
5	05:36 21:02	06:05 20:35	06:41 19:45	07:16 18:50	06:56 17:00	08:52 (MC02) 16:36
6	05:37 21:01	06:06 20:34	06:42 19:44	07:17 18:48	06:57 16:59	08:52 (MC02) 16:36
7	05:38 21:01	06:08 20:33	06:43 19:42	07:18 18:46	06:58 08:31 (MC03)	08:51 (MC02) 16:36
8	05:38 21:00	06:09 20:31	06:44 19:40	07:20 18:44	06:58 08:32 (MC03)	08:51 (MC02) 16:36
9	05:39 21:00	06:10 20:30	06:46 19:38	07:21 18:43	06:59 08:33 (MC03)	08:50 (MC02) 16:36
10	05:40 21:00	06:11 20:28	06:47 19:36	07:22 18:41	06:59 08:34 (MC03)	08:50 (MC02) 16:36
11	05:41 20:59	06:12 20:27	06:48 19:34	07:23 18:39	06:59 08:35 (MC03)	08:50 (MC02) 16:36
12	05:41 20:59	06:13 20:26	06:49 19:33	07:25 18:37	06:59 08:36 (MC03)	08:50 (MC02) 16:36
13	05:42 20:58	06:14 20:24	06:50 19:31	07:26 18:36	06:59 08:37 (MC03)	08:50 (MC02) 16:36
14	05:43 20:57	06:15 20:23	06:51 19:29	07:27 18:34	06:59 08:38 (MC03)	08:50 (MC02) 16:36
15	05:44 20:57	06:17 20:21	06:52 19:27	07:28 18:32	06:59 08:39 (MC03)	08:50 (MC02) 16:36
16	05:45 20:56	06:18 20:19	06:54 19:25	07:30 18:31	06:59 08:40 (MC03)	08:50 (MC02) 16:36
17	05:46 20:55	06:19 20:18	06:55 19:23	07:31 18:29	06:59 08:41 (MC03)	08:50 (MC02) 16:36
18	05:47 20:54	06:20 20:16	06:56 19:21	07:32 18:27	06:59 08:42 (MC03)	08:50 (MC02) 16:36
19	05:47 20:54	06:21 20:15	06:57 19:20	07:33 18:25	06:59 08:43 (MC03)	08:50 (MC02) 16:36
20	05:48 20:53	06:22 20:13	06:58 19:18	07:35 18:24	06:59 08:44 (MC03)	08:50 (MC02) 16:36
21	05:49 20:52	06:24 20:11	06:59 19:16	07:36 18:22	06:59 08:45 (MC03)	08:50 (MC02) 16:36
22	05:50 20:51	06:25 20:10	07:01 19:14	07:37 18:21	06:59 08:46 (MC03)	08:50 (MC02) 16:36
23	05:51 20:50	06:26 20:08	07:02 19:12	07:38 18:19	06:59 08:47 (MC03)	08:50 (MC02) 16:36
24	05:52 20:49	06:27 20:06	07:03 19:10	07:40 18:17	06:59 08:48 (MC03)	08:50 (MC02) 16:36
25	05:53 20:48	06:28 20:05	07:04 19:08	07:41 18:16	06:59 08:49 (MC03)	08:50 (MC02) 16:36
26	05:54 20:47	06:29 20:03	07:05 19:06	07:42 18:14	06:59 08:50 (MC03)	08:50 (MC02) 16:36
27	05:55 20:46	06:31 20:01	07:06 19:05	07:44 18:13	06:59 08:51 (MC03)	08:50 (MC02) 16:36
28	05:56 20:45	06:32 20:00	07:08 19:03	07:45 18:11	06:59 08:52 (MC03)	08:50 (MC02) 16:36
29	05:58 20:44	06:33 19:58	07:09 19:01	07:46 18:10	06:59 08:53 (MC03)	08:50 (MC02) 16:36
30	05:59 20:43	06:34 19:56	07:10 18:59	07:48 18:08	06:59 08:54 (MC03)	08:50 (MC02) 16:36
31	06:00 20:42	06:35 19:54	07:11 18:57	07:49 18:07	06:59 08:55 (MC03)	08:50 (MC02) 16:36
Potential sun hours	470	434	376	342	290	277
Total, worst case				317	2070	1774
Sun reduction				0,44	0,30	0,29
Oper. time red.				0,83	0,83	0,83
Wind dir. red.				0,55	0,55	0,55
Total reduction				0,20	0,14	0,13
Total, real				64	288	232

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

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R15 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (9)
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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

January		February		March		April	May	June
1	07:51	08:44 (MC02)	07:34	08:43 (MC01)	06:54	06:58	06:07	05:34
	16:46	8 08:52 (MC02)	17:23	44 09:27 (MC01)	18:02	19:41	20:17	20:51
2	07:51	08:44 (MC02)	07:33	08:43 (MC01)	06:52	06:56	06:06	05:34
	16:46	8 08:52 (MC02)	17:24	44 09:27 (MC01)	18:03	19:42	20:19	20:52
3	07:51	08:44 (MC02)	07:32	08:43 (MC01)	06:50	06:54	06:04	05:33
	16:47	9 08:53 (MC02)	17:26	45 09:28 (MC01)	18:04	19:43	20:20	20:52
4	07:51	08:44 (MC02)	07:30	08:43 (MC01)	06:48	06:52	06:03	05:33
	16:48	9 08:53 (MC02)	17:27	46 09:29 (MC01)	18:06	19:44	20:21	20:53
5	07:51	08:44 (MC02)	07:29	08:42 (MC01)	06:47	06:50	06:01	05:32
	16:49	10 08:54 (MC02)	17:29	46 09:28 (MC01)	18:07	19:46	20:22	20:54
6	07:50	08:43 (MC02)	07:28	08:43 (MC01)	06:45	06:49	06:00	05:32
	16:50	10 08:53 (MC02)	17:30	46 09:29 (MC01)	18:08	19:47	20:23	20:55
7	07:50	08:43 (MC02)	07:27	08:43 (MC01)	06:43	06:47	05:59	05:32
	16:51	11 08:54 (MC02)	17:31	46 09:29 (MC01)	18:09	19:48	20:25	20:55
8	07:50	08:43 (MC02)	07:26	08:42 (MC01)	06:41	06:45	05:57	05:31
	16:52	11 08:54 (MC02)	17:33	47 09:29 (MC01)	18:11	19:49	20:26	20:56
9	07:50	08:42 (MC02)	07:24	08:43 (MC01)	06:40	06:43	05:56	05:31
	16:54	12 08:54 (MC02)	17:34	46 09:29 (MC01)	18:12	19:51	20:27	20:57
10	07:50	08:42 (MC02)	07:23	08:43 (MC01)	06:38	06:42	05:55	05:31
	16:55	12 08:54 (MC02)	17:36	47 09:30 (MC01)	18:13	19:52	20:28	20:57
11	07:49	08:42 (MC02)	07:22	08:43 (MC01)	06:36	06:40	05:54	05:31
	16:56	13 08:55 (MC02)	17:37	46 09:29 (MC01)	18:15	19:53	20:29	20:58
12	07:49	08:41 (MC02)	07:20	08:43 (MC01)	06:34	06:38	05:52	05:30
	16:57	13 08:54 (MC02)	17:38	46 09:29 (MC01)	18:16	19:54	20:30	20:59
13	07:49	08:41 (MC02)	07:19	08:43 (MC01)	06:32	06:36	05:51	05:30
	16:58	13 08:54 (MC02)	17:40	45 09:28 (MC01)	18:17	19:55	20:32	20:59
14	07:48	08:40 (MC02)	07:17	08:44 (MC01)	06:31	06:35	05:50	05:30
	16:59	14 08:54 (MC02)	17:41	44 09:28 (MC01)	18:18	19:57	20:33	21:00
15	07:48	08:41 (MC02)	07:16	08:44 (MC01)	06:29	06:33	05:49	05:30
	17:00	13 08:54 (MC02)	17:43	43 09:27 (MC01)	18:20	19:58	20:34	21:00
16	07:47	08:42 (MC02)	07:14	08:45 (MC01)	06:27	06:31	05:48	05:30
	17:02	10 08:52 (MC02)	17:44	41 09:26 (MC01)	18:21	19:59	20:35	21:00
17	07:47	08:43 (MC02)	07:13	08:46 (MC01)	06:25	06:29	05:47	05:30
	17:03	8 08:51 (MC02)	17:45	39 09:25 (MC01)	18:22	20:00	20:36	21:01
18	07:46		07:11	08:47 (MC01)	06:23	06:28	05:46	05:30
	17:04		17:47	37 09:24 (MC01)	18:23	20:02	20:37	21:01
19	07:45	08:57 (MC01)	07:10	08:48 (MC01)	06:22	06:26	05:45	05:30
	17:06	11 09:08 (MC01)	17:48	34 09:22 (MC01)	18:25	20:03	20:38	21:02
20	07:45	08:54 (MC01)	07:08	08:49 (MC01)	06:20	06:24	05:44	05:30
	17:07	17 09:11 (MC01)	17:49	32 09:21 (MC01)	18:26	20:04	20:39	21:02
21	07:44	08:52 (MC01)	07:07	08:51 (MC01)	06:18	06:23	05:43	05:30
	17:08	21 09:13 (MC01)	17:51	28 09:19 (MC01)	18:27	20:05	20:40	21:02
22	07:43	08:51 (MC01)	07:05	08:52 (MC01)	06:16	06:21	05:42	05:31
	17:09	25 09:16 (MC01)	17:52	24 09:16 (MC01)	18:28	20:06	20:41	21:02
23	07:42	08:50 (MC01)	07:04	08:55 (MC01)	06:14	06:19	05:41	05:31
	17:11	28 09:18 (MC01)	17:54	19 09:14 (MC01)	18:30	20:08	20:42	21:02
24	07:42	08:49 (MC01)	07:02	08:59 (MC01)	06:12	06:18	05:40	05:31
	17:12	30 09:19 (MC01)	17:55	10 09:09 (MC01)	18:31	20:09	20:43	21:03
25	07:41	08:48 (MC01)	07:00		06:11	06:16	05:39	05:31
	17:13	32 09:20 (MC01)	17:56		18:32	20:10	20:44	21:03
26	07:40	08:47 (MC01)	06:59		06:09	06:15	05:38	05:32
	17:15	35 09:22 (MC01)	17:58		18:33	20:11	20:45	21:03
27	07:39	08:46 (MC01)	06:57		06:07	06:13	05:38	05:32
	17:16	37 09:23 (MC01)	17:59		18:35	20:13	20:46	21:03
28	07:38	08:46 (MC01)	06:55		06:05	06:12	05:37	05:33
	17:18	38 09:24 (MC01)	18:00		18:36	20:14	20:47	21:03
29	07:37	08:45 (MC01)			07:03	06:10	05:36	05:33
	17:19	40 09:25 (MC01)			19:37	20:15	20:48	21:03
30	07:36	08:45 (MC01)			07:01	06:09	05:36	05:33
	17:20	41 09:26 (MC01)			19:38	20:16	20:49	21:03
31	07:35	08:45 (MC01)			07:00		05:35	
	17:22	42 09:27 (MC01)			19:40		20:50	
Potential sun hours	288		292		369	403	458	464
Total, worst case	581		945					
Sun reduction	0,27		0,32					
Oper. time red.	0,83		0,83					
Wind dir. red.	0,52		0,52					
Total reduction	0,11		0,14					
Total, real	66		129					

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

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R15 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (9)
Assumptions for shadow calculations 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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	July	August	September	October	November	December
1	05:34	06:01	06:36	07:11	06:50	08:12 (MC01) 07:29
	21:02	20:40	19:53	18:57	17:06	46 08:58 (MC01) 16:37
2	05:35	06:02	06:38	07:12	06:52	08:12 (MC01) 07:30
	21:02	20:39	19:51	18:55	17:04	47 08:59 (MC01) 16:37
3	05:35	06:03	06:39	07:14	06:53	08:12 (MC01) 07:31
	21:02	20:38	19:49	18:54	17:03	47 08:59 (MC01) 16:37
4	05:36	06:04	06:40	07:15	06:54	08:13 (MC01) 07:33
	21:02	20:37	19:47	18:52	17:02	46 08:59 (MC01) 16:36
5	05:36	06:05	06:41	07:16	06:56	08:12 (MC01) 07:34
	21:02	20:35	19:45	18:50	17:00	47 08:59 (MC01) 16:36
6	05:37	06:06	06:42	07:17	06:57	08:13 (MC01) 07:35
	21:01	20:34	19:44	18:48	16:59	46 08:59 (MC01) 16:36
7	05:38	06:08	06:43	07:18	06:58	08:13 (MC01) 07:36
	21:01	20:33	19:42	18:46	16:58	46 08:59 (MC01) 16:36
8	05:38	06:09	06:44	07:20	07:00	08:13 (MC01) 07:37
	21:01	20:31	19:40	18:45	16:56	45 08:58 (MC01) 16:36
9	05:39	06:10	06:46	07:21	07:01	08:14 (MC01) 07:38
	21:00	20:30	19:38	18:43	16:55	44 08:58 (MC01) 16:36
10	05:40	06:11	06:47	07:22	07:02	08:14 (MC01) 07:39
	21:00	20:29	19:36	18:41	16:54	43 08:57 (MC01) 16:36
11	05:41	06:12	06:48	07:23	07:04	08:16 (MC01) 07:39
	20:59	20:27	19:34	18:39	16:53	42 08:58 (MC01) 16:36
12	05:41	06:13	06:49	07:25	07:05	08:16 (MC01) 07:40
	20:59	20:26	19:33	18:37	16:52	41 08:57 (MC01) 16:36
13	05:42	06:14	06:50	07:26	07:07	08:17 (MC01) 07:41
	20:58	20:24	19:31	18:36	16:51	40 08:57 (MC01) 16:36
14	05:43	06:16	06:51	07:27	07:08	08:18 (MC01) 07:42
	20:57	20:23	19:29	18:34	16:50	38 08:56 (MC01) 16:36
15	05:44	06:17	06:52	07:28	07:09	08:19 (MC01) 07:43
	20:57	20:21	19:27	18:32	16:49	37 08:56 (MC01) 16:36
16	05:45	06:18	06:54	07:30	07:10	08:20 (MC01) 07:44
	20:56	20:20	19:25	18:31	16:48	35 08:55 (MC01) 16:36
17	05:46	06:19	06:55	07:31	07:12	08:21 (MC01) 07:44
	20:55	20:18	19:23	18:29	16:47	32 08:53 (MC01) 16:36
18	05:47	06:20	06:56	07:32	09:29 (MC01) 07:13	08:23 (MC01) 07:45
	20:55	20:16	19:21	18:27	16:46	30 08:53 (MC01) 16:37
19	05:47	06:21	06:57	07:33	09:25 (MC01) 07:14	08:24 (MC01) 07:46
	20:54	20:15	19:20	18:26	16:45	28 08:52 (MC01) 16:37
20	05:48	06:22	06:58	07:35	09:23 (MC01) 07:16	08:26 (MC01) 07:46
	20:53	20:13	19:18	18:24	16:44	25 08:51 (MC01) 16:38
21	05:49	06:24	06:59	07:36	09:21 (MC01) 07:17	08:28 (MC01) 07:47
	20:52	20:12	19:16	18:22	16:43	21 08:49 (MC01) 16:38
22	05:50	06:25	07:01	07:37	09:19 (MC01) 07:18	08:30 (MC01) 07:47
	20:51	20:10	19:14	18:21	16:43	17 08:47 (MC01) 16:38
23	05:51	06:26	07:02	07:39	09:18 (MC01) 07:20	08:34 (MC01) 07:48
	20:50	20:08	19:12	18:19	16:42	11 08:45 (MC01) 16:39
24	05:52	06:27	07:03	07:40	09:16 (MC01) 07:21	08:36 (MC01) 07:48
	20:49	20:07	19:10	18:17	16:41	10 08:44 (MC01) 16:40
25	05:53	06:28	07:04	06:41	08:16 (MC01) 07:22	08:22 (MC02) 07:49
	20:48	20:05	19:08	17:16	16:40	7 08:29 (MC02) 16:40
26	05:54	06:29	07:05	06:42	08:15 (MC01) 07:23	08:21 (MC02) 07:49
	20:47	20:03	19:07	17:14	16:40	10 08:31 (MC02) 16:41
27	05:55	06:31	07:06	06:44	08:14 (MC01) 07:25	08:20 (MC02) 07:49
	20:46	20:01	19:05	17:13	16:39	13 08:33 (MC02) 16:41
28	05:57	06:32	07:08	06:45	08:14 (MC01) 07:26	08:20 (MC02) 07:50
	20:45	20:00	19:03	17:11	16:39	14 08:34 (MC02) 16:42
29	05:58	06:33	07:09	06:46	08:13 (MC01) 07:27	08:21 (MC02) 07:50
	20:44	19:58	19:01	17:10	16:38	13 08:34 (MC02) 16:43
30	05:59	06:34	07:10	06:48	08:13 (MC01) 07:28	08:22 (MC02) 07:50
	20:43	19:56	18:59	17:08	16:38	13 08:35 (MC02) 16:44
31	06:00	06:35		06:49	08:12 (MC01)	07:50
	20:42	19:54		17:07	08:59 (MC01)	16:44
Potential sun hours	470	434	376	342	290	277
Total, worst case				499	924	230
Sun reduction				0,44	0,30	0,29
Oper. time red.				0,83	0,83	0,83
Wind dir. red.				0,52	0,52	0,52
Total reduction				0,19	0,13	0,12
Total, real				94	120	28

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

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R16 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (10)
Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June
1	07:50 16:46	07:34 17:23	06:54 18:02	06:58 19:41	08:29 (MC01) 09:35 (MC01)	06:07 20:17
2	07:51 16:46	07:33 17:24	06:52 18:03	06:56 19:42	08:27 (MC01) 09:36 (MC01)	06:06 20:19
3	07:51 16:47	07:32 17:26	06:50 18:04	06:54 19:43	08:27 (MC01) 09:37 (MC01)	06:04 20:20
4	07:51 16:48	07:30 17:27	06:48 18:06	06:52 19:44	08:26 (MC01) 09:37 (MC01)	06:03 20:21
5	07:51 16:49	07:29 17:29	06:47 18:07	06:50 19:46	08:24 (MC01) 09:37 (MC01)	06:01 20:22
6	07:50 16:50	07:28 17:30	06:45 18:08	06:49 19:47	08:23 (MC01) 09:37 (MC01)	06:00 20:23
7	07:50 16:51	07:27 17:31	06:43 18:09	06:47 19:48	08:22 (MC01) 09:37 (MC01)	05:59 20:25
8	07:50 16:52	07:25 17:33	06:41 18:11	06:45 19:49	08:22 (MC01) 09:37 (MC01)	05:57 20:26
9	07:50 16:54	07:24 17:34	06:40 18:12	06:43 19:51	08:21 (MC01) 09:37 (MC01)	05:56 20:27
10	07:50 16:55	07:23 17:36	06:38 18:13	06:42 19:52	08:20 (MC01) 09:37 (MC01)	05:55 20:28
11	07:49 16:56	07:21 17:37	06:36 18:15	06:40 19:53	08:19 (MC01) 09:36 (MC01)	05:54 20:29
12	07:49 16:57	07:20 17:38	06:34 18:16	06:38 19:54	08:19 (MC01) 09:36 (MC01)	05:52 20:30
13	07:49 16:58	07:19 17:40	06:32 18:17	06:36 19:55	08:19 (MC01) 09:36 (MC01)	05:51 20:32
14	07:48 16:59	07:17 17:41	06:31 18:18	06:35 19:57	08:18 (MC01) 09:35 (MC01)	05:50 20:33
15	07:48 17:00	07:16 17:43	06:29 18:20	06:33 19:58	08:17 (MC01) 09:34 (MC01)	05:49 20:34
16	07:47 17:02	07:14 17:44	06:27 18:21	06:31 19:59	08:18 (MC01) 09:34 (MC01)	05:48 20:35
17	07:47 17:03	07:13 17:45	06:25 18:22	06:29 20:00	08:17 (MC01) 09:33 (MC01)	05:47 20:36
18	07:46 17:04	07:11 17:47	06:23 18:23	06:28 20:02	08:17 (MC01) 09:32 (MC01)	05:46 20:37
19	07:45 17:06	07:10 17:48	06:22 18:25	06:26 20:03	08:17 (MC01) 09:32 (MC01)	05:45 20:38
20	07:45 17:07	07:08 17:49	06:20 18:26	06:24 20:04	08:17 (MC01) 09:31 (MC01)	05:44 20:39
21	07:44 17:08	07:07 17:51	06:18 18:27	06:23 20:05	08:17 (MC01) 09:31 (MC01)	05:43 20:40
22	07:43 17:09	07:05 17:52	06:16 18:28	06:21 20:06	08:17 (MC01) 09:30 (MC01)	05:42 20:41
23	07:42 17:11	07:04 17:54	06:14 18:30	06:19 20:08	08:16 (MC01) 09:28 (MC01)	05:41 20:42
24	07:42 17:12	07:02 17:55	06:12 18:31	06:18 20:09	08:17 (MC01) 09:28 (MC01)	05:40 20:43
25	07:41 17:13	07:00 17:56	06:11 18:32	06:16 20:10	08:17 (MC01) 09:27 (MC01)	05:39 20:44
26	07:40 17:15	06:59 17:58	06:09 18:33	06:15 20:11	08:18 (MC01) 09:26 (MC01)	05:38 20:45
27	07:39 17:16	06:57 17:59	06:07 18:35	06:13 20:13	08:17 (MC01) 09:25 (MC01)	05:38 20:46
28	07:38 17:18	06:55 18:00	06:05 18:36	06:12 20:14	08:18 (MC01) 09:24 (MC01)	05:37 20:47
29	07:37 17:19		07:03 19:37	06:10 20:15	08:18 (MC01) 09:22 (MC01)	05:36 20:48
30	07:36 17:20		07:01 19:38	06:09 20:16	08:19 (MC01) 09:22 (MC01)	05:36 20:49
31	07:35 17:22		07:00 19:40	06:08 09:35 (MC01)		05:35 20:50
Potential sun hours	288	292	369	403	458	464
Total, worst case			506	2176	667	
Sun reduction			0,38	0,43	0,49	
Oper. time red.			0,83	0,83	0,83	
Wind dir. red.			0,51	0,51	0,51	
Total reduction			0,16	0,18	0,20	
Total, real			81	393	137	

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R16 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (10)
Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

July		August		September		October		November		December	
1	05:34	06:01	08:40 (MC01)	06:36	08:18 (MC01)	07:11	06:50	07:29			
	21:02	20:40	34 09:14 (MC01)	19:53	77 09:35 (MC01)	18:57	17:06	16:37			
2	05:35	06:02	08:39 (MC01)	06:37	08:19 (MC01)	07:12	06:52	07:30			
	21:02	20:39	38 09:17 (MC01)	19:51	77 09:36 (MC01)	18:55	17:04	16:37			
3	05:35	06:03	08:38 (MC01)	06:39	08:19 (MC01)	07:14	06:53	07:31			
	21:02	20:38	41 09:19 (MC01)	19:49	76 09:35 (MC01)	18:54	17:03	16:37			
4	05:36	06:04	08:36 (MC01)	06:40	08:19 (MC01)	07:15	06:54	07:33			
	21:02	20:37	44 09:20 (MC01)	19:47	75 09:34 (MC01)	18:52	17:02	16:36			
5	05:36	06:05	08:35 (MC01)	06:41	08:19 (MC01)	07:16	06:56	07:34			
	21:02	20:35	47 09:22 (MC01)	19:45	75 09:34 (MC01)	18:50	17:00	16:36			
6	05:37	06:06	08:34 (MC01)	06:42	08:19 (MC01)	07:17	06:57	07:35			
	21:01	20:34	49 09:23 (MC01)	19:44	74 09:33 (MC01)	18:48	16:59	16:36			
7	05:38	06:08	08:33 (MC01)	06:43	08:19 (MC01)	07:18	06:58	07:36			
	21:01	20:33	51 09:24 (MC01)	19:42	73 09:32 (MC01)	18:46	16:58	16:36			
8	05:38	06:09	08:31 (MC01)	06:44	08:20 (MC01)	07:20	07:00	07:37			
	21:01	20:31	54 09:25 (MC01)	19:40	71 09:31 (MC01)	18:45	16:56	16:36			
9	05:39	06:10	08:30 (MC01)	06:46	08:20 (MC01)	07:21	07:01	07:38			
	21:00	20:30	56 09:26 (MC01)	19:38	70 09:30 (MC01)	18:43	16:55	16:36			
10	05:40	06:11	08:29 (MC01)	06:47	08:20 (MC01)	07:22	07:02	07:39			
	21:00	20:29	58 09:27 (MC01)	19:36	69 09:29 (MC01)	18:41	16:54	16:36			
11	05:41	06:12	08:28 (MC01)	06:48	08:21 (MC01)	07:23	07:04	07:39			
	20:59	20:27	60 09:28 (MC01)	19:34	67 09:28 (MC01)	18:39	16:53	16:36			
12	05:41	06:13	08:27 (MC01)	06:49	08:22 (MC01)	07:25	07:05	07:40			
	20:59	20:26	62 09:29 (MC01)	19:33	65 09:27 (MC01)	18:37	16:52	16:36			
13	05:42	06:14	08:27 (MC01)	06:50	08:23 (MC01)	07:26	07:06	07:41			
	20:58	20:24	62 09:29 (MC01)	19:31	63 09:26 (MC01)	18:36	16:51	16:36			
14	05:43	06:16	08:27 (MC01)	06:51	08:24 (MC01)	07:27	07:08	07:42			
	20:57	20:23	64 09:31 (MC01)	19:29	60 09:24 (MC01)	18:34	16:50	16:36			
15	05:44	06:17	08:26 (MC01)	06:52	08:25 (MC01)	07:28	07:09	07:43			
	20:57	20:21	66 09:32 (MC01)	19:27	57 09:22 (MC01)	18:32	16:49	16:36			
16	05:45	06:18	08:25 (MC01)	06:54	08:26 (MC01)	07:30	07:10	07:44			
	20:56	20:20	67 09:32 (MC01)	19:25	54 09:20 (MC01)	18:31	16:48	16:36			
17	05:46	06:19	08:24 (MC01)	06:55	08:27 (MC01)	07:31	07:12	07:44			
	20:55	20:18	69 09:33 (MC01)	19:23	51 09:18 (MC01)	18:29	16:47	16:36			
18	05:47	06:20	08:24 (MC01)	06:56	08:29 (MC01)	07:32	07:13	07:45			
	20:55	20:16	69 09:33 (MC01)	19:21	46 09:15 (MC01)	18:27	16:46	16:37			
19	05:47	06:21	08:23 (MC01)	06:57	08:31 (MC01)	07:33	07:14	07:46			
	20:54	20:15	71 09:34 (MC01)	19:20	41 09:12 (MC01)	18:26	16:45	16:37			
20	05:48	06:22	08:22 (MC01)	06:58	08:34 (MC01)	07:35	07:16	07:46			
	20:53	20:13	72 09:34 (MC01)	19:18	36 09:10 (MC01)	18:24	16:44	16:38			
21	05:49	06:24	08:22 (MC01)	06:59	08:37 (MC01)	07:36	07:17	07:47			
	20:52	20:12	73 09:35 (MC01)	19:16	29 09:06 (MC01)	18:22	16:43	16:38			
22	05:50	06:25	08:21 (MC01)	07:01	08:42 (MC01)	07:37	07:18	07:47			
	20:51	20:10	74 09:35 (MC01)	19:14	18 09:00 (MC01)	18:21	16:43	16:38			
23	05:51	06:26	08:20 (MC01)	07:02		07:39	07:20	07:48			
	20:50	20:08	75 09:35 (MC01)	19:12		18:19	16:42	16:39			
24	05:52	06:27	08:21 (MC01)	07:03		07:40	07:21	07:48			
	20:49	20:07	75 09:36 (MC01)	19:10		18:17	16:41	16:40			
25	05:53	06:28	08:20 (MC01)	07:04		06:41	07:22	07:49			
	20:48	20:05	76 09:36 (MC01)	19:08		17:16	16:40	16:40			
26	05:54	06:29	08:20 (MC01)	07:05		06:42	07:23	07:49			
	20:47	20:03	76 09:36 (MC01)	19:06		17:14	16:40	16:41			
27	05:55	08:56 (MC01)	06:31	08:20 (MC01)	07:06	06:44	07:25	07:49			
	20:46	1 08:57 (MC01)	20:01	09:36 (MC01)	19:05	17:13	16:39	16:41			
28	05:57	08:49 (MC01)	06:32	08:19 (MC01)	07:08	06:45	07:26	07:50			
	20:45	16 09:05 (MC01)	20:00	09:36 (MC01)	19:03	17:11	16:39	16:42			
29	05:58	08:46 (MC01)	06:33	08:19 (MC01)	07:09	06:46	07:27	07:50			
	20:44	22 09:08 (MC01)	19:58	09:36 (MC01)	19:01	17:10	16:38	16:43			
30	05:59	08:44 (MC01)	06:34	08:19 (MC01)	07:10	06:48	07:28	07:50			
	20:43	26 09:10 (MC01)	19:56	09:36 (MC01)	18:59	17:08	16:38	16:44			
31	06:00	08:42 (MC01)	06:35	08:18 (MC01)		06:49		07:50			
	20:42	31 09:13 (MC01)	19:54	09:35 (MC01)		17:07		16:44			
Potential sun hours	470		434	376		342	290	277			
Total, worst case	96		1967	1324							
Sun reduction	0,62		0,60	0,53							
Oper. time red.	0,83		0,83	0,83							
Wind dir. red.	0,51		0,51	0,51							
Total reduction	0,26		0,25	0,22							
Total, real	25		497	297							

