

PARCO EOLICO "ALIENTU"

COMUNE DI SEUI

PROVINCIA DEL SUD SARDEGNA (SU)



STUDIO DI IMPATTO AMBIENTALE

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Relazione sullo shadow-flickering

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1. PREMESSA

La presente relazione espone l'analisi dell'evoluzione dell'ombra giornaliera generata dalla presenza degli aerogeneratori del parco eolico proposto denominato Alientu, sito nel Comune di Seui, Sud Sardegna, così come richiesto nell'allegato alla D.G.R n.3/17 del 16/01/09, "Studio per l'individuazione delle aree in cui ubicare gli impianti eolici". Lo studio prende in considerazione la formazione di ghiaccio sulle strade e lo sfarfallio dell'ombra (shadow flicker) sugli edifici presenti nell'ambiente circostante al parco.

La formazione di ghiaccio costituisce un pericolo per gli utilizzatori delle strade, e si presenta tipicamente in zone montane, pedemontane o appenniniche. L'analisi è limitata alle strade statali e provinciali e alle principali strade comunali che attraversano l'area vasta del parco.

Lo sfarfallio dell'ombra si presenta quando la pala di una turbina interposta tra un recettore e il sole "taglia" il fascio luminoso, producendo un alternarsi di ombra e luce. A seconda della frequenza di sfarfallio questo fenomeno può indurre attacchi epilettici su soggetti predisposti. È stato mostrato¹ che frequenze di sfarfallio inferiori a 3 Hz non pongono un rischio su soggetti fotosensibili². Pertanto in questo studio si prenderà tale valore come riferimento.

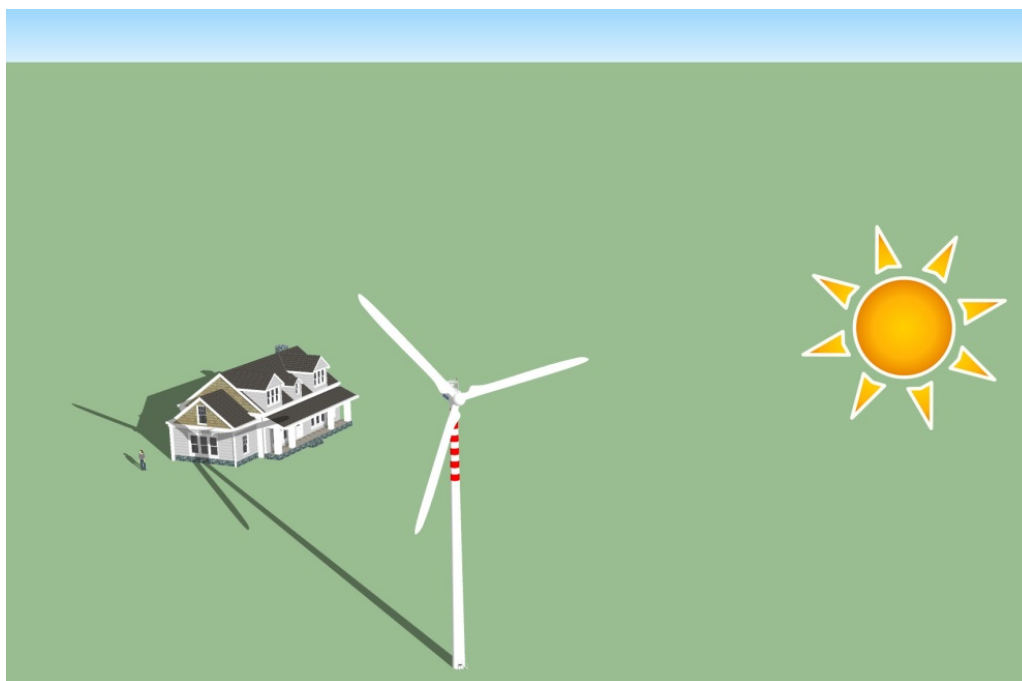


Figura 1: rappresentazione grafica del fenomeno di ombreggiamento.

1 Harding et al doi:10.1111/j.1528-1167.2008.01563.x

2 Ovvero il rischio cumulativo di attacco epilettico è inferiore a 17 persone per milione di soggetti fotosensitivi quando la frequenza di sfarfallio è inferiore a 3 Hz.

Allo stato attuale solo la Germania possiede linee-guida dettagliate sui limiti e sulle condizioni per il calcolo dell'impatto dell'ombra e sono consultabili nel documento "Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windenergieanlagen" (WEA-Shattenwurf-Hinweise).

Una condizione necessaria affinché si verifichi il fenomeno dello sfarfallio in un dato recettore è che, da quel sito, la dimensione angolare delle pale sia paragonabile alla dimensione angolare del sole, in quanto se la dimensione relativa della pala è piccola rispetto al sole, questa non produce ombra percettibile sul recettore. Seguendo le linee guida tedesche, si pone la soglia di 1/5 come rapporto minimo tra la dimensione angolare della pala e la dimensione angolare del sole perché si possa verificare lo sfarfallio in un certo sito.

I problemi sopra esposti non sussistono qualora (linee guida tedesche):

- Il recettore subisca meno di 30 ore/anno di ombra da parte degli aerogeneratori;
- per ogni giorno dell'anno, il recettore subisca meno di 30 minuti di ombra;
- la frequenza di sfarfallio (flickering) è inferiore ai 3Hz.

Inoltre le linee guida specificano che gli ombreggiamenti diventano rilevanti solamente quando si considerano i recettori comportanti attività residenziali e lavorative stabili: "è auspicabile (che l'effetto flickering) si mantenga al di sotto delle 30 ore/anno in presenza di attività lavorative statiche, tipo ufficio, scuole, ospedali, interessate direttamente da impatto".

Questa indicazione è legata al fatto che all'interno di un edificio adibito a uffici, le postazioni di lavoro sono generalmente fisse, pertanto se l'edificio con pareti finestrate risulta prospiciente l'impianto eolico, chiaramente lo sfarfallio delle ombre oltre certi limiti può costituire un problema per quei lavoratori che si trovino con le loro postazioni proprio davanti alle pareti vetrate. Viceversa, lo sfarfallio diventa irrilevante per tutti gli edifici di tipo non residenziale e dedicati ad attività che non richiedono un'assidua presenza in una stazione fissa, come ad esempio le attività agricole e agropastorali, nelle quali il personale addetto si muove in continuazione all'interno dei terreni per svolgere le proprie mansioni.

Le stesse considerazioni valgono per tutti i beni paesaggistici, manufatti, beni archeologici etc, i quali possono essere frequentati ma le persone devono, per natura dei luoghi, muoversi in continuazione e non stazionare ferme nello stesso punto per quantità considerevoli di tempo. L'unica eccezione vale per quei contesti nei quali delle persone devono svolgere dei lavori e/o passare del tempo in maniera continuativa in una certa posizione fissa rispetto alle turbine. In quel caso si procede ad uno studio approfondito esattamente come nel caso dei recettori residenziali.

2. METODOLOGIA

2.1 Specifiche aerogeneratori

Il modello proposto per gli aerogeneratori è Vestas V162. Questi hanno altezza al mozzo di 119 m e altezza totale all'apice di 200 m. Le pale sono lunghe 79.35 m e possiedono larghezza massima di 4.3m. La velocità massima di rotazione del rotore è pari a 12.1 rpm.

2.2 Modello digitale di elevazione (DEM)

Il modello digitale di elevazione (DEM) utilizzato per effettuare le simulazioni con il software WindPro è quello fornito dalla Regione Sardegna³, con risoluzione 10 m. Inoltre si è ipotizzata l'altezza degli occhi di un generico osservatore pari a 1.6 m. L'orografia può determinare l'occlusione della vista degli aerogeneratori da parte dei recettori (Figura 2) ed in questi casi non viene considerato il possibile effetto di ombreggiamento.