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

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

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R18 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (11)
Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:50 16:46	07:34 17:23	06:53 18:01	06:58 19:41	06:07 20:17	05:34 20:51	05:34 21:02	06:01 20:40	06:36 19:53	07:11 18:57	06:50 17:06	07:29 16:37
2	07:50 16:46	07:33 17:24	06:52 18:03	06:56 19:42	06:06 20:19	05:34 20:52	05:34 21:02	06:02 20:39	06:37 19:51	07:12 18:55	06:52 17:04	07:30 16:37
3	07:50 16:47	07:32 17:26	06:50 18:04	06:54 19:43	06:04 20:20	05:33 20:52	05:35 21:02	06:03 20:38	06:39 19:49	07:14 18:53	06:53 17:03	07:31 16:37
4	07:50 16:48	07:30 17:27	06:48 18:05	06:52 19:44	06:03 20:21	05:33 20:53	05:36 21:02	06:04 20:37	06:40 19:47	07:15 18:52	06:54 17:01	07:32 16:36
5	07:50 16:49	07:29 17:29	06:47 18:07	06:50 19:46	06:01 20:22	05:32 20:54	05:36 21:01	06:05 20:35	06:41 19:45	07:16 18:50	06:56 17:00	07:33 16:36
6	07:50 16:50	07:28 17:30	06:45 18:08	06:49 19:47	06:00 20:23	05:32 20:55	05:37 21:01	06:06 20:34	06:42 19:44	07:17 18:48	06:57 16:59	07:35 16:36
7	07:50 16:51	07:27 17:31	06:43 18:09	06:47 19:48	05:59 20:24	05:32 20:55	05:38 21:01	06:07 20:33	06:43 19:42	07:18 18:46	06:58 16:58	07:36 16:36
8	07:50 16:52	07:25 17:33	06:41 18:11	06:45 19:49	05:57 20:26	05:31 20:56	05:38 21:00	06:09 20:31	06:44 19:40	07:20 18:44	07:00 16:56	07:37 16:36
9	07:50 16:53	07:24 17:34	06:40 18:12	06:43 19:50	05:56 20:27	05:31 20:57	05:39 21:00	06:10 20:30	06:45 19:38	07:21 18:43	07:01 16:55	07:37 16:35
10	07:49 16:55	07:23 17:36	06:38 18:13	06:41 19:52	05:55 20:28	05:31 20:57	05:40 20:59	06:11 20:28	06:47 19:36	07:22 18:41	07:02 16:54	07:38 16:35
11	07:49 16:56	07:21 17:37	06:36 18:14	06:40 19:53	05:54 20:29	05:30 20:58	05:41 20:59	06:12 20:27	06:48 19:34	07:23 18:39	07:04 16:53	07:39 16:35
12	07:49 16:57	07:20 17:38	06:34 18:16	06:38 19:54	05:52 20:30	05:30 20:58	05:41 20:58	06:13 20:25	06:49 19:33	07:24 18:37	07:05 16:52	07:40 16:36
13	07:48 16:58	07:19 17:40	06:32 18:17	06:36 19:55	05:51 20:31	05:30 20:59	05:42 20:58	06:14 20:24	06:50 19:31	07:26 18:36	07:06 16:51	07:41 16:36
14	07:48 16:59	07:17 17:41	06:31 18:18	06:34 19:57	05:50 20:33	05:30 20:59	05:43 20:57	06:15 20:23	06:51 19:29	07:27 18:34	07:08 16:50	07:42 16:36
15	07:48 17:00	07:16 17:43	06:29 18:20	06:33 19:58	05:49 20:34	05:30 21:00	05:44 20:57	06:17 20:21	06:52 19:27	07:28 18:32	07:09 16:49	07:43 16:36
16	07:47 17:02	07:14 17:44	06:27 18:21	06:31 19:59	05:48 20:35	05:30 21:00	05:45 20:56	06:18 20:19	06:54 19:25	07:29 18:30	07:10 16:48	07:43 16:36
17	07:46 17:03	07:13 17:45	06:25 18:22	06:29 20:00	05:47 20:36	05:30 21:01	05:46 20:55	06:19 20:18	06:55 19:23	07:31 18:29	07:12 16:47	07:44 16:36
18	07:46 17:04	07:11 17:47	06:23 18:23	06:28 20:01	05:46 20:37	05:30 21:01	05:46 20:54	06:20 20:16	06:56 19:21	07:32 18:27	07:13 16:46	07:45 16:37
19	07:45 17:05	07:10 17:48	06:21 18:25	06:26 20:03	05:45 20:38	05:30 21:01	05:47 20:54	06:21 20:15	06:57 19:19	07:33 18:25	07:14 16:45	07:45 16:37
20	07:45 17:07	07:08 17:49	06:20 18:26	06:24 20:04	05:44 20:39	05:30 21:02	05:48 20:53	06:22 20:13	06:58 19:18	07:35 18:24	07:16 16:44	07:46 16:37
21	07:44 17:08	07:07 17:51	06:18 18:27	06:23 20:05	05:43 20:40	05:30 21:02	05:49 20:52	06:24 20:11	06:59 19:16	07:36 18:22	07:17 16:43	07:47 16:38
22	07:43 17:09	07:05 17:52	06:16 18:28	06:21 20:06	05:42 20:41	05:31 21:02	05:50 20:51	06:25 20:10	07:01 19:14	07:37 18:21	07:18 16:42	07:47 16:38
23	07:42 17:11	07:03 17:53	06:14 18:30	06:19 20:08	05:41 20:42	05:31 21:02	05:51 20:50	06:26 20:08	07:02 19:12	07:38 18:19	07:19 16:42	07:48 16:39
24	07:42 17:12	07:02 17:55	06:12 18:31	06:18 20:09	05:40 20:43	05:31 21:02	05:52 20:49	06:27 20:06	07:03 19:10	07:40 18:17	07:21 16:41	07:48 16:39
25	07:41 17:13	07:00 17:56	06:10 18:32	06:16 20:10	05:39 20:44	05:31 21:03	05:53 20:48	06:28 20:05	07:04 19:08	06:41 17:16	07:22 16:40	07:49 16:40
26	07:40 17:15	06:59 17:58	06:09 18:33	06:15 20:11	05:38 20:45	05:32 21:03	05:54 20:47	06:29 20:03	07:05 19:06	06:42 17:14	07:23 16:40	07:49 16:41
27	07:39 17:16	06:57 17:59	06:07 18:35	06:13 20:12	05:38 20:46	05:32 21:03	05:55 20:46	06:30 20:01	07:06 19:05	06:44 17:13	07:24 16:39	07:49 16:41
28	07:38 17:17	06:55 18:00	06:05 18:36	06:12 20:14	05:37 20:47	05:33 21:03	05:56 20:45	06:32 20:00	07:08 19:03	06:45 17:11	07:26 16:39	07:50 16:42
29	07:37 17:19		07:03 19:37	06:10 20:15	05:36 20:48	05:33 21:03	05:58 20:44	06:33 19:58	07:09 19:01	06:46 17:10	07:27 16:38	07:50 16:43
30	07:36 17:20		07:01 19:38	06:09 20:16	05:35 20:49	05:33 21:02	05:59 20:43	06:34 19:56	07:10 18:59	06:48 17:08	07:28 16:38	07:50 16:44
31	07:35 17:22		06:59 19:39		05:35 20:50		06:00 20:42	06:35 19:54		06:49 17:07		07:50 16:44
Potential sun hours	288	292	369	403	458	464	470	434	376	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R19 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (12)
Assumptions for shadow calculations 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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:50 16:46	07:34 17:23	06:53 18:01	06:58 19:41	06:07 20:17	05:34 20:51	05:34 21:02	06:01 20:40	06:36 19:53	07:11 18:57	06:50 17:06	07:29 16:37
2	07:50 16:46	07:33 17:24	06:52 18:03	06:56 19:42	06:06 20:18	05:34 20:52	05:34 21:02	06:02 20:39	06:37 19:51	07:12 18:55	06:52 17:04	07:30 16:37
3	07:50 16:47	07:31 17:26	06:50 18:04	06:54 19:43	06:04 20:20	05:33 20:52	05:35 21:02	06:03 20:38	06:39 19:49	07:13 18:53	06:53 17:03	07:31 16:37
4	07:50 16:48	07:30 17:27	06:48 18:05	06:52 19:44	06:03 20:21	05:33 20:53	05:36 21:02	06:04 20:37	06:40 19:47	07:15 18:52	06:54 17:01	07:32 16:36
5	07:50 16:49	07:29 17:29	06:47 18:07	06:50 19:46	06:01 20:22	05:32 20:54	05:36 21:01	06:05 20:35	06:41 19:45	07:16 18:50	06:56 17:00	07:33 16:36
6	07:50 16:50	07:28 17:30	06:45 18:08	06:49 19:47	06:00 20:23	05:32 20:55	05:37 21:01	06:06 20:34	06:42 19:44	07:17 18:48	06:57 16:59	07:34 16:36
7	07:50 16:51	07:27 17:31	06:43 18:09	06:47 19:48	05:59 20:24	05:32 20:55	05:38 21:01	06:07 20:33	06:43 19:42	07:18 18:46	06:58 16:58	07:36 16:36
8	07:50 16:52	07:25 17:33	06:41 18:11	06:45 19:49	05:57 20:26	05:31 20:56	05:38 21:00	06:09 20:31	06:44 19:40	07:20 18:44	07:00 16:56	07:37 16:36
9	07:50 16:53	07:24 17:34	06:40 18:12	06:43 19:50	05:56 20:27	05:31 20:57	05:39 21:00	06:10 20:30	06:45 19:38	07:21 18:43	07:01 16:55	07:37 16:35
10	07:49 16:55	07:23 17:36	06:38 18:13	06:41 19:52	05:55 20:28	05:31 20:57	05:40 20:59	06:11 20:28	06:47 19:36	07:22 18:41	07:02 16:54	07:38 16:35
11	07:49 16:56	07:21 17:37	06:36 18:14	06:40 19:53	05:53 20:29	05:30 20:58	05:40 20:59	06:12 20:27	06:48 19:34	07:23 18:39	07:04 16:53	07:39 16:35
12	07:49 16:57	07:20 17:38	06:34 18:16	06:38 19:54	05:52 20:30	05:30 20:58	05:41 20:58	06:13 20:25	06:49 19:33	07:24 18:37	07:05 16:52	07:40 16:35
13	07:48 16:58	07:19 17:40	06:32 18:17	06:36 19:55	05:51 20:31	05:30 20:59	05:42 20:58	06:14 20:24	06:50 19:31	07:26 18:36	07:06 16:51	07:41 16:36
14	07:48 16:59	07:17 17:41	06:31 18:18	06:34 19:57	05:50 20:33	05:30 20:59	05:43 20:57	06:15 20:22	06:51 19:29	07:27 18:34	07:08 16:50	07:42 16:36
15	07:48 17:00	07:16 17:43	06:29 18:20	06:33 19:58	05:49 20:34	05:30 21:00	05:44 20:57	06:17 20:21	06:52 19:27	07:28 18:32	07:09 16:49	07:43 16:36
16	07:47 17:02	07:14 17:44	06:27 18:21	06:31 19:59	05:48 20:35	05:30 21:00	05:45 20:56	06:18 20:19	06:54 19:25	07:29 18:30	07:10 16:48	07:43 16:36
17	07:46 17:03	07:13 17:45	06:25 18:22	06:29 20:00	05:47 20:36	05:30 21:01	05:46 20:55	06:19 20:18	06:55 19:23	07:31 18:29	07:12 16:47	07:44 16:36
18	07:46 17:04	07:11 17:47	06:23 18:23	06:28 20:01	05:46 20:37	05:30 21:01	05:46 20:54	06:20 20:16	06:56 19:21	07:32 18:27	07:13 16:46	07:45 16:37
19	07:45 17:05	07:10 17:48	06:21 18:25	06:26 20:03	05:45 20:38	05:30 21:01	05:47 20:54	06:21 20:15	06:57 19:19	07:33 18:25	07:14 16:45	07:45 16:37
20	07:45 17:07	07:08 17:49	06:20 18:26	06:24 20:04	05:44 20:39	05:30 21:02	05:48 20:53	06:22 20:13	06:58 19:18	07:35 18:24	07:16 16:44	07:46 16:37
21	07:44 17:08	07:07 17:51	06:18 18:27	06:23 20:05	05:43 20:40	05:30 21:02	05:49 20:52	06:24 20:11	06:59 19:16	07:36 18:22	07:17 16:43	07:47 16:38
22	07:43 17:09	07:05 17:52	06:16 18:28	06:21 20:06	05:42 20:41	05:31 21:02	05:50 20:51	06:25 20:10	07:00 19:14	07:37 18:21	07:18 16:42	07:47 16:38
23	07:42 17:11	07:03 17:53	06:14 18:30	06:19 20:08	05:41 20:42	05:31 21:02	05:51 20:50	06:26 20:08	07:02 19:12	07:38 18:19	07:19 16:42	07:48 16:39
24	07:42 17:12	07:02 17:55	06:12 18:31	06:18 20:09	05:40 20:43	05:31 21:02	05:52 20:49	06:27 20:06	07:03 19:10	07:40 18:17	07:21 16:41	07:48 16:39
25	07:41 17:13	07:00 17:56	06:10 18:32	06:16 20:10	05:39 20:44	05:31 21:02	05:53 20:48	06:28 20:05	07:04 19:08	06:41 17:16	07:22 16:40	07:48 16:40
26	07:40 17:15	06:58 17:57	06:09 18:33	06:15 20:11	05:38 20:45	05:32 21:03	05:54 20:47	06:29 20:03	07:05 19:06	06:42 17:14	07:23 16:40	07:49 16:41
27	07:39 17:16	06:57 17:59	06:07 18:34	06:13 20:12	05:38 20:46	05:32 21:03	05:55 20:46	06:30 20:01	07:06 19:05	06:44 17:13	07:24 16:39	07:49 16:41
28	07:38 17:17	06:55 18:00	06:05 18:36	06:12 20:14	05:37 20:47	05:33 21:03	05:56 20:45	06:32 20:00	07:08 19:03	06:45 17:11	07:26 16:39	07:49 16:42
29	07:37 17:19		07:03 19:37	06:10 20:15	05:36 20:48	05:33 21:03	05:58 20:44	06:33 19:58	07:09 19:01	06:46 17:10	07:27 16:38	07:50 16:43
30	07:36 17:20		07:01 19:38	06:08 20:16	05:35 20:49	05:33 21:02	05:59 20:43	06:34 19:56	07:10 18:59	06:48 17:08	07:28 16:38	07:50 16:44
31	07:35 17:22		06:59 19:39		05:35 20:50		06:00 20:42	06:35 19:54		06:49 17:07		07:50 16:44
Potential sun hours	288	292	369	403	458	464	470	434	376	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R20 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (13)
Assumptions for shadow calculations 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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June
1	07:50 16:45	07:34 17:23	06:53 18:01	06:58 19:41	06:07 20:17	18:57 (MC02) 22 19:19 (MC02) 45
2	07:50 16:46	07:33 17:24	06:52 18:03	06:56 19:42	06:06 20:18	18:58 (MC02) 20 19:18 (MC02) 45
3	07:50 16:47	07:31 17:26	06:50 18:04	06:54 19:43	06:04 20:20	18:59 (MC02) 18 19:17 (MC02) 46
4	07:50 16:48	07:30 17:27	06:48 18:05	06:52 19:44	06:03 20:21	19:00 (MC02) 15 19:15 (MC02) 45
5	07:50 16:49	07:29 17:29	06:47 18:07	06:50 19:46	06:01 20:22	19:02 (MC02) 11 19:13 (MC02) 46
6	07:50 16:50	07:28 17:30	06:45 18:08	06:49 19:47	06:00 20:23	05:32 20:55
7	07:50 16:51	07:27 17:31	06:43 18:09	06:47 19:48	05:59 20:24	05:31 20:55
8	07:50 16:52	07:25 17:33	06:41 18:11	06:45 19:49	05:57 20:26	05:31 20:56
9	07:50 16:53	07:24 17:34	06:40 18:12	06:43 19:50	05:56 20:27	05:31 20:57
10	07:49 16:55	07:23 17:36	06:38 18:13	06:41 19:52	05:55 20:28	05:31 20:57
11	07:49 16:56	07:21 17:37	06:36 18:14	06:40 19:53	05:53 20:29	05:30 20:58
12	07:49 16:57	07:20 17:38	06:34 18:16	06:38 19:54	05:52 20:30	05:30 20:58
13	07:48 16:58	07:19 17:40	06:32 18:17	06:36 19:55	05:51 20:31	05:30 20:59
14	07:48 16:59	07:17 17:41	06:31 18:18	06:34 19:57	05:50 20:33	05:30 20:59
15	07:48 17:00	07:16 17:42	06:29 18:20	06:33 19:58	05:49 20:34	19:07 (MC03) 6 19:13 (MC03) 48
16	07:47 17:02	07:14 17:44	06:27 18:21	06:31 19:59	05:48 20:35	19:02 (MC03) 16 19:18 (MC03) 48
17	07:46 17:03	07:13 17:45	06:25 18:22	06:29 20:00	05:47 20:36	19:00 (MC03) 20 19:20 (MC03) 48
18	07:46 17:04	07:11 17:47	06:23 18:23	06:28 20:01	05:46 20:37	18:58 (MC03) 24 19:22 (MC03) 48
19	07:45 17:05	07:10 17:48	06:21 18:25	06:26 20:03	05:44 20:38	18:56 (MC03) 28 19:24 (MC03) 48
20	07:45 17:07	07:08 17:49	06:20 18:26	06:24 20:04	05:43 20:39	18:55 (MC03) 30 19:25 (MC03) 48
21	07:44 17:08	07:07 17:51	06:18 18:27	06:23 20:05	05:43 20:40	18:55 (MC03) 32 19:27 (MC03) 49
22	07:43 17:09	07:05 17:52	06:16 18:28	06:21 20:06	05:42 20:41	18:54 (MC03) 34 19:28 (MC03) 49
23	07:42 17:11	07:03 17:53	06:14 18:30	06:19 20:08	05:41 20:42	18:53 (MC03) 35 19:28 (MC03) 48
24	07:41 17:12	07:02 17:55	06:12 18:31	06:18 20:09	05:40 20:43	18:52 (MC03) 37 19:29 (MC03) 48
25	07:41 17:13	07:00 17:56	06:10 18:32	06:16 20:10	05:39 20:44	18:51 (MC03) 39 19:30 (MC03) 48
26	07:40 17:15	06:58 17:57	06:09 18:33	06:15 20:11	05:38 20:45	18:51 (MC03) 40 19:31 (MC03) 48
27	07:39 17:16	06:57 17:59	06:07 18:34	06:13 20:12	05:37 20:46	18:51 (MC03) 40 19:31 (MC03) 48
28	07:38 17:17	06:55 18:00	06:05 18:36	06:11 20:14	05:37 20:47	18:50 (MC03) 42 19:32 (MC03) 48
29	07:37 17:19		06:03 19:37	06:10 20:15	05:36 20:48	18:50 (MC03) 43 19:33 (MC03) 48
30	07:36 17:20		07:01 19:38	06:08 20:16	05:35 20:49	18:50 (MC03) 43 19:33 (MC03) 48
31	07:35 17:22		06:59 19:39		05:35 20:50	18:50 (MC03) 44 19:34 (MC03)
Potential sun hours	288	292	369	403	458	464
Total, worst case				290	639	1421
Sun reduction				0,43	0,49	0,54
Oper. time red.				0,83	0,83	0,83
Wind dir. red.				0,52	0,48	0,48
Total reduction				0,19	0,19	0,21
Total, real				54	124	303

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R20 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (13)
Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

July		August		September		October		November		December	
1	05:34	18:54 (MC03)	06:01		06:36	07:11	06:50	07:29			
	21:02	48 19:42 (MC03)	20:40		19:53	18:57	17:05	16:37			
2	05:34	18:55 (MC03)	06:02		06:37	07:12	06:52	07:30			
	21:02	47 19:42 (MC03)	20:39		19:51	18:55	17:04	16:37			
3	05:35	18:54 (MC03)	06:03		06:39	07:13	06:53	07:31			
	21:02	48 19:42 (MC03)	20:38		19:49	18:53	17:03	16:37			
4	05:36	18:55 (MC03)	06:04		06:40	07:15	06:54	07:32			
	21:02	47 19:42 (MC03)	20:37		19:47	18:52	17:01	16:36			
5	05:36	18:56 (MC03)	06:05		06:41	07:16	06:56	07:33			
	21:01	47 19:43 (MC03)	20:35		19:45	18:50	17:00	16:36			
6	05:37	18:55 (MC03)	06:06		06:42	07:17	06:57	07:34			
	21:01	47 19:42 (MC03)	20:34		19:44	18:48	16:59	16:36			
7	05:38	18:56 (MC03)	06:07	19:15 (MC02)	06:43	07:18	06:58	07:35			
	21:01	46 19:42 (MC03)	20:33	6 19:21 (MC02)	19:42	18:46	16:58	16:36			
8	05:38	18:57 (MC03)	06:09	19:11 (MC02)	06:44	07:20	07:00	07:36			
	21:00	46 19:43 (MC03)	20:31	12 19:23 (MC02)	19:40	18:44	16:56	16:36			
9	05:39	18:56 (MC03)	06:10	19:09 (MC02)	06:45	07:21	07:01	07:37			
	21:00	46 19:42 (MC03)	20:30	16 19:25 (MC02)	19:38	18:43	16:55	16:35			
10	05:40	18:57 (MC03)	06:11	19:08 (MC02)	06:47	07:22	07:02	07:38			
	20:59	45 19:42 (MC03)	20:28	18 19:26 (MC02)	19:36	18:41	16:54	16:35			
11	05:40	18:58 (MC03)	06:12	19:06 (MC02)	06:48	07:23	07:04	07:39			
	20:59	44 19:42 (MC03)	20:27	21 19:27 (MC02)	19:34	18:39	16:53	16:35			
12	05:41	18:58 (MC03)	06:13	19:05 (MC02)	06:49	07:24	07:05	07:40			
	20:58	44 19:42 (MC03)	20:25	23 19:28 (MC02)	19:32	18:37	16:52	16:35			
13	05:42	18:58 (MC03)	06:14	19:04 (MC02)	06:50	07:26	07:06	07:41			
	20:58	43 19:41 (MC03)	20:24	24 19:28 (MC02)	19:31	18:36	16:51	16:36			
14	05:43	18:59 (MC03)	06:15	19:03 (MC02)	06:51	07:27	07:08	07:42			
	20:57	42 19:41 (MC03)	20:22	25 19:28 (MC02)	19:29	18:34	16:50	16:36			
15	05:44	18:59 (MC03)	06:17	19:04 (MC02)	06:52	07:28	07:09	07:43			
	20:57	42 19:41 (MC03)	20:21	25 19:29 (MC02)	19:27	18:32	16:49	16:36			
16	05:45	19:00 (MC03)	06:18	19:03 (MC02)	06:53	07:29	07:10	07:43			
	20:56	41 19:41 (MC03)	20:19	26 19:29 (MC02)	19:25	18:30	16:48	16:36			
17	05:46	19:01 (MC03)	06:19	19:03 (MC02)	06:55	07:31	07:12	07:44			
	20:55	40 19:41 (MC03)	20:18	25 19:28 (MC02)	19:23	18:29	16:47	16:36			
18	05:46	19:01 (MC03)	06:20	19:02 (MC02)	06:56	07:32	07:13	07:45			
	20:54	39 19:40 (MC03)	20:16	25 19:27 (MC02)	19:21	18:27	16:46	16:37			
19	05:47	19:01 (MC03)	06:21	19:02 (MC02)	06:57	07:33	07:14	07:45			
	20:54	38 19:39 (MC03)	20:15	23 19:25 (MC02)	19:19	18:25	16:45	16:37			
20	05:48	19:02 (MC03)	06:22	19:02 (MC02)	06:58	07:35	07:16	07:46			
	20:53	36 19:38 (MC03)	20:13	22 19:24 (MC02)	19:18	18:24	16:44	16:37			
21	05:49	19:03 (MC03)	06:23	19:02 (MC02)	06:59	07:36	07:17	07:47			
	20:52	35 19:38 (MC03)	20:11	21 19:23 (MC02)	19:16	18:22	16:43	16:38			
22	05:50	19:04 (MC03)	06:25	19:02 (MC02)	07:00	07:37	07:18	07:47			
	20:51	33 19:37 (MC03)	20:10	19 19:21 (MC02)	19:14	18:21	16:42	16:38			
23	05:51	19:05 (MC03)	06:26	19:03 (MC02)	07:02	07:38	07:19	07:48			
	20:50	31 19:36 (MC03)	20:08	17 19:20 (MC02)	19:12	18:19	16:42	16:39			
24	05:52	19:06 (MC03)	06:27	19:04 (MC02)	07:03	07:40	07:21	07:48			
	20:49	29 19:35 (MC03)	20:06	14 19:18 (MC02)	19:10	18:17	16:41	16:39			
25	05:53	19:08 (MC03)	06:28	19:06 (MC02)	07:04	06:41	07:22	07:48			
	20:48	25 19:33 (MC03)	20:05	12 19:18 (MC02)	19:08	17:16	16:40	16:40			
26	05:54	19:09 (MC03)	06:29	19:08 (MC02)	07:05	06:42	07:23	07:49			
	20:47	23 19:32 (MC03)	20:03	9 19:17 (MC02)	19:06	17:14	16:40	16:41			
27	05:55	19:11 (MC03)	06:30		07:06	06:44	07:24	07:49			
	20:46	19 19:30 (MC03)	20:01		19:04	17:13	16:39	16:41			
28	05:56	19:14 (MC03)	06:32		07:07	06:45	07:26	07:49			
	20:45	13 19:27 (MC03)	20:00		19:03	17:11	16:39	16:42			
29	05:57		06:33		07:09	06:46	07:27	07:50			
	20:44		19:58		19:01	17:10	16:38	16:43			
30	05:59		06:34		07:10	06:48	07:28	07:50			
	20:43		19:56		18:59	17:08	16:38	16:44			
31	06:00		06:35			06:49		07:50			
	20:42		19:54			17:07		16:44			
Potential sun hours	470		434		376	342	290	277			
Total, worst case	1084		383								
Sun reduction	0,62		0,60								
Oper. time red.	0,83		0,83								
Wind dir. red.	0,48		0,52								
Total reduction	0,24		0,26								
Total, real	265		100								

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

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R21 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (14)
Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:50 16:46	07:34 17:23	06:53 18:02	06:58 19:41	06:07 20:17	05:34 20:51	05:34 21:02	06:01 20:40	06:36 19:53	07:11 18:57	06:50 17:06	07:29 16:37
2	07:50 16:46	07:33 17:24	06:52 18:03	06:56 19:42	06:06 20:19	05:34 20:52	05:35 21:02	06:02 20:39	06:37 19:51	07:12 18:55	06:52 17:04	07:30 16:37
3	07:50 16:47	07:32 17:26	06:50 18:04	06:54 19:43	06:04 20:20	05:33 20:52	05:35 21:02	06:03 20:38	06:39 19:49	07:14 18:54	06:53 17:03	07:31 16:37
4	07:50 16:48	07:30 17:27	06:48 18:05	06:52 19:44	06:03 20:21	05:33 20:53	05:36 21:02	06:04 20:37	06:40 19:47	07:15 18:52	06:54 17:01	07:32 16:36
5	07:50 16:49	07:29 17:29	06:47 18:07	06:50 19:46	06:01 20:22	05:32 20:54	05:36 21:01	06:05 20:35	06:41 19:45	07:16 18:50	06:56 17:00	07:33 16:36
6	07:50 16:50	07:28 17:30	06:45 18:08	06:49 19:47	06:00 20:23	05:32 20:55	05:37 21:01	06:06 20:34	06:42 19:44	07:17 18:48	06:57 16:59	07:35 16:36
7	07:50 16:51	07:27 17:31	06:43 18:09	06:47 19:48	05:59 20:24	05:32 20:55	05:38 21:01	06:08 20:33	06:43 19:42	07:18 18:46	06:58 16:58	07:36 16:36
8	07:50 16:52	07:25 17:33	06:41 18:11	06:45 19:49	05:57 20:26	05:31 20:56	05:38 21:00	06:09 20:31	06:44 19:40	07:20 18:44	07:00 16:56	07:37 16:36
9	07:50 16:53	07:24 17:34	06:40 18:12	06:43 19:50	05:56 20:27	05:31 20:57	05:39 21:00	06:10 20:30	06:46 19:38	07:21 18:43	07:01 16:55	07:37 16:36
10	07:50 16:55	07:23 17:36	06:38 18:13	06:41 19:52	05:55 20:28	05:31 20:57	05:40 20:59	06:11 20:28	06:47 19:36	07:22 18:41	07:02 16:54	07:38 16:35
11	07:49 16:56	07:21 17:37	06:36 18:15	06:40 19:53	05:54 20:29	05:31 20:58	05:41 20:59	06:12 20:27	06:48 19:34	07:23 18:39	07:04 16:53	07:39 16:36
12	07:49 16:57	07:20 17:38	06:34 18:16	06:38 19:54	05:52 20:30	05:30 20:58	05:41 20:58	06:13 20:26	06:49 19:33	07:24 18:37	07:05 16:52	07:40 16:36
13	07:48 16:58	07:19 17:40	06:32 18:17	06:36 19:55	05:51 20:31	05:30 20:59	05:42 20:58	06:14 20:24	06:50 19:31	07:26 18:36	07:06 16:51	07:41 16:36
14	07:48 16:59	07:17 17:41	06:31 18:18	06:34 19:57	05:50 20:33	05:30 20:59	05:43 20:57	06:16 20:23	06:51 19:29	07:27 18:34	07:08 16:50	07:42 16:36
15	07:48 17:00	07:16 17:43	06:29 18:20	06:33 19:58	05:49 20:34	05:30 21:00	05:44 20:57	06:17 20:21	06:52 19:27	07:28 18:32	07:09 16:49	07:43 16:36
16	07:47 17:02	07:14 17:44	06:27 18:21	06:31 19:59	05:48 20:35	05:30 21:00	05:45 20:56	06:18 20:19	06:54 19:25	07:29 18:31	07:10 16:48	07:43 16:36
17	07:46 17:03	07:13 17:45	06:25 18:22	06:29 20:00	05:47 20:36	05:30 21:01	05:46 20:55	06:19 20:18	06:55 19:23	07:31 18:29	07:12 16:47	07:44 16:36
18	07:46 17:04	07:11 17:47	06:23 18:23	06:28 20:01	05:46 20:37	05:30 21:01	05:47 20:54	06:20 20:16	06:56 19:21	07:32 18:27	07:13 16:46	07:45 16:37
19	07:45 17:05	07:10 17:48	06:21 18:25	06:26 20:03	05:45 20:38	05:30 21:01	05:47 20:54	06:21 20:15	06:57 19:19	07:33 18:25	07:14 16:45	07:45 16:37
20	07:45 17:07	07:08 17:49	06:20 18:26	06:24 20:04	05:44 20:39	05:30 21:02	05:48 20:53	06:22 20:13	06:58 19:18	07:35 18:24	07:16 16:44	07:46 16:38
21	07:44 17:08	07:07 17:51	06:18 18:27	06:23 20:05	05:43 20:40	05:30 21:02	05:49 20:52	06:24 20:11	06:59 19:16	07:36 18:22	07:17 16:43	07:47 16:38
22	07:43 17:09	07:05 17:52	06:16 18:28	06:21 20:06	05:42 20:41	05:31 21:02	05:50 20:51	06:25 20:10	07:01 19:14	07:37 18:21	07:18 16:43	07:47 16:38
23	07:42 17:11	07:03 17:54	06:14 18:30	06:19 20:08	05:41 20:42	05:31 21:02	05:51 20:50	06:26 20:08	07:02 19:12	07:38 18:19	07:19 16:42	07:48 16:39
24	07:42 17:12	07:02 17:55	06:12 18:31	06:18 20:09	05:40 20:43	05:31 21:02	05:52 20:49	06:27 20:06	07:03 19:10	07:40 18:17	07:21 16:41	07:48 16:40
25	07:41 17:13	07:00 17:56	06:10 18:32	06:16 20:10	05:39 20:44	05:31 21:03	05:53 20:48	06:28 20:05	07:04 19:08	06:41 17:16	07:22 16:40	07:49 16:40
26	07:40 17:15	06:59 17:58	06:09 18:33	06:15 20:11	05:38 20:45	05:32 21:03	05:54 20:47	06:29 20:03	07:05 19:06	06:42 17:14	07:23 16:40	07:49 16:41
27	07:39 17:16	06:57 17:59	06:07 18:35	06:13 20:12	05:38 20:46	05:32 21:03	05:55 20:46	06:31 20:01	07:06 19:05	06:44 17:13	07:24 16:39	07:49 16:41
28	07:38 17:18	06:55 18:00	06:05 18:36	06:12 20:14	05:37 20:47	05:33 21:03	05:57 20:45	06:32 20:00	07:08 19:03	06:45 17:11	07:26 16:39	07:50 16:42
29	07:37 17:19		07:03 19:37	06:10 20:15	05:36 20:48	05:33 21:03	05:58 20:44	06:33 19:58	07:09 19:01	06:46 17:10	07:27 16:38	07:50 16:43
30	07:36 17:20		07:01 19:38	06:09 20:16	05:36 20:49	05:33 21:02	05:59 20:43	06:34 19:56	07:10 18:59	06:48 17:08	07:28 16:38	07:50 16:44
31	07:35 17:22		06:59 19:39		05:35 20:50		06:00 20:42	06:35 19:54		06:49 17:07		07:50 16:44
Potential sun hours	288	292	369	403	458	464	470	434	376	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R22 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (15)
Assumptions for shadow calculations 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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:50 16:46	07:34 17:23	06:53 18:01	06:58 19:41	06:07 20:17	05:34 20:51	05:34 21:02	06:01 20:40	06:36 19:53	07:11 18:57	06:50 17:06	07:29 16:37
2	07:50 16:46	07:33 17:24	06:52 18:03	06:56 19:42	06:06 20:18	05:34 20:51	05:34 21:02	06:02 20:39	06:37 19:51	07:12 18:55	06:52 17:04	07:30 16:37
3	07:50 16:47	07:31 17:26	06:50 18:04	06:54 19:43	06:04 20:20	05:33 20:52	05:35 21:02	06:03 20:38	06:39 19:49	07:13 18:53	06:53 17:03	07:31 16:37
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31	07:35 17:22		06:59 19:39		05:35 20:50		06:00 20:42	06:35 19:54		06:49 17:07		07:50 16:44
Potential sun hours	288	292	369	403	458	464	470	434	376	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R23 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (16)
Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:50 16:46	07:34 17:23	06:53 18:01	06:58 19:41	06:07 20:17	05:34 20:51	05:34 21:02	06:01 20:40	06:36 19:53	07:11 18:57	06:50 17:06	07:29 16:37
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31	07:35 17:22		06:59 19:39		05:35 20:50		06:00 20:42	06:35 19:54		06:49 17:07		07:50 16:44
Potential sun hours	288	292	369	403	458	464	470	434	376	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R24 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (17)
Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:50 16:46	07:34 17:23	06:53 18:01	06:58 19:41	06:07 20:17	05:34 20:51	05:34 21:02	06:01 20:40	06:36 19:53	07:11 18:57	06:50 17:06	07:29 16:37
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22	07:43 17:09	07:05 17:52	06:16 18:28	06:21 20:06	05:42 20:41	05:31 21:02	05:50 20:51	06:25 20:10	07:00 19:14	07:37 18:21	07:18 16:42	07:47 16:38
23	07:42 17:11	07:03 17:53	06:14 18:30	06:19 20:08	05:41 20:42	05:31 21:02	05:51 20:50	06:26 20:08	07:02 19:12	07:38 18:19	07:19 16:42	07:48 16:39
24	07:41 17:12	07:02 17:55	06:12 18:31	06:18 20:09	05:40 20:43	05:31 21:02	05:52 20:49	06:27 20:06	07:03 19:10	07:40 18:17	07:21 16:41	07:48 16:39
25	07:41 17:13	07:00 17:56	06:10 18:32	06:16 20:10	05:39 20:44	05:31 21:02	05:53 20:48	06:28 20:05	07:04 19:08	06:41 17:16	07:22 16:40	07:48 16:40
26	07:40 17:15	06:58 17:57	06:09 18:33	06:15 20:11	05:38 20:45	05:32 21:03	05:54 20:47	06:29 20:03	07:05 19:06	06:42 17:14	07:23 16:40	07:49 16:41
27	07:39 17:16	06:57 17:59	06:07 18:34	06:13 20:12	05:38 20:46	05:32 21:03	05:55 20:46	06:30 20:01	07:06 19:05	06:44 17:13	07:24 16:39	07:49 16:41
28	07:38 17:17	06:55 18:00	06:05 18:36	06:11 20:14	05:37 20:47	05:33 21:03	05:56 20:45	06:32 20:00	07:07 19:03	06:45 17:11	07:26 16:39	07:49 16:42
29	07:37 17:19		07:03 19:37	06:10 20:15	05:36 20:48	05:33 21:02	05:58 20:44	06:33 19:58	07:09 19:01	06:46 17:10	07:27 16:38	07:50 16:43
30	07:36 17:20		07:01 19:38	06:08 20:16	05:35 20:49	05:33 21:02	05:59 20:43	06:34 19:56	07:10 18:59	06:48 17:08	07:28 16:38	07:50 16:44
31	07:35 17:22		06:59 19:39		05:35 20:50		06:00 20:41	06:35 19:54		06:49 17:07		07:50 16:44
Potential sun hours	288	292	369	403	458	464	470	434	376	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R26 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (18)
Assumptions for shadow calculations 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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