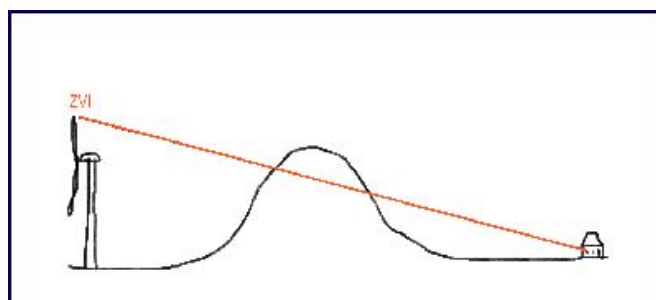


Figura 2: occlusione visiva dell'aerogeneratore rispetto al recettore, a causa dell'andamento orografico.

2.3 Recettori

Sono presenti complessivamente 13 recettori entro un buffer di 1km attorno al parco in proposta e sono classificati tutti come recettori non residenziali (possiedono categoria catastale diversa da A). In particolare tutti i 13 recettori sono censiti al catasto fabbricati in quanto si tratta di locali per allevamento o locali diruti. In via conservativa è stato considerato il caso peggiore, ovvero che tutti i recettori siano delle serre sferiche (green house), ovvero che tutte le pareti siano trasparenti e che siano ortogonali a tutti gli aerogeneratori. In questo modo la simulazione fornisce una sovrastima degli effetti di ombra delle turbine sui recettori.

³ <http://www.sardegnaegeoportale.it/webgis2/sardegnamappe/>

Se i risultati della simulazione non indicano superamenti dei limiti indicati nelle linee guida, non si procede oltre, in caso contrario può essere necessario procedere a delle verifiche di dettaglio considerando le reali aperture dei ricettori (dimensioni ed orientazioni di finestre e porte).

Per gli edifici non residenziali non è necessario procedere con ulteriori analisi in quanto lo shadow flickering non è impattante per questi (capitolo 1).

| Recettore | Tipo | Categoria catastale | Est GB (m) | Nord GB (m) | Altitudine (m) | WTG più vicina | Distanza WTG più vicina (m) |
|-----------|------------------|---------------------|------------|-------------|----------------|----------------|-----------------------------|
| R01 | Non residenziale | Non censito al C.F. | 1531280 | 4404540 | 745 | AG_01 | 990 |
| R02 | Non residenziale | Non censito al C.F. | 1531817 | 4403866 | 710 | AG_01 | 490 |
| R03 | Non residenziale | Non censito al C.F. | 1533043 | 4402479 | 725 | AG_01 | 380 |
| R04 | Non residenziale | Non censito al C.F. | 1533078 | 4402528 | 725 | AG_02 | 339 |
| R05 | Non residenziale | Non censito al C.F. | 1533086 | 4402397 | 730 | AG_03 | 733 |
| R06 | Non residenziale | Non censito al C.F. | 1531916 | 4402533 | 860 | AG_03 | 130 |
| R07 | Non residenziale | Non censito al C.F. | 1531987 | 4402500 | 860 | AG_03 | 359 |
| R08 | Non residenziale | Non censito al C.F. | 1532170 | 4401988 | 825 | AG_03 | 697 |
| R09 | Non residenziale | Non censito al C.F. | 1532475 | 4400665 | 726 | AG_03 | 745 |
| R10 | Non residenziale | Non censito al C.F. | 1533203 | 4399841 | 616 | AG_04 | 351 |
| R11 | Non residenziale | Non censito al C.F. | 1532219 | 4402505 | 870 | AG_03 | 519 |
| R12 | Non residenziale | Non censito al C.F. | 1531942 | 4402305 | 840 | AG_10 | 368 |
| R13 | Non residenziale | Non censito al C.F. | 1531787 | 4403697 | 746 | AG_10 | 737 |

Tabella 1 Recettori adiacenti al parco in proposta (1km).

2.4 Eliofoania e distribuzione dei venti

I problemi dovuti all'ombra degli aerogeneratori sono presenti solamente quando è presente illuminazione diretta del sole (eliofoania). I dati rilevanti nelle nostre simulazioni sono la lunghezza del dì (ovvero le ore presenti tra alba e tramonto, che non dipende dalle condizioni meteo) e le ore di illuminazione diretta. La prima varia con continuità nell'arco dell'anno, senza apprezzabili distinzioni tra le varie zone della Sardegna, mentre la seconda è variabile da zona a zona e dipende da fenomeni a grande scala che influenzano in maniera sostanzialmente uniforme l'intera superficie isolana.

Di conseguenza il valore climatologico dell'eliofoania è da considerarsi lo stesso su tutta la Sardegna (fonte: ARPA Sardegna), e per questo motivo sono stati utilizzati i valori di eliofoania forniti dalla stazione meteorologica di Elmas.

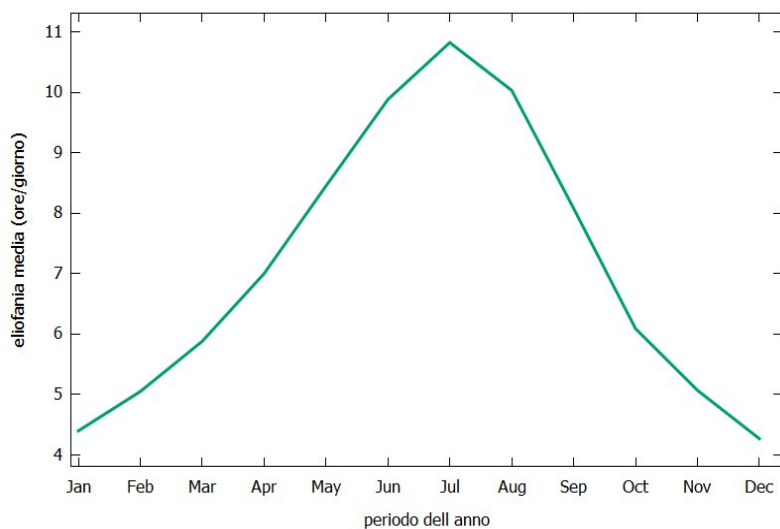


Figura 3: Eliofania media. Dati rilevati nella stazione di Elmas.

L'ombra che gli aerogeneratori proiettano sui recettori dipende anche dalla direzione del piano di rotazione delle pale; nello specifico, l'ombra è massima quando il piano di rotazione è perpendicolare al recettore. L'orientamento del piano di rotazione è determinato dalla direzione del vento, quindi l'orientamento segue la distribuzione dei venti:

| | N | NNE | ENE | E | ESE | SSE |
|-------------------------|----|-----|-----|-----|-----|-----|
| ore di attività annuali | 86 | 55 | 78 | 159 | 368 | 188 |
| | S | SSW | WSW | W | WNW | NNW |
| ore di attività annuali | 65 | 104 | 357 | 605 | 339 | 206 |

Tabella 2 Rosa dei venti. Valori scalati su un anno equivalente di attività, ovvero su un totale di 2612 ore.

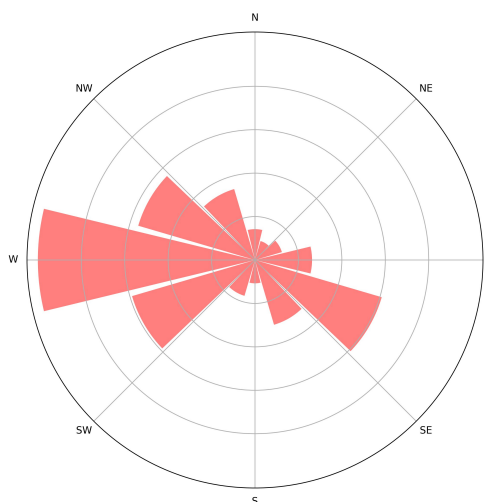


Figura 4: rosa dei venti per la località del parco in proposta in unità arbitrarie.