January			February			March			April			May			June		
1	07:50	15:24 (MC02)	07:34		15:40 (MC02)	06:53		06:58				06:07		05:34			
	16:45	39 16:03 (MC02)	17:23	27	16:07 (MC02)	18:01		19:41				20:17		20:51			
2	07:50	15:24 (MC02)	07:33		15:42 (MC02)	06:52		06:56				06:06		05:34			
	16:46	39 16:03 (MC02)	17:24	24	16:06 (MC02)	18:03		19:42				20:19		20:52			
3	07:50	15:24 (MC02)	07:32		15:44 (MC02)	06:50		06:54		19:15 (MC01)		06:04		05:33			
	16:47	40 16:04 (MC02)	17:26	21	16:05 (MC02)	18:04		19:43	5	19:20 (MC01)		20:20		20:52			
4	07:50	15:25 (MC02)	07:30		15:47 (MC02)	06:48		06:52		19:12 (MC01)		06:03		05:33			
	16:48	40 16:05 (MC02)	17:27	16	16:03 (MC02)	18:05		19:44	10	19:22 (MC01)		20:21		20:53			
5	07:50	15:24 (MC02)	07:29		15:51 (MC02)	06:47		06:50		19:10 (MC01)		06:01		05:32			
	16:49	40 16:04 (MC02)	17:29	6	15:57 (MC02)	18:07		19:46	13	19:23 (MC01)		20:22		20:54			
6	07:50	15:25 (MC02)	07:28			06:45		06:49		19:08 (MC01)		06:00		05:32			
	16:50	40 16:05 (MC02)	17:30			18:08		19:47	16	19:24 (MC01)		20:23		20:55			
7	07:50	15:25 (MC02)	07:27			06:43		06:47		19:07 (MC01)		05:59		05:32			
	16:51	41 16:06 (MC02)	17:31			18:09		19:48	18	19:25 (MC01)		20:24		20:55			
8	07:50	15:26 (MC02)	07:25			06:41		06:45		19:05 (MC01)		05:57		05:31			
	16:52	41 16:07 (MC02)	17:33			18:11		19:49	21	19:26 (MC01)		20:26		20:56			
9	07:50	15:25 (MC02)	07:24			06:40		06:43		19:05 (MC01)		05:56		05:31			
	16:53	42 16:07 (MC02)	17:34			18:12		19:50	23	19:28 (MC01)		20:27		20:57			
10	07:50	15:26 (MC02)	07:23			06:38		06:41		19:05 (MC01)		05:55		05:31			
	16:55	42 16:08 (MC02)	17:36			18:13		19:52	24	19:29 (MC01)		20:28		20:57			
11	07:49	15:26 (MC02)	07:21			06:36		06:40		19:04 (MC01)		05:53		05:30			
	16:56	43 16:09 (MC02)	17:37			18:14		19:53	25	19:29 (MC01)		20:29		20:58			
12	07:49	15:26 (MC02)	07:20			06:34		06:38		19:04 (MC01)		05:52		05:30			
	16:57	43 16:09 (MC02)	17:38			18:16		19:54	24	19:28 (MC01)		20:30		20:58			
13	07:48	15:27 (MC02)	07:19			06:32		06:36		19:05 (MC01)		05:51		05:30			
	16:58	43 16:10 (MC02)	17:40			18:17		19:55	23	19:28 (MC01)		20:31		20:59			
14	07:48	15:27 (MC02)	07:17			06:31		06:34		19:04 (MC01)		05:50		05:30			
	16:59	43 16:10 (MC02)	17:41			18:18		19:57	23	19:27 (MC01)		20:33		20:59			
15	07:48	15:27 (MC02)	07:16			06:29		06:33		19:05 (MC01)		05:49		05:30			
	17:00	43 16:10 (MC02)	17:43			18:20		19:58	21	19:26 (MC01)		20:34		21:00			
16	07:47	15:28 (MC02)	07:14			06:27		06:31		19:06 (MC01)		05:48		05:30			
	17:02	43 16:11 (MC02)	17:44			18:21		19:59	19	19:25 (MC01)		20:35		21:00			
17	07:46	15:28 (MC02)	07:13			06:25		06:29		19:07 (MC01)		05:47		05:30			
	17:03	43 16:11 (MC02)	17:45			18:22		20:00	16	19:23 (MC01)		20:36		21:01			
18	07:46	15:29 (MC02)	07:11			06:23		06:28		19:08 (MC01)		05:46		05:30			
	17:04	43 16:12 (MC02)	17:47			18:23		20:01	13	19:21 (MC01)		20:37		21:01			
19	07:45	15:29 (MC02)	07:10			06:21		06:26		19:12 (MC01)		05:44		05:30			
	17:05	43 16:12 (MC02)	17:48			18:25		20:03	6	19:18 (MC01)		20:38		21:01			
20	07:45	15:29 (MC02)	07:08			06:20		06:24				05:44		05:30			
	17:07	43 16:12 (MC02)	17:49			18:26		20:04				20:39		21:02			
21	07:44	15:30 (MC02)	07:07			06:18		06:23				05:43		05:30			
	17:08	41 16:11 (MC02)	17:51			18:27		20:05				20:40		21:02			
22	07:43	15:30 (MC02)	07:05			06:16		06:21				05:42		05:31			
	17:09	41 16:11 (MC02)	17:52			18:28		20:06				20:41		21:02			
23	07:42	15:31 (MC02)	07:03			06:14		06:19				05:41		05:31			
	17:11	41 16:12 (MC02)	17:53			18:30		20:08				20:42		21:02			
24	07:42	15:32 (MC02)	07:02			06:12		06:18				05:40		05:31			
	17:12	40 16:12 (MC02)	17:55			18:31		20:09				20:43		21:02			
25	07:41	15:33 (MC02)	07:00			06:10		06:16				05:39		05:31			
	17:13	39 16:12 (MC02)	17:56			18:32		20:10				20:44		21:03			
26	07:40	15:33 (MC02)	06:58			06:09		06:15				05:38		05:32			
	17:15	39 16:12 (MC02)	17:57			18:33		20:11				20:45		21:03			
27	07:39	15:34 (MC02)	06:57			06:07		06:13				05:37		05:32			
	17:16	37 16:11 (MC02)	17:59			18:34		20:12				20:46		21:03			
28	07:38	15:35 (MC02)	06:55			06:05		06:11				05:37		05:32			
	17:17	36 16:11 (MC02)	18:00			18:36		20:14				20:47		21:03			
29	07:37	15:36 (MC02)				07:03		06:10				05:36		05:33			
	17:19	35 16:11 (MC02)				19:37		20:15				20:48		21:03			
30	07:36	15:37 (MC02)				07:01		06:08				05:35		05:33			
	17:20	33 16:10 (MC02)				19:38		20:16				20:49		21:02			
31	07:35	15:38 (MC02)				06:59						05:35					
	17:22	30 16:08 (MC02)				19:39						20:50					
Potential sun hours	288		292			369		403				458		464			
Total, worst case	1246		94					300									
Sun reduction	0,27		0,32					0,43									
Oper. time red.	0,83		0,83					0,83									
Wind dir. red.	0,73		0,73					0,54									
Total reduction	0,17		0,20					0,20									
Total, real	206		19					59									

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

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

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R26 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (18)
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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	July	August	September	October	November	December
1	05:34 21:02	06:01 20:40	06:36 19:53	19:03 (MC01) 18:57	07:11 17:06	06:50 16:37
2	05:34 21:02	06:02 20:39	06:37 19:51	19:03 (MC01) 18:55	07:12 17:04	06:52 16:37
3	05:35 21:02	06:03 20:38	06:39 19:49	19:04 (MC01) 18:53	07:13 17:03	06:53 16:37
4	05:36 21:02	06:04 20:37	06:40 19:47	19:03 (MC01) 18:52	07:15 17:01	06:54 16:36
5	05:36 21:01	06:05 20:35	06:41 19:45	19:04 (MC01) 18:50	07:16 17:00	06:56 16:36
6	05:37 21:01	06:06 20:34	06:42 19:44	19:04 (MC01) 18:48	07:17 16:59	15:20 (MC02) 16:36
7	05:38 21:01	06:07 20:33	06:43 19:42	19:05 (MC01) 18:46	07:18 16:58	15:16 (MC02) 16:36
8	05:38 21:00	06:09 20:31	06:44 19:40	19:06 (MC01) 18:44	07:20 16:56	15:14 (MC02) 16:36
9	05:39 21:00	06:10 20:30	06:45 19:38	19:09 (MC01) 18:43	07:21 16:55	15:12 (MC02) 16:35
10	05:40 21:00	06:11 20:28	06:47 19:36	19:15 (MC01) 18:41	07:22 16:54	15:10 (MC02) 16:35
11	05:40 20:59	06:12 20:27	06:48 19:34	07:23 18:39	07:04 16:53	15:10 (MC02) 16:35
12	05:41 20:58	06:13 20:26	06:49 19:33	07:24 18:37	07:05 16:52	15:08 (MC02) 16:35
13	05:42 20:58	06:14 20:24	06:50 19:31	07:26 18:36	07:06 16:51	15:08 (MC02) 16:36
14	05:43 20:57	06:15 20:23	06:51 19:29	07:27 18:34	07:08 16:50	15:07 (MC02) 16:36
15	05:44 20:57	06:17 20:21	06:52 19:27	07:28 18:32	07:09 16:49	15:06 (MC02) 16:36
16	05:45 20:56	06:18 20:19	06:54 19:25	07:29 18:30	07:10 16:48	15:06 (MC02) 16:36
17	05:46 20:55	06:19 20:18	06:55 19:23	07:31 18:29	07:12 16:47	15:06 (MC02) 16:36
18	05:46 20:54	06:20 20:16	06:56 19:21	07:32 18:27	07:13 16:46	15:06 (MC02) 16:37
19	05:47 20:54	06:21 20:15	06:57 19:19	07:33 18:25	07:14 16:45	15:05 (MC02) 16:37
20	05:48 20:53	06:22 20:13	06:58 19:18	07:35 18:24	07:16 16:44	15:05 (MC02) 16:37
21	05:49 20:52	06:24 20:11	06:59 19:16	07:36 18:22	07:17 16:43	15:06 (MC02) 16:38
22	05:50 20:51	06:25 20:10	07:00 19:14	07:37 18:21	07:18 16:42	15:05 (MC02) 16:38
23	05:51 20:50	06:26 20:08	07:02 19:12	07:38 18:19	07:19 16:42	15:05 (MC02) 16:39
24	05:52 20:49	06:27 20:06	19:14 (MC01) 19:10	07:03 18:17	07:21 16:41	15:06 (MC02) 16:39
25	05:53 20:48	06:28 20:05	19:12 (MC01) 19:08	07:04 17:16	07:22 16:40	15:06 (MC02) 16:40
26	05:54 20:47	06:29 20:03	19:10 (MC01) 19:06	07:05 17:14	07:23 16:40	15:06 (MC02) 16:41
27	05:55 20:46	06:30 20:01	19:08 (MC01) 19:05	07:06 17:13	07:24 16:39	15:07 (MC02) 16:41
28	05:56 20:45	06:32 20:00	19:06 (MC01) 19:03	07:08 17:11	07:26 16:39	15:07 (MC02) 16:42
29	05:57 20:44	06:33 19:58	19:05 (MC01) 19:01	07:09 17:10	07:27 16:38	15:07 (MC02) 16:43
30	05:59 20:43	06:34 19:56	19:04 (MC01) 18:59	07:10 17:08	07:28 16:38	15:07 (MC02) 16:44
31	06:00 20:42	06:35 19:54	19:04 (MC01) 19:28 (MC01)	07:11 17:07	07:29 16:44	15:07 (MC02) 16:44
Potential sun hours	470	434	376	342	290	277
Total, worst case		148	156		897	1200
Sun reduction		0,60	0,53		0,30	0,29
Oper. time red.		0,83	0,83		0,83	0,83
Wind dir. red.		0,54	0,54		0,73	0,73
Total reduction		0,28	0,24		0,19	0,18
Total, real		41	38		169	212

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R27 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (19)
Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

		January	February	March	April	May	June	July	August	September	October	November	December							
1	07:50	07:34	06:53	06:58		06:07	19:08 (MC03)	05:34	05:34	06:01	19:16 (MC03)	06:36	07:11	06:50	07:29					
	16:45	17:23	18:01	19:41		20:17	27	19:35 (MC03)	20:51	21:02	20:40	30	19:46 (MC03)	19:52	18:57	17:05	16:37			
2	07:50	07:33	06:52	06:56		06:06		19:08 (MC03)	05:34	05:34	06:02		19:16 (MC03)	06:37	07:12	06:52	07:30			
	16:46	17:24	18:03	19:42		20:18	28	19:36 (MC03)	20:51	21:02	20:39	30	19:46 (MC03)	19:51	18:55	17:04	16:37			
3	07:50	07:31	06:50	06:54		06:04		19:07 (MC03)	05:33	05:35	06:03		19:16 (MC03)	06:38	07:13	06:53	07:31			
	16:47	17:26	18:04	19:43		20:20	29	19:36 (MC03)	20:52	21:02	20:38	30	19:46 (MC03)	19:49	18:53	17:03	16:37			
4	07:50	07:30	06:48	06:52		06:03		19:06 (MC03)	05:33	05:36	06:04		19:16 (MC03)	06:40	07:15	06:54	07:32			
	16:48	17:27	18:05	19:44		20:21	30	19:36 (MC03)	20:53	21:02	20:37	31	19:47 (MC03)	19:47	18:52	17:01	16:36			
5	07:50	07:29	06:47	06:50		06:01		19:06 (MC03)	05:32	05:36	06:05		19:16 (MC03)	06:41	07:16	06:56	07:33			
	16:49	17:29	18:07	19:45		20:22	30	19:36 (MC03)	20:54	21:01	20:35	31	19:47 (MC03)	19:45	18:50	17:00	16:36			
6	07:50	07:28	06:45	06:48		06:00		19:06 (MC03)	05:32	05:37	06:06		19:16 (MC03)	06:42	07:17	06:57	07:34			
	16:50	17:30	18:08	19:47		20:23	31	19:37 (MC03)	20:55	21:01	20:34	31	19:47 (MC03)	19:43	18:48	16:59	16:36			
7	07:50	07:27	06:43	06:47		05:59		19:05 (MC03)	05:31	05:37	06:07		19:16 (MC03)	06:43	07:18	06:58	07:35			
	16:51	17:31	18:09	19:48		20:24	31	19:36 (MC03)	20:55	21:01	20:33	30	19:46 (MC03)	19:42	18:46	16:58	16:36			
8	07:50	07:25	06:41	06:45		05:57		19:05 (MC03)	05:31	05:38	06:09		19:16 (MC03)	06:44	07:19	07:00	07:36			
	16:52	17:33	18:11	19:49		20:26	31	19:36 (MC03)	20:56	21:00	20:31	30	19:46 (MC03)	19:40	18:44	16:56	16:35			
9	07:50	07:24	06:39	06:43		05:56		19:06 (MC03)	05:31	05:39	06:10		19:16 (MC03)	06:45	07:21	07:01	07:37			
	16:53	17:34	18:12	19:50		20:27	30	19:36 (MC03)	20:57	21:00	20:30	30	19:46 (MC03)	19:38	18:43	16:55	16:35			
10	07:49	07:23	06:38	06:41		05:55		19:06 (MC03)	05:31	05:40	06:11		19:16 (MC03)	06:47	07:22	07:02	07:38			
	16:54	17:36	18:13	19:52		20:28	30	19:36 (MC03)	20:57	20:59	20:28	29	19:45 (MC03)	19:36	18:41	16:54	16:35			
11	07:49	07:21	06:36	06:40		05:53		19:06 (MC03)	05:30	05:40	06:12		19:16 (MC03)	06:48	07:23	07:04	07:39			
	16:56	17:37	18:14	19:53		20:29	30	19:36 (MC03)	20:58	20:58	20:27	28	19:44 (MC03)	19:34	18:39	16:53	16:35			
12	07:49	07:20	06:34	06:38		19:15 (MC02)	05:52	19:06 (MC03)	05:30	05:41	06:13		19:17 (MC03)	06:49	07:24	07:05	07:40			
	16:57	17:38	18:16	19:54	8	19:23 (MC02)	20:30	29	19:35 (MC03)	20:58	20:25	26	19:43 (MC03)	19:32	18:37	16:52	16:35			
13	07:48	07:19	06:32	06:36		19:13 (MC02)	05:51	19:06 (MC03)	05:30	05:42	06:14		19:17 (MC03)	06:50	07:26	07:06	07:41			
	16:58	17:40	18:17	19:55	12	19:25 (MC02)	20:31	29	19:35 (MC03)	20:59	20:24	25	19:42 (MC03)	19:31	18:36	16:51	16:36			
14	07:48	07:17	06:31	06:34		19:11 (MC02)	05:50	19:07 (MC03)	05:30	05:43	06:15		19:18 (MC03)	06:51	07:27	07:08	07:42			
	16:59	17:41	18:18	19:57	15	19:26 (MC02)	20:33	27	19:34 (MC03)	20:59	20:22	23	19:41 (MC03)	19:29	18:34	16:50	16:36			
15	07:47	07:16	06:29	06:33		19:10 (MC02)	05:49	19:08 (MC03)	05:30	05:44	06:17		19:19 (MC03)	06:52	07:28	07:09	07:43			
	17:00	17:42	18:19	19:58	16	19:26 (MC02)	20:34	26	19:34 (MC03)	21:00	20:21	20	19:39 (MC03)	19:27	18:32	16:49	16:36			
16	07:47	07:14	06:27	06:31		19:09 (MC02)	05:48	19:08 (MC03)	05:30	05:45	06:18		19:22 (MC03)	06:53	07:29	07:10	07:43			
	17:02	17:44	18:21	19:59	19	19:28 (MC02)	20:35	25	19:33 (MC03)	21:00	20:19	16	19:38 (MC03)	19:25	18:30	16:48	16:36			
17	07:46	07:13	06:25	06:29		19:08 (MC02)	05:47	19:09 (MC03)	05:30	05:45	06:19		19:24 (MC03)	06:55	07:31	07:12	07:44			
	17:03	17:45	18:22	20:00	20	19:28 (MC02)	20:36	24	19:33 (MC03)	21:01	20:18	11	19:35 (MC03)	19:23	18:29	16:47	16:36			
18	07:46	07:11	06:23	06:28		19:08 (MC02)	05:45	19:10 (MC03)	05:30	05:46	06:20		19:19 (MC02)	06:56	07:32	07:13	07:45			
	17:04	17:47	18:23	20:01	20	19:28 (MC02)	20:37	22	19:32 (MC03)	21:01	20:16	8	19:27 (MC02)	19:21	18:27	16:46	16:37			
19	07:45	07:10	06:21	06:26		19:08 (MC02)	05:44	19:11 (MC03)	05:30	05:47	06:21		19:16 (MC02)	06:57	07:33	07:14	07:45			
	17:05	17:48	18:25	20:03	20	19:28 (MC02)	20:38	20	19:31 (MC03)	21:01	20:15	13	19:29 (MC02)	19:19	18:25	16:45	16:37			
20	07:45	07:08	06:20	06:24		19:08 (MC02)	05:43	19:12 (MC03)	05:30	05:48	06:22		19:15 (MC02)	06:58	07:34	07:16	07:46			
	17:07	17:49	18:26	20:04	19	19:27 (MC02)	20:39	17	19:29 (MC03)	21:02	20:13	15	19:30 (MC02)	19:18	18:24	16:44	16:37			
21	07:44	07:07	06:18	06:23		19:08 (MC02)	05:43	19:15 (MC03)	05:30	05:49	19:27 (MC03)	06:23	19:13 (MC02)	06:59	07:36	07:17	07:47			
	17:08	17:51	18:27	20:05	18	19:26 (MC02)	20:40	14	19:29 (MC03)	21:02	20:52	8	19:35 (MC03)	20:11	18	19:31 (MC02)	19:16	18:22	16:43	16:38
22	07:43	07:05	06:16	06:21		19:09 (MC02)	05:42	19:16 (MC03)	05:31	05:50	19:25 (MC03)	06:25	19:12 (MC02)	07:00	07:37	07:18	07:47			
	17:09	17:52	18:28	20:06	17	19:26 (MC02)	20:41	11	19:27 (MC03)	21:02	20:51	13	19:38 (MC03)	20:10	19	19:31 (MC02)	19:14	18:21	16:42	16:38
23	07:42	07:03	06:14	06:19		19:09 (MC02)	05:41	19:19 (MC03)	05:31	05:51	19:23 (MC03)	06:26	19:11 (MC02)	07:02	07:38	07:19	07:48			
	17:11	17:53	18:29	20:08	15	19:24 (MC02)	20:42	5	19:24 (MC03)	21:02	20:50	16	19:39 (MC03)	20:08	20	19:31 (MC02)	19:12	18:19	16:42	16:39
24	07:41	07:02	06:12	06:18		19:11 (MC02)	05:40		05:52	19:22 (MC03)	06:27		19:11 (MC02)	07:03	07:40	07:21	07:48			
	17:12	17:55	18:31	20:09	12	19:23 (MC02)	20:43		21:02	20:49	19	19:41 (MC03)	20:06	20	19:31 (MC02)	19:10	18:17	16:41	16:38	
25	07:41	07:00	06:10	06:16		19:12 (MC02)	05:39		05:53	19:21 (MC03)	06:28		19:11 (MC02)	07:04	07:41	07:22	07:48			
	17:13	17:56	18:32	20:10	8	19:20 (MC02)	20:44		21:02	20:48	21	19:42 (MC03)	20:05	20	19:31 (MC02)	19:08	17:16	16:40	16:40	
26	07:40	06:58	06:09	06:15		19:17 (MC03)	05:38		05:52	05:54	19:20 (MC03)	06:29		19:11 (MC02)	07:05	06:42	07:23	07:49		
	17:15	17:57	18:33	20:11	12	19:29 (MC03)	20:45		21:03	20:47	23	19:43 (MC03)	20:03	20	19:31 (MC02)	19:06	17:14	16:40	16:41	
27	07:39	06:57	06:07	06:13		19:14 (MC03)	05:37		05:52	05:55	19:19 (MC03)	06:30		19:11 (MC02)	07:06	06:44	07:24	07:49		
	17:16	17:59	18:34	20:12	17	19:31 (MC03)	20:46		21:03	20:46	24	19:43 (MC03)	20:01	19	19:30 (MC02)	19:04	17:13	16:39	16:41	
28	07:38	06:55	06:05	06:11		19:12 (MC03)	05:37		05:52	05:56	19:19 (MC03)	06:32		19:11 (MC02)	07:07	06:45	07:26	07:49		
	17:17	18:00	18:36	20:14	21	19:33 (MC03)	20:47		21:03	20:45	25	19:44 (MC03)	20:00	17	19:28 (MC02)	19:03	17:11	16:39	16:42	
29	07:37		07:03	06:10		19:10 (MC03)	05:36		05:53	05:57	19:18 (MC03)	06:33		19:12 (MC02)	07:09	06:46	07:27	07:50		
	17:19		17:37	20:15	23	19:33 (MC03)	20:48		21:02	20:44	27	19:45 (MC03)	19:58	14	19:26 (MC02)	19:01	17:10	16:38	16:43	
30	07:36		07:01	06:08		19:09 (MC03)	05:35		05:53	05:59	19:17 (MC03)	06:34		19:13 (MC02)	07:10	06:48	07:28	07:50		
	17:20		17:38	20:16	26	19:35 (MC03)	20:49		21:02	20:43	28	19:45 (MC03)	19:56	12	19:25 (MC02)	18:59	17:08	16:38	16:44	
31	07:35		06:59			05:35				06:00	19:17 (MC03)	06:35		19:15 (MC02)		06:49	07:50			
	17:22		17:39			20:50				20:41	29	19:46 (MC03)	19:54	8	19:23 (MC02)	17:07		16:44		
Potential sun hours		288	292	369	403		458		464	470		434		376		342	290	277		
Total, worst case					318		576			233		674								
Sun reduction																				

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

Day in month	S
--------------	---

SHADOW - Calendar

Calculation: Parco Eolico Emilia: Shadow flickeringShadow receptor: R28 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (20)
Assumptions for shadow calculations 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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:50 16:46	07:34 17:23	06:54 18:02	06:58 19:41	06:07 20:17	05:35 20:51	05:34 21:02	06:01 20:40	06:36 19:53	07:11 18:57	06:50 17:06	07:29 16:38
2	07:50 16:47	07:33 17:25	06:52 18:03	06:56 19:42	06:06 20:19	05:34 20:52	05:35 21:02	06:02 20:39	06:38 19:51	07:12 18:56	06:52 17:04	07:30 16:37
3	07:50 16:48	07:32 17:26	06:50 18:04	06:54 19:43	06:04 20:20	05:34 20:52	05:35 21:02	06:03 20:38	06:39 19:49	07:14 18:54	06:53 17:03	07:31 16:37
4	07:50 16:49	07:30 17:27	06:48 18:06	06:52 19:44	06:03 20:21	05:33 20:53	05:36 21:02	06:04 20:37	06:40 19:47	07:15 18:52	06:54 17:02	07:32 16:37
5	07:50 16:50	07:29 17:29	06:47 18:07	06:51 19:46	06:02 20:22	05:33 20:54	05:37 21:01	06:06 20:35	06:41 19:46	07:16 18:50	06:56 17:00	07:34 16:36
6	07:50 16:51	07:28 17:30	06:45 18:08	06:49 19:47	06:00 20:23	05:32 20:55	05:37 21:01	06:07 20:34	06:42 19:44	07:17 18:48	06:57 16:59	07:35 16:36
7	07:50 16:52	07:27 17:32	06:43 18:10	06:47 19:48	05:59 20:25	05:32 20:55	05:38 21:01	06:08 20:33	06:43 19:42	07:18 18:46	06:58 16:58	07:36 16:36
8	07:50 16:53	07:25 17:33	06:41 18:11	06:45 19:49	05:58 20:26	05:32 20:56	05:39 21:00	06:09 20:31	06:45 19:40	07:20 18:45	07:00 16:57	07:37 16:36
9	07:50 16:54	07:24 17:34	06:40 18:12	06:43 19:51	05:56 20:27	05:31 20:57	05:39 21:00	06:10 20:30	06:46 19:38	07:21 18:43	07:01 16:55	07:38 16:36
10	07:50 16:55	07:23 17:36	06:38 18:13	06:42 19:52	05:55 20:28	05:31 20:57	05:40 21:00	06:11 20:28	06:47 19:36	07:22 18:41	07:02 16:54	07:38 16:36
11	07:49 16:56	07:21 17:37	06:36 18:15	06:40 19:53	05:54 20:29	05:31 20:58	05:41 20:59	06:12 20:27	06:48 19:35	07:23 18:39	07:04 16:53	07:39 16:36
12	07:49 16:57	07:20 17:39	06:34 18:16	06:38 19:54	05:53 20:30	05:31 20:58	05:42 20:58	06:13 20:26	06:49 19:33	07:25 18:38	07:05 16:52	07:40 16:36
13	07:48 16:58	07:19 17:40	06:33 18:17	06:36 19:55	05:51 20:32	05:31 20:59	05:42 20:58	06:15 20:24	06:50 19:31	07:26 18:36	07:06 16:51	07:41 16:36
14	07:48 17:00	07:17 17:41	06:31 18:18	06:35 19:57	05:50 20:33	05:30 20:59	05:43 20:57	06:16 20:23	06:51 19:29	07:27 18:34	07:08 16:50	07:42 16:36
15	07:48 17:01	07:16 17:43	06:29 18:20	06:33 19:58	05:49 20:34	05:30 21:00	05:44 20:57	06:17 20:21	06:53 19:27	07:28 18:32	07:09 16:49	07:43 16:36
16	07:47 17:02	07:14 17:44	06:27 18:21	06:31 19:59	05:48 20:35	05:30 21:00	05:45 20:56	06:18 20:20	06:54 19:25	07:30 18:31	07:10 16:48	07:43 16:36
17	07:47 17:03	07:13 17:46	06:25 18:22	06:30 20:00	05:47 20:36	05:30 21:01	05:46 20:55	06:19 20:18	06:55 19:23	07:31 18:29	07:12 16:47	07:44 16:37
18	07:46 17:04	07:11 17:47	06:23 18:24	06:28 20:02	05:46 20:37	05:30 21:01	05:47 20:54	06:20 20:16	06:56 19:22	07:32 18:27	07:13 16:46	07:45 16:37
19	07:45 17:06	07:10 17:48	06:22 18:25	06:26 20:03	05:45 20:38	05:30 21:01	05:48 20:54	06:21 20:15	06:57 19:20	07:33 18:26	07:14 16:45	07:45 16:37
20	07:45 17:07	07:08 17:50	06:20 18:26	06:25 20:04	05:44 20:39	05:31 21:02	05:49 20:53	06:23 20:13	06:58 19:18	07:35 18:24	07:16 16:44	07:46 16:38
21	07:44 17:08	07:07 17:51	06:18 18:27	06:23 20:05	05:43 20:40	05:31 21:02	05:50 20:52	06:24 20:12	07:00 19:16	07:36 18:22	07:17 16:44	07:47 16:38
22	07:43 17:10	07:05 17:52	06:16 18:28	06:21 20:06	05:42 20:41	05:31 21:02	05:51 20:51	06:25 20:10	07:01 19:14	07:37 18:21	07:18 16:43	07:47 16:39
23	07:42 17:11	07:04 17:54	06:14 18:30	06:20 20:08	05:41 20:42	05:31 21:02	05:52 20:50	06:26 20:08	07:02 19:12	07:39 18:19	07:19 16:42	07:48 16:39
24	07:42 17:12	07:02 17:55	06:12 18:31	06:18 20:09	05:40 20:43	05:31 21:02	05:53 20:49	06:27 20:07	07:03 19:10	07:40 18:18	07:21 16:41	07:48 16:40
25	07:41 17:14	07:00 17:56	06:11 18:32	06:16 20:10	05:39 20:44	05:32 21:03	05:54 20:48	06:28 20:05	07:04 19:08	06:41 17:16	07:22 16:41	07:49 16:40
26	07:40 17:15	06:59 17:58	06:09 18:33	06:15 20:11	05:39 20:45	05:32 21:03	05:55 20:47	06:30 20:03	07:05 19:07	06:42 17:15	07:23 16:40	07:49 16:41
27	07:39 17:16	06:57 17:59	06:07 18:35	06:13 20:13	05:38 20:46	05:32 21:03	05:56 20:46	06:31 20:01	07:07 19:05	06:44 17:13	07:24 16:40	07:49 16:42
28	07:38 17:18	06:55 18:00	06:05 18:36	06:12 20:14	05:37 20:47	05:33 21:03	05:57 20:45	06:32 20:00	07:08 19:03	06:45 17:12	07:26 16:39	07:50 16:42
29	07:37 17:19		07:03 19:37	06:10 20:15	05:36 20:48	05:33 21:03	05:58 20:44	06:33 19:58	07:09 19:01	06:46 17:10	07:27 16:38	07:50 16:43
30	07:36 17:21		07:01 19:38	06:09 20:16	05:36 20:49	05:34 21:02	05:59 20:43	06:34 19:56	07:10 18:59	06:48 17:09	07:28 16:38	07:50 16:44
31	07:35 17:22		07:00 19:40		05:35 20:50		06:00 20:42	06:35 19:54		06:49 17:07		07:50 16:45
Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

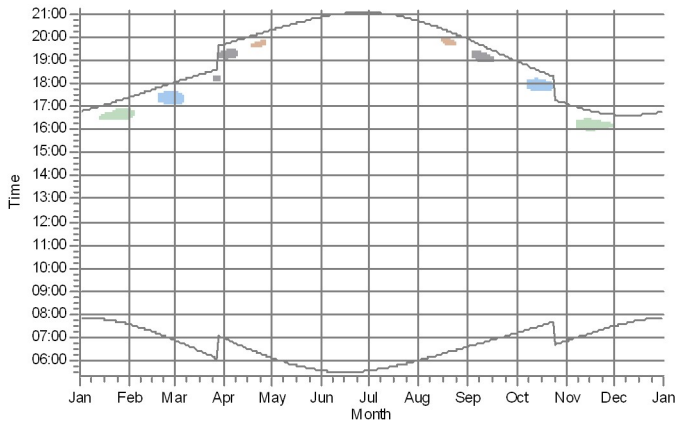
Calculated:

30/09/2022 13:05/3.5.587

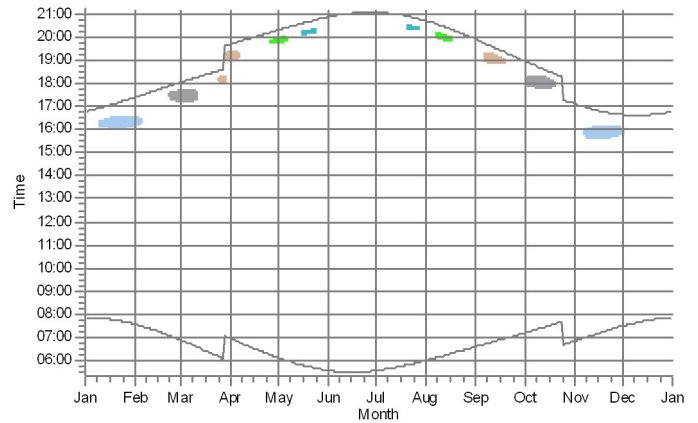
SHADOW - Calendar, graphical

Calculation: Parco Eolico Emilia: Shadow flickering

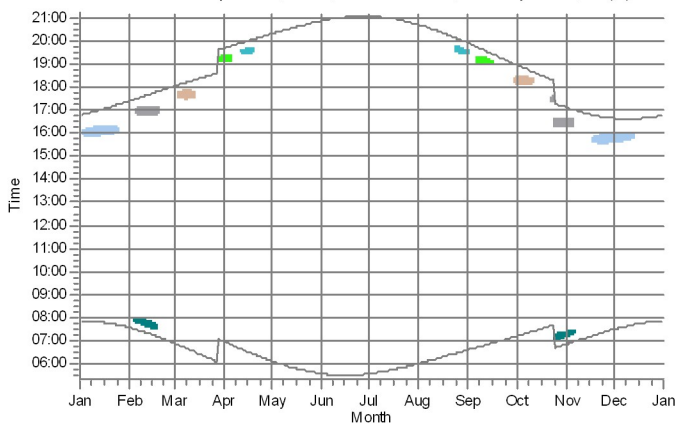
R01: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (1)



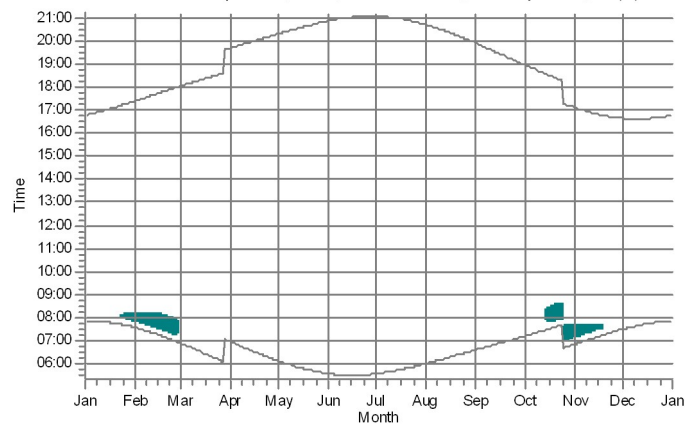
R02: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (2)



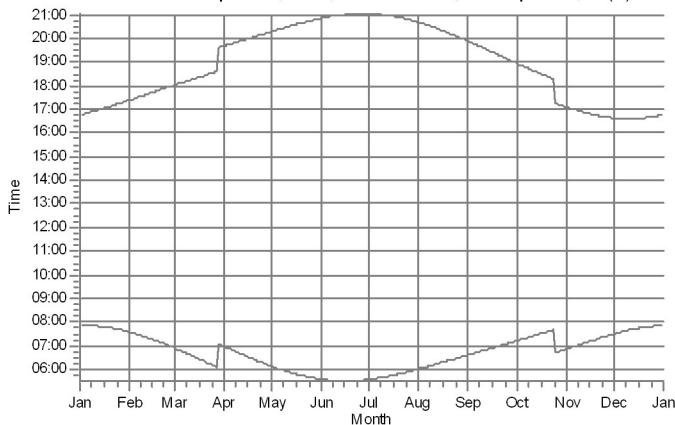
R03: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (3)



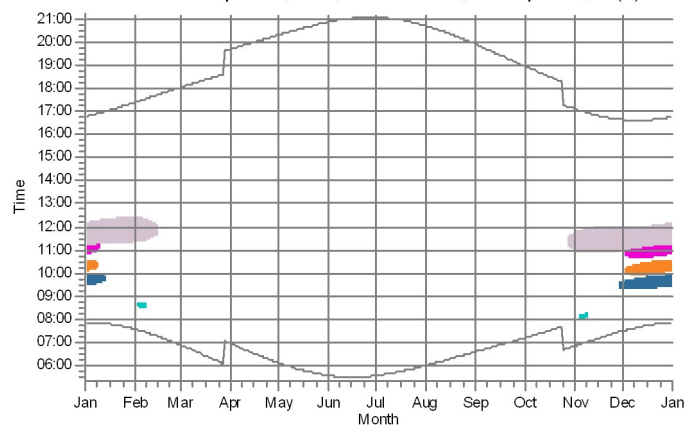
R04: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (4)



R05: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (5)



R09: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (6)



WTGs

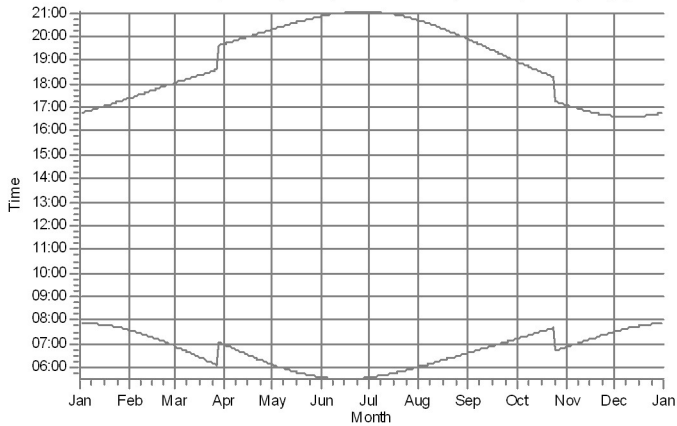
MC06: Siemens Gamesa SG 6.6-170 6600 170.0 I-1 hub: 135,0 m (TOT: 220,0 m) (6)
ER05: ENERCON E-53 800 53.0 I-1 hub: 60,0 m (TOT: 86,5 m) (5)
ER06: ENERCON E-53 800 53.0 I-1 hub: 60,0 m (TOT: 86,5 m) (6)
ER07: ENERCON E-53 800 53.0 I-1 hub: 60,0 m (TOT: 86,5 m) (7)
ER08: ENERCON E-53 800 53.0 I-1 hub: 60,0 m (TOT: 86,5 m) (8)
ER09: ENERCON E-53 800 53.0 I-1 hub: 60,0 m (TOT: 86,5 m) (9)

ER10: ENERCON E-53 800 53.0 I-1 hub: 60,0 m (TOT: 86,5 m) (10)
ER12: ENERCON E-53 800 53.0 I-1 hub: 60,0 m (TOT: 86,5 m) (12)
ER13: ENERCON E-53 800 53.0 I-1 hub: 60,0 m (TOT: 86,5 m) (13)
ER14: ENERCON E-53 800 53.0 I-1 hub: 60,0 m (TOT: 86,5 m) (14)
ER15: ENERCON E-53 800 53.0 I-1 hub: 60,0 m (TOT: 86,5 m) (15)
ER16: ENERCON E-53 800 53.0 I-1 hub: 60,0 m (TOT: 86,5 m) (16)

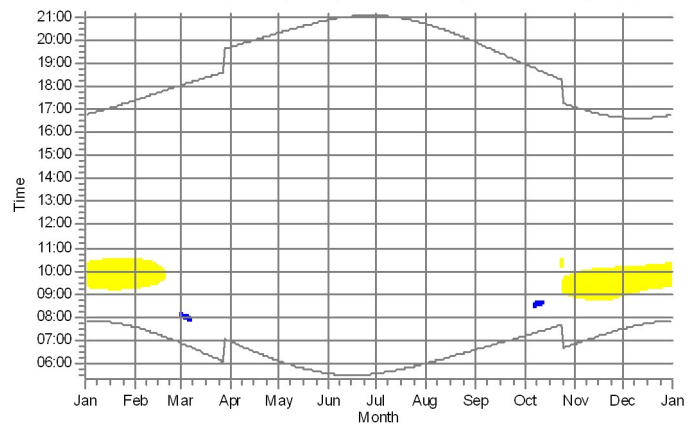
SHADOW - Calendar, graphical

Calculation: Parco Eolico Emilia: Shadow flickering

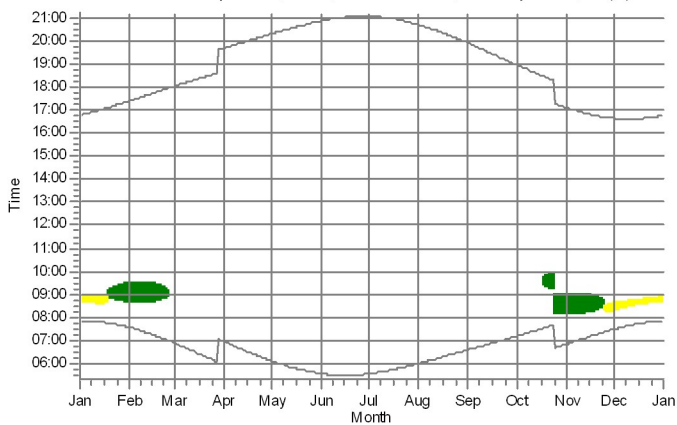
R10: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (7)



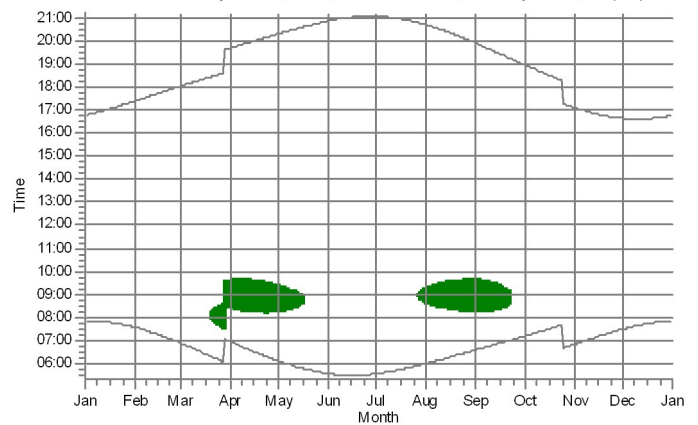
R14: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (8)



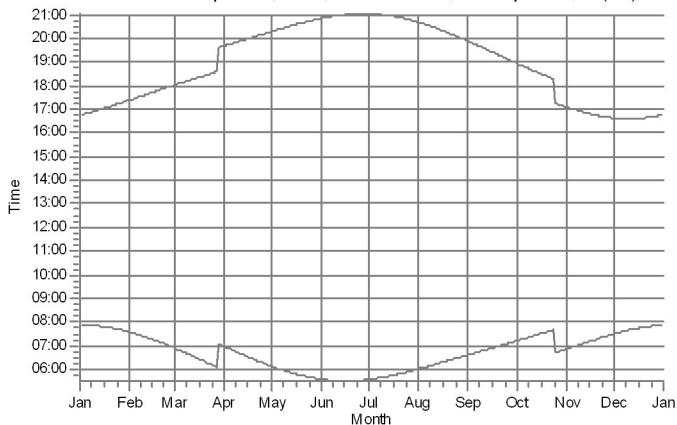
R15: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (9)



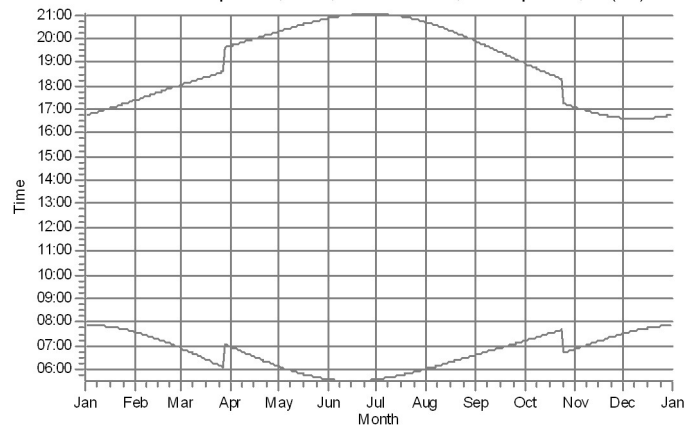
R16: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (10)



R18: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (11)



R19: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (12)



WTGs

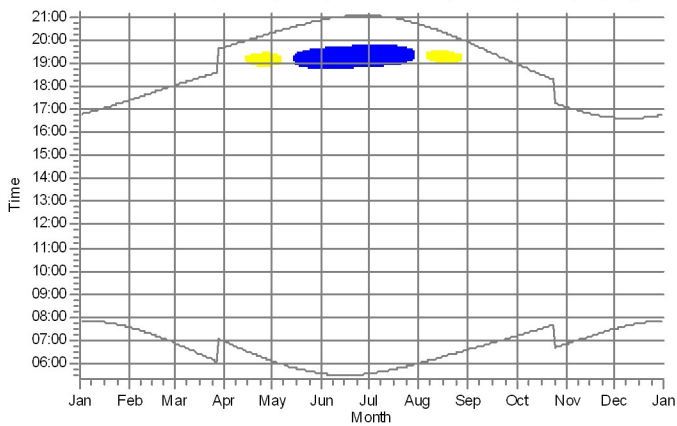
MC01: Siemens Gamesa SG 6.6-170 6600 170.0 !0! hub: 135,0 m (TOT: 220,0 m) (1)
MC02: Siemens Gamesa SG 6.6-170 6600 170.0 !0! hub: 135,0 m (TOT: 220,0 m) (2)

MC03: Siemens Gamesa SG 6.6-170 6600 170.0 !0! hub: 135,0 m (TOT: 220,0 m) (3)

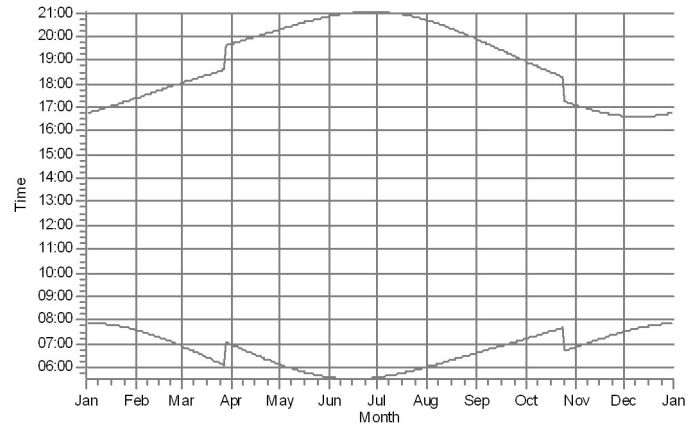
SHADOW - Calendar, graphical

Calculation: Parco Eolico Emilia: Shadow flickering

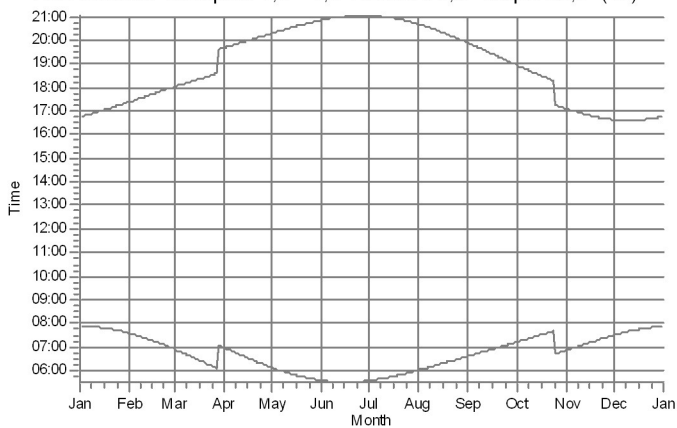
R20: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (13)



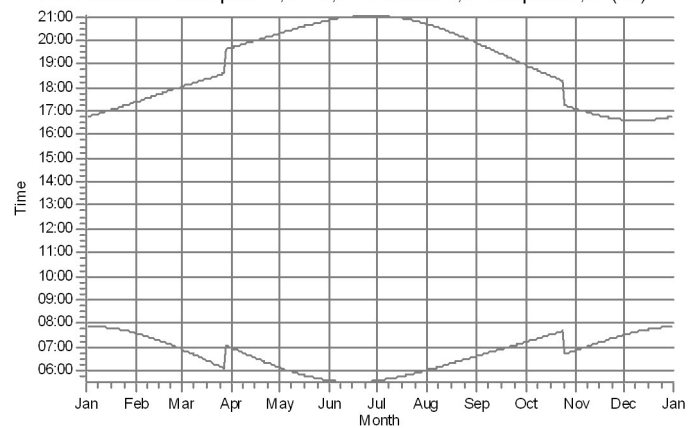
R21: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (14)



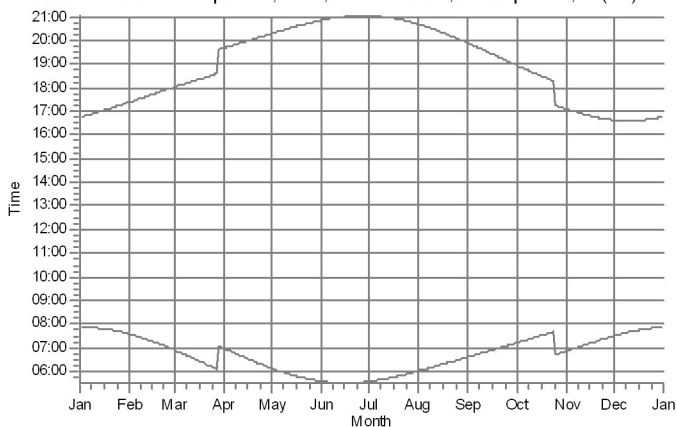
R22: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (15)



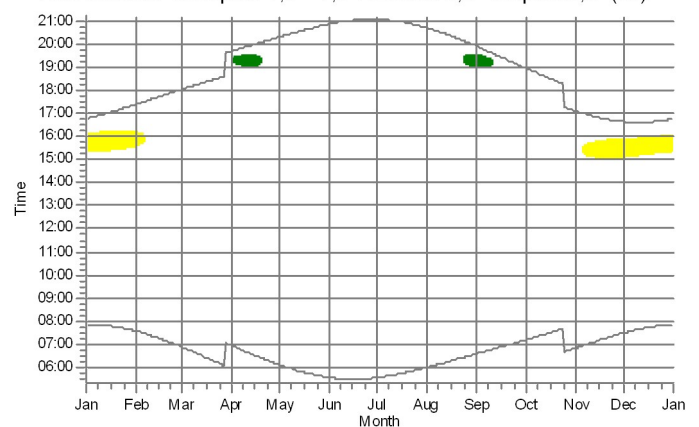
R23: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (16)



R24: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (17)



R26: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (18)



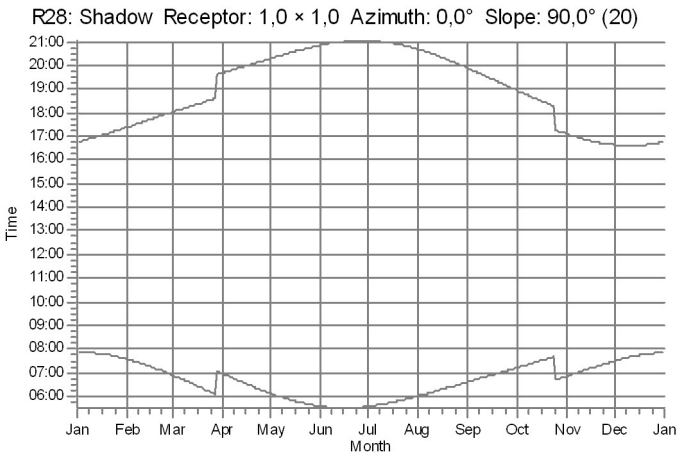
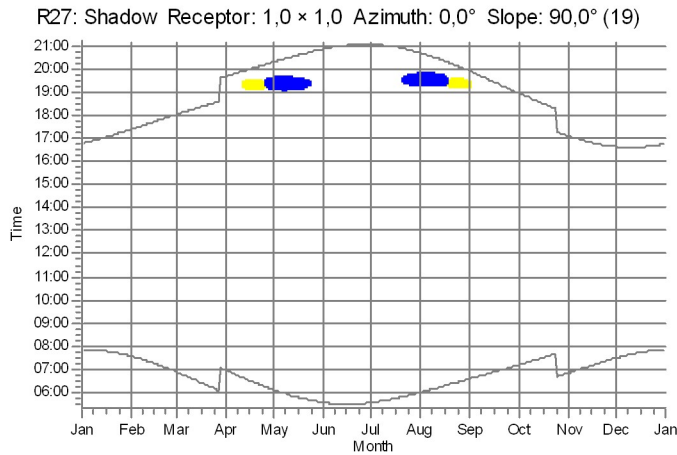
WTGs

MC01: Siemens Gamesa SG 6.6-170 6600 170.0 !0! hub: 135,0 m (TOT: 220,0 m) (1)
 MC02: Siemens Gamesa SG 6.6-170 6600 170.0 !0! hub: 135,0 m (TOT: 220,0 m) (2)

MC03: Siemens Gamesa SG 6.6-170 6600 170.0 !0! hub: 135,0 m (TOT: 220,0 m) (3)

SHADOW - Calendar, graphical

Calculation: Parco Eolico Emilia: Shadow flickering



WTGs

MC02: Siemens Gamesa SG 6.6-170 6600 170.0 !0! hub: 135,0 m (TOT: 220,0 m) (2)

MC03: Siemens Gamesa SG 6.6-170 6600 170.0 !0! hub: 135,0 m (TOT: 220,0 m) (3)

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: MC01 - Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (1)
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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June
1	07:50 16:46	07:34 08:43-09:27/44 17:23	06:54 18:02	06:58 08:29-09:35/66 19:41	06:07 08:20-09:21/61 20:17	05:34 20:51
2	07:51 16:46	07:33 08:43-09:27/44 17:24	06:52 18:03	06:56 08:27-09:36/69 19:42	06:06 08:20-09:19/59 20:19	05:34 20:52
3	07:51 16:47	07:32 08:43-09:28/45 17:26	06:50 18:04	06:54 19:15-19:20/5 19:43 08:27-09:37/70	06:04 08:21-09:18/57 20:20	05:33 20:52
4	07:51 16:48	07:30 08:43-09:29/46 17:27	06:48 18:05	06:52 19:12-19:22/10 19:44 08:26-09:37/71	06:03 08:21-09:16/55 20:21	05:33 20:53
5	07:51 16:49	07:29 08:42-09:28/46 17:29	06:47 18:07	06:50 19:10-19:23/13 19:46 08:24-09:37/73	06:01 08:22-09:15/53 20:22	05:32 20:54
6	07:50 16:50	07:28 08:43-09:29/46 17:30	06:45 18:08	06:49 19:08-19:24/16 19:47 08:23-09:37/74	06:00 08:23-09:14/51 20:23	05:32 20:55
7	07:50 16:51	07:27 08:43-09:29/46 17:31	06:43 18:09	06:47 19:07-19:25/18 19:48 08:22-09:37/75	05:59 08:25-09:13/48 20:25	05:32 20:55
8	07:50 16:52	07:25 08:42-09:29/47 17:33	06:41 18:11	06:45 19:05-19:26/21 19:49 08:22-09:37/75	05:57 08:25-09:10/45 20:26	05:31 20:56
9	07:50 16:53	07:24 08:43-09:29/46 17:34	06:40 18:12	06:43 19:05-19:28/23 19:51 08:21-09:37/76	05:56 08:26-09:09/43 20:27	05:31 20:57
10	07:50 16:55	07:23 08:43-09:30/47 17:36	06:38 18:13	06:41 19:05-19:29/24 19:52 08:20-09:37/77	05:55 08:28-09:08/40 20:28	05:31 20:57
11	07:49 16:56	07:21 08:43-09:29/46 17:37	06:36 18:15	06:40 19:04-19:29/25 19:53 08:19-09:36/77	05:54 08:29-09:06/37 20:29	05:31 20:58
12	07:49 16:57	07:20 08:43-09:29/46 17:38	06:34 18:16	06:38 19:04-19:28/24 19:54 08:19-09:36/77	05:52 08:31-09:04/33 20:30	05:30 20:58
13	07:49 16:58	07:19 08:43-09:28/45 17:40	06:32 18:17	06:36 19:05-19:28/23 19:55 08:19-09:36/77	05:51 08:33-09:02/29 20:32	05:30 20:59
14	07:48 16:59	07:17 08:44-09:28/44 17:41	06:31 18:18	06:34 19:04-19:27/23 19:57 08:18-09:35/77	05:50 08:34-08:59/25 20:33	05:30 21:00
15	07:48 17:00	07:16 08:44-09:27/43 17:43	06:29 18:20	06:33 19:05-19:26/21 19:58 08:17-09:34/77	05:49 08:37-08:56/19 20:34	05:30 21:00
16	07:47 17:02	07:14 08:45-09:26/41 17:44	06:27 18:21	06:31 19:06-19:25/19 19:59 08:18-09:34/76	05:48 08:40-08:52/12 20:35	05:30 21:00
17	07:47 17:03	07:13 08:46-09:25/39 17:45	06:25 18:22	06:29 19:07-19:23/16 20:00 08:17-09:33/76	05:47 20:36	05:30 21:01
18	07:46 17:04	07:11 08:47-09:24/37 17:47	06:23 18:23	06:28 19:08-19:21/13 20:02 08:17-09:32/75	05:46 20:37	05:30 21:01
19	07:45 08:57-09:08/11 17:05	07:10 08:48-09:22/34 17:48	06:22 18:25	06:26 19:12-19:18/6 20:03 08:17-09:32/75	05:45 20:38	05:30 21:01
20	07:45 08:54-09:11/17 17:07	07:08 08:49-09:21/32 17:49	06:20 18:26	06:24 08:17-09:31/74 20:04	05:44 20:39	05:30 21:02
21	07:44 08:52-09:13/21 17:08	07:07 08:51-09:19/28 17:51	06:18 07:58-08:13/15 18:27	06:23 08:17-09:31/74 20:05	05:43 20:40	05:30 21:02
22	07:43 08:51-09:16/25 17:09	07:05 08:52-09:16/24 17:52	06:16 07:53-08:19/26 18:28	06:21 08:17-09:30/73 20:06	05:42 20:41	05:31 21:02
23	07:42 08:50-09:18/28 17:11	07:03 08:55-09:14/19 17:54	06:14 07:49-08:23/34 18:30	06:19 08:16-09:28/72 20:08	05:41 20:42	05:31 21:02
24	07:42 08:49-09:19/30 17:12	07:02 08:59-09:09/10 17:55	06:12 07:45-08:25/40 18:31	06:18 08:17-09:28/71 20:09	05:40 20:43	05:31 21:03
25	07:41 08:48-09:20/32 17:13	07:00 17:56	06:11 07:42-08:27/45 18:32	06:16 08:17-09:27/70 20:10	05:39 20:44	05:31 21:03
26	07:40 08:47-09:22/35 17:15	06:59 17:58	06:09 07:39-08:29/50 18:33	06:15 08:18-09:26/68 20:11	05:38 20:45	05:32 21:03
27	07:39 08:46-09:23/37 17:16	06:57 17:59	06:07 07:37-08:30/53 18:35	06:13 08:17-09:25/68 20:13	05:38 20:46	05:32 21:03
28	07:38 08:46-09:24/38 17:18	06:55 18:00	06:05 07:35-08:32/57 18:36	06:12 08:18-09:24/66 20:14	05:37 20:47	05:33 21:03
29	07:37 08:45-09:25/40 17:19		07:03 08:34-09:33/59 19:37	06:10 08:18-09:22/64 20:15	05:36 20:48	05:33 21:03
30	07:36 08:45-09:26/41 17:20		07:01 08:32-09:34/62 19:38	06:09 08:19-09:22/63 20:16	05:35 20:49	05:33 21:03
31	07:35 08:45-09:27/42 17:22		06:59 08:30-09:35/65 19:39		05:35 20:50	
Potential sun hours	288	292	369	403	458	464
Sum of minutes with flicker	397	945	506	2476	667	0

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

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

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: MC01 - Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (1)
Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	July	August	September	October	November	December
1	05:34 21:02	06:01 08:40-09:14/34 20:40	06:36 19:03-19:28/25 19:53 08:18-09:35/77	07:11 18:57	06:50 08:12-08:58/46 17:06	07:29 16:37
2	05:34 21:02	06:02 08:39-09:17/38 20:39	06:37 19:03-19:27/24 19:51 08:19-09:36/77	07:12 18:55	06:52 08:12-08:59/47 17:04	07:30 16:37
3	05:35 21:02	06:03 08:38-09:19/41 20:38	06:39 19:04-19:26/22 19:49 08:19-09:35/76	07:14 18:54	06:53 08:12-08:59/47 17:03	07:31 16:37
4	05:36 21:02	06:04 08:36-09:20/44 20:37	06:40 19:03-19:24/21 19:47 08:19-09:34/75	07:15 18:52	06:54 08:13-08:59/46 17:02	07:33 16:36
5	05:36 21:02	06:05 08:35-09:22/47 20:35	06:41 19:04-19:22/18 19:45 08:19-09:34/75	07:16 18:50	06:56 08:12-08:59/47 17:00	07:34 16:36
6	05:37 21:01	06:06 08:34-09:23/49 20:34	06:42 19:04-19:20/16 19:44 08:19-09:33/74	07:17 18:48	06:57 08:13-08:59/46 16:59	07:35 16:36
7	05:38 21:01	06:08 08:33-09:24/51 20:33	06:43 19:05-19:18/13 19:42 08:19-09:32/73	07:18 18:46	06:58 08:13-08:59/46 16:58	07:36 16:36
8	05:38 21:00	06:09 08:31-09:25/54 20:31	06:44 19:06-19:17/11 19:40 08:20-09:31/71	07:20 18:45	07:00 08:13-08:58/45 16:56	07:37 16:36
9	05:39 21:00	06:10 08:30-09:26/56 20:30	06:46 19:09-19:15/6 19:38 08:20-09:30/70	07:21 18:43	07:01 08:14-08:58/44 16:55	07:38 16:36
10	05:40 21:00	06:11 08:29-09:27/58 20:29	06:47 08:20-09:29/69 19:36	07:22 18:41	07:02 08:14-08:57/43 16:54	07:39 16:35
11	05:41 20:59	06:12 08:28-09:28/60 20:27	06:48 08:21-09:28/67 19:34	07:23 18:39	07:04 08:16-08:58/42 16:53	07:39 16:35
12	05:41 20:59	06:13 08:27-09:29/62 20:26	06:49 08:22-09:27/65 19:33	07:25 18:37	07:05 08:16-08:57/41 16:52	07:40 16:36
13	05:42 20:58	06:14 08:27-09:29/62 20:24	06:50 08:23-09:26/63 19:31	07:26 18:36	07:06 08:17-08:57/40 16:51	07:41 16:36
14	05:43 20:57	06:16 08:27-09:31/64 20:23	06:51 08:24-09:24/60 19:29	07:27 18:34	07:08 08:18-08:56/38 16:50	07:42 16:36
15	05:44 20:57	06:17 08:26-09:32/66 20:21	06:52 08:25-09:22/57 19:27	07:28 18:32	07:09 08:19-08:56/37 16:49	07:43 16:36
16	05:45 20:56	06:18 08:25-09:32/67 20:20	06:54 08:26-09:20/54 19:25	07:30 18:31	07:10 08:20-08:55/35 16:48	07:44 16:36
17	05:46 20:55	06:19 08:24-09:33/69 20:18	06:55 08:27-09:18/51 19:23	07:31 18:29	07:12 08:21-08:53/32 16:47	07:44 16:36
18	05:47 20:55	06:20 08:24-09:33/69 20:16	06:56 08:29-09:15/46 19:21	07:32 09:29-09:42/13 18:27	07:13 08:23-08:53/30 16:46	07:45 16:37
19	05:47 20:54	06:21 08:23-09:34/71 20:15	06:57 08:31-09:12/41 19:20	07:33 09:25-09:46/21 18:26	07:14 08:24-08:52/28 16:45	07:46 16:37
20	05:48 20:53	06:22 08:22-09:34/72 20:13	06:58 08:34-09:10/36 19:18	07:35 09:23-09:49/26 18:24	07:16 08:26-08:51/25 16:44	07:46 16:38
21	05:49 20:52	06:24 08:22-09:35/73 20:12	06:59 08:37-09:06/29 19:16	07:36 09:21-09:50/29 18:22	07:17 08:28-08:49/21 16:43	07:47 16:38
22	05:50 20:51	06:25 08:21-09:35/74 20:10	07:01 08:42-09:00/18 19:14	07:37 09:19-09:51/32 18:21	07:18 08:30-08:47/17 16:43	07:47 16:38
23	05:51 20:50	06:26 08:20-09:35/75 20:08	07:02 19:12	07:39 09:18-09:53/35 18:19	07:20 08:34-08:45/11 16:42	07:48 16:39
24	05:52 20:49	06:27 19:14-19:21/7 20:07	07:03 19:10	07:40 09:16-09:54/38 18:17	07:21 16:41	07:48 16:40
25	05:53 20:48	06:28 19:12-19:25/13 20:05	07:04 19:08	06:41 08:16-08:56/40 17:16	07:22 16:40	07:49 16:40
26	05:54 20:47	06:29 19:10-19:26/16 20:03	07:05 19:06	06:42 08:15-08:56/41 17:14	07:23 16:40	07:49 16:41
27	05:55 08:56-08:57/1 20:46	06:31 19:08-19:27/19 20:01	07:06 19:05	06:44 08:14-08:56/42 17:13	07:24 16:39	07:49 16:41
28	05:57 08:49-09:05/16 20:45	06:32 19:06-19:28/22 20:00	07:08 19:03	06:45 08:14-08:58/44 17:11	07:26 16:39	07:50 16:42
29	05:58 08:46-09:08/22 20:44	06:33 19:05-19:28/23 19:58	07:09 19:01	06:46 08:13-08:58/45 17:10	07:27 16:38	07:50 16:43
30	05:59 08:44-09:10/26 20:43	06:34 19:04-19:28/24 19:56	07:10 18:59	06:48 08:13-08:59/46 17:08	07:28 16:38	07:50 16:44
31	06:00 08:42-09:13/31 20:42	06:35 19:04-19:28/24 19:54	07:11 17:07	06:49 08:12-08:59/47 17:07	07:29 16:44	07:50 16:44
Potential sun hours	470	434	376	342	290	277
Sum of minutes with flicker	96	2115	1480	499	854	0

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: MC02 - Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (2)
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

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
446	588	709	537	307	224	366	1.786	992	318	487	496	7.256

	January			February			March			April			May			June		
1	07:50	15:24-16:03/39	09:21-10:19/58	07:34	15:40-16:07/27	06:53	06:58						06:07	18:57-19:19/22	05:34			
	16:46	08:44-08:52/8		17:23	09:19-10:28/69	18:02	19:41						20:17		20:51			
2	07:50	15:24-16:03/39	09:21-10:19/58	07:33	15:42-16:06/24	06:52	06:56						06:06	18:58-19:18/20	05:34			
	16:46	08:44-08:52/8		17:24	09:19-10:27/68	18:03	19:42						20:19		20:52			
3	07:50	15:24-16:04/40	09:21-10:20/59	07:32	15:44-16:05/21	06:50	06:54						06:04	18:59-19:17/18	05:33			
	16:47	08:44-08:53/9		17:26	09:20-10:27/67	18:04	19:43						20:20		20:52			
4	07:50	15:25-16:05/40	09:21-10:21/60	07:30	15:47-16:03/16	06:48	06:52						06:03	19:00-19:15/15	05:33			
	16:48	08:44-08:53/9		17:27	09:21-10:27/66	18:05	19:44						20:21		20:53			
5	07:50	15:24-16:04/40	09:20-10:20/60	07:29	15:51-15:57/6	06:47	06:50						06:01	19:02-19:13/11	05:32			
	16:49	08:44-08:54/10		17:29	09:21-10:25/64	18:07	19:46						20:22		20:54			
6	07:50	15:25-16:05/40	09:20-10:21/61	07:28	09:22-10:25/63	06:45	06:49						06:00		05:32			
	16:50	08:43-08:53/10		17:30		18:08	19:47						20:23		20:55			
7	07:50	15:25-16:06/41	09:20-10:22/62	07:27	09:23-10:24/61	06:43	06:47						05:59		05:32			
	16:51	08:43-08:54/11		17:31		18:09	19:48						20:25		20:55			
8	07:50	15:26-16:07/41	09:20-10:23/63	07:25	09:24-10:23/59	06:41	06:45						05:57		05:31			
	16:52	08:43-08:54/11		17:33		18:11	19:49						20:26		20:56			
9	07:50	15:25-16:07/42	09:19-10:23/64	07:24	09:25-10:22/57	06:40	06:43						05:56		05:31			
	16:53	08:42-08:54/12		17:34		18:12	19:50						20:27		20:57			
10	07:50	15:26-16:08/42	09:19-10:24/65	07:23	09:26-10:21/55	06:38	06:41						05:55		05:31			
	16:55	08:42-08:54/12		17:36		18:13	19:52						20:28		20:57			
11	07:49	15:26-16:09/43	09:19-10:25/66	07:21	09:27-10:19/52	06:36	06:40						05:54		05:30			
	16:56	08:42-08:55/13		17:37		18:15	19:53						20:29		20:58			
12	07:49	15:26-16:09/43	09:17-10:25/68	07:20	09:29-10:17/48	06:34	06:38	19:15-19:23/8					05:52		05:30			
	16:57	08:41-08:54/13		17:38		18:16	19:54						20:30		20:58			
13	07:48	15:27-16:10/43	09:17-10:26/69	07:19	09:30-10:15/45	06:32	06:36	19:13-19:25/12					05:51		05:30			
	16:58	08:41-08:54/13		17:40		18:17	19:55						20:31		20:59			
14	07:48	15:27-16:10/43	09:16-10:26/70	07:17	09:32-10:13/41	06:31	06:34	19:11-19:26/15					05:50		05:30			
	16:59	08:40-08:54/14		17:41		18:18	19:57						20:33		20:59			
15	07:48	15:27-16:10/43	09:16-10:27/71	07:16	09:34-10:10/36	06:29	06:33	19:10-19:26/16					05:49		05:30			
	17:00	08:41-08:54/13		17:43		18:20	19:58						20:34		21:00			
16	07:47	15:28-16:11/43	09:15-10:27/72	07:14	09:37-10:08/31	06:27	06:31	19:09-19:28/19					05:48		05:30			
	17:02	08:42-08:52/10		17:44		18:21	19:59						20:35		21:00			
17	07:47	15:28-16:11/43	09:14-10:27/73	07:13	09:39-10:03/24	06:25	06:29	19:05-19:28/23					05:47		05:30			
	17:03	08:43-08:51/8		17:45		18:22	20:00						20:36		21:01			
18	07:46	15:29-16:12/43		07:11	09:45-09:58/13	06:23	06:28	19:02-19:28/26					05:46		05:30			
	17:04	09:14-10:28/74		17:47		18:23	20:02						20:37		21:01			
19	07:45	15:29-16:12/43		07:10		06:21	06:26	19:01-19:28/27					05:45		05:30			
	17:05	09:14-10:28/74		17:48		18:25	20:03						20:38		21:01			
20	07:45	15:29-16:12/43		07:08		06:20	06:24	18:59-19:27/28					05:44		05:30			
	17:07	09:14-10:28/74		17:49		18:26	20:04						20:39		21:02			
21	07:44	15:30-16:11/41		07:07		06:18	06:23	18:58-19:26/28					05:43		05:30			
	17:08	09:14-10:28/74		17:51		18:27	20:05						20:40		21:02			
22	07:43	15:30-16:11/41		07:05		06:16	06:21	18:57-19:26/29					05:42		05:31			
	17:09	09:14-10:28/74		17:52		18:28	20:06						20:41		21:02			
23	07:42	15:31-16:12/41		07:03		06:14	06:19	18:56-19:24/28					05:41		05:31			
	17:11	09:16-10:29/73		17:53		18:30	20:08						20:42		21:02			
24	07:42	15:32-16:12/40		07:02		06:12	06:18	18:56-19:23/27					05:40		05:31			
	17:12	09:16-10:29/73		17:55		18:31	20:09						20:43		21:02			
25	07:41	15:33-16:12/39		07:00		06:10	06:16	18:56-19:20/24					05:39		05:31			
	17:13	09:16-10:29/73		17:56		18:32	20:10						20:44		21:03			
26	07:40	15:33-16:12/39		06:59		06:09	06:15	18:56-19:22/26					05:38		05:32			
	17:15	09:16-10:29/73		17:58		18:33	20:11						20:45		21:03			
27	07:39	15:34-16:11/37		06:57		06:07	06:13	18:55-19:21/26					05:38		05:32			
	17:16	09:17-10:29/72		17:59		18:35	20:12						20:46		21:03			
28	07:38	15:35-16:11/36		06:55		06:05	06:12	18:56-19:21/25					05:37		05:33			
	17:17	09:17-10:29/72		18:00		18:36	20:14						20:47		21:03			
29	07:37	15:36-16:11/35				07:03	06:10	18:56-19:20/24					05:36		05:33			
	17:19	09:18-10:29/71				19:37	20:15						20:48		21:03			
30	07:36	15:37-16:10/33				07:01	06:09	18:57-19:20/23					05:35		05:33			
	17:20	09:18-10:29/71				19:38	20:16						20:49		21:02			
31	07:35	15:38-16:08/30				06:59							05:35					
	17:22	09:18-10:28/70				19:39							20:50					
Potential sun hours	288			292		369	403						458		464			
Sum of minutes with flicker	3547			1013		0	434						86		0			