Nella simulazione questo fattore è preso in considerazione, in modo da diminuire o aumentare l'ombra a seconda dell'orientamento relativo tra il piano di rotazione delle pale e i recettori. In Figura 4 è riportata la rosa dei venti in unità arbitrarie e in Tabella 2. la distribuzione dei venti normalizzata rispetto ad un anno di attività, ovvero al 30% di un anno, che rappresenta il tempo medio di attività del parco. Questo quantitativo di ore è quello che viene inserito come input nella simulazione per determinare la porzione di tempo nella quale una turbina ruota in una specifica direzione.

Tutte le considerazioni espone tengono conto dei risultati delle simulazioni realistiche, ovvero simulazioni basate sull'eliofania e sulla distribuzione dei venti (a differenza della simulazione rispetto al caso peggiore in cui non se ne tiene conto).

3. RISULTATI

3.1 Recettori

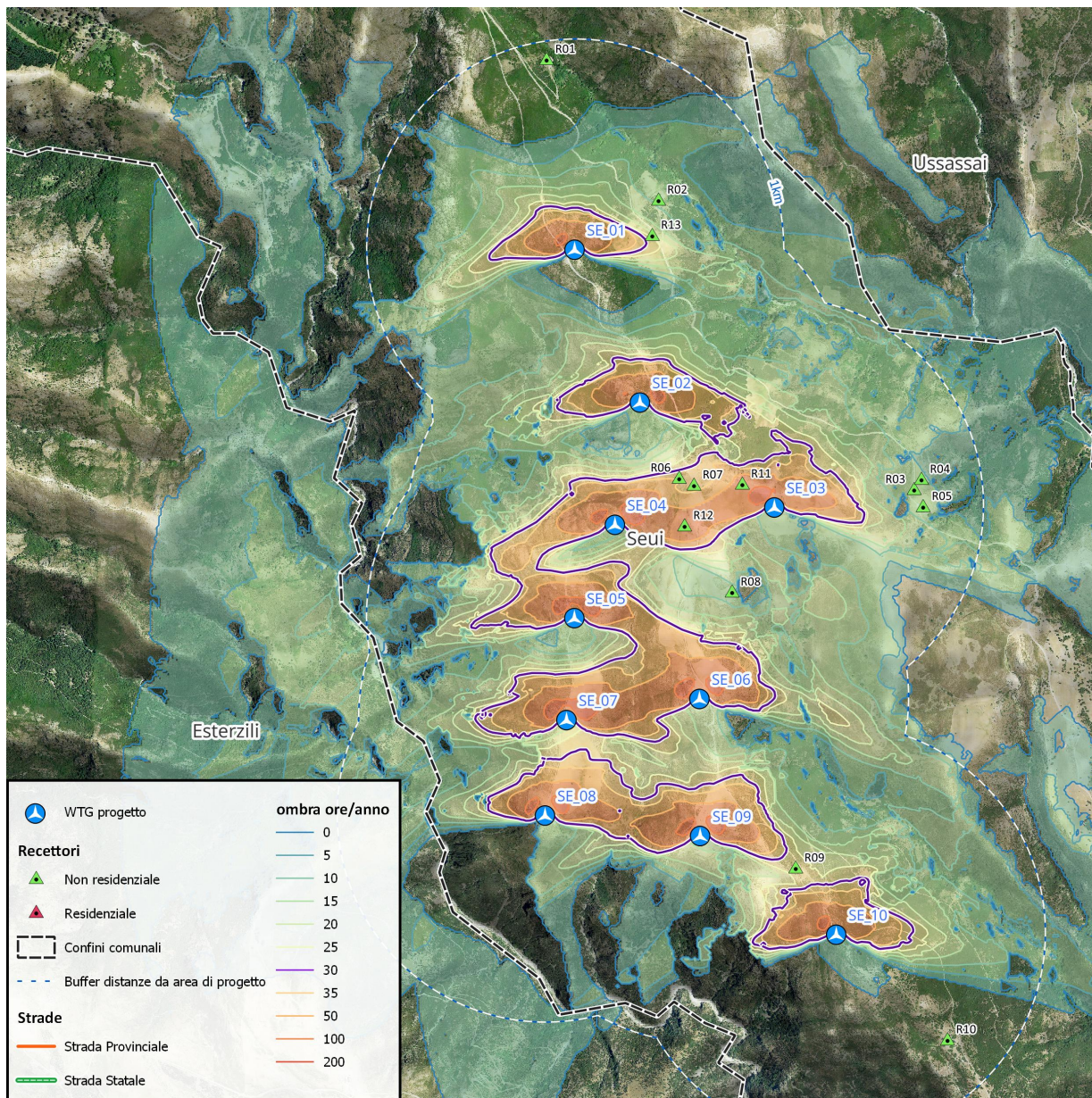


Figura 5: Ore di ombra totale all'anno su ortofoto, caso realistico che tiene conto dell'eliofania e della rosa dei venti. Sono presenti tutti i recettori. L'isolinea viola delimita al suo interno regioni con ombra > 30 ore/anno e al suo esterno regioni con ombra < 30 ore/anno.

In Figura 5 sono riportati i risultati della simulazione di ore totali di ombra all'anno, la zona ad alto impatto (ombra > 30 ore/anno) è delimitata dalla curva viola. I relativi valori sono tabulati in Tabella 3. I recettori [R06,R07,R11,R12] subiscono un ombreggiatura > 30 ore/anno, tuttavia si tratta di locali per allevamento o diruti, per cui l'ombreggiamento non impone un impatto rilevante su di essi (capitolo 1).

| Nome | ombra (ore/anno) | massimo ombra giornaliera (min/giorno) | Giornate di ombra all'anno | Nome | ombra (ore/anno) | massimo ombra giornaliera (min/giorno) | Giornate di ombra all'anno |
|------|---------------------|---|----------------------------------|------|---------------------|---|----------------------------------|
| R01 | 0 | 0 | 0 | R08 | 8 | 7 | 125 |
| R02 | 9 | 10 | 84 | R09 | 27 | 13 | 212 |
| R03 | 7 | 9 | 69 | R10 | 0 | 0 | 0 |
| R04 | 6 | 7 | 63 | R11 | 62 | 27 | 275 |
| R05 | 7 | 8 | 78 | R12 | 71 | 31 | 269 |
| R06 | 34 | 17 | 215 | R13 | 23 | 14 | 153 |
| R07 | 32 | 22 | 177 | | | | |

Tabella 3 Ombra proiettata sui recettori. Caso realistico che tiene conto dell'eliofania e della rosa dei venti.

Nessun recettore subisce ombreggiatura maggiore di 30 ore/anno.