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: MC02 - Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (2)
Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	July	August	September	October	November	December
1	05:34 21:02	06:01 20:40	06:36 19:53	07:11 18:57	06:50 17:06	07:29 16:37
2	05:34 21:02	06:02 20:39	06:37 19:51	07:12 18:55	06:52 17:04	07:30 16:37
3	05:35 21:02	06:03 20:38	06:39 19:49	07:14 18:54	06:53 17:03	07:31 16:37
4	05:36 21:02	06:04 20:37	06:40 19:47	07:15 18:52	06:54 17:01	07:32 16:36
5	05:36 21:01	06:05 20:35	06:41 19:45	07:16 18:50	06:56 17:00	07:34 16:36
6	05:37 21:01	06:06 20:34	06:42 19:44	07:17 18:48	06:57 16:59	07:35 16:36
7	05:38 21:01	06:07 20:33	06:43 19:42	07:18 18:46	06:58 16:58	07:36 16:36
8	05:38 21:00	06:09 20:31	06:44 19:40	07:20 18:44	07:00 16:56	07:37 16:36
9	05:39 21:00	06:10 20:30	06:46 19:38	07:21 18:43	07:01 16:55	07:38 16:36
10	05:40 21:00	06:11 20:28	06:47 19:36	07:22 18:41	07:02 16:54	07:38 16:35
11	05:41 20:59	06:12 20:27	06:48 19:34	07:23 18:39	07:04 16:53	07:39 16:35
12	05:41 20:58	06:13 20:26	06:49 19:33	07:25 18:37	07:05 16:52	07:40 16:36
13	05:42 20:58	06:14 20:24	06:50 19:31	07:26 18:36	07:06 16:51	07:41 16:36
14	05:43 20:57	06:15 20:23	06:51 19:29	07:27 18:34	07:08 16:50	07:42 16:36
15	05:44 20:57	06:17 20:21	06:52 19:27	07:28 18:32	07:09 16:49	07:43 16:36
16	05:45 20:56	06:18 20:19	06:54 19:25	07:30 18:31	07:10 16:48	07:43 16:36
17	05:46 20:55	06:19 20:18	06:55 19:23	07:31 18:29	07:12 16:47	07:44 16:36
18	05:47 20:54	06:20 20:16	06:56 19:21	07:32 18:27	07:13 16:46	07:45 16:37
19	05:47 20:54	06:21 20:15	06:57 19:19	07:33 18:25	07:14 16:45	07:45 16:37
20	05:48 20:53	06:22 20:13	06:58 19:18	07:35 18:24	07:16 16:44	07:46 16:38
21	05:49 20:52	06:24 20:11	06:59 19:16	07:36 18:22	07:17 16:43	07:47 16:38
22	05:50 20:51	06:25 20:10	07:01 19:14	07:37 18:21	07:18 16:42	07:47 16:38
23	05:51 20:50	06:26 20:08	07:02 19:12	07:38 18:19	07:19 16:42	07:48 16:39
24	05:52 20:49	06:27 20:06	07:03 19:10	07:40 18:17	07:21 16:41	07:48 16:39
25	05:53 20:48	06:28 20:05	07:04 19:08	07:41 18:16	07:22 16:40	07:49 16:40
26	05:54 20:47	06:29 20:03	07:05 19:06	07:42 18:14	07:23 16:40	07:49 16:41
27	05:55 20:46	06:31 20:01	07:06 19:05	07:44 18:13	07:24 16:39	07:49 16:41
28	05:56 20:45	06:32 20:00	07:08 19:03	07:45 18:11	07:26 16:39	07:50 16:42
29	05:58 20:44	06:33 19:58	07:09 19:01	07:46 18:10	07:27 16:38	07:50 16:43
30	05:59 20:43	06:34 19:56	07:10 18:59	07:48 18:08	07:28 16:38	07:50 16:44
31	06:00 20:42	06:35 19:54	07:11 18:57	07:49 18:07	07:29 16:38	07:50 16:44
Potential sun hours	470	434	376	342	290	277
Sum of minutes with flicker	0	532	0	303	3037	3204

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

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

Project:

Parco Eolico Emilia

Licensed user:

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Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: MC03 - Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (3)
Assumptions for shadow calculations 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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June
1	07:50 16:46	07:34 17:23	06:53 18:01	08:07-08:08/1 19:41	06:07 20:17	19:08-19:35/27 20:51
2	07:50 16:46	07:33 17:24	06:52 18:03	08:05-08:06/1 19:42	06:06 20:19	19:08-19:36/28 20:52
3	07:50 16:47	07:32 17:26	06:50 18:04	08:02-08:05/3 19:43	06:04 20:20	19:07-19:36/29 20:52
4	07:50 16:48	07:30 17:27	06:48 18:05	08:00-08:03/3 19:44	06:03 20:21	19:06-19:36/30 20:53
5	07:50 16:49	07:29 17:29	06:47 18:07	07:59-08:02/3 19:46	06:01 20:22	19:06-19:36/30 20:54
6	07:50 16:50	07:28 17:30	06:45 18:08	07:56-07:59/3 19:47	06:00 20:23	19:06-19:37/31 20:55
7	07:50 16:51	07:27 17:31	06:43 18:09	07:54-07:55/1 19:48	05:59 20:24	19:05-19:36/31 20:55
8	07:50 16:52	07:25 17:33	06:41 18:11	19:49	05:57 20:26	19:05-19:36/31 20:56
9	07:50 16:53	07:24 17:34	06:40 18:12	19:50	05:56 20:27	19:06-19:36/30 20:57
10	07:49 16:55	07:23 17:36	06:38 18:13	19:52	05:55 20:28	19:06-19:36/30 20:57
11	07:49 16:56	07:21 17:37	06:36 18:14	19:53	05:53 20:29	19:06-19:36/30 20:58
12	07:49 16:57	07:20 17:38	06:34 18:16	19:54	05:52 20:30	19:06-19:35/29 20:58
13	07:48 16:58	07:19 17:40	06:32 18:17	19:55	05:51 20:31	19:06-19:35/29 20:59
14	07:48 16:59	07:17 17:41	06:31 18:18	19:57	05:50 20:33	19:07-19:34/27 20:59
15	07:48 17:00	07:16 17:43	06:29 18:20	19:58	05:49 20:34	19:07-19:34/27 21:00
16	07:47 17:02	07:14 17:44	06:27 18:21	20:00	05:48 20:35	19:02-19:33/31 21:00
17	07:46 17:03	07:13 17:45	06:25 18:22	20:01	05:47 20:36	19:00-19:33/33 21:01
18	07:46 17:04	07:11 17:47	06:23 18:23	20:02	05:46 20:37	18:58-19:32/34 21:01
19	07:45 17:05	07:10 17:48	06:21 18:25	20:03	05:45 20:38	18:56-19:31/35 21:01
20	07:45 17:07	07:08 17:49	06:20 18:26	20:04	05:44 20:39	18:55-19:29/34 21:02
21	07:44 17:08	07:07 17:51	06:18 18:27	20:05	05:43 20:40	18:55-19:29/34 21:02
22	07:43 17:09	07:05 17:52	06:16 18:28	20:06	05:42 20:41	18:54-19:28/34 21:02
23	07:42 17:11	07:03 17:53	06:14 18:30	20:08	05:41 20:42	18:53-19:28/35 21:02
24	07:41 17:12	07:02 17:55	06:12 18:31	20:09	05:40 20:43	18:52-19:29/37 21:02
25	07:41 17:13	07:00 17:56	06:10 18:32	20:10	05:39 20:44	18:51-19:30/39 21:03
26	07:40 17:15	06:58 17:57	06:09 18:33	20:11	05:38 20:45	18:51-19:31/40 21:03
27	07:39 17:16	06:57 17:59	06:07 18:34	20:12	05:38 20:46	18:51-19:31/40 21:03
28	07:38 17:17	06:55 18:00	06:05 18:36	20:14	05:37 20:47	18:50-19:32/42 21:03
29	07:37 17:19		07:03 19:37	20:15	05:36 20:48	18:50-19:33/43 21:03
30	07:36 17:20		07:01 19:38	20:16	05:35 20:49	18:50-19:33/43 21:02
31	07:35 17:22		06:59 19:39		05:35 20:50	18:50-19:34/44 21:02
Potential sun hours	288	292	369	403	458	464
Sum of minutes with flicker	0	0	15	99	1037	1421

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

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

Project:

Parco Eolico Emilia

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Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: MC03 - Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (3)
Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	July		August		September		October		November		December	
1	05:34	18:54-19:42/48	06:01	19:16-19:46/30	06:36	07:11			06:50	07:29		
	21:02		20:40		19:53	18:57			17:06	16:37		
2	05:34	18:55-19:42/47	06:02	19:16-19:46/30	06:37	07:12			06:52	07:30		
	21:02		20:39		19:51	18:55			17:04	16:37		
3	05:35	18:54-19:42/48	06:03	19:16-19:46/30	06:39	07:13			06:53	07:31		
	21:02		20:38		19:49	18:53			17:03	16:37		
4	05:36	18:55-19:42/47	06:04	19:16-19:47/31	06:40	07:15			06:54	07:32		
	21:02		20:37		19:47	18:52			17:01	16:36		
5	05:36	18:56-19:43/47	06:05	19:16-19:47/31	06:41	07:16			06:56	07:33		
	21:01		20:35		19:45	18:50			17:00	16:36		
6	05:37	18:55-19:42/47	06:06	19:16-19:47/31	06:42	07:17			06:57	07:35		
	21:01		20:34		19:44	18:48			16:59	16:36		
7	05:38	18:56-19:42/46	06:07	19:16-19:46/30	06:43	07:18	08:31-08:33/2		06:58	07:36		
	21:01		20:33		19:42	18:46			16:58	16:36		
8	05:38	18:57-19:43/46	06:09	19:16-19:46/30	06:44	07:20	08:32-08:35/3		07:00	07:37		
	21:00		20:31		19:40	18:44			16:56	16:36		
9	05:39	18:56-19:42/46	06:10	19:16-19:46/30	06:45	07:21	08:34-08:37/3		07:01	07:37		
	21:00		20:30		19:38	18:43			16:55	16:35		
10	05:40	18:57-19:42/45	06:11	19:16-19:45/29	06:47	07:22	08:36-08:39/3		07:02	07:38		
	20:59		20:28		19:36	18:41			16:54	16:35		
11	05:40	18:58-19:42/44	06:12	19:16-19:44/28	06:48	07:23	08:38-08:40/2		07:04	07:39		
	20:59		20:27		19:34	18:39			16:53	16:35		
12	05:41	18:58-19:42/44	06:13	19:17-19:43/26	06:49	07:24	08:39-08:40/1		07:05	07:40		
	20:58		20:25		19:33	18:37			16:52	16:35		
13	05:42	18:58-19:41/43	06:14	19:17-19:42/25	06:50	07:26			07:06	07:41		
	20:58		20:24		19:31	18:36			16:51	16:36		
14	05:43	18:59-19:41/42	06:15	19:18-19:41/23	06:51	07:27			07:08	07:42		
	20:57		20:22		19:29	18:34			16:50	16:36		
15	05:44	18:59-19:41/42	06:17	19:19-19:39/20	06:52	07:28			07:09	07:43		
	20:57		20:21		19:27	18:32			16:49	16:36		
16	05:45	19:00-19:41/41	06:18	19:22-19:38/16	06:54	07:29			07:10	07:43		
	20:56		20:19		19:25	18:30			16:48	16:36		
17	05:46	19:01-19:41/40	06:19	19:24-19:35/11	06:55	07:31			07:12	07:44		
	20:55		20:18		19:23	18:29			16:47	16:36		
18	05:46	19:01-19:40/39	06:20		06:56	07:32			07:13	07:45		
	20:54		20:16		19:21	18:27			16:46	16:37		
19	05:47	19:01-19:39/38	06:21		06:57	07:33			07:14	07:45		
	20:54		20:15		19:19	18:25			16:45	16:37		
20	05:48	19:02-19:38/36	06:22		06:58	07:35			07:16	07:46		
	20:53		20:13		19:18	18:24			16:44	16:37		
21	05:49	19:03-19:38/35	06:24		06:59	07:36			07:17	07:47		
	20:52		20:11		19:16	18:22			16:43	16:38		
22	05:50	19:04-19:38/34	06:25		07:00	07:37			07:18	07:47		
	20:51		20:10		19:14	18:21			16:42	16:38		
23	05:51	19:05-19:39/34	06:26		07:02	07:38			07:19	07:48		
	20:50		20:08		19:12	18:19			16:42	16:39		
24	05:52	19:06-19:41/35	06:27		07:03	07:40			07:21	07:48		
	20:49		20:06		19:10	18:17			16:41	16:39		
25	05:53	19:08-19:42/34	06:28		07:04	06:41			07:22	07:49		
	20:48		20:05		19:08	17:16			16:40	16:40		
26	05:54	19:09-19:43/34	06:29		07:05	06:42			07:23	07:49		
	20:47		20:03		19:06	17:14			16:40	16:41		
27	05:55	19:11-19:43/32	06:30		07:06	06:44			07:24	07:49		
	20:46		20:01		19:05	17:13			16:39	16:41		
28	05:56	19:14-19:44/30	06:32		07:08	06:45			07:26	07:50		
	20:45		20:00		19:03	17:11			16:39	16:42		
29	05:58	19:18-19:45/27	06:33		07:09	06:46			07:27	07:50		
	20:44		19:58		19:01	17:10			16:38	16:43		
30	05:59	19:17-19:45/28	06:34		07:10	06:48			07:28	07:50		
	20:43		19:56		18:59	17:08			16:38	16:44		
31	06:00	19:17-19:46/29	06:35			06:49				07:50		
	20:42		19:54			17:07				16:44		
Potential sun hours	470		434		376		342		290		277	
Sum of minutes with flicker	1228		451		0		14		0		0	

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: MC04 - Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (4)
Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:51	07:34	06:54	06:58	06:07	05:35	05:34	06:01	06:37	07:11	06:51	07:29
	16:46	17:23	18:02	19:41	20:18	20:51	21:03	20:41	19:53	18:57	17:06	16:38
2	07:51	07:33	06:52	06:56	06:06	05:34	05:35	06:02	06:38	07:13	06:52	07:31
	16:47	17:25	18:03	19:42	20:19	20:52	21:02	20:39	19:51	18:56	17:04	16:37
3	07:51	07:32	06:50	06:54	06:04	05:33	05:35	06:03	06:39	07:14	06:53	07:32
	16:48	17:26	18:04	19:43	20:20	20:53	21:02	20:38	19:49	18:54	17:03	16:37
4	07:51	07:31	06:49	06:52	06:03	05:33	05:36	06:04	06:40	07:15	06:55	07:33
	16:49	17:27	18:06	19:45	20:21	20:53	21:02	20:37	19:47	18:52	17:02	16:37
5	07:51	07:29	06:47	06:51	06:02	05:33	05:37	06:06	06:41	07:16	06:56	07:34
	16:50	17:29	18:07	19:46	20:22	20:54	21:02	20:36	19:46	18:50	17:00	16:36
6	07:51	07:28	06:45	06:49	06:00	05:32	05:37	06:07	06:42	07:17	06:57	07:35
	16:51	17:30	18:08	19:47	20:24	20:55	21:01	20:34	19:44	18:48	16:59	16:36
7	07:50	07:27	06:43	06:47	05:59	05:32	05:38	06:08	06:43	07:19	06:59	07:36
	16:52	17:32	18:10	19:48	20:25	20:56	21:01	20:33	19:42	18:47	16:58	16:36
8	07:50	07:26	06:42	06:45	05:58	05:31	05:39	06:09	06:45	07:20	07:00	07:37
	16:53	17:33	18:11	19:50	20:26	20:56	21:01	20:32	19:40	18:45	16:57	16:36
9	07:50	07:24	06:40	06:43	05:56	05:31	05:39	06:10	06:46	07:21	07:01	07:38
	16:54	17:34	18:12	19:51	20:27	20:57	21:00	20:30	19:38	18:43	16:55	16:36
10	07:50	07:23	06:38	06:42	05:55	05:31	05:40	06:11	06:47	07:22	07:03	07:39
	16:55	17:36	18:13	19:52	20:28	20:58	21:00	20:29	19:37	18:41	16:54	16:36
11	07:49	07:22	06:36	06:40	05:54	05:31	05:41	06:12	06:48	07:24	07:04	07:40
	16:56	17:37	18:15	19:53	20:29	20:58	20:59	20:27	19:35	18:39	16:53	16:36
12	07:49	07:20	06:34	06:38	05:53	05:31	05:42	06:13	06:49	07:25	07:05	07:40
	16:57	17:39	18:16	19:54	20:31	20:59	20:59	20:26	19:33	18:38	16:52	16:36
13	07:49	07:19	06:33	06:36	05:51	05:30	05:42	06:15	06:50	07:26	07:07	07:41
	16:58	17:40	18:17	19:56	20:32	20:59	20:58	20:24	19:31	18:36	16:51	16:36
14	07:48	07:17	06:31	06:35	05:50	05:30	05:43	06:16	06:52	07:27	07:08	07:42
	16:59	17:41	18:19	19:57	20:33	21:00	20:58	20:23	19:29	18:34	16:50	16:36
15	07:48	07:16	06:29	06:33	05:49	05:30	05:44	06:17	06:53	07:29	07:09	07:43
	17:01	17:43	18:20	19:58	20:34	21:00	20:57	20:21	19:27	18:32	16:49	16:36
16	07:47	07:15	06:27	06:31	05:48	05:30	05:45	06:18	06:54	07:30	07:11	07:44
	17:02	17:44	18:21	19:59	20:35	21:01	20:56	20:20	19:25	18:31	16:48	16:36
17	07:47	07:13	06:25	06:30	05:47	05:30	05:46	06:19	06:55	07:31	07:12	07:44
	17:03	17:46	18:22	20:01	20:36	21:01	20:55	20:18	19:23	18:29	16:47	16:37
18	07:46	07:12	06:24	06:28	05:46	05:30	05:47	06:20	06:56	07:32	07:13	07:45
	17:04	17:47	18:24	20:02	20:37	21:01	20:55	20:17	19:22	18:27	16:46	16:37
19	07:46	07:10	06:22	06:26	05:45	05:30	05:48	06:22	06:57	07:34	07:15	07:46
	17:06	17:48	18:25	20:03	20:38	21:02	20:54	20:15	19:20	18:26	16:45	16:37
20	07:45	07:08	06:20	06:25	05:44	05:31	05:49	06:23	06:58	07:35	07:16	07:46
	17:07	17:50	18:26	20:04	20:39	21:02	20:53	20:13	19:18	18:24	16:44	16:38
21	07:44	07:07	06:18	06:23	05:43	05:31	05:50	06:24	07:00	07:36	07:17	07:47
	17:08	17:51	18:27	20:05	20:41	21:02	20:52	20:12	19:16	18:22	16:44	16:38
22	07:43	07:05	06:16	06:21	05:42	05:31	05:51	06:25	07:01	07:37	07:18	07:47
	17:10	17:52	18:29	20:07	20:42	21:02	20:51	20:10	19:14	18:21	16:43	16:39
23	07:43	07:04	06:14	06:20	05:41	05:31	05:52	06:26	07:02	07:39	07:20	07:48
	17:11	17:54	18:30	20:08	20:43	21:03	20:50	20:08	19:12	18:19	16:42	16:39
24	07:42	07:02	06:13	06:18	05:40	05:31	05:53	06:27	07:03	07:40	07:21	07:48
	17:12	17:55	18:31	20:09	20:44	21:03	20:49	20:07	19:10	18:18	16:41	16:40
25	07:41	07:00	06:11	06:16	05:39	05:32	05:54	06:28	07:04	06:41	07:22	07:49
	17:14	17:56	18:32	20:10	20:45	21:03	20:48	20:05	19:09	17:16	16:41	16:40
26	07:40	06:59	06:09	06:15	05:39	05:32	05:55	06:30	07:05	06:43	07:23	07:49
	17:15	17:58	18:34	20:12	20:46	21:03	20:47	20:03	19:07	17:15	16:40	16:41
27	07:39	06:57	06:07	06:13	05:38	05:32	05:56	06:31	07:07	06:44	07:25	07:50
	17:16	17:59	18:35	20:13	20:47	21:03	20:46	20:02	19:05	17:13	16:39	16:42
28	07:38	06:55	06:05	06:12	05:37	05:33	05:57	06:32	07:08	06:45	07:26	07:50
	17:18	18:00	18:36	20:14	20:47	21:03	20:45	20:00	19:03	17:12	16:39	16:42
29	07:37		07:03	06:10	05:36	05:33	05:58	06:33	07:09	06:47	07:27	07:50
	17:19		19:37	20:15	20:48	21:03	20:44	19:58	19:01	17:10	16:38	16:43
30	07:36		07:02	06:09	05:36	05:34	05:59	06:34	07:10	06:48	07:28	07:50
	17:21		19:38	20:16	20:49	21:03	20:43	19:56	18:59	17:09	16:38	16:44
31	07:35		07:00		05:35		06:00	06:35		06:49		07:50
	17:22		19:40		20:50		20:42	19:55		17:07		16:45
Potential sun hours	288	292	369	403	458	464	470	434	376	342	290	277
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: MC05 - Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (5)
Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:51 16:46	07:34 17:23	06:54 18:02	06:58 19:41	06:07 20:18	05:35 20:51	05:34 21:03	06:01 20:41	06:37 19:53	07:11 18:57	06:51 17:06	07:29 16:38
2	07:51 16:47	07:33 17:25	06:52 18:03	06:56 19:42	06:06 20:19	05:34 20:52	05:35 21:02	06:02 20:39	06:38 19:51	07:13 18:56	06:52 17:04	07:30 16:37
3	07:51 16:48	07:32 17:26	06:50 18:04	06:54 19:43	06:04 20:20	05:34 20:53	05:35 21:02	06:03 20:38	06:39 19:49	07:14 18:54	06:53 17:03	07:32 16:37
4	07:51 16:49	07:31 17:27	06:49 18:06	06:52 19:45	06:03 20:21	05:33 20:53	05:36 21:02	06:04 20:37	06:40 19:47	07:15 18:52	06:55 17:02	07:33 16:37
5	07:51 16:50	07:29 17:29	06:47 18:07	06:51 19:46	06:02 20:22	05:33 20:54	05:37 21:02	06:06 20:36	06:41 19:46	07:16 18:50	06:56 17:00	07:34 16:36
6	07:51 16:51	07:28 17:30	06:45 18:08	06:49 19:47	06:00 20:24	05:32 20:55	05:37 21:01	06:07 20:34	06:42 19:44	07:17 18:48	06:57 16:59	07:35 16:36
7	07:50 16:52	07:27 17:32	06:43 18:10	06:47 19:48	05:59 20:25	05:32 20:56	05:38 21:01	06:08 20:33	06:43 19:42	07:19 18:47	06:59 16:58	07:36 16:36
8	07:50 16:53	07:26 17:33	06:42 18:11	06:45 19:50	05:58 20:26	05:32 20:56	05:39 21:01	06:09 20:31	06:45 19:40	07:20 18:45	07:00 16:57	07:37 16:36
9	07:50 16:54	07:24 17:34	06:40 18:12	06:43 19:51	05:56 20:27	05:31 20:57	05:39 21:00	06:10 20:30	06:46 19:38	07:21 18:43	07:01 16:55	07:38 16:36
10	07:50 16:55	07:23 17:36	06:38 18:13	06:42 19:52	05:55 20:28	05:31 20:58	05:40 21:00	06:11 20:29	06:47 19:36	07:22 18:41	07:03 16:54	07:39 16:36
11	07:49 16:56	07:22 17:37	06:36 18:15	06:40 19:53	05:54 20:29	05:31 20:58	05:41 20:59	06:12 20:27	06:48 19:35	07:24 18:39	07:04 16:53	07:40 16:36
12	07:49 16:57	07:20 17:39	06:34 18:16	06:38 19:54	05:53 20:31	05:31 20:59	05:42 20:59	06:13 20:26	06:49 19:33	07:25 18:38	07:05 16:52	07:40 16:36
13	07:49 16:58	07:19 17:40	06:33 18:17	06:36 19:56	05:51 20:32	05:30 20:59	05:42 20:58	06:15 20:24	06:50 19:31	07:26 18:36	07:07 16:51	07:41 16:36
14	07:48 17:00	07:17 17:41	06:31 18:19	06:35 19:57	05:50 20:33	05:30 21:00	05:43 20:57	06:16 20:23	06:52 19:29	07:27 18:34	07:08 16:50	07:42 16:36
15	07:48 17:01	07:16 17:43	06:29 18:20	06:33 19:58	05:49 20:34	05:30 21:00	05:44 20:57	06:17 20:21	06:53 19:27	07:28 18:32	07:09 16:49	07:43 16:36
16	07:47 17:02	07:15 17:44	06:27 18:21	06:31 19:59	05:48 20:35	05:30 21:01	05:45 20:56	06:18 20:20	06:54 19:25	07:30 18:31	07:11 16:48	07:44 16:36
17	07:47 17:03	07:13 17:46	06:25 18:22	06:30 20:01	05:47 20:36	05:30 21:01	05:46 20:55	06:19 20:18	06:55 19:23	07:31 18:29	07:12 16:47	07:44 16:37
18	07:46 17:04	07:12 17:47	06:24 18:24	06:28 20:02	05:46 20:37	05:30 21:01	05:47 20:55	06:20 20:17	06:56 19:22	07:32 18:27	07:13 16:46	07:45 16:37
19	07:46 17:06	07:10 17:48	06:22 18:25	06:26 20:03	05:45 20:38	05:30 21:02	05:48 20:54	06:22 20:15	06:57 19:20	07:34 18:26	07:15 16:45	07:46 16:37
20	07:45 17:07	07:08 17:50	06:20 18:26	06:25 20:04	05:44 20:39	05:31 21:02	05:49 20:53	06:23 20:13	06:58 19:18	07:35 18:24	07:16 16:44	07:46 16:38
21	07:44 17:08	07:07 17:51	06:18 18:27	06:23 20:05	05:43 20:40	05:31 21:02	05:50 20:52	06:24 20:12	07:00 19:16	07:36 18:22	07:17 16:44	07:47 16:38
22	07:43 17:10	07:05 17:52	06:16 18:29	06:21 20:07	05:42 20:42	05:31 21:02	05:51 20:51	06:25 20:10	07:01 19:14	07:37 18:21	07:18 16:43	07:47 16:39
23	07:43 17:11	07:04 17:54	06:14 18:30	06:20 20:08	05:41 20:43	05:31 21:03	05:52 20:50	06:26 20:08	07:02 19:12	07:39 18:19	07:20 16:42	07:48 16:39
24	07:42 17:12	07:02 17:55	06:13 18:31	06:18 20:09	05:40 20:44	05:31 21:03	05:53 20:49	06:27 20:07	07:03 19:10	07:40 18:18	07:21 16:41	07:48 16:40
25	07:41 17:14	07:00 17:56	06:11 18:32	06:16 20:10	05:39 20:45	05:32 21:03	05:54 20:48	06:28 20:05	07:04 19:09	06:41 17:16	07:22 16:41	07:49 16:40
26	07:40 17:15	06:59 17:58	06:09 18:34	06:15 20:12	05:39 20:46	05:32 21:03	05:55 20:47	06:30 20:03	07:05 19:07	06:43 17:15	07:23 16:40	07:49 16:41
27	07:39 17:16	06:57 17:59	06:07 18:35	06:13 20:13	05:38 20:46	05:32 21:03	05:56 20:46	06:31 20:02	07:07 19:05	06:44 17:13	07:25 16:39	07:49 16:42
28	07:38 17:18	06:55 18:00	06:05 18:36	06:12 20:14	05:37 20:47	05:33 21:03	05:57 20:45	06:32 20:00	07:08 19:03	06:45 17:12	07:26 16:39	07:50 16:42
29	07:37 17:19		07:03 19:37	06:10 20:15	05:36 20:48	05:33 21:03	05:58 20:44	06:33 19:58	07:09 19:01	06:47 17:10	07:27 16:38	07:50 16:43
30	07:36 17:21		07:02 19:38	06:09 20:16	05:36 20:49	05:34 21:03	05:59 20:43	06:34 19:56	07:10 18:59	06:48 17:09	07:28 16:38	07:50 16:44
31	07:35 17:22		07:00 19:40		05:35 20:50		06:00 20:42	06:35 19:55		06:49 17:07		07:50 16:45
Potential sun hours	288	292	369	403	458	464	470	434	376	342	290	277
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: MC06 - Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (6)
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