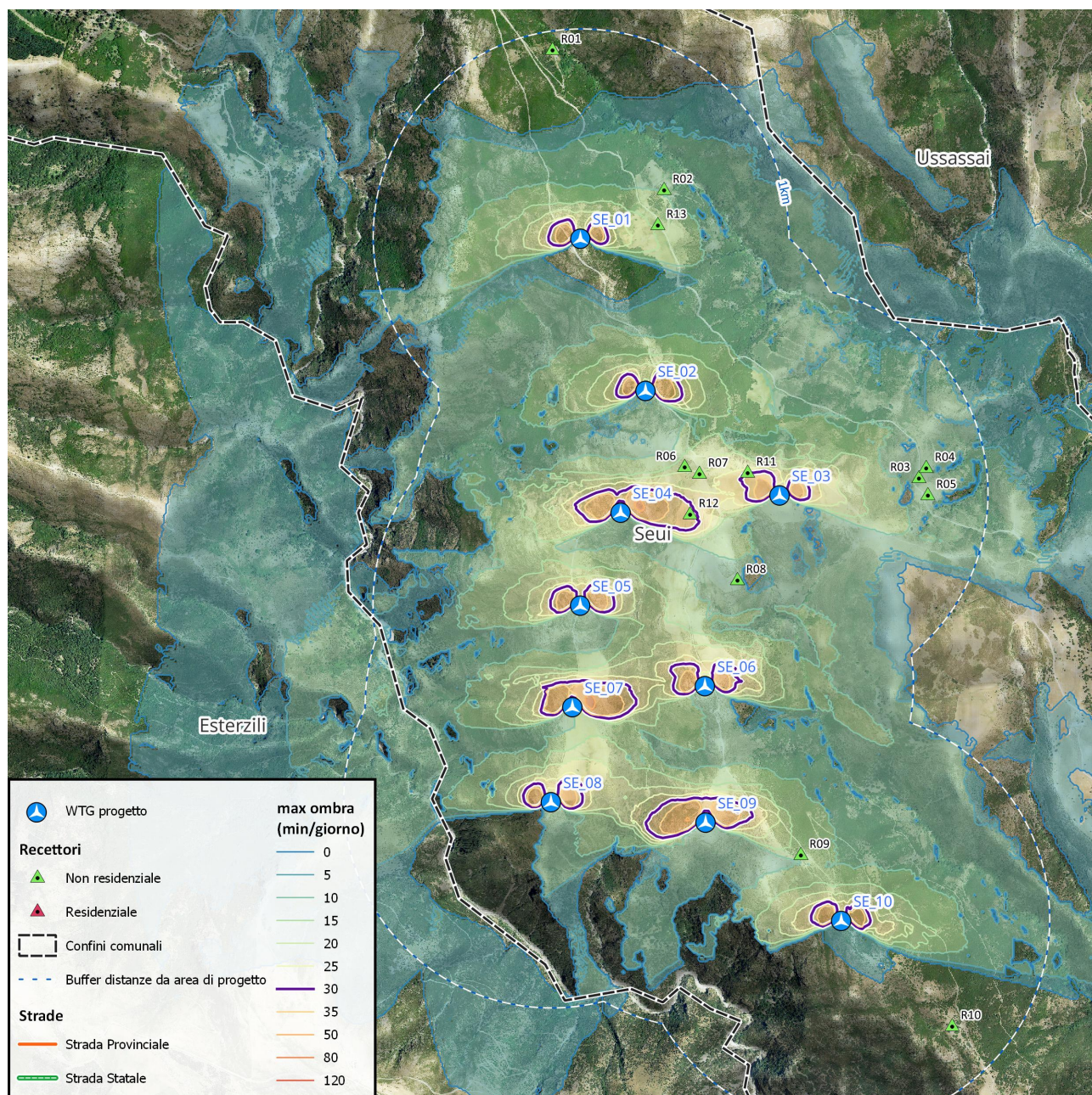


Figura 6: Massimo tempo di ombreggiatura giornaliera (minuti/giorno), caso realistico che tiene conto dell'eliofania e della rosa dei venti. L'isolinea viola delimita le zone a basso impatto (ombra < 30 min/giorno) dalle zone ad alto impatto (ombra > 30 minuti/giorno).

In Figura 6 è riportato il massimo numero di minuti di ombra percepita dai recettori e fabbricati in un singolo giorno realisticamente; Il recettore R12 ricade dentro l'area con ombreggiatura massima giornaliera > 30 min/giorno (Tabella 3), tuttavia questo non impone un impatto rilevante ai fini dello studio sulle ombre poiché il recettore R12 è di tipologia non residenziale (capitolo 1).

3.2 Effetti cumulativi

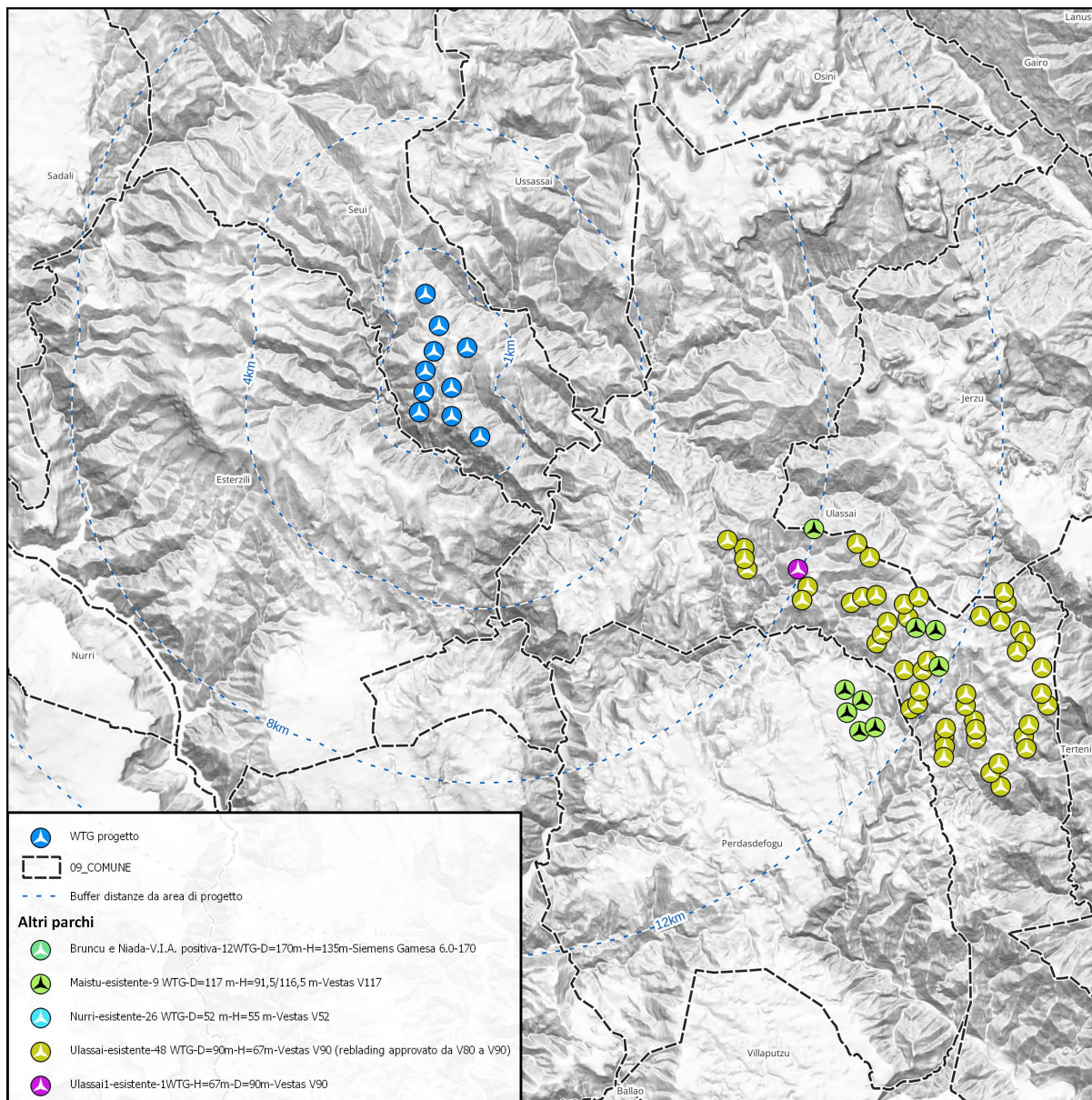


Figura 7 Parchi esistenti o autorizzati limitrofi al parco in proposta.

I parchi esistenti o autorizzati nelle vicinanze del parco in proposta sono riportati in Figura 7. Nelle analisi di ombreggiamento si considerano recettori limitrofi al parco entro una distanza di 1 km, pertanto nell'analisi cumulativa è necessario analizzare gli effetti complessivi di tutti i parchi esistenti o autorizzati entro 2 km da quello in proposta. Nessun parco esistente o autorizzato ricade entro una distanza da 2 km dal parco in proposta. In particolare il parco più vicino risulta essere ubicato nel comune di Ulassai (bianco-giallo in legenda della Figura 7) distante oltre 6 km dal parco in proposta. Di conseguenza l'impatto cumulativo ai fini dello studio delle ombre risulta essere nullo.

3.3 Flickering

Le turbine in proposta (Vestas V162) hanno una velocità massima di rotazione pari a 12.1 rpm, ossia 0.20Hz, che poi risulta in una frequenza di taglio di 0.60Hz (ovvero la frequenza con cui le pale tagliano la luce di una sorgente luminosa) poiché la turbina è composta di 3 pale. Affinché si verifichi il fenomeno di flickering con almeno 3Hz (soglia minima per soggetti fotosensibili, vedi capitolo 1) è necessario dunque che 4 o più turbine siano allineate rispetto ad un recettore; ciò non avviene in nessun caso per i recettori considerati.

Questo scongiura la possibilità del verificarsi di potenziali rischi per soggetti fotosensibili, che si manifestano in presenza di frequenze di flickering superiori a 3Hz.

Inoltre gli effetti di flickering su recettori non residenziali (tutti i recettori considerati entro 1 km dal parco sono di tipologia non residenziale) risultano nulli per quanto esposto in premessa (capitolo 1).

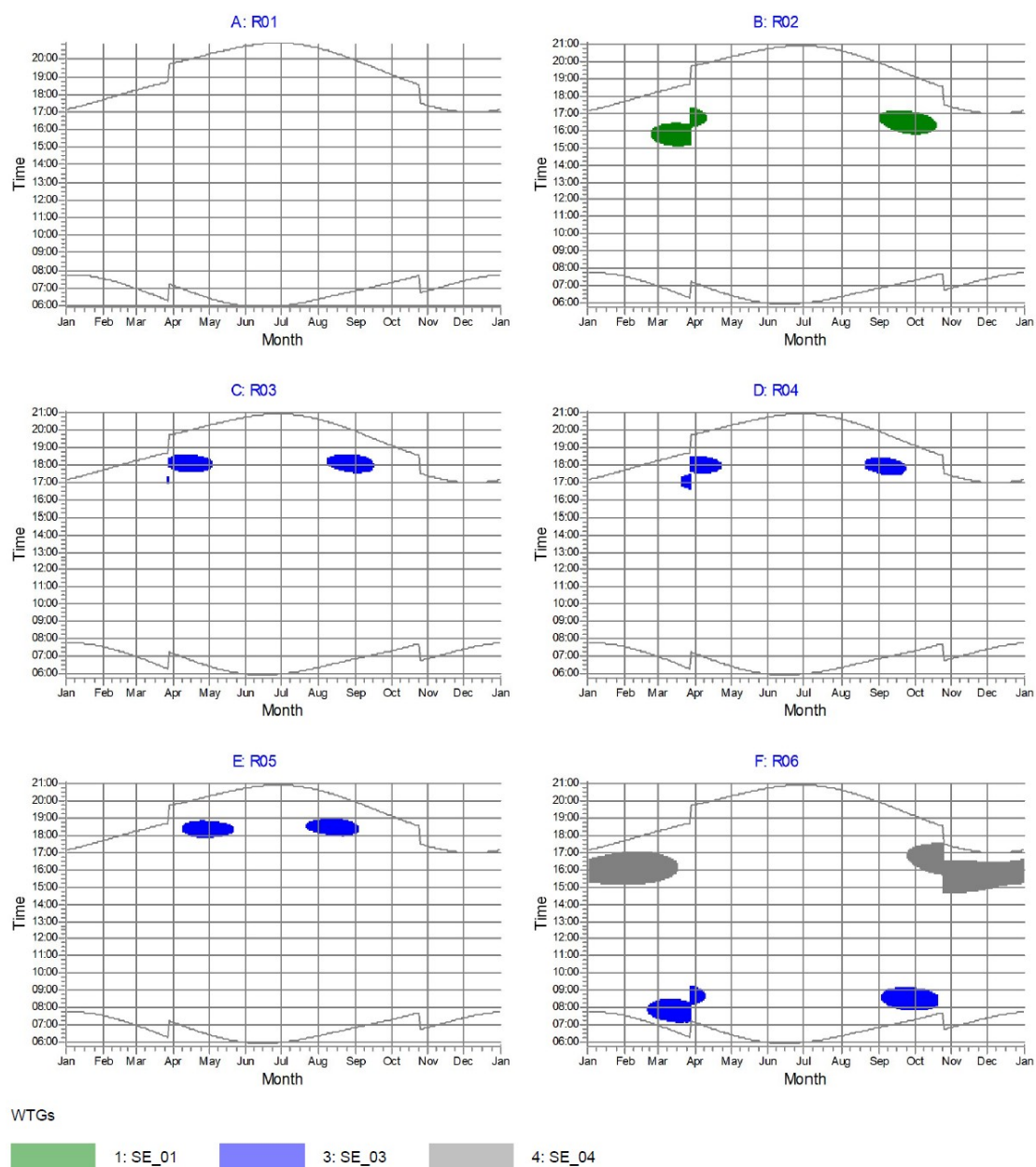
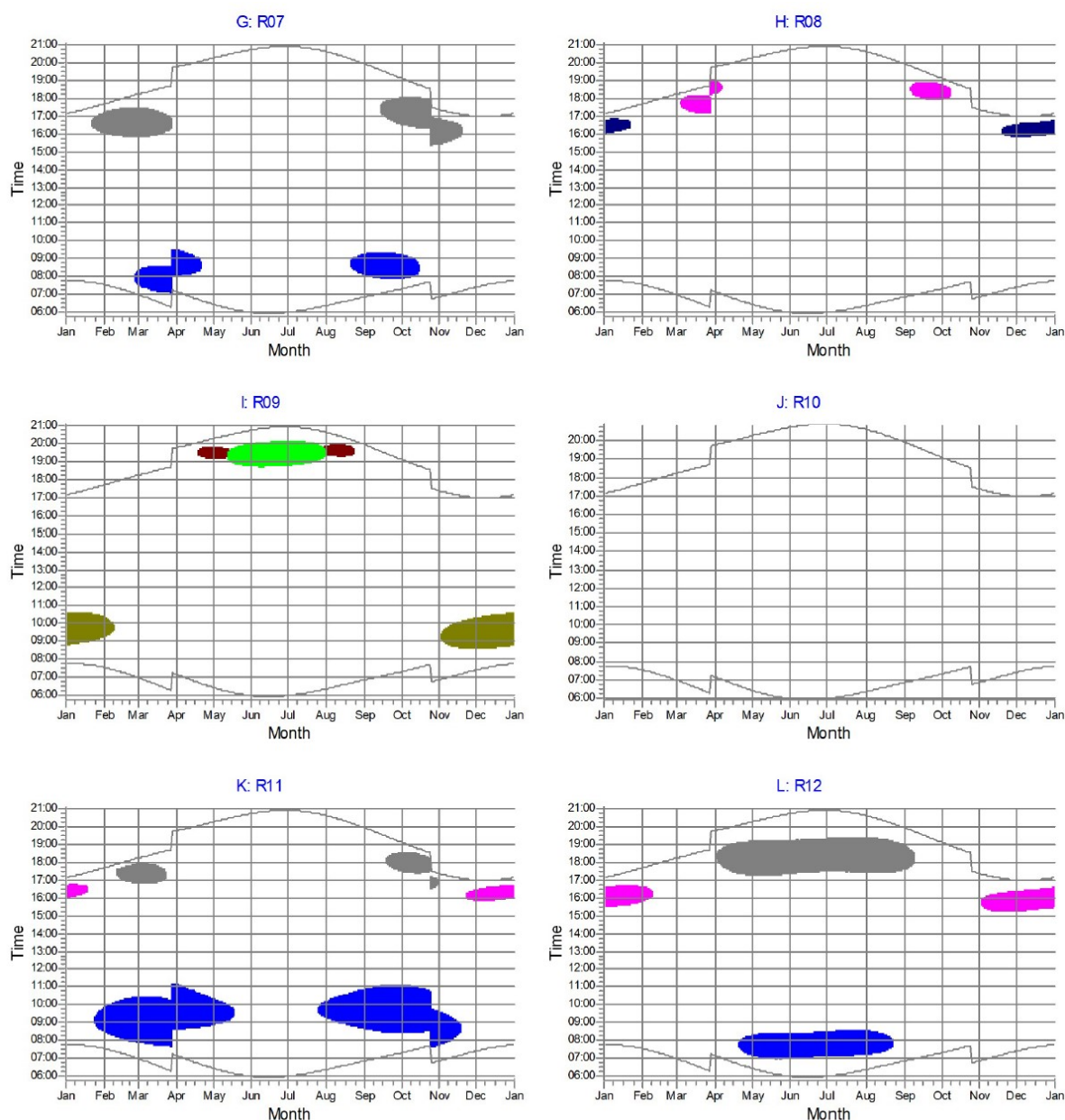