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
446	588	709	537	307	224	366	1.786	992	318	487	496	7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1 07:50	07:34 07:55-08:09/14	06:54	06:58	06:07	05:35	05:34	06:01	06:36	07:11	06:50 07:13-07:39/26	07:29	
16:46	17:23	18:02	19:41	20:17	20:51	21:02	20:40	19:53	18:57	17:06	16:38	
2 07:51	07:33 07:54-08:10/16	06:52	06:56	06:06	05:34	05:35	06:02	06:38	07:12	06:52 07:15-07:40/25	07:30	
16:47	17:25	18:03	19:42	20:19	20:52	21:02	20:39	19:51	18:55	17:04	16:37	
3 07:51	07:32 07:53-08:10/17	06:50	06:54	06:04	05:33	05:35	06:03	06:39	07:14	06:53 07:16-07:39/23	07:31	
16:48	17:26	18:04	19:43	20:20	20:52	21:02	20:38	19:49	18:54	17:03	16:37	
4 07:51	07:30 07:52-08:10/18	06:48	06:52	06:03	05:33	05:36	06:04	06:40	07:15	06:54 07:18-07:40/22	07:32	
16:49	17:27	18:06	19:44	20:21	20:53	21:02	20:37	19:47	18:52	17:02	16:37	
5 07:50	07:29 07:50-08:10/20	06:47	06:51	06:02	05:33	05:36	06:05	06:41	07:16	06:56 07:19-07:40/21	07:34	
16:50	17:29	18:07	19:46	20:22	20:54	21:02	20:35	19:46	18:50	17:00	16:36	
6 07:50	07:28 07:49-08:10/21	06:45	06:49	06:00	05:32	05:37	06:07	06:42	07:17	06:57 07:21-07:41/20	07:35	
16:51	17:30	18:08	19:47	20:23	20:55	21:01	20:34	19:44	18:48	16:59	16:36	
7 07:50	07:27 07:48-08:10/22	06:43	06:47	05:59	05:32	05:38	06:08	06:43	07:18	06:58 07:22-07:40/18	07:36	
16:52	17:32	18:10	19:48	20:25	20:55	21:01	20:33	19:42	18:46	16:58	16:36	
8 07:50	07:25 07:46-08:10/24	06:41	06:45	05:58	05:31	05:39	06:09	06:45	07:20	07:00 07:23-07:40/17	07:37	
16:53	17:33	18:11	19:49	20:26	20:56	21:00	20:31	19:40	18:45	16:57	16:36	
9 07:50	07:24 07:45-08:10/25	06:40	06:43	05:56	05:31	05:39	06:10	06:46	07:21	07:01 07:25-07:41/16	07:38	
16:54	17:34	18:12	19:51	20:27	20:57	21:00	20:30	19:38	18:43	16:55	16:36	
10 07:50	07:23 07:44-08:10/26	06:38	06:42	05:55	05:31	05:40	06:11	06:47	07:22	07:02 07:26-07:40/14	07:39	
16:55	17:36	18:13	19:52	20:28	20:57	21:00	20:29	19:36	18:41	16:54	16:36	
11 07:49	07:21 07:42-08:09/27	06:36	06:40	05:54	05:31	05:41	06:12	06:48	07:23	07:04 07:28-07:41/13	07:39	
16:56	17:37	18:15	19:53	20:29	20:58	20:59	20:27	19:35	18:39	16:53	16:36	
12 07:49	07:20 07:41-08:09/28	06:34	06:38	05:53	05:31	05:42	06:13	06:49	07:25	07:05 07:29-07:40/11	07:40	
16:57	17:39	18:16	19:54	20:30	20:58	20:59	20:26	19:33	18:38	16:52	16:36	
13 07:49	07:19 07:39-08:08/29	06:33	06:36	05:51	05:30	05:42	06:15	06:50	07:26	07:06 07:31-07:41/10	07:41	
16:58	17:40	18:17	19:55	20:32	20:59	20:58	20:24	19:31	18:36	16:51	16:36	
14 07:48	07:17 07:38-08:08/30	06:31	06:35	05:50	05:30	05:43	06:16	06:51	07:27 08:06-08:13/7	07:08 07:32-07:40/8	07:42	
16:59	17:41	18:18	19:57	20:33	20:59	20:57	20:23	19:29	18:34	16:50	16:36	
15 07:48	07:16 07:36-08:07/31	06:29	06:33	05:49	05:30	05:44	06:17	06:53	07:28 07:58-08:19/21	07:09 07:33-07:40/7	07:43	
17:01	17:43	18:20	19:58	20:34	21:00	20:57	20:21	19:27	18:32	16:49	16:36	
16 07:47	07:14 07:35-08:07/32	06:27	06:31	05:48	05:30	05:45	06:18	06:54	07:30 07:54-08:22/28	07:10 07:35-07:40/5	07:43	
17:02	17:44	18:21	19:59	20:35	21:00	20:56	20:20	19:25	18:31	16:48	16:36	
17 07:47	07:13 07:33-08:05/32	06:25	06:29	05:47	05:30	05:46	06:19	06:55	07:31 07:53-08:25/32	07:12 07:36-07:39/3	07:44	
17:03	17:46	18:22	20:00	20:36	21:01	20:55	20:18	19:23	18:29	16:47	16:37	
18 07:46	07:11 07:32-08:05/33	06:23	06:28	05:46	05:30	05:47	06:20	06:56	07:32 07:54-08:27/33	07:13 07:38-07:40/2	07:45	
17:04	17:47	18:24	20:02	20:37	21:01	20:54	20:16	19:21	18:27	16:46	16:37	
19 07:45	07:10 07:30-08:03/33	06:22	06:26	05:45	05:30	05:48	06:21	06:57	07:33 07:55-08:28/33	07:14	07:46	
17:06	17:48	18:25	20:03	20:38	21:01	20:54	20:15	19:20	18:26	16:45	16:37	
20 07:45	07:08 07:29-08:02/33	06:20	06:24	05:44	05:31	05:49	06:23	06:58	07:35 07:57-08:31/34	07:16	07:46	
17:07	17:50	18:26	20:04	20:39	21:02	20:53	20:13	19:18	18:24	16:44	16:38	
21 07:44	07:07 07:27-08:01/34	06:18	06:23	05:43	05:31	05:50	06:24	07:00	07:36 07:58-08:32/34	07:17	07:47	
17:08	17:51	18:27	20:05	20:40	21:02	20:52	20:12	19:16	18:22	16:43	16:38	
22 07:43	07:05 07:25-07:59/34	06:16	06:21	05:42	05:31	05:51	06:25	07:01	07:37 07:59-08:32/33	07:18	07:47	
17:10	17:52	18:28	20:06	20:41	21:02	20:51	20:10	19:14	18:21	16:43	16:39	
23 07:42	07:04 07:24-07:57/33	06:14	06:20	05:41	05:31	05:52	06:26	07:02	07:39 08:01-08:34/33	07:20	07:48	
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24 07:42 08:04-08:06/2	07:02 07:22-07:55/33	06:12	06:18	05:40	05:31	05:53	06:27	07:03	07:40 08:02-08:35/33	07:21	07:48	
17:12	17:55	18:31	20:09	20:43	21:02	20:49	20:07	19:10	18:18	16:41	16:40	
25 07:41 08:03-08:06/3	07:00 07:20-07:52/32	06:11	06:16	05:39	05:32	05:54	06:28	07:04	06:41 07:04-07:36/32	07:22	07:49	
17:14	17:56	18:32	20:10	20:44	21:03	20:48	20:05	19:08	17:16	16:41	16:40	
26 07:40 08:02-08:07/5	06:59 07:24-07:49/25	06:09	06:15	05:39	05:32	05:55	06:30	07:05	06:42 07:05-07:36/31	07:23	07:49	
17:15	17:58	18:33	20:11	20:45	21:03	20:47	20:03	19:07	17:15	16:40	16:41	
27 07:39 08:01-08:08/7	06:57 07:28-07:44/16	06:07	06:13	05:38	05:32	05:56	06:31	07:07	06:44 07:06-07:37/31	07:24	07:49	
17:16	17:59	18:35	20:13	20:46	21:03	20:46	20:01	19:05	17:13	16:39	16:42	
28 07:38 08:00-08:08/8	06:55	06:05	06:12	05:37	05:33	05:57	06:32	07:08	06:45 07:08-07:38/30	07:26	07:50	
17:18	18:00	18:36	20:14	20:47	21:03	20:45	20:00	19:03	17:12	16:39	16:42	
29 07:37 07:59-08:09/10		07:03	06:10	05:36	05:33	05:58	06:33	07:09	06:46 07:09-07:38/29	07:27	07:50	
17:19		19:37	20:15	20:48	21:03	20:44	19:58	19:01	17:10	16:38	16:43	
30 07:36 07:58-08:09/11		07:01	06:09	05:36	05:34	05:59	06:34	07:10	06:48 07:11-07:39/28	07:28	07:50	
17:20		19:38	20:16	20:49	21:03	20:43	19:56	18:59	17:09	16:38	16:44	
31 07:35 07:56-08:09/13		07:00		05:35		06:00	06:35		06:49 07:12-07:39/27		07:50	
17:22		19:40		20:50		20:42	19:54		17:07		16:45	
Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277
Sum of minutes with flicker	59	718	0	0	0	0	0	0	0	529	261	0

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: MC07 - Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (7)
Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:50 16:46	07:34 17:23	06:54 18:02	06:58 19:41	06:07 20:17	05:34 20:51	05:34 21:02	06:01 20:40	06:36 19:53	07:11 18:57	06:50 17:06	07:29 16:38
2	07:50 16:47	07:33 17:25	06:52 18:03	06:56 19:42	06:06 20:19	05:34 20:52	05:35 21:02	06:02 20:39	06:38 19:51	07:12 18:55	06:52 17:04	07:30 16:37
3	07:51 16:48	07:32 17:26	06:50 18:04	06:54 19:43	06:04 20:20	05:33 20:52	05:35 21:02	06:03 20:38	06:39 19:49	07:14 18:54	06:53 17:03	07:31 16:37
4	07:50 16:49	07:30 17:27	06:48 18:06	06:52 19:44	06:03 20:21	05:33 20:53	05:36 21:02	06:04 20:37	06:40 19:47	07:15 18:52	06:54 17:02	07:32 16:37
5	07:50 16:49	07:29 17:29	06:47 18:07	06:51 19:46	06:02 20:22	05:33 20:54	05:36 21:01	06:05 20:35	06:41 19:45	07:16 18:50	06:56 17:00	07:34 16:36
6	07:50 16:50	07:28 17:30	06:45 18:08	06:49 19:47	06:00 20:23	05:32 20:55	05:37 21:01	06:07 20:34	06:42 19:44	07:17 18:48	06:57 16:59	07:35 16:36
7	07:50 16:52	07:27 17:32	06:43 18:09	06:47 19:48	05:59 20:25	05:32 20:55	05:38 21:01	06:08 20:33	06:43 19:42	07:18 18:46	06:58 16:58	07:36 16:36
8	07:50 16:53	07:25 17:33	06:41 18:11	06:45 19:49	05:58 20:26	05:31 20:56	05:38 21:00	06:09 20:31	06:44 19:40	07:20 18:45	07:00 16:57	07:37 16:36
9	07:50 16:54	07:24 17:34	06:40 18:12	06:43 19:51	05:56 20:27	05:31 20:57	05:39 21:00	06:10 20:30	06:46 19:38	07:21 18:43	07:01 16:55	07:38 16:36
10	07:50 16:55	07:23 17:36	06:38 18:13	06:42 19:52	05:55 20:28	05:31 20:57	05:40 21:00	06:11 20:28	06:47 19:36	07:22 18:41	07:02 16:54	07:38 16:36
11	07:49 16:56	07:21 17:37	06:36 18:15	06:40 19:53	05:54 20:29	05:31 20:58	05:41 20:59	06:12 20:27	06:48 19:34	07:23 18:39	07:04 16:53	07:39 16:36
12	07:49 16:57	07:20 17:39	06:34 18:16	06:38 19:54	05:52 20:30	05:31 20:58	05:42 20:58	06:13 20:26	06:49 19:33	07:25 18:38	07:05 16:52	07:40 16:36
13	07:49 16:58	07:19 17:40	06:33 18:17	06:36 19:55	05:51 20:32	05:30 20:59	05:42 20:58	06:15 20:24	06:50 19:31	07:26 18:36	07:06 16:51	07:41 16:36
14	07:48 16:59	07:17 17:41	06:31 18:18	06:35 19:57	05:50 20:33	05:30 20:59	05:43 20:57	06:16 20:23	06:51 19:29	07:27 18:34	07:08 16:50	07:42 16:36
15	07:48 17:01	07:16 17:43	06:29 18:20	06:33 19:58	05:49 20:34	05:30 21:00	05:44 20:57	06:17 20:21	06:53 19:27	07:28 18:32	07:09 16:49	07:43 16:36
16	07:47 17:02	07:14 17:44	06:27 18:21	06:31 19:59	05:48 20:35	05:30 21:00	05:45 20:56	06:18 20:20	06:54 19:25	07:30 18:31	07:10 16:48	07:43 16:36
17	07:47 17:03	07:13 17:45	06:25 18:22	06:29 20:00	05:47 20:36	05:30 21:01	05:46 20:55	06:19 20:18	06:55 19:23	07:31 18:29	07:12 16:47	07:44 16:37
18	07:46 17:04	07:11 17:47	06:23 18:23	06:28 20:02	05:46 20:37	05:30 21:01	05:47 20:54	06:20 20:16	06:56 19:21	07:32 18:27	07:13 16:46	07:45 16:37
19	07:45 17:06	07:10 17:48	06:22 18:25	06:26 20:03	05:45 20:38	05:30 21:01	05:48 20:54	06:21 20:15	06:57 19:20	07:33 18:26	07:14 16:45	07:45 16:37
20	07:45 17:07	07:08 17:50	06:20 18:26	06:24 20:04	05:44 20:39	05:30 21:02	05:49 20:53	06:23 20:13	06:58 19:18	07:35 18:24	07:16 16:44	07:46 16:38
21	07:44 17:08	07:07 17:51	06:18 18:27	06:23 20:05	05:43 20:40	05:31 21:02	05:50 20:52	06:24 20:12	06:59 19:16	07:36 18:22	07:17 16:43	07:47 16:38
22	07:43 17:10	07:05 17:52	06:16 18:28	06:21 20:06	05:42 20:41	05:31 21:02	05:51 20:51	06:25 20:10	07:01 19:14	07:37 18:21	07:18 16:43	07:47 16:39
23	07:42 17:11	07:03 17:54	06:14 18:30	06:20 20:08	05:41 20:42	05:31 21:02	05:52 20:50	06:26 20:08	07:02 19:12	07:39 18:19	07:19 16:42	07:48 16:39
24	07:42 17:12	07:02 17:55	06:12 18:31	06:18 20:09	05:40 20:43	05:31 21:02	05:53 20:49	06:27 20:07	07:03 19:10	07:40 18:18	07:21 16:41	07:48 16:40
25	07:41 17:14	07:00 17:56	06:11 18:32	06:16 20:10	05:39 20:44	05:32 21:03	05:54 20:48	06:28 20:05	07:04 19:08	06:41 17:16	07:22 16:41	07:49 16:40
26	07:40 17:15	06:59 17:58	06:09 18:33	06:15 20:11	05:39 20:45	05:32 21:03	05:55 20:47	06:30 20:03	07:05 19:07	06:42 17:15	07:23 16:40	07:49 16:41
27	07:39 17:16	06:57 17:59	06:07 18:35	06:13 20:13	05:38 20:46	05:32 21:03	05:56 20:46	06:31 20:01	07:06 19:05	06:44 17:13	07:24 16:39	07:49 16:42
28	07:38 17:18	06:55 18:00	06:05 18:36	06:12 20:14	05:37 20:47	05:33 21:03	05:57 20:45	06:32 20:00	07:08 19:03	06:45 17:11	07:26 16:39	07:50 16:42
29	07:37 17:19		07:03 19:37	06:10 20:15	05:36 20:48	05:33 21:03	05:58 20:44	06:33 19:58	07:09 19:01	06:46 17:10	07:27 16:38	07:50 16:43
30	07:36 17:20		07:01 19:38	06:09 20:16	05:36 20:49	05:34 21:02	05:59 20:43	06:34 19:56	07:10 18:59	06:48 17:09	07:28 16:38	07:50 16:44
31	07:35 17:22		07:00 19:40		05:35 20:50		06:00 20:42	06:35 19:54		06:49 17:07		07:50 16:45
Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: MC08 - Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (8)
Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:50 16:46	07:34 17:23	06:54 18:02	06:58 19:41	06:07 20:17	05:35 20:51	05:34 21:02	06:01 20:40	06:37 19:53	07:11 18:57	06:50 17:06	07:29 16:38
2	07:51 16:47	07:33 17:25	06:52 18:03	06:56 19:42	06:06 20:19	05:34 20:52	05:35 21:02	06:02 20:39	06:38 19:51	07:13 18:56	06:52 17:04	07:30 16:37
3	07:51 16:48	07:32 17:26	06:50 18:04	06:54 19:43	06:04 20:20	05:34 20:52	05:35 21:02	06:03 20:38	06:39 19:49	07:14 18:54	06:53 17:03	07:31 16:37
4	07:51 16:49	07:30 17:27	06:49 18:06	06:52 19:45	06:03 20:21	05:33 20:53	05:36 21:02	06:04 20:37	06:40 19:47	07:15 18:52	06:54 17:02	07:33 16:37
5	07:50 16:50	07:29 17:29	06:47 18:07	06:51 19:46	06:02 20:22	05:33 20:54	05:37 21:02	06:06 20:35	06:41 19:46	07:16 18:50	06:56 17:00	07:34 16:36
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8	07:50 16:53	07:26 17:33	06:42 18:11	06:45 19:49	05:58 20:26	05:32 20:56	05:39 21:00	06:09 20:31	06:45 19:40	07:20 18:45	07:00 16:57	07:37 16:36
9	07:50 16:54	07:24 17:34	06:40 18:12	06:43 19:51	05:56 20:27	05:31 20:57	05:39 21:00	06:10 20:30	06:46 19:38	07:21 18:43	07:01 16:55	07:38 16:36
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31	07:35 17:22		07:00 19:40		05:35 20:50		06:00 20:42	06:35 19:54		06:49 17:07		07:50 16:45
Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: MC09 - Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 220,0 m) (9)
Sunshine probability S (Average daily sunshine hours) [BOLOGNA]

Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:50 16:46	07:34 17:23	06:54 18:02	06:58 19:41	06:07 20:17	05:35 20:51	05:34 21:02	06:01 20:40	06:36 19:53	07:11 18:57	06:50 17:06	07:29 16:38
2	07:50 16:47	07:33 17:25	06:52 18:03	06:56 19:42	06:06 20:19	05:34 20:52	05:35 21:02	06:02 20:39	06:38 19:51	07:12 18:56	06:52 17:04	07:30 16:37
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31	07:35 17:22		07:00 19:40		05:35 20:50		06:00 20:42	06:35 19:54		06:49 17:07		07:50 16:45
Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: ER01 - ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (1)
Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:50 16:46	07:34 17:23	06:54 18:02	06:58 19:41	06:07 20:17	05:35 20:51	05:34 21:02	06:01 20:41	06:37 19:53	07:11 18:57	06:50 17:06	07:29 16:38
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29	07:37 17:19		07:03 19:37	06:10 20:15	05:36 20:48	05:33 21:03	05:58 20:44	06:33 19:58	07:09 19:01	06:47 17:10	07:27 16:39	07:50 16:43
30	07:36 17:21		07:02 19:38	06:09 20:16	05:36 20:49	05:34 21:03	05:59 20:43	06:34 19:56	07:10 18:59	06:48 17:09	07:28 16:38	07:50 16:44
31	07:35 17:22		07:00 19:40		05:35 20:50		06:00 20:42	06:35 19:55		06:49 17:07		07:50 16:45
Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: ER02 - ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (2)
Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:50 16:46	07:34 17:23	06:54 18:02	06:58 19:41	06:07 20:17	05:35 20:51	05:34 21:02	06:01 20:41	06:37 19:53	07:11 18:57	06:50 17:06	07:29 16:38
2	07:51 16:47	07:33 17:25	06:52 18:03	06:56 19:42	06:06 20:19	05:34 20:52	05:35 21:02	06:02 20:39	06:38 19:51	07:13 18:56	06:52 17:04	07:30 16:37
3	07:51 16:48	07:32 17:26	06:50 18:04	06:54 19:43	06:04 20:20	05:34 20:52	05:35 21:02	06:03 20:38	06:39 19:49	07:14 18:54	06:53 17:03	07:31 16:37
4	07:51 16:49	07:31 17:28	06:49 18:06	06:52 19:45	06:03 20:21	05:33 20:53	05:36 21:02	06:04 20:37	06:40 19:47	07:15 18:52	06:54 17:02	07:33 16:37
5	07:51 16:50	07:29 17:29	06:47 18:07	06:51 19:46	06:02 20:22	05:33 20:54	05:37 21:02	06:06 20:35	06:41 19:46	07:16 18:50	06:56 17:00	07:34 16:36
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9	07:50 16:54	07:24 17:35	06:40 18:12	06:43 19:51	05:56 20:27	05:31 20:57	05:39 21:00	06:10 20:30	06:46 19:38	07:21 18:43	07:01 16:56	07:38 16:36
10	07:50 16:55	07:23 17:36	06:38 18:13	06:42 19:52	05:55 20:28	05:31 20:57	05:40 21:00	06:11 20:29	06:47 19:36	07:22 18:41	07:03 16:54	07:39 16:36
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Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: ER03 - ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (3)
Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:50 16:46	07:34 17:23	06:54 18:02	06:58 19:41	06:07 20:17	05:35 20:51	05:34 21:02	06:01 20:41	06:37 19:53	07:11 18:57	06:50 17:06	07:29 16:38
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Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: ER04 - ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (4)
Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:51 16:46	07:34 17:23	06:54 18:02	06:58 19:41	06:07 20:17	05:35 20:51	05:34 21:02	06:01 20:41	06:37 19:53	07:11 18:57	06:50 17:06	07:29 16:38
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12	07:49 16:57	07:20 17:39	06:34 18:16	06:38 19:54	05:53 20:30	05:31 20:59	05:42 20:59	06:13 20:26	06:49 19:33	07:25 18:38	07:05 16:52	07:40 16:36
13	07:49 16:58	07:19 17:40	06:33 18:17	06:36 19:56	05:51 20:32	05:31 20:59	05:42 20:58	06:15 20:24	06:50 19:31	07:26 18:36	07:07 16:51	07:41 16:36
14	07:48 17:00	07:17 17:41	06:31 18:19	06:35 19:57	05:50 20:33	05:30 21:00	05:43 20:57	06:16 20:23	06:52 19:29	07:27 18:34	07:08 16:50	07:42 16:36
15	07:48 17:01	07:16 17:43	06:29 18:20	06:33 19:58	05:49 20:34	05:30 21:00	05:44 20:57	06:17 20:21	06:53 19:27	07:28 18:32	07:09 16:49	07:43 16:36
16	07:47 17:02	07:14 17:44	06:27 18:21	06:31 19:59	05:48 20:35	05:30 21:00	05:45 20:56	06:18 20:20	06:54 19:25	07:30 18:31	07:11 16:48	07:44 16:37
17	07:47 17:03	07:13 17:46	06:25 18:22	06:30 20:00	05:47 20:36	05:30 21:01	05:46 20:55	06:19 20:18	06:55 19:23	07:31 18:29	07:12 16:47	07:44 16:37
18	07:46 17:05	07:11 17:47	06:24 18:24	06:28 20:02	05:46 20:37	05:30 21:01	05:47 20:55	06:20 20:16	06:56 19:22	07:32 18:27	07:13 16:46	07:45 16:37
19	07:45 17:06	07:10 17:48	06:22 18:25	06:26 20:03	05:45 20:38	05:30 21:01	05:48 20:54	06:22 20:15	06:57 19:20	07:33 18:26	07:14 16:45	07:46 16:37
20	07:45 17:07	07:08 17:50	06:20 18:26	06:25 20:04	05:44 20:39	05:31 21:02	05:49 20:53	06:23 20:13	06:58 19:18	07:35 18:24	07:16 16:44	07:46 16:38
21	07:44 17:08	07:07 17:51	06:18 18:27	06:23 20:05	05:43 20:40	05:31 21:02	05:50 20:52	06:24 20:12	07:00 19:16	07:36 18:22	07:17 16:44	07:47 16:38
22	07:43 17:10	07:05 17:52	06:16 18:29	06:21 20:07	05:42 20:41	05:31 21:02	05:51 20:51	06:25 20:10	07:01 19:14	07:37 18:21	07:18 16:43	07:47 16:39
23	07:43 17:11	07:04 17:54	06:14 18:30	06:20 20:08	05:41 20:42	05:31 21:02	05:52 20:50	06:26 20:08	07:02 19:12	07:39 18:19	07:20 16:42	07:48 16:39
24	07:42 17:12	07:02 17:55	06:13 18:31	06:18 20:09	05:40 20:43	05:31 21:03	05:53 20:49	06:27 20:07	07:03 19:10	07:40 18:18	07:21 16:41	07:48 16:40
25	07:41 17:14	07:00 17:56	06:11 18:32	06:16 20:10	05:39 20:44	05:32 21:03	05:54 20:48	06:28 20:05	07:04 19:09	06:41 17:16	07:22 16:41	07:49 16:40
26	07:40 17:15	06:59 17:58	06:09 18:34	06:15 20:11	05:39 20:45	05:32 21:03	05:55 20:47	06:30 20:03	07:05 19:07	06:43 17:15	07:23 16:40	07:49 16:41
27	07:39 17:16	06:57 17:59	06:07 18:35	06:13 20:13	05:38 20:46	05:32 21:03	05:56 20:46	06:31 20:02	07:07 19:05	06:44 17:13	07:25 16:40	07:49 16:42
28	07:38 17:18	06:55 18:00	06:05 18:36	06:12 20:14	05:37 20:47	05:33 21:03	05:57 20:45	06:32 20:00	07:08 19:03	06:45 17:12	07:26 16:39	07:50 16:42
29	07:37 17:19		07:03 19:37	06:10 20:15	05:36 20:48	05:33 21:03	05:58 20:44	06:33 19:58	07:09 19:01	06:46 17:10	07:27 16:38	07:50 16:43
30	07:36 17:21		07:02 19:38	06:09 20:16	05:36 20:49	05:34 21:03	05:59 20:43	06:34 19:56	07:10 18:59	06:48 17:09	07:28 16:38	07:50 16:44
31	07:35 17:22		07:00 19:40		05:35 20:50		06:00 20:42	06:35 19:55		06:49 17:07		07:50 16:45
Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: ER05 - ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (5)
Assumptions for shadow calculations

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

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
446	588	709	537	307	224	366	1.786	992	318	487	496	7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:51 16:46	07:34 16:34-16:49/15 17:23	06:54 18:02	06:58 19:41	06:07 20:17	05:35 20:51	05:34 21:02	06:01 20:41	06:37 19:53	07:11 18:57	06:50 17:06	07:29 16:38
2	07:51 16:47	07:33 16:36-16:47/11 17:25	06:52 18:03	06:56 19:42	06:06 20:19	05:34 20:52	05:35 21:02	06:02 20:39	06:38 19:51	07:13 18:56	06:52 17:04	07:30 16:37
3	07:51 16:48	07:32 16:39-16:45/6 17:26	06:50 18:04	06:54 19:43	06:04 20:20	05:34 20:52	05:35 21:02	06:03 20:38	06:39 19:49	07:14 18:54	06:53 17:03	07:31 16:37
4	07:51 16:49	07:31 17:27	06:49 18:06	06:52 19:45	06:03 20:21	05:33 20:53	05:36 21:02	06:04 20:37	06:40 19:47	07:15 18:52	06:54 17:02	07:33 16:37
5	07:51 16:50	07:29 17:29	06:47 18:07	06:51 19:46	06:02 20:22	05:33 20:54	05:37 21:02	06:06 20:35	06:41 19:46	07:16 18:50	06:56 17:00	07:34 16:36
6	07:50 16:51	07:28 17:30	06:45 18:08	06:49 19:47	06:00 20:23	05:32 20:55	05:37 21:01	06:07 20:34	06:42 19:44	07:17 18:48	06:57 16:59	07:35 16:36
7	07:50 16:52	07:27 17:32	06:43 18:10	06:47 19:48	05:59 20:25	05:32 20:55	05:38 21:01	06:08 20:33	06:43 19:42	07:19 18:46	06:59 16:58	07:36 16:36
8	07:50 16:53	07:26 17:33	06:42 18:11	06:45 19:49	05:58 20:26	05:32 20:56	05:39 21:01	06:09 20:31	06:45 19:40	07:20 18:45	16:08-16:15/7 16:57	07:37 16:36
9	07:50 16:54	07:24 17:34	06:40 18:12	06:43 19:51	05:56 20:27	05:31 20:57	05:39 21:00	06:10 20:30	06:46 19:38	07:21 18:43	16:07-16:19/12 16:55	07:38 16:36
10	07:50 16:55	07:23 17:36	06:38 18:13	06:42 19:52	05:55 20:28	05:31 20:57	05:40 21:00	06:11 20:29	06:47 19:36	07:22 18:41	16:05-16:20/15 16:54	07:39 16:36
11	07:49 16:56	07:22 17:37	06:36 18:15	06:40 19:53	05:54 20:29	05:31 20:58	05:41 20:59	06:12 20:27	06:48 19:35	07:23 18:39	16:04-16:22/18 16:53	07:39 16:36
12	07:49 16:57	07:20 17:39	06:34 18:16	06:38 19:54	05:53 20:30	05:31 20:59	05:42 20:59	06:13 20:26	06:49 19:33	07:25 18:38	16:03-16:22/19 16:52	07:40 16:36
13	07:49 16:58	07:19 17:40	06:33 18:17	06:36 19:56	05:51 20:32	05:31 20:59	05:42 20:58	06:15 20:24	06:50 19:31	07:26 18:36	16:03-16:23/20 16:51	07:41 16:36
14	07:48 17:00	16:30-16:32/2 17:41	06:31 18:19	06:35 19:57	05:50 20:33	05:30 21:00	05:43 20:57	06:16 20:23	06:51 19:29	07:27 18:34	16:02-16:24/22 16:50	07:42 16:36
15	07:48 17:01	16:30-16:34/4 17:43	06:29 18:20	06:33 19:58	05:49 20:34	05:30 21:00	05:44 20:57	06:17 20:21	06:53 19:27	07:28 18:32	16:03-16:24/21 16:49	07:43 16:36
16	07:47 17:02	16:29-16:35/6 17:44	06:27 18:21	06:31 19:59	05:48 20:35	05:30 21:00	05:45 20:56	06:18 20:20	06:54 19:25	07:30 18:31	16:02-16:22/20 16:48	07:44 16:36
17	07:47 17:03	16:28-16:36/8 17:46	06:25 18:22	06:30 20:00	05:47 20:36	05:30 21:01	05:46 20:55	06:19 20:18	06:55 19:23	07:31 18:29	16:02-16:21/19 16:47	07:44 16:37
18	07:46 17:04	16:29-16:38/9 17:47	06:24 18:24	06:28 20:02	05:46 20:37	05:30 21:01	05:47 20:55	06:20 20:16	06:56 19:22	07:32 18:27	16:03-16:20/17 16:46	07:45 16:37
19	07:45 17:06	16:28-16:39/11 17:48	06:22 18:25	06:26 20:03	05:45 20:38	05:30 21:01	05:48 20:54	06:22 20:15	06:57 19:20	07:33 18:26	16:03-16:19/16 16:45	07:46 16:37
20	07:45 17:07	16:28-16:40/12 17:50	06:20 18:26	06:25 20:04	05:44 20:39	05:31 21:02	05:49 20:53	06:23 20:13	06:58 19:18	07:35 18:24	16:03-16:18/15 16:44	07:46 16:38
21	07:44 17:08	16:28-16:42/14 17:51	06:18 18:27	06:23 20:05	05:43 20:40	05:31 21:02	05:50 20:52	06:24 20:12	07:00 19:16	07:36 18:22	16:04-16:18/14 16:44	07:47 16:38
22	07:43 17:10	16:29-16:44/15 17:52	06:16 18:29	06:21 20:07	05:42 20:41	05:31 21:02	05:51 20:51	06:25 20:10	07:01 19:14	07:37 18:21	16:04-16:16/12 16:43	07:47 16:39
23	07:43 17:11	16:29-16:45/16 17:54	06:14 18:30	06:20 20:08	05:41 20:42	05:31 21:02	05:52 20:50	06:26 20:08	07:02 19:12	07:39 18:19	16:05-16:16/11 16:42	07:48 16:39
24	07:42 17:12	16:29-16:46/17 17:55	06:13 18:31	06:18 20:09	05:40 20:43	05:31 21:03	05:53 20:49	06:27 20:07	07:03 19:10	07:40 18:18	16:06-16:15/9 16:41	07:48 16:40
25	07:41 17:14	16:29-16:48/19 17:56	06:11 18:32	06:16 20:10	05:39 20:44	05:32 21:03	05:54 20:48	06:28 20:05	07:04 19:09	06:41 17:16	16:06-16:14/8 16:41	07:49 16:40
26	07:40 17:15	16:29-16:49/20 17:58	06:09 18:33	06:15 20:11	05:39 20:45	05:32 21:03	05:55 20:47	06:30 20:03	07:05 19:07	06:43 17:15	16:07-16:13/6 16:40	07:49 16:41
27	07:39 17:16	16:30-16:51/21 17:59	06:07 18:35	06:13 20:13	05:38 20:46	05:32 21:03	05:56 20:46	06:31 20:02	07:07 19:05	06:44 17:13	16:09-16:13/4 16:40	07:49 16:42
28	07:38 17:18	16:30-16:52/22 18:00	06:05 18:36	06:12 20:14	05:37 20:47	05:33 21:03	05:57 20:45	06:32 20:00	07:08 19:03	06:45 17:12	16:10-16:12/2 16:39	07:50 16:42
29	07:37 17:19	16:31-16:51/20 17:19	07:03 19:37	06:10 20:15	05:36 20:48	05:33 21:03	05:58 20:44	06:33 19:58	07:09 19:01	06:46 17:10	16:11-16:12/1 16:38	07:50 16:43
30	07:36 17:21	16:32-16:51/19 17:21	07:02 19:38	06:09 20:16	05:36 20:49	05:34 21:03	05:59 20:43	06:34 19:56	07:10 18:59	06:48 17:09	07:28 16:38	07:50 16:44
31	07:35 17:22	16:33-16:51/18 17:22	07:00 19:40		05:35 20:50		06:00 20:42	06:35 19:55		06:49 17:07		07:50 16:45
Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277
Sum of minutes with flicker	253	32	0	0	0	0	0	0	0	0	288	0

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: ER06 - ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (6)
Assumptions for shadow calculations

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

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
446	588	709	537	307	224	366	1.786	992	318	487	496	7.256

	January		February		March		April	May	June
1	07:51	15:59-16:02/3	07:34	16:11-16:29/18	06:54	17:11-17:33/22	06:58	06:07	05:35
	16:46		17:23		18:02		19:41	20:17	20:51
2	07:51	15:58-16:03/5	07:33	16:13-16:29/16	06:52	17:11-17:32/21	06:56	06:06	05:34
	16:47		17:25		18:03		19:42	20:19	20:52
3	07:51	15:58-16:05/7	07:32	16:15-16:27/12	06:50	17:11-17:31/20	06:54	06:04	05:34
	16:48		17:26		18:04		19:43	20:20	20:52
4	07:51	15:58-16:06/8	07:31	16:18-16:25/7	06:49	17:12-17:29/17	06:52	06:03	05:33
	16:49		17:27		18:06		19:45	20:21	20:53
5	07:51	15:57-16:06/9	07:29		06:47	17:14-17:28/14	06:51	06:02	05:33
	16:50		17:29		18:07		19:46	20:22	20:54
6	07:50	15:57-16:08/11	07:28		06:45	17:17-17:25/8	06:49	06:00	05:32
	16:51		17:30		18:08		19:47	20:23	20:55
7	07:50	15:57-16:09/12	07:27		06:43		06:47	05:59	05:32
	16:52		17:32		18:10		19:48	20:25	20:55
8	07:50	15:57-16:11/14	07:26		06:42		06:45	05:58	05:32
	16:53		17:33		18:11		19:49	20:26	20:56
9	07:50	15:57-16:11/14	07:24		06:40		06:43	05:56	05:31
	16:54		17:34		18:12		19:51	20:27	20:57
10	07:50	15:57-16:12/15	07:23		06:38		06:42	05:55	05:31
	16:55		17:36		18:13		19:52	20:28	20:57
11	07:49	15:57-16:18/21	07:22		06:36		06:40	05:54	05:31
	16:56		17:37		18:15		19:53	20:29	20:58
12	07:49	15:57-16:20/23	07:20		06:34		06:38	05:53	05:31
	16:57		17:39		18:16		19:54	20:30	20:59
13	07:49	15:58-16:22/24	07:19		06:33		06:36	05:51	05:31
	16:58		17:40		18:17		19:56	20:32	20:59
14	07:48	15:58-16:23/25	07:17		06:31		06:35	05:50	05:30
	17:00		17:41		18:19		19:57	20:33	21:00
15	07:48	15:58-16:25/27	07:16		06:29		06:33	05:49	05:30
	17:01		17:43		18:20		19:58	20:34	21:00
16	07:47	15:58-16:26/28	07:14		06:27		06:31	05:48	05:30
	17:02		17:44		18:21		19:59	20:35	21:00
17	07:47	15:59-16:26/27	07:13		06:25		06:30	05:47	05:30
	17:03		17:46		18:22		20:00	20:36	21:01
18	07:46	16:00-16:28/28	07:11		06:24		06:28	05:46	05:30
	17:04		17:47		18:24		20:02	20:37	21:01
19	07:45	16:00-16:28/28	07:10		06:22		06:26	05:45	05:30
	17:06		17:48		18:25		20:03	20:38	21:01
20	07:45	16:01-16:29/28	07:08	17:17-17:27/10	06:20		06:25	05:44	05:31
	17:07		17:50		18:26		20:04	20:39	21:02
21	07:44	16:02-16:29/27	07:07	17:15-17:28/13	06:18		06:23	05:43	05:31
	17:08		17:51		18:27		20:05	20:40	21:02
22	07:43	16:04-16:31/27	07:05	17:13-17:29/16	06:16		06:21	05:42	05:31
	17:10		17:52		18:29		20:07	20:41	21:02
23	07:43	16:05-16:31/26	07:04	17:13-17:31/18	06:14		06:20	05:41	05:31
	17:11		17:54		18:30		20:08	20:42	21:02
24	07:42	16:07-16:31/24	07:02	17:11-17:32/21	06:13		06:18	05:40	05:31
	17:12		17:55		18:31		20:09	20:43	21:03
25	07:41	16:07-16:32/25	07:00	17:10-17:33/23	06:11		06:16	05:39	05:32
	17:14		17:56		18:32		20:10	20:44	21:03
26	07:40	16:07-16:32/25	06:59	17:11-17:34/23	06:09		06:15	05:39	05:32
	17:15		17:58		18:33		20:11	20:45	21:03
27	07:39	16:08-16:32/24	06:57	17:10-17:34/24	06:07		06:13	05:38	05:32
	17:16		17:59		18:35		20:13	20:46	21:03
28	07:38	16:08-16:32/24	06:55	17:10-17:33/23	06:05		06:12	05:37	05:33
	17:18		18:00		18:36		20:14	20:47	21:03
29	07:37	16:09-16:32/23			07:03		06:10	05:36	05:33
	17:19				19:37		20:15	20:48	21:03
30	07:36	16:10-16:31/21			07:02		06:09	05:36	05:34
	17:21				19:38		20:16	20:49	21:03
31	07:35	16:11-16:31/20			07:00			05:35	
	17:22				19:40			20:50	
Potential sun hours		288	292		369		403	457	464
Sum of minutes with flicker		623	224		102		0	0	0