Figura 8: Calendario grafico ombre per ogni recettore nel caso peggiore, senza tenere conto di eliofania e rosa dei venti. Le linee continue indicano l'ora di alba e tramonto. Le macchie colorate indicano il periodo dell'anno e le ore nelle quali i recettori sono interessati dall'ombra di una turbina.



WTGs

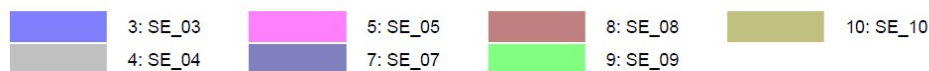


Figura 9: Calendario grafico ombre per ogni recettore nel caso peggiore, senza tenere conto di eliofania e rosa dei venti. Le linee continue indicano l'ora di alba e tramonto. Le macchie colorate indicano il periodo dell'anno e le ore nelle quali i recettori sono interessati dall'ombra di una turbina.

La Figura 8 e Figura 9 riportano i calendari grafici delle ombre subite da alcuni recettori. Da questi è possibile determinare il periodo dell'anno e della giornata nel quale il recettore è interessato dall'ombra di una turbina. Ad esempio è possibile determinare che il recettore R12 subisce l'ombra della turbina SE_03 nelle mattine (e SE_04 nelle sere) dei mesi Aprile-Agosto e della turbina SE_05 nelle sere dei mesi Novembre-Febbraio.

3.4 Strade

Non sono presenti strade provinciali e statali nelle vicinanze del parco in proposta. La più vicina risulta essere la SP198, ad una distanza di oltre 2.5 km direzione nord dal parco. L'impatto delle ombre del parco in proposta sulle strade statali e provinciali limitrofe risulta nullo.

4. Conclusioni

Sono presenti 13 recettori entro una distanza di 1 km dal parco proposto. Tutti i recettori risultano essere di tipologia non residenziale (categoria catastale diversa da A) e per essi gli impatti di ombreggiamento del parco in proposta risultano essere trascurabili (capitolo 1).

Gli impatti cumulativi degli altri parchi esistenti o autorizzati limitrofi risultano nulli, in quanto il parco più vicino (Ulassai) risulta essere ad una distanza di oltre 6 km, maggiore della soglia di 2 km che si considera per gli impatti cumulativi.

Nessun recettore subisce ombreggiamento da parte di 3 o più turbine contemporaneamente, pertanto il fenomeno di flickering a 3Hz o maggiore non si presenta per nessun recettore.

La strada provinciale o statale più vicina risulta essere la strada provinciale SP198 e si trova ad una distanza maggiore di 2.5 km per la quale l'impatto ai fini dello studio sulle ombre è nullo.

5. Appendice

Si riporta in appendice il calendario grafico e tabellare per ogni recettore e per ogni turbina. Le metodologie di lettura delle tabelle e dei grafici sono state esposte nei precedenti paragrafi.

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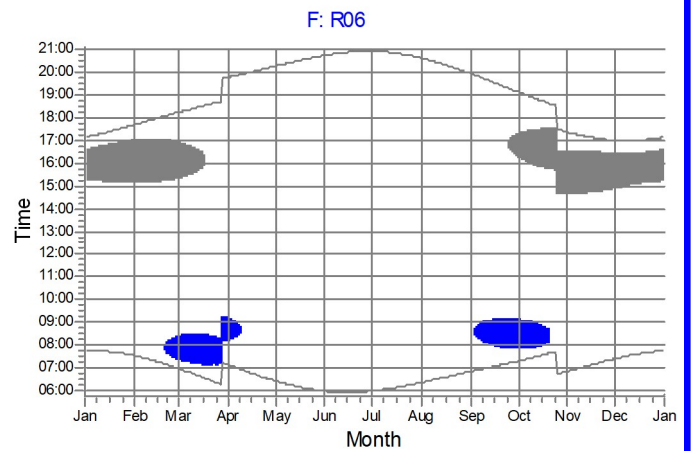
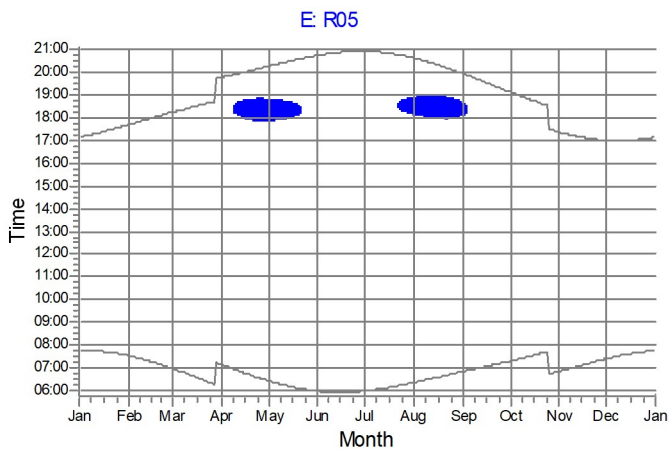
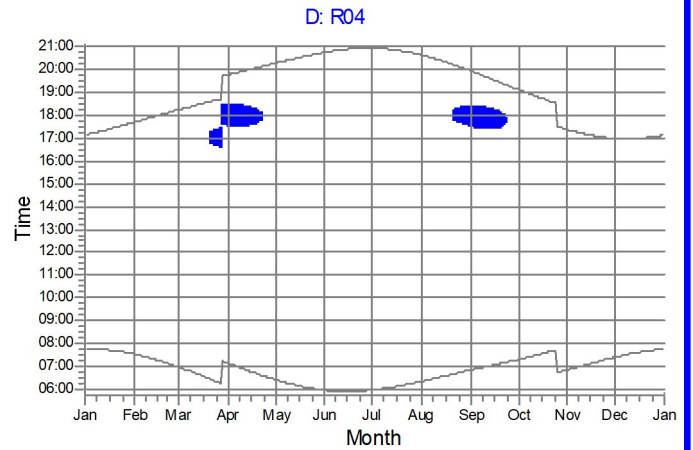
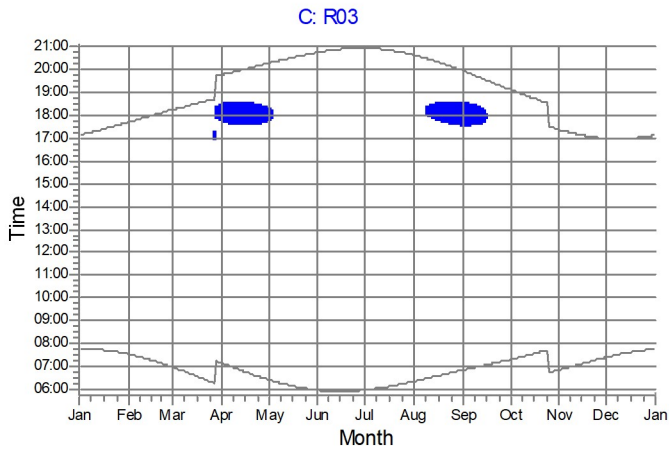
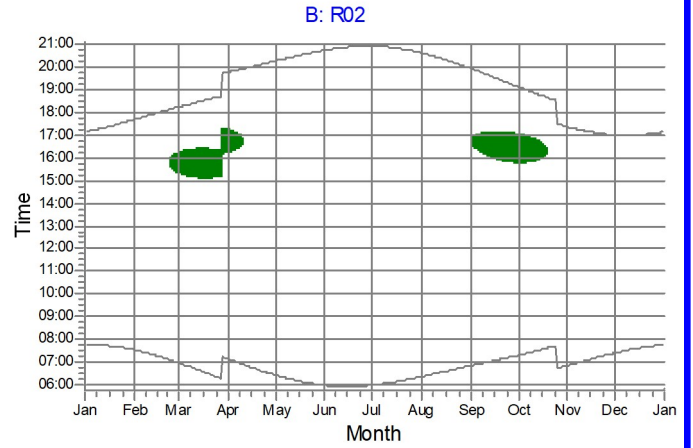
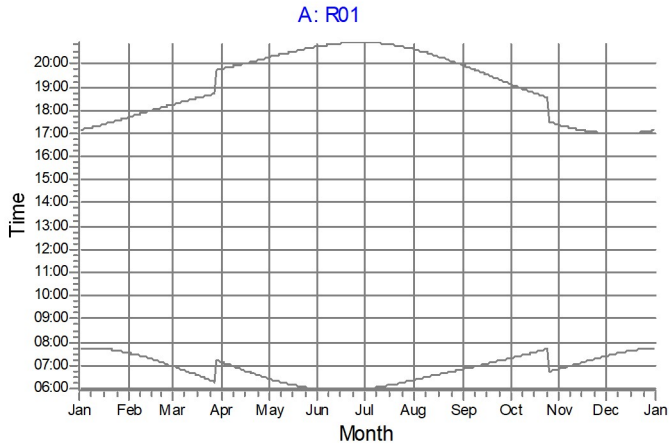
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WTGs



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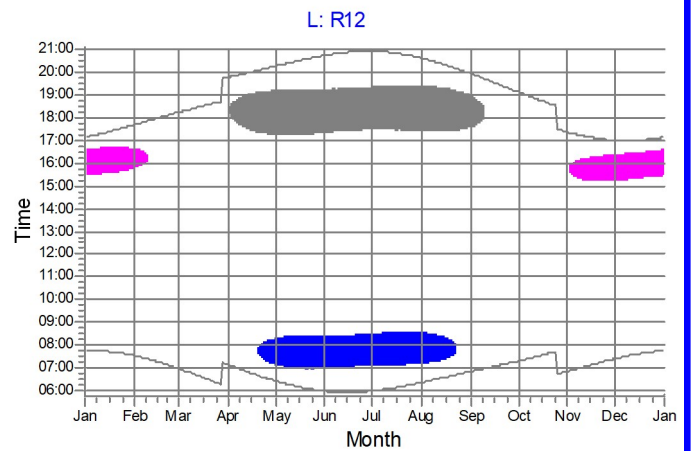
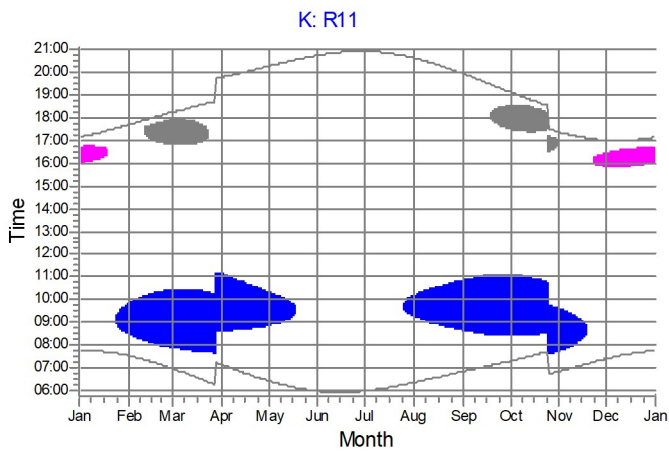
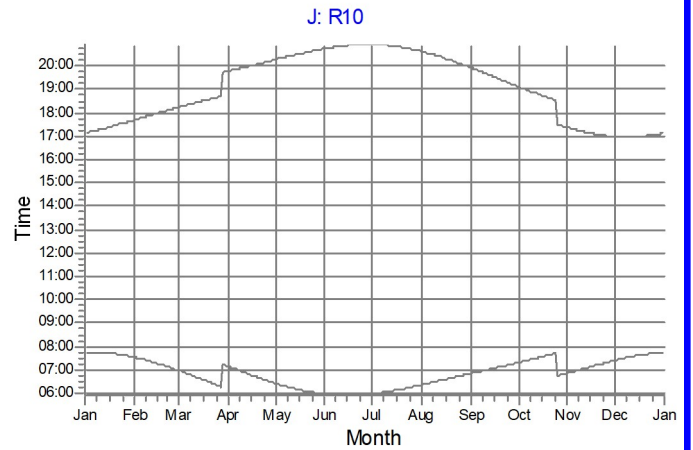
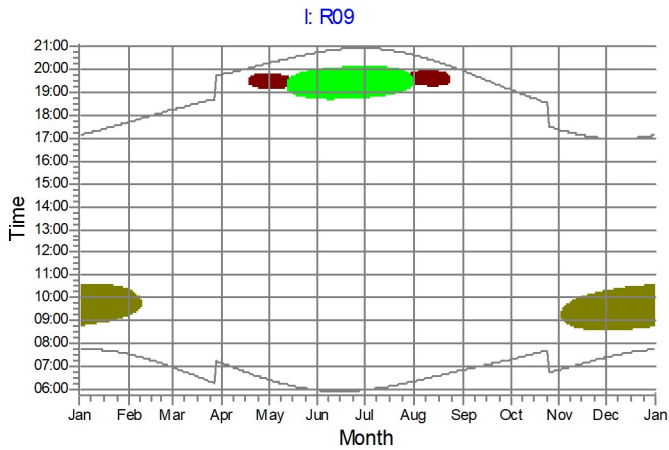
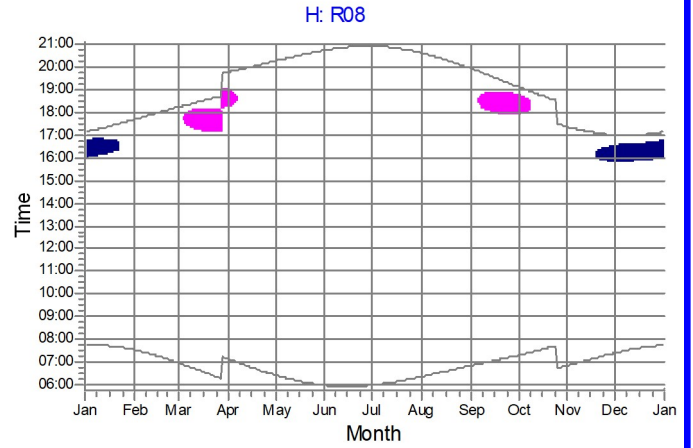
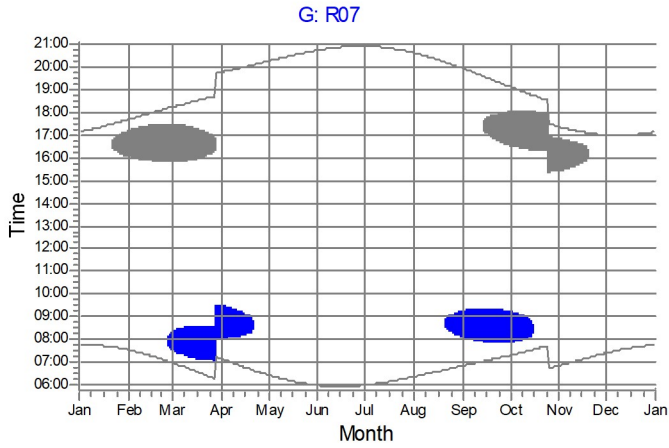
Bruno Manca / ingbrunomanca@gmail.com