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

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

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: ER06 - ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (6)
Assumptions for shadow calculations

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

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
446	588	709	537	307	224	366	1.786	992	318	487	496	7.256

	July	August	September	October	November	December
1	05:34 21:02	06:01 20:41	06:37 19:53	07:11 18:57	06:50 17:06	07:29 15:40-16:00/20 16:38
2	05:35 21:02	06:02 20:39	06:38 19:51	07:13 18:56	06:52 17:04	07:30 15:40-15:55/15 16:37
3	05:35 21:02	06:03 20:38	06:39 19:49	07:14 18:54	06:53 17:03	07:31 15:41-15:55/14 16:37
4	05:36 21:02	06:04 20:37	06:40 19:47	07:15 18:52	06:54 17:02	07:33 15:41-15:55/14 16:37
5	05:37 21:02	06:06 20:35	06:41 19:46	07:16 18:50	06:56 17:00	07:34 15:42-15:54/12 16:36
6	05:37 21:01	06:07 20:34	06:42 19:44	07:17 18:48	06:57 16:59	07:35 15:43-15:54/11 16:36
7	05:38 21:01	06:08 20:33	06:43 19:42	07:19 18:46	06:59 15:48-15:55/7 16:58	07:36 15:44-15:53/9 16:36
8	05:39 21:01	06:09 20:31	06:45 19:40	07:20 17:50-18:02/12 18:45	07:00 15:46-15:58/12 16:57	07:37 15:45-15:53/8 16:36
9	05:39 21:00	06:10 20:30	06:46 19:38	07:21 17:48-18:03/15 18:43	07:01 15:44-16:00/16 16:55	07:38 15:46-15:53/7 16:36
10	05:40 21:00	06:11 20:29	06:47 19:36	07:22 17:47-18:05/18 18:41	07:03 15:42-16:00/18 16:54	07:39 15:47-15:53/6 16:36
11	05:41 20:59	06:12 20:27	06:48 19:35	07:23 17:45-18:06/21 18:39	07:04 15:42-16:02/20 16:53	07:39 15:48-15:53/5 16:36
12	05:42 20:59	06:13 20:26	06:49 19:33	07:25 17:44-18:06/22 18:38	07:05 15:41-16:02/21 16:52	07:40 15:51-15:53/2 16:36
13	05:42 20:58	06:15 20:24	06:50 19:31	07:26 17:44-18:07/23 18:36	07:07 15:41-16:04/23 16:51	07:41 16:36
14	05:43 20:57	06:16 20:23	06:51 19:29	07:27 17:43-18:06/23 18:34	07:08 15:40-16:04/24 16:50	07:42 16:36
15	05:44 20:57	06:17 20:21	06:53 19:27	07:28 17:43-18:06/23 18:32	07:09 15:41-16:05/24 16:49	07:43 16:36
16	05:45 20:56	06:18 20:20	06:54 19:25	07:30 17:42-18:05/23 18:31	07:11 15:40-16:05/25 16:48	07:44 16:36
17	05:46 20:55	06:19 20:18	06:55 19:23	07:31 17:43-18:05/22 18:29	07:12 15:40-16:05/25 16:47	07:44 16:37
18	05:47 20:55	06:20 20:16	06:56 19:22	07:32 17:43-18:03/20 18:27	07:13 15:41-16:05/24 16:46	07:45 16:37
19	05:48 20:54	06:22 20:15	06:57 19:20	07:33 17:43-18:01/18 18:26	07:14 15:39-16:05/26 16:45	07:46 16:37
20	05:49 20:53	06:23 20:13	06:58 19:18	07:35 17:45-18:00/15 18:24	07:16 15:38-16:05/27 16:44	07:46 16:38
21	05:50 20:52	06:24 20:12	07:00 19:16	07:36 17:46-17:58/12 18:22	07:17 15:38-16:05/27 16:44	07:47 16:38
22	05:51 20:51	06:25 20:10	07:01 19:14	07:37 17:48-17:56/8 18:21	07:18 15:37-16:05/28 16:43	07:47 16:39
23	05:52 20:50	06:26 20:08	07:02 19:12	07:39 18:19	07:20 15:37-16:05/28 16:42	07:48 16:39
24	05:53 20:49	06:27 20:07	07:03 19:10	07:40 18:18	07:21 15:37-16:05/28 16:41	07:48 16:40
25	05:54 20:48	06:28 20:05	07:04 19:09	07:41 17:16	07:22 15:37-16:04/27 16:41	07:49 16:40
26	05:55 20:47	06:30 20:03	07:05 19:07	07:43 17:15	07:23 15:37-16:04/27 16:40	07:49 16:41
27	05:56 20:46	06:31 20:02	07:07 19:05	07:44 17:13	07:25 15:38-16:04/26 16:40	07:49 16:42
28	05:57 20:45	06:32 20:00	07:08 19:03	07:45 17:12	07:26 15:38-16:03/25 16:39	07:50 16:42
29	05:58 20:44	06:33 19:58	07:09 19:01	07:46 17:10	07:27 15:38-16:02/24 16:38	07:50 16:43
30	05:59 20:43	06:34 19:56	07:10 18:59	07:48 17:09	07:28 15:38-16:01/23 16:38	07:50 16:44
31	06:00 20:42	06:35 19:55		07:49 17:07		07:50 16:45
Potential sun hours	470	434	376	342	290	277
Sum of minutes with flicker	0	0	0	275	555	123

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

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

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: ER07 - ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (7)
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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June
1	07:51 16:46	07:34 17:23	06:54 18:02	17:16-17:39/23 18:02	06:58 19:07-19:18/11 19:41	06:07 20:17 20:51
2	07:51 16:47	07:33 17:25	06:52 18:03	17:15-17:41/26 18:03	06:56 19:06-19:19/13 19:42	06:06 20:19 20:52
3	07:51 16:48	07:32 17:26	06:50 18:04	17:15-17:41/26 18:04	06:54 19:07-19:21/14 19:43	06:04 20:20 20:52
4	07:51 16:49	07:31 17:27	06:49 18:06	17:14-17:41/27 18:06	06:52 19:07-19:22/15 19:45	06:03 20:21 20:53
5	07:51 16:50	07:29 17:29	06:47 18:07	17:15-17:41/26 18:07	06:51 19:08-19:23/15 19:46	06:02 20:22 20:54
6	07:50 16:51	07:28 17:30	06:45 18:08	17:15-17:40/25 18:08	06:49 19:08-19:24/16 19:47	06:00 20:23 20:55
7	07:50 16:52	07:27 17:32	06:43 18:10	17:16-17:39/23 18:10	06:47 19:10-19:23/13 19:48	05:59 20:25 20:55
8	07:50 16:53	07:26 17:33	06:42 18:11	17:16-17:37/21 18:11	06:45 19:13-19:21/8 19:49	05:58 20:26 20:56
9	07:50 16:54	07:24 17:34	06:40 18:12	17:18-17:37/19 18:12	06:43 19:51 20:27	05:56 20:27 20:57
10	07:50 16:55	07:23 17:36	06:38 18:13	17:20-17:34/14 18:13	06:42 19:52 20:28	05:55 20:28 20:57
11	07:49 16:56	07:22 17:37	06:36 18:15	17:23-17:31/8 18:15	06:40 19:53 20:29	05:54 20:29 20:58
12	07:49 16:57	07:20 17:39	06:34 18:16	17:23-17:31/8 18:16	06:38 19:54 20:30	05:53 20:30 20:59
13	07:49 16:58	07:19 17:40	06:33 18:17	17:23-17:31/8 18:17	06:36 19:56 20:32	05:51 20:32 20:59
14	07:48 17:00	07:17 17:41	06:31 18:19	17:23-17:31/8 18:19	06:35 19:57 20:33	05:50 20:33 21:00
15	07:48 17:01	07:16 17:43	06:29 18:20	17:23-17:31/8 18:20	06:33 19:58 20:34	05:49 20:34 21:00
16	07:47 17:02	07:14 17:44	06:27 18:21	17:23-17:31/8 18:21	06:31 19:59 20:35	05:48 20:35 21:00
17	07:47 17:03	07:13 17:46	06:25 18:22	17:23-17:31/8 18:22	06:30 20:00 20:36	05:47 20:36 21:01
18	07:46 17:04	07:11 17:47	06:24 18:24	17:23-17:31/8 18:24	06:28 20:02 20:37	05:46 20:37 21:01
19	07:45 17:06	07:10 17:48	06:22 18:25	17:23-17:31/8 18:25	06:26 20:03 20:38	05:45 20:38 21:01
20	07:45 17:07	07:08 17:50	06:20 18:26	17:23-17:31/8 18:26	06:25 20:04 20:39	05:44 20:39 21:02
21	07:44 17:08	07:07 17:51	06:18 18:27	17:23-17:31/8 18:27	06:23 20:05 20:40	05:43 20:40 21:02
22	07:43 17:10	07:05 17:52	06:16 18:29	17:23-17:31/8 18:29	06:21 20:07 20:41	05:42 20:41 21:02
23	07:43 17:11	07:04 17:54	06:14 18:30	17:23-17:31/8 18:30	06:20 20:08 20:42	05:41 20:42 21:02
24	07:42 17:12	07:02 17:55	06:13 18:31	17:23-17:31/8 18:31	06:18 20:09 20:43	05:40 20:43 21:03
25	07:41 17:14	07:00 17:56	06:11 18:32	17:23-17:31/8 18:32	06:16 20:10 20:44	05:39 20:44 21:03
26	07:40 17:15	06:59 17:58	06:09 18:33	17:23-17:31/8 18:33	06:15 20:11 20:45	05:39 20:45 21:03
27	07:39 17:16	06:57 17:59	06:07 18:35	17:23-17:31/8 18:35	06:13 20:13 20:46	05:38 20:46 21:03
28	07:38 17:18	06:55 18:00	06:05 18:36	17:23-17:31/8 18:36	06:12 20:14 20:47	05:37 20:47 21:03
29	07:37 17:19		07:03 19:37	19:09-19:15/6 19:37	06:10 20:15 20:48	05:36 20:48 21:03
30	07:36 17:21		07:02 19:38	19:08-19:16/8 19:38	06:09 20:16 20:49	05:36 20:49 21:03
31	07:35 17:22		07:00 19:40	19:07-19:17/10 19:40		05:35 20:50 21:03
Potential sun hours	288	292	369	403	457	464
Sum of minutes with flicker	0	289	267	105	0	0

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

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

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: ER07 - ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (7)
Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	July	August	September	October	November	December
1	05:34 21:02	06:01 20:41	06:37 19:53	07:11 18:57	06:50 16:18-16:35/17 17:06	07:29 16:38
2	05:35 21:02	06:02 20:39	06:38 19:51	07:13 18:56	06:52 16:19-16:35/16 17:04	07:30 16:37
3	05:35 21:02	06:03 20:38	06:39 19:49	07:14 17:59-18:11/12 18:54	06:53 16:20-16:34/14 17:03	07:31 16:37
4	05:36 21:02	06:04 20:37	06:40 19:10-19:18/8 19:47	07:15 17:56-18:13/17 18:52	06:55 16:22-16:33/11 17:02	07:33 16:37
5	05:37 21:02	06:06 20:35	06:41 19:07-19:20/13 19:46	07:16 17:54-18:14/20 18:50	06:56 16:24-16:31/7 17:00	07:34 16:36
6	05:37 21:01	06:07 20:34	06:42 19:05-19:20/15 19:44	07:17 17:53-18:15/22 18:48	06:57 16:59	07:35 16:36
7	05:38 21:01	06:08 20:33	06:43 19:03-19:18/15 19:42	07:19 17:52-18:16/24 18:46	06:59 16:58	07:36 16:36
8	05:39 21:01	06:09 20:31	06:45 19:01-19:16/15 19:40	07:20 17:50-18:16/26 18:45	07:00 16:57	07:37 16:36
9	05:39 21:00	06:10 20:30	06:46 19:00-19:15/15 19:38	07:21 17:49-18:16/27 18:43	07:01 16:55	07:38 16:36
10	05:40 21:00	06:11 20:29	06:47 19:00-19:14/14 19:36	07:22 17:50-18:16/26 18:41	07:03 16:54	07:39 16:36
11	05:41 20:59	06:12 20:27	06:48 19:00-19:12/12 19:35	07:23 17:49-18:15/26 18:39	07:04 16:53	07:39 16:36
12	05:42 20:59	06:13 20:26	06:49 18:59-19:10/11 19:33	07:25 17:49-18:13/24 18:38	07:05 16:52	07:40 16:36
13	05:42 20:58	06:15 20:24	06:50 18:59-19:08/9 19:31	07:26 17:49-18:12/23 18:36	07:07 16:51	07:41 16:36
14	05:43 20:57	06:16 20:23	06:51 18:59-19:06/7 19:29	07:27 17:49-18:10/21 18:34	07:08 16:50	07:42 16:36
15	05:44 20:57	06:17 20:21	06:53 18:59-19:04/5 19:27	07:28 17:49-18:08/19 18:32	07:09 16:49	07:43 16:36
16	05:45 20:56	06:18 20:20	06:54 19:00-19:02/2 19:25	07:30 17:50-18:06/16 18:31	07:11 16:48	07:44 16:36
17	05:46 20:55	06:19 20:18	06:55 19:23	07:31 17:52-18:05/13 18:29	07:12 16:47	07:44 16:37
18	05:47 20:55	06:20 20:16	06:56 19:22	07:32 17:53-18:03/10 18:27	07:13 16:46	07:45 16:37
19	05:48 20:54	06:22 20:15	06:57 19:20	07:33 17:55-18:01/6 18:26	07:14 16:45	07:46 16:37
20	05:49 20:53	06:23 20:13	06:58 19:18	07:35 18:24	07:16 16:44	07:46 16:38
21	05:50 20:52	06:24 20:12	07:00 19:16	07:36 18:22	07:17 16:44	07:47 16:38
22	05:51 20:51	06:25 20:10	07:01 19:14	07:37 18:21	07:18 16:43	07:47 16:39
23	05:52 20:50	06:26 20:08	07:02 19:12	07:39 17:26-17:30/4 18:19	07:20 16:42	07:48 16:39
24	05:53 20:49	06:27 20:07	07:03 19:10	07:40 17:23-17:33/10 18:18	07:21 16:41	07:48 16:40
25	05:54 20:48	06:28 20:05	07:04 19:09	06:41 16:21-16:35/14 17:16	07:22 16:41	07:49 16:40
26	05:55 20:47	06:30 20:03	07:05 19:07	06:43 16:20-16:36/16 17:15	07:23 16:40	07:49 16:41
27	05:56 20:46	06:31 20:02	07:07 19:05	06:44 16:19-16:36/17 17:13	07:25 16:40	07:49 16:42
28	05:57 20:45	06:32 20:00	07:08 19:03	06:45 16:19-16:37/18 17:12	07:26 16:39	07:50 16:42
29	05:58 20:44	06:33 19:58	07:09 19:01	06:47 16:18-16:36/18 17:10	07:27 16:38	07:50 16:43
30	05:59 20:43	06:34 19:56	07:10 18:59	06:48 16:19-16:37/18 17:09	07:28 16:38	07:50 16:44
31	06:00 20:42	06:35 19:55		06:49 16:18-16:36/18 17:07		07:50 16:45
Potential sun hours	470	434	376	342	290	277
Sum of minutes with flicker	0	0	141	465	65	0

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: ER08 - ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (8)
Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:51 16:46	07:34 17:23	06:54 18:02	06:58 19:02-19:18/16 19:41	06:07 20:17	05:35 20:51	05:34 21:02	06:01 20:41	06:37 19:53	07:11 18:13-18:23/10 18:57	06:51 17:06	07:29 16:38
2	07:51 16:47	07:33 17:25	06:52 18:03	06:56 19:02-19:19/17 19:42	06:06 20:19	05:34 20:52	05:35 21:02	06:02 20:39	06:38 19:51	07:13 18:11-18:24/13 18:56	06:52 17:04	07:30 16:37
3	07:51 16:48	07:32 17:26	06:50 18:04	06:54 19:03-19:21/18 19:43	06:04 20:20	05:34 20:53	05:35 21:02	06:03 20:38	06:39 19:49	07:14 18:10-18:24/14 18:54	06:53 17:03	07:32 16:37
4	07:51 16:49	07:31 17:27	06:49 17:36-17:43/7 18:06	06:52 19:04-19:20/16 19:45	06:03 20:21	05:33 20:53	05:36 21:02	06:04 20:37	06:40 19:47	07:15 18:09-18:24/15 18:52	06:55 17:02	07:33 16:37
5	07:51 16:50	07:29 17:29	06:47 17:35-17:45/10 18:07	06:51 19:05-19:18/13 19:46	06:02 20:22	05:33 20:54	05:37 21:02	06:06 20:35	06:41 19:46	07:16 18:08-18:24/16 18:50	06:56 17:00	07:34 16:36
6	07:50 16:51	07:28 17:30	06:45 17:33-17:46/13 18:08	06:49 19:07-19:14/7 19:47	06:00 20:23	05:32 20:55	05:37 21:01	06:07 20:34	06:42 19:03-19:10/7 19:44	07:17 18:09-18:24/15 18:48	06:57 16:59	07:35 16:36
7	07:50 16:52	07:27 17:32	06:43 17:32-17:47/15 18:10	06:47 19:48	05:59 20:25	05:32 20:55	05:38 21:01	06:08 20:33	06:43 19:00-19:13/13 19:42	07:19 18:08-18:23/15 18:47	06:59 16:58	07:36 16:36
8	07:50 16:53	07:26 17:33	06:42 17:31-17:47/16 18:11	06:45 19:49	05:58 20:26	05:32 20:56	05:39 21:01	06:09 20:31	06:45 18:58-19:14/16 19:40	07:20 18:09-18:21/12 18:45	07:00 16:57	07:37 16:36
9	07:50 16:54	07:24 17:34	06:40 17:32-17:48/16 18:12	06:43 19:51	05:56 20:27	05:31 20:57	05:39 21:00	06:10 20:30	06:46 18:56-19:14/18 19:38	07:21 18:10-18:18/8 18:43	07:01 16:55	07:38 16:36
10	07:50 16:55	07:23 17:36	06:38 17:32-17:47/15 18:13	06:42 19:52	05:55 20:28	05:31 20:57	05:40 21:00	06:11 20:29	06:47 18:56-19:14/18 19:36	07:22 18:14-18:17/3 18:41	07:03 16:54	07:39 16:36
11	07:49 16:56	07:22 17:37	06:36 17:32-17:46/14 18:15	06:40 19:53	05:54 20:29	05:31 20:58	05:41 20:59	06:12 20:27	06:48 18:55-19:12/17 19:35	07:23 18:39	07:04 16:53	07:40 16:36
12	07:49 16:57	07:20 17:39	06:34 17:33-17:44/11 18:16	06:38 19:54	05:53 20:31	05:31 20:59	05:42 20:59	06:13 20:26	06:49 18:55-19:10/15 19:33	07:25 18:38	07:05 16:52	07:40 16:36
13	07:49 16:58	07:19 17:40	06:33 17:34-17:42/8 18:17	06:36 19:56	05:51 20:32	05:31 20:59	05:42 20:58	06:15 20:24	06:50 18:54-19:08/14 19:31	07:26 18:36	07:07 16:51	07:41 16:36
14	07:48 17:00	07:17 17:41	06:31 18:19	06:35 19:57	05:50 20:33	05:30 21:00	05:43 20:57	06:16 20:23	06:52 18:54-19:06/12 19:29	07:27 18:34	07:08 16:50	07:42 16:36
15	07:48 17:01	07:16 17:43	06:29 18:20	06:33 19:58	05:49 20:34	05:30 21:00	05:44 20:57	06:17 20:21	06:53 18:54-19:04/10 19:27	07:28 18:32	07:09 16:49	07:43 16:36
16	07:47 17:02	07:14 17:44	06:27 18:21	06:31 19:59	05:48 20:35	05:30 21:00	05:45 20:56	06:18 20:20	06:54 18:54-19:02/8 19:25	07:30 18:31	07:11 16:48	07:44 16:36
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19	07:45 17:06	07:10 17:48	06:22 18:25	06:26 19:39-19:40/1 20:03	05:45 20:38	05:30 21:02	05:48 20:54	06:22 19:45-19:51/6 20:15	06:57 19:20	07:34 18:26	07:14 16:45	07:46 16:37
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21	07:44 17:08	07:07 17:51	06:18 18:27	06:23 19:39-19:42/3 20:05	05:43 20:40	05:31 21:02	05:50 20:52	06:24 19:43-19:47/4 20:12	07:00 19:16	07:36 18:22	07:17 16:44	07:47 16:38
22	07:43 17:10	07:05 17:52	06:16 18:29	06:21 19:38-19:43/5 20:07	05:42 20:41	05:31 21:02	05:51 20:51	06:25 19:43-19:47/4 20:10	07:01 19:14	07:37 18:21	07:18 16:43	07:47 16:39
23	07:43 17:11	07:04 17:54	06:14 18:30	06:20 19:39-19:45/6 20:08	05:41 20:42	05:31 21:02	05:52 20:50	06:26 19:43-19:45/2 20:08	07:02 19:12	07:39 18:19	07:20 16:42	07:48 16:39
24	07:42 17:12	07:02 17:55	06:13 18:31	06:18 19:39-19:45/6 20:09	05:40 20:43	05:31 21:03	05:53 20:49	06:27 20:07	07:03 19:10	07:40 18:18	07:21 16:41	07:48 16:40
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31	07:35 17:22		07:00 19:02-19:17/15 19:40		05:35 20:50		06:00 20:42	06:35 19:55		06:49 17:07		07:50 16:45
Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277
Sum of minutes with flicker	0	0	185	122	0	0	0	35	160	121	0	0

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: ER09 - ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (9)
Assumptions for shadow calculations

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

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
446	588	709	537	307	224	366	1.786	992	318	487	496	7.256

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:51 16:46	07:34 17:23	06:54 18:02	06:58 19:41	19:09-19:18/9 20:18	06:07 20:18	19:47-19:54/7 20:51	05:34 21:03	06:01 20:41	06:37 19:53	07:11 18:57	06:51 17:06	07:29 16:38
2	07:51 16:47	07:33 17:25	06:52 18:03	06:56 19:42	19:08-19:19/11 20:19	06:06 20:19	19:47-19:54/7 20:52	05:34 21:02	06:02 20:39	06:38 19:51	07:13 18:56	06:52 17:04	07:30 16:37
3	07:51 16:48	07:32 17:26	06:50 18:04	06:54 19:43	19:09-19:21/12 20:20	06:04 20:20	19:49-19:56/7 20:53	05:35 21:02	06:03 20:38	06:39 19:49	07:14 18:54	06:53 17:03	07:32 16:37
4	07:51 16:49	07:31 17:27	06:49 18:06	06:52 19:45	19:10-19:21/11 20:21	06:03 20:21	19:51-19:57/6 20:53	05:36 21:02	06:04 20:37	06:40 19:47	07:15 18:52	06:55 17:02	07:33 16:37
5	07:51 16:50	07:29 17:29	06:47 18:07	06:51 19:46	19:11-19:19/8 20:22	06:02 20:22	19:53-19:55/2 20:54	05:37 21:02	06:06 20:35	06:41 19:46	07:16 18:50	06:56 17:00	07:34 16:36
6	07:50 16:51	07:28 17:30	06:45 18:08	06:49 19:47	06:00 20:23	05:32 20:23	05:37 21:01	06:07 20:34	06:42 19:44	06:46 19:06-19:14/8	07:17 18:48	06:57 16:59	07:35 16:36
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8	07:50 16:53	07:26 17:33	06:42 18:11	06:45 19:49	05:58 20:26	05:32 20:56	05:39 21:01	06:09 20:31	20:01-20:07/6 20:31	06:45 19:40	07:20 18:45	07:00 16:57	07:37 16:36
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15	07:48 17:01	07:16 17:43	06:29 18:20	06:33 19:58	05:49 20:34	05:30 21:00	05:44 20:57	06:17 20:21	19:54-19:57/3 20:21	06:53 19:03-19:04/1	07:28 18:32	07:09 16:49	07:43 16:36
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19	07:45 17:06	07:10 17:48	06:22 18:25	06:26 20:03	05:45 20:38	05:30 21:02	05:48 20:54	06:22 20:15	06:22 20:15	06:57 19:20	07:34 18:26	07:14 16:45	07:46 16:37
20	07:45 17:07	07:08 17:50	06:20 18:26	06:25 20:04	05:44 20:39	05:31 21:02	05:49 20:53	06:23 20:13	06:23 20:13	06:58 19:18	07:35 18:24	07:16 16:44	07:46 16:38
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23	07:43 17:11	07:04 17:54	06:14 18:30	06:20 20:08	05:41 20:42	05:31 21:02	05:52 20:50	06:26 20:08	06:26 20:08	07:02 19:12	07:39 18:19	07:20 16:42	07:48 16:39
24	07:42 17:12	07:02 17:55	06:13 18:31	06:18 20:09	05:40 20:43	05:31 21:03	05:53 20:49	06:27 20:07	06:27 20:07	07:03 19:10	07:40 18:18	07:21 16:41	07:48 16:40
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26	07:40 17:15	06:59 17:58	06:09 18:34	06:15 20:11	19:47-19:48/1 20:45	05:32 21:03	05:55 20:47	06:30 20:03	06:30 20:03	07:05 19:07	06:43 17:15	07:23 16:40	07:49 16:41
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Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277	0
Sum of minutes with flicker	0	0	17	66	29	0	0	45	73	0	0	0	0

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: ER10 - ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (10)
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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:51 16:46	07:34 17:23	06:54 18:02	06:58 19:41	06:07 20:18	05:35 20:51	05:34 21:03	06:01 20:41	06:37 19:53	07:11 18:57	06:51 17:06	07:29 16:38
2	07:51 16:47	07:33 17:25	06:52 18:03	06:56 19:42	06:06 20:19	05:34 20:52	05:35 21:02	06:02 20:39	06:38 19:51	07:13 18:56	06:52 17:04	07:30 16:37
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25	07:41 17:14	07:00 17:56	06:11 18:32	06:16 20:10	05:39 20:44	05:32 21:03	05:54 20:48	06:28 20:05	07:04 19:09	07:41 17:16	07:22 16:41	07:49 16:40
26	07:40 17:15	06:59 17:58	06:09 18:34	06:15 20:11	05:39 20:45	05:32 21:03	05:55 20:47	06:30 20:03	07:05 19:07	07:43 17:15	07:23 16:40	07:49 16:41
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29	07:37 17:19	06:54 18:01	06:04 18:37	06:11 20:15	05:36 20:48	05:33 21:03	05:58 20:44	06:33 19:58	07:09 19:01	07:47 17:10	07:27 16:38	07:50 16:43
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31	07:35 17:22	06:52 18:03	06:02 18:39	06:09 20:17	05:35 20:50	05:33 21:04	06:00 20:42	06:35 19:55	07:11 19:00	07:49 17:08	07:29 16:38	07:50 16:45
Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277
Sum of minutes with flicker	0	0	0	49	10	0	10	48	0	0	0	0

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: ER11 - ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (11)
Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:51 16:46	07:34 17:23	06:54 18:02	06:58 19:41	06:07 20:18	05:35 20:51	05:34 21:03	06:01 20:41	06:37 19:53	07:11 18:57	06:51 17:06	07:29 16:38
2	07:51 16:47	07:33 17:25	06:52 18:03	06:56 19:42	06:06 20:19	05:34 20:52	05:35 21:02	06:02 20:39	06:38 19:51	07:13 18:56	06:52 17:04	07:30 16:37
3	07:51 16:48	07:32 17:26	06:50 18:04	06:54 19:43	06:04 20:20	05:34 20:53	05:35 21:02	06:03 20:38	06:39 19:49	07:14 18:54	06:53 17:03	07:32 16:37
4	07:51 16:49	07:31 17:27	06:49 18:06	06:52 19:45	06:03 20:21	05:33 20:53	05:36 21:02	06:04 20:37	06:40 19:47	07:15 18:52	06:55 17:02	07:33 16:37
5	07:51 16:50	07:29 17:29	06:47 18:07	06:51 19:46	06:02 20:22	05:33 20:54	05:37 21:02	06:06 20:36	06:41 19:46	07:16 18:50	06:56 17:00	07:34 16:36
6	07:51 16:51	07:28 17:30	06:45 18:08	06:49 19:47	06:00 20:24	05:32 20:55	05:37 21:01	06:07 20:34	06:42 19:44	07:17 18:48	06:57 16:59	07:35 16:36
7	07:50 16:52	07:27 17:32	06:43 18:10	06:47 19:48	05:59 20:25	05:32 20:56	05:38 21:01	06:08 20:33	06:43 19:42	07:19 18:47	06:59 16:58	07:36 16:36
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29	07:37 17:19		07:03 19:37	06:10 20:15	05:36 20:48	05:33 21:03	05:58 20:44	06:33 19:58	07:09 19:01	06:47 17:10	07:27 16:38	07:50 16:43
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31	07:35 17:22		07:00 19:40		05:35 20:50		06:00 20:42	06:35 19:55		06:49 17:07		07:50 16:45
Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: ER12 - ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (12)
Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:51 16:46	07:34 17:23	06:54 18:02	06:58 19:41	06:07 20:18	05:35 20:51	05:34 21:03	06:01 20:41	06:37 19:53	07:11 18:57	06:51 17:06	07:29 16:38
2	07:51 16:47	07:33 17:25	06:52 18:03	06:56 19:42	06:06 20:19	05:34 20:52	05:35 21:02	06:02 20:39	06:38 19:51	07:13 18:56	06:52 17:04	07:30 16:37
3	07:51 16:48	07:32 17:26	08:40-08:41/1 06:50	06:54 18:04	06:04 20:20	05:34 20:53	05:35 21:02	06:03 20:38	06:39 19:49	07:14 18:54	06:53 17:03	07:32 16:37
4	07:51 16:49	07:31 17:27	08:38-08:41/3 06:49	06:52 18:06	06:03 20:21	05:33 20:53	05:36 21:02	06:04 20:37	06:40 19:47	07:15 18:52	06:55 17:02	07:33 16:37
5	07:51 16:50	07:29 17:29	08:36-08:40/4 06:47	06:51 18:07	06:02 20:22	05:33 20:54	05:37 21:02	06:06 20:36	06:41 19:46	07:16 18:50	06:56 17:00	08:04-08:08/4 07:34 16:36
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Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277
Sum of minutes with flicker	0	12	0	0	0	0	0	0	0	0	12	0

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: ER13 - ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (13)
Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
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3	07:51 09:33-09:53/20 16:48	07:32 06:50 17:26 18:04	06:54 19:43 20:20	05:34 20:53 21:02	05:34 20:41 19:53	06:01 19:53 17:06	06:37 18:57 17:06	07:11 18:57 17:06	06:51 17:06	07:29 09:23-09:33/10	16:38	16:38
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24	07:42 17:12	07:02 06:13 17:55 18:31	06:18 19:58 20:44	05:31 20:57 20:49	05:34 20:41 19:53	06:01 19:53 17:06	06:37 18:57 17:06	07:11 18:57 17:06	06:51 17:06	07:29 09:23-09:33/10	16:38	16:38
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29	07:37 17:19	07:03 06:10 19:37 19:37	06:10 19:58 20:48	05:33 20:58 20:44	05:34 20:41 19:53	06:01 19:53 17:06	06:37 18:57 17:06	07:11 18:57 17:06	06:51 17:06	07:29 09:23-09:33/10	16:38	16:38
30	07:36 17:21	07:02 06:09 19:38 19:38	06:09 19:58 20:49	05:34 20:59 20:43	05:34 20:41 19:53	06:01 19:53 17:06	06:37 18:57 17:06	07:11 18:57 17:06	06:51 17:06	07:29 09:23-09:33/10	16:38	16:38
31	07:35 17:22	07:00 06:08 19:40 19:40	06:08 19:58 20:50	05:35 20:59 20:42	05:34 20:41 19:53	06:01 19:53 17:06	06:37 18:57 17:06	07:11 18:57 17:06	06:51 17:06	07:29 09:23-09:33/10	16:38	16:38
Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277
Sum of minutes with flicker	188	0	0	0	0	0	0	0	0	0	6	624

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: ER14 - ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (14)
Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:51 10:10-10:29/19 16:46	07:34 18:02 17:23	06:54 18:02 18:03	06:58 19:41 19:42	06:07 20:18 20:19	05:35 20:51 21:03	05:34 21:03 21:02	06:01 20:41 20:39	06:37 19:53 19:51	07:11 18:57 18:56	06:51 17:06 17:04	07:29 16:38 16:37
2	07:51 10:10-10:29/19 16:47	07:33 18:03 17:25	06:52 18:03 18:04	06:56 19:42 19:43	06:06 20:19 20:20	05:34 20:52 21:02	05:35 21:02 21:02	06:02 20:39 20:38	06:38 19:51 19:49	07:13 18:56 18:54	06:52 17:04 17:03	07:30 16:37 16:37
3	07:51 10:11-10:29/18 16:48	07:32 18:04 17:26	06:50 18:04 18:04	06:54 19:43 19:43	06:04 20:20 20:20	05:34 20:53 21:02	05:35 21:02 21:02	06:03 20:38 20:38	06:39 19:49 19:49	07:14 18:54 18:54	06:53 17:03 17:03	07:32 16:37 16:37
4	07:51 10:13-10:29/16 16:49	07:31 18:06 17:28	06:49 18:06 18:06	06:52 19:45 19:45	06:03 20:21 20:21	05:33 20:53 21:02	05:36 21:02 21:02	06:04 20:37 20:37	06:40 19:47 19:47	07:15 18:52 18:52	06:55 17:02 17:02	07:33 10:03-10:09/6 16:37
5	07:51 10:14-10:29/15 16:50	07:29 18:07 17:29	06:47 18:07 18:07	06:51 19:46 19:46	06:02 20:22 20:22	05:33 20:54 21:02	05:37 21:02 21:02	06:06 20:36 20:36	06:41 19:46 19:46	07:16 18:50 18:50	06:56 17:00 17:00	07:34 10:02-10:11/9 16:36
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Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277
Sum of minutes with flicker	115	0	0	0	0	0	0	0	0	0	0	555