Calculated:







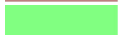
2023-12-19 11:53/2.8.579

SHADOW - Calendar, graphical

Calculation: shadow flickering Seui - progetto



WTGs

- | | | | |
|--|--|--|--|
|  3: SE_03 |  5: SE_05 |  8: SE_08 |  10: SE_10 |
|  4: SE_04 |  7: SE_07 |  9: SE_09 | |

Project:

windpro Seui - flickering

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2023-12-20 10:53 / 3

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+390702358125

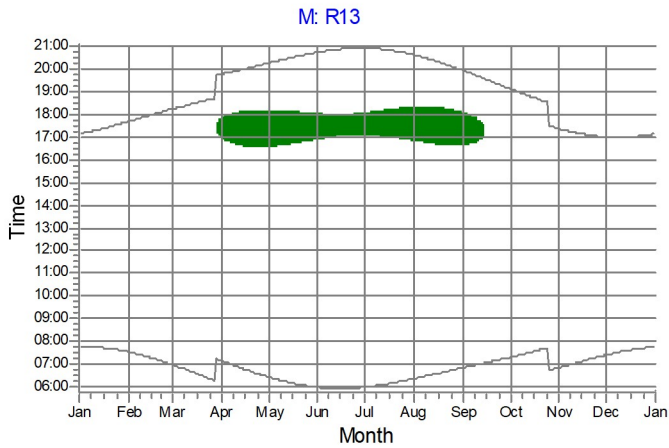
Bruno Manca / ingbrunomanca@gmail.com

Calculated:

2023-12-19 11:53/2.8.579

SHADOW - Calendar, graphical

Calculation: shadow flickering Seui - progetto



WTGs



1: SE_01

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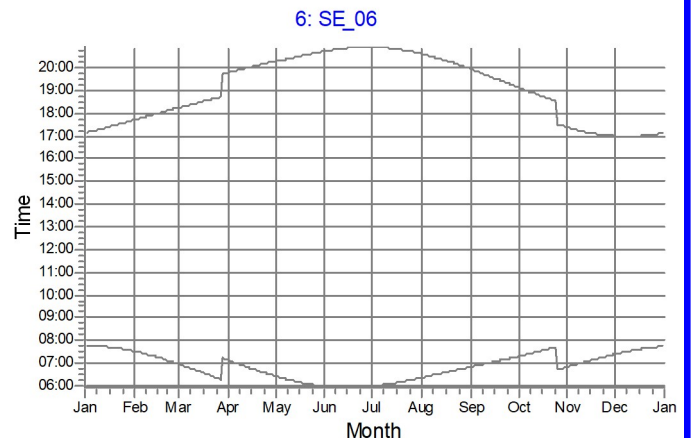
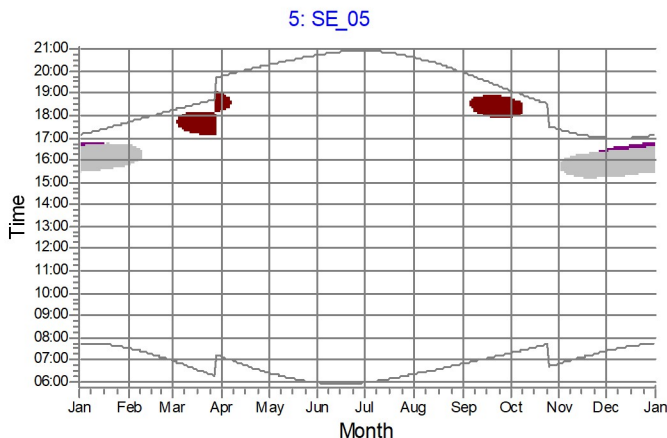
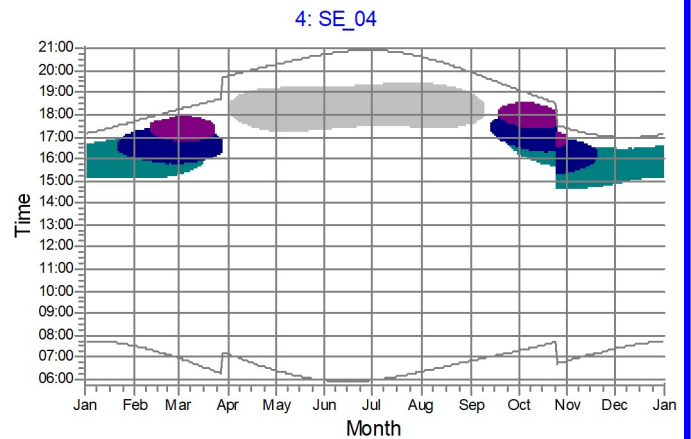
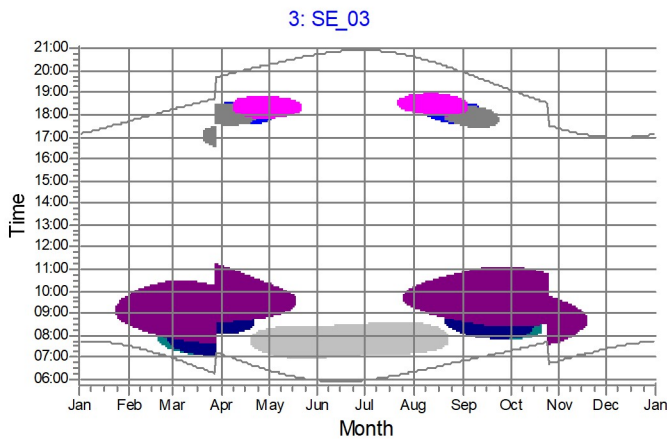
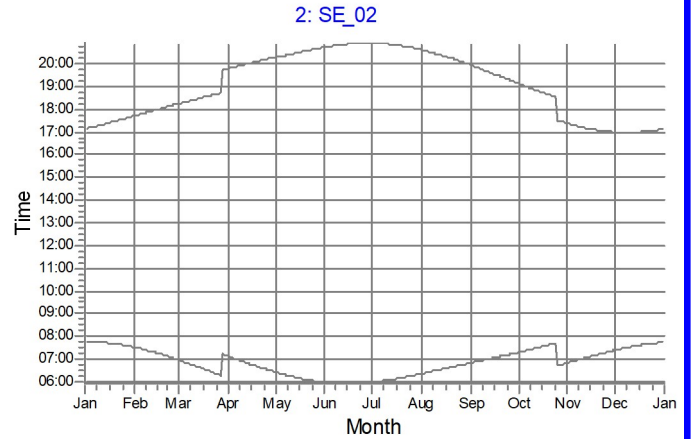