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: ER15 - ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (15)
Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:51 10:53-11:19/26 16:46	07:34 18:02 17:23	06:54 18:02 18:03	06:58 19:41 19:42	06:07 20:18 20:19	05:35 20:51 21:03	05:34 21:03 21:02	06:01 20:41 20:39	06:37 19:53 19:51	07:11 18:57 18:56	06:51 17:06 17:04	07:29 16:38 16:37
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Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277
Sum of minutes with flicker	170	0	0	0	0	0	0	0	0	0	0	741

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

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

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl
Via G. Garibaldi, 15
IT-74023 Grottaglie (TA)

Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG

Calculation: Parco Eolico Emilia: Shadow flickering WTG: ER16 - ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (16)
Assumptions for shadow calculations

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

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
446 588 709 537 307 224 366 1.786 992 318 487 496 7.256

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:51 11:20-12:07/47 16:46	07:34 11:25-12:21/56 17:23	06:54 11:25-12:21/56 18:02	06:58 11:25-12:21/56 19:41	06:07 11:25-12:21/56 20:18	05:35 11:25-12:21/56 20:51	05:34 11:25-12:21/56 21:03	06:01 11:25-12:21/56 20:41	06:37 11:25-12:21/56 19:53	07:11 11:25-12:21/56 18:57	06:51 11:04-11:42/38 17:06	07:29 11:03-11:57/54 16:38
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21	07:44 11:21-12:20/59 17:08	07:07 11:51 17:51	06:18 11:51 18:27	06:23 11:51 19:59	05:43 11:51 20:40	05:31 11:51 21:02	05:50 11:51 20:52	06:24 11:51 20:12	07:00 11:51 19:16	07:36 11:51 18:23	07:17 10:57-11:56/59 16:44	07:47 11:16-12:00/44 16:38
22	07:43 11:22-12:21/59 17:10	07:05 11:52 17:52	06:16 11:52 18:29	06:21 11:52 19:59	05:42 11:52 20:42	05:31 11:52 21:02	05:51 11:52 20:51	06:25 11:52 20:10	07:01 11:52 19:14	07:37 11:52 18:21	07:18 10:57-11:55/58 16:43	07:47 11:17-12:01/44 16:39
23	07:43 11:22-12:21/59 17:11	07:04 11:54 17:54	06:14 11:54 18:30	06:20 11:54 19:59	05:41 11:54 20:43	05:31 11:54 21:03	05:52 11:54 20:50	06:26 11:54 20:08	07:02 11:54 19:12	07:39 11:54 18:19	07:20 10:59-11:56/57 16:42	07:48 11:17-12:01/44 16:39
24	07:42 11:23-12:21/58 17:12	07:02 11:55 17:55	06:13 11:55 18:31	06:18 11:55 19:59	05:40 11:55 20:44	05:31 11:55 21:03	05:53 11:55 20:49	06:27 11:55 20:07	07:03 11:55 19:10	07:40 11:55 18:18	07:21 10:59-11:56/57 16:41	07:48 11:17-12:01/44 16:40
25	07:41 11:23-12:21/58 17:14	07:00 11:56 17:56	06:11 11:56 18:32	06:16 11:56 19:59	05:39 11:56 20:45	05:32 11:56 21:03	05:54 11:56 20:48	06:28 11:56 20:05	07:04 11:56 19:09	07:41 11:56 17:16	07:22 10:59-11:56/57 16:41	07:49 11:18-12:02/44 16:40
26	07:40 11:23-12:22/59 17:15	06:59 11:58 17:58	06:09 11:58 18:34	06:15 11:58 19:59	05:39 11:58 20:46	05:32 11:58 21:03	05:55 11:58 20:47	06:30 11:58 20:03	07:05 11:58 19:07	07:42 11:58 17:15	07:23 11:00-11:56/56 16:40	07:49 11:18-12:03/45 16:41
27	07:39 11:23-12:22/59 17:16	06:57 11:59 17:59	06:07 11:59 18:35	06:13 11:59 19:59	05:38 11:59 20:46	05:32 11:59 21:03	05:56 11:59 20:46	06:31 11:59 20:02	07:07 11:59 19:05	07:43 11:59 17:13	07:25 11:00-11:56/56 16:40	07:49 11:18-12:03/45 16:42
28	07:38 11:24-12:22/58 17:18	06:55 18:00	06:05 18:00	06:12 18:00	05:37 18:00	05:33 18:00	05:57 18:00	06:32 18:00	07:08 18:00	07:45 18:00	07:26 11:01-11:56/55 16:39	07:50 11:20-12:04/44 16:42
29	07:37 11:24-12:22/58 17:19		07:03 18:00	06:10 18:00	05:36 18:00	05:33 18:00	05:58 18:00	06:33 18:00	07:09 18:00	07:47 18:00	07:27 11:01-11:56/55 16:39	07:50 11:20-12:05/45 16:43
30	07:36 11:25-12:22/57 17:21		07:02 18:00	06:09 18:00	05:36 18:00	05:34 18:00	05:59 18:00	06:34 18:00	07:10 18:00	07:48 18:00	07:28 11:03-11:57/54 16:38	07:50 11:20-12:05/45 16:44
31	07:35 11:25-12:22/57 17:22		07:00 18:00		05:35 18:00		06:00 18:00	06:35 18:00	06:49 18:00	07:50 18:00	11:06-11:39/33 17:07	07:50 11:20-12:06/46 16:45
Potential sun hours	288	292	369	403	457	464	470	434	376	342	290	277
Sum of minutes with flicker	1694	562	0	0	0	0	0	0	0	81	1634	1444

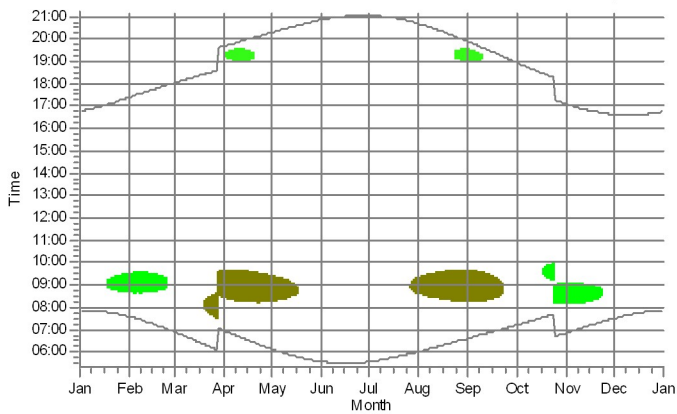
Table layout: For each day in each month the following matrix apply

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

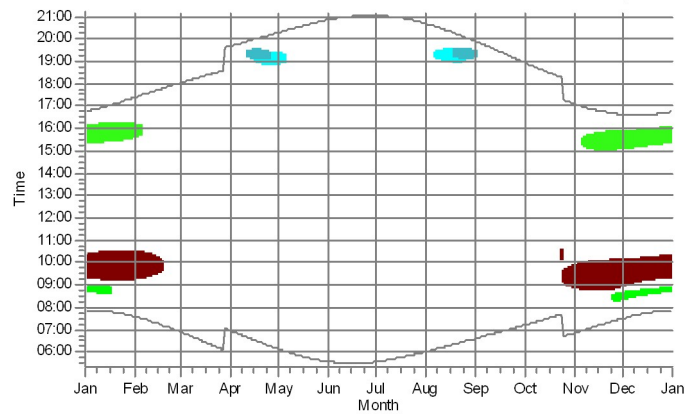
SHADOW - Calendar per WTG, graphical

Calculation: Parco Eolico Emilia: Shadow flickering

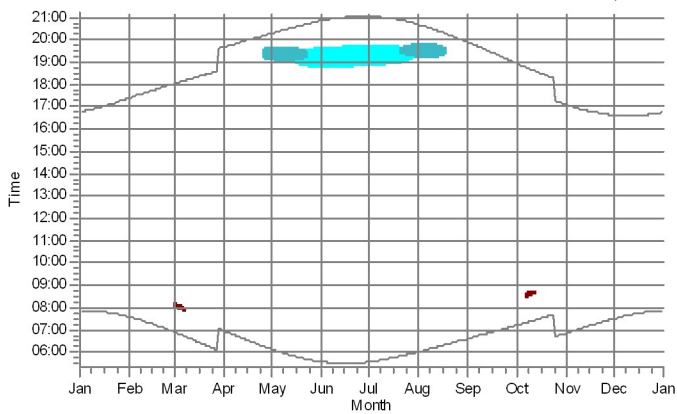
MC01: Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 2:



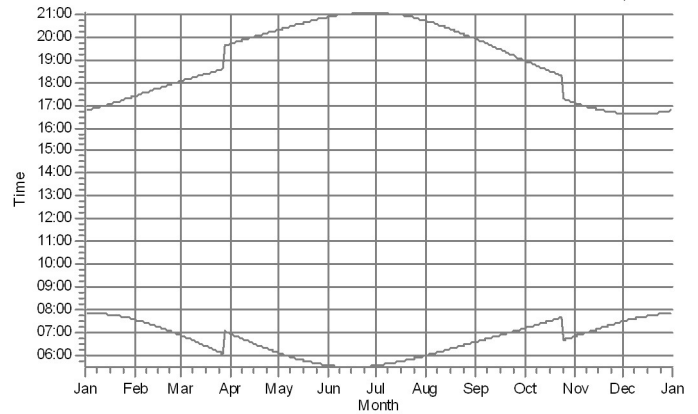
MC02: Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 2:



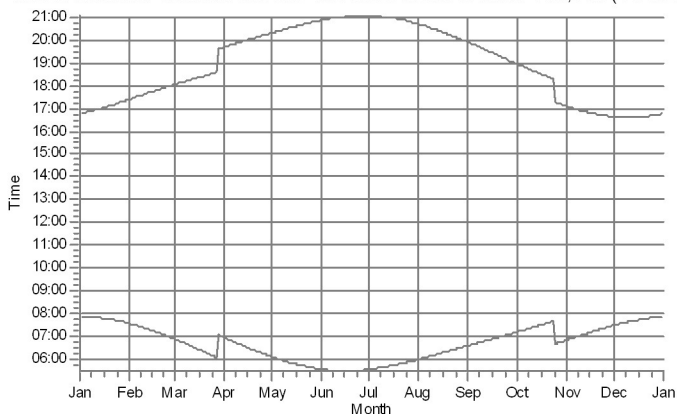
MC03: Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 2:



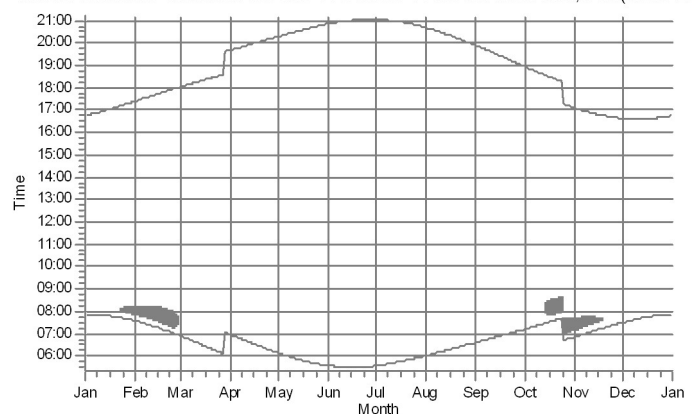
MC04: Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 2:



MC05: Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 2:



MC06: Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 2:



Shadow receptors

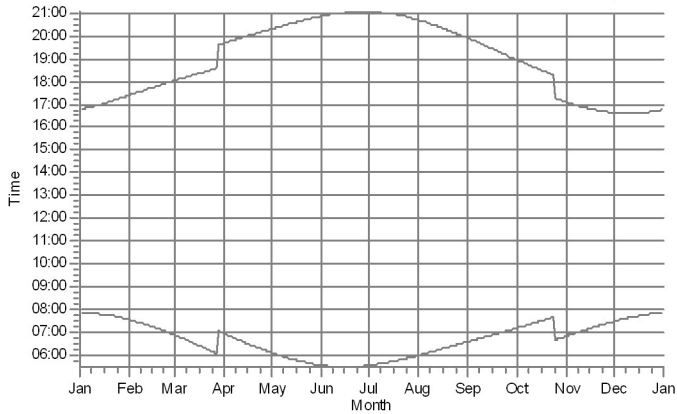
R03: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (3)
 R04: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (4)
 R14: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (8)
 R15: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (9)

R16: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (10)
 R20: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (13)
 R26: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (18)
 R27: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (19)

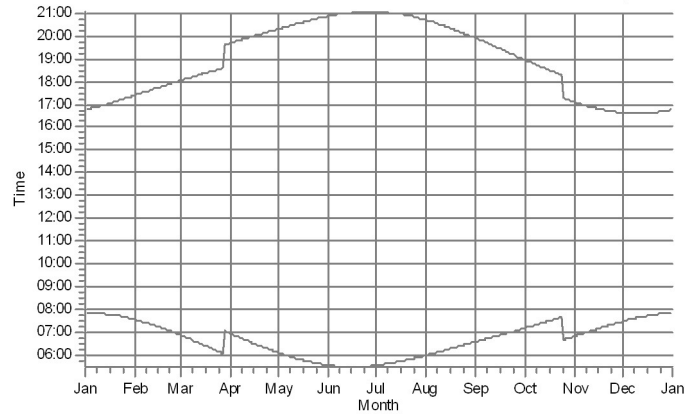
SHADOW - Calendar per WTG, graphical

Calculation: Parco Eolico Emilia: Shadow flickering

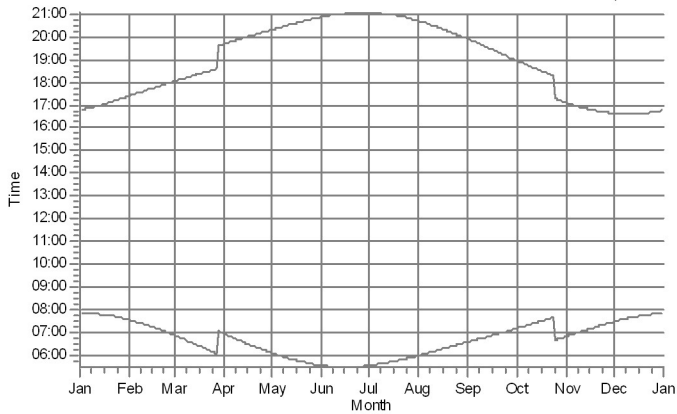
MC07: Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 2:



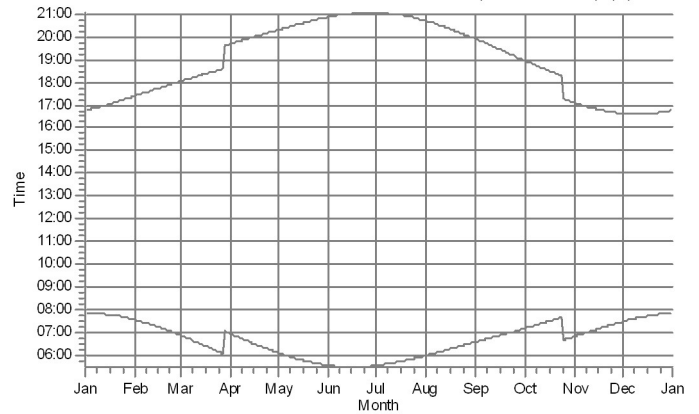
MC08: Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 2:



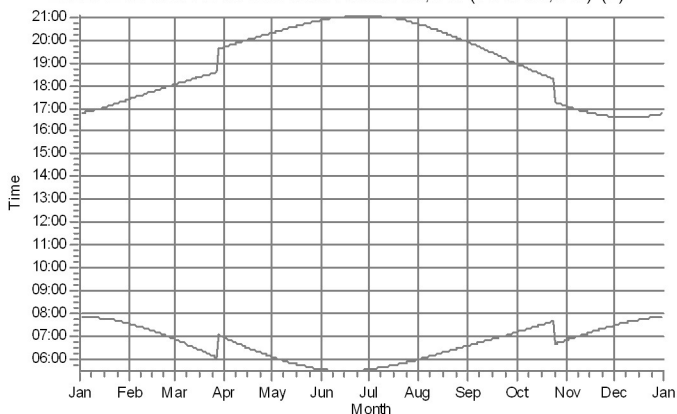
MC09: Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 135,0 m (TOT: 2:



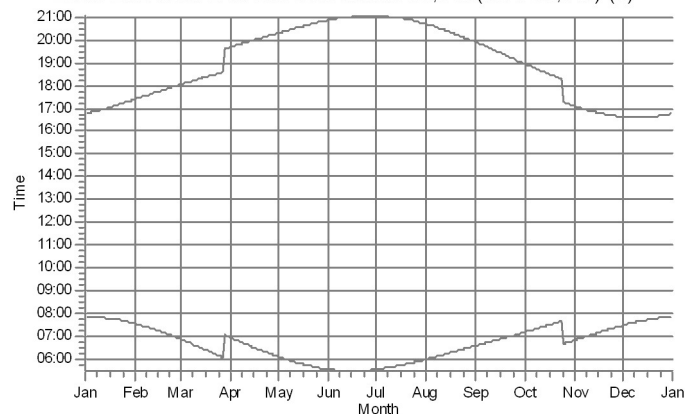
ER01: ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (1)



ER02: ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (2)



ER03: ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (3)

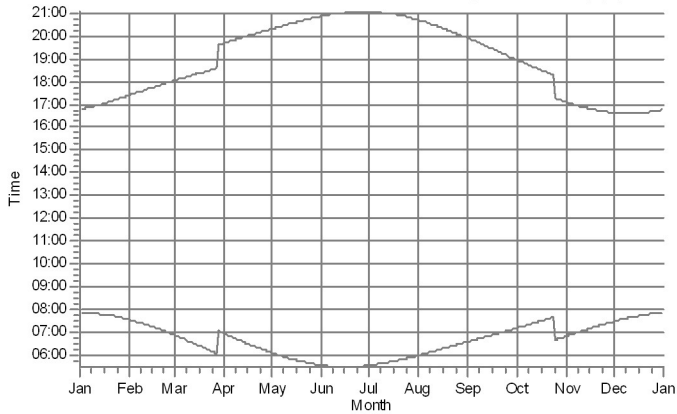


Shadow receptors

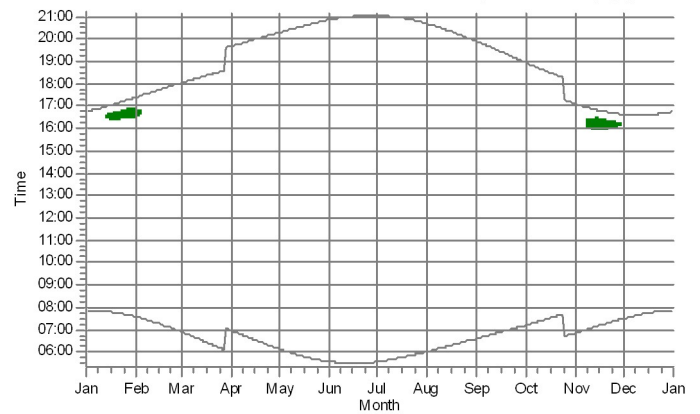
SHADOW - Calendar per WTG, graphical

Calculation: Parco Eolico Emilia: Shadow flickering

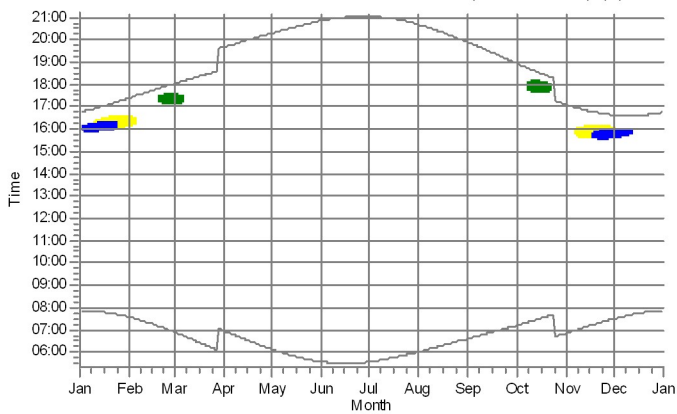
ER04: ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (4)



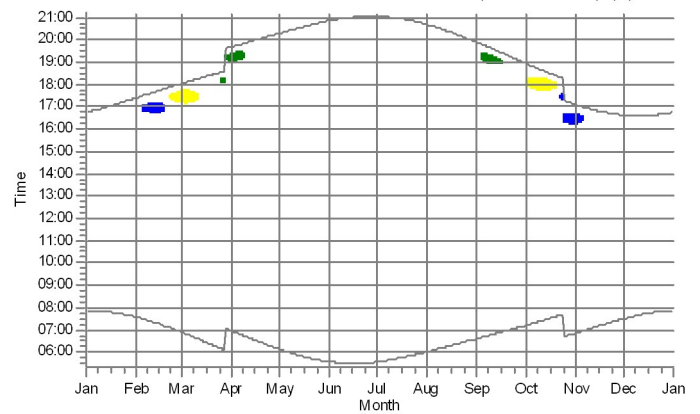
ER05: ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (5)



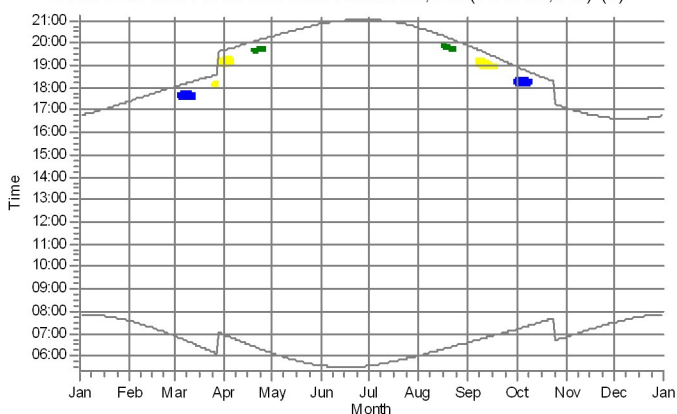
ER06: ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (6)



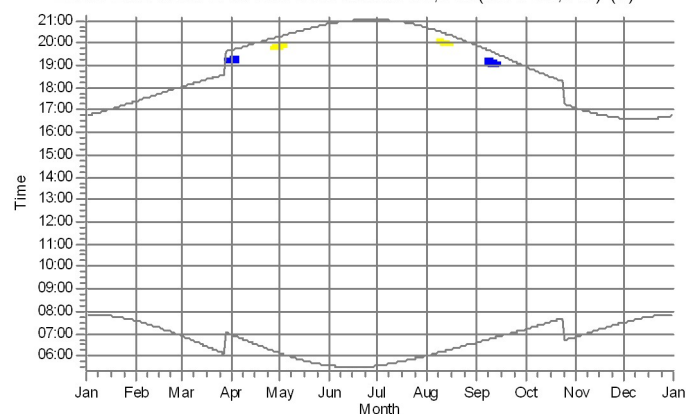
ER07: ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (7)



ER08: ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (8)



ER09: ENERCON E-53 800 53.0 !-! hub: 60,0 m (TOT: 86,5 m) (9)



Shadow receptors

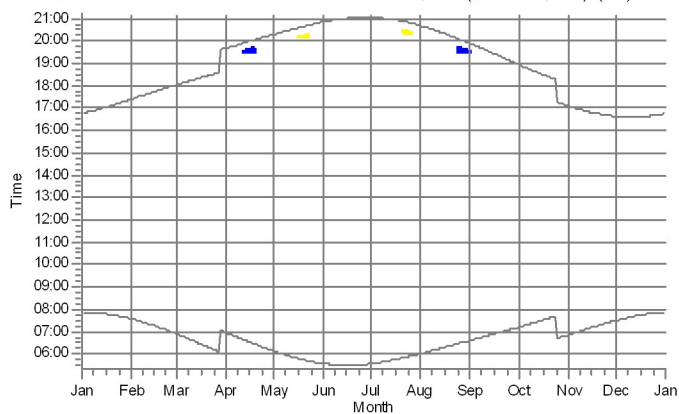
R01: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (1)
R02: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (2)

R03: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (3)

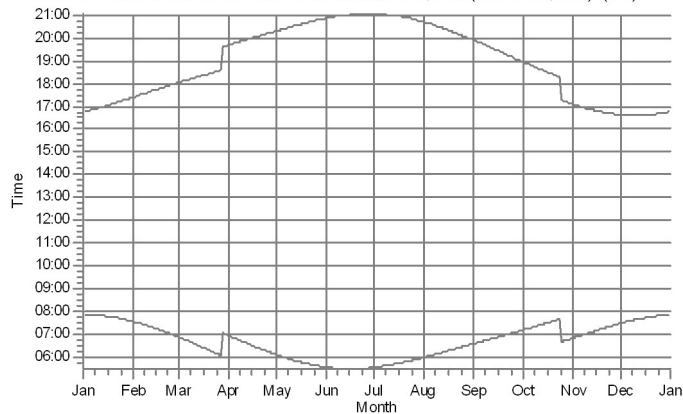
SHADOW - Calendar per WTG, graphical

Calculation: Parco Eolico Emilia: Shadow flickering

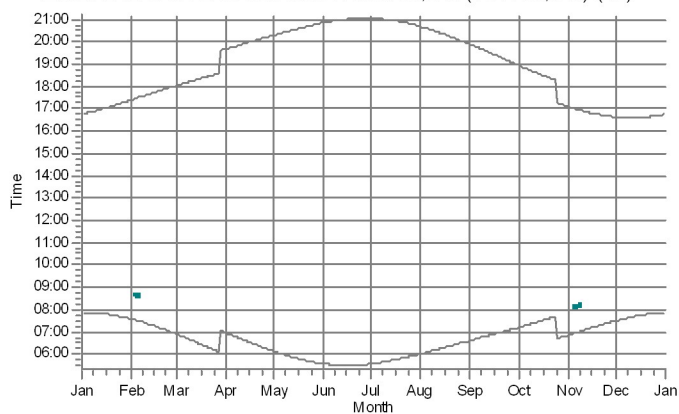
ER10: ENERCON E-53 800 53.0 ! hub: 60,0 m (TOT: 86,5 m) (10)



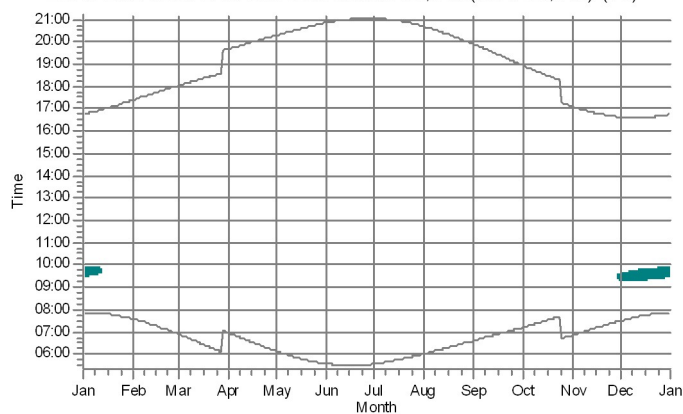
ER11: ENERCON E-53 800 53.0 ! hub: 60,0 m (TOT: 86,5 m) (11)



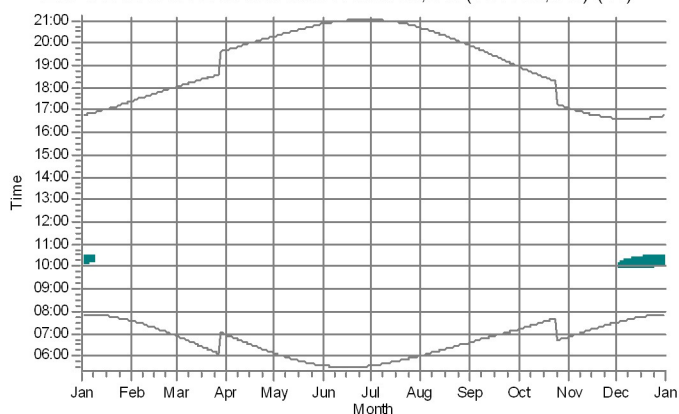
ER12: ENERCON E-53 800 53.0 ! hub: 60,0 m (TOT: 86,5 m) (12)



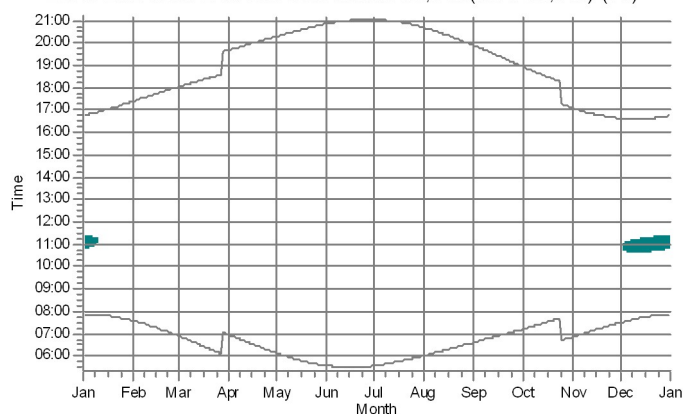
ER13: ENERCON E-53 800 53.0 ! hub: 60,0 m (TOT: 86,5 m) (13)



ER14: ENERCON E-53 800 53.0 ! hub: 60,0 m (TOT: 86,5 m) (14)



ER15: ENERCON E-53 800 53.0 ! hub: 60,0 m (TOT: 86,5 m) (15)



Shadow receptors

R02: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (2)

R03: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (3)

R09: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (6)

Project:

Parco Eolico Emilia

Licensed user:

Ge.co.Dor srl

Via G. Garibaldi, 15

IT-74023 Grottaglie (TA)

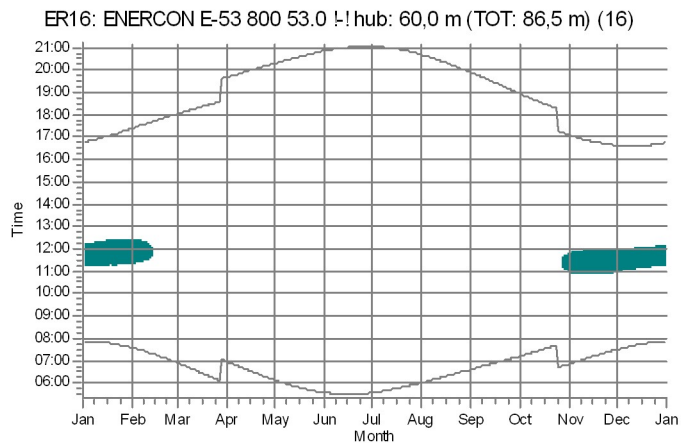
Gaetano D'Oronzio / info@gecodor.it

Calculated:

30/09/2022 13:05/3.5.587

SHADOW - Calendar per WTG, graphical

Calculation: Parco Eolico Emilia: Shadow flickering



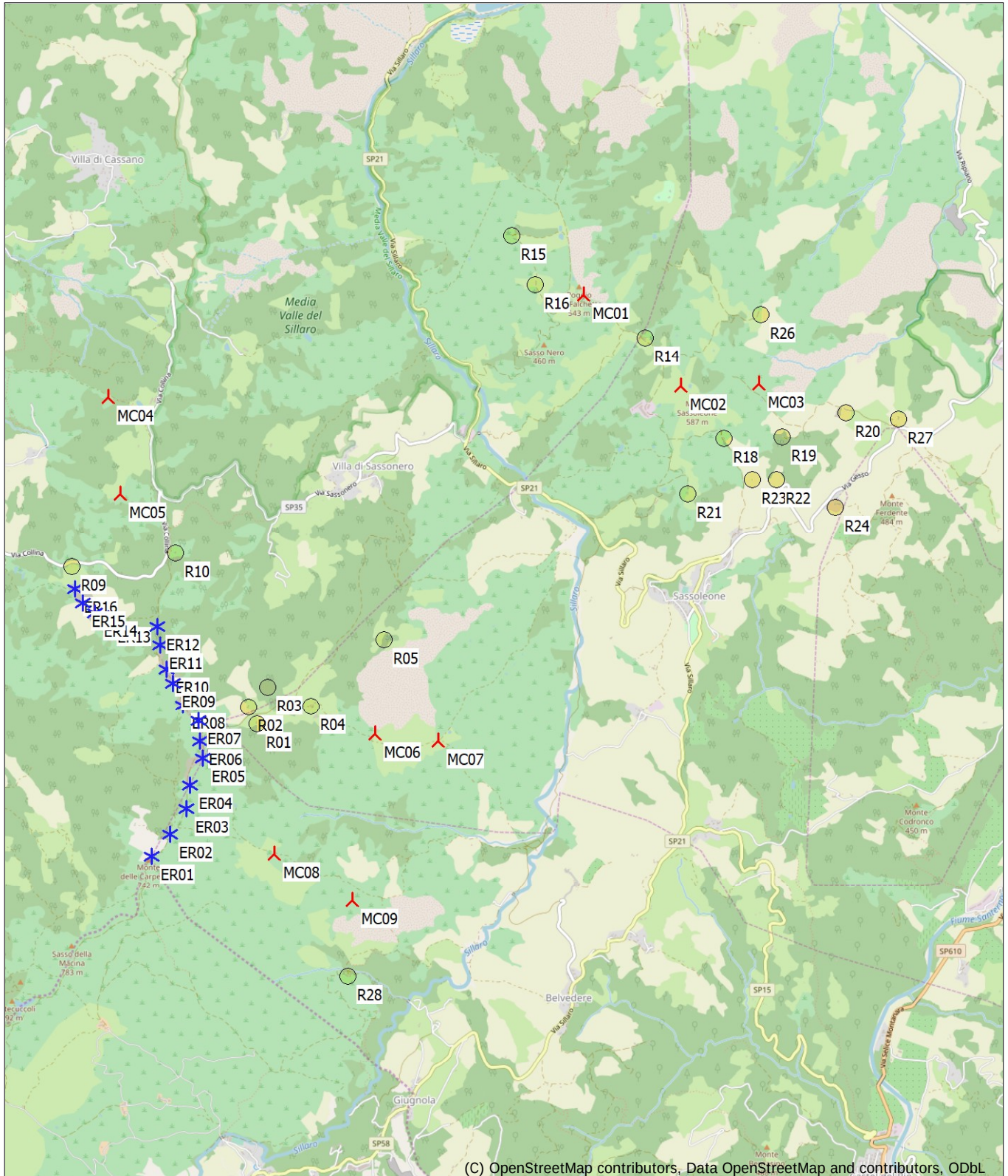
Shadow receptors



R09: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (6)

SHADOW - Map

Calculation: Parco Eolico Emilia: Shadow flickering



0 500 1000 1500 2000 m

Map: EMD OpenStreetMap , Print scale 1:50.000, Map center Geo WGS84 East: 11,459567° E North: 44,260239° N
 New WTG Existing WTG Shadow receptor

Flicker map level: Elevation Grid Data Object: WF EMILIA wind_EMDGrid_0.wpg (1)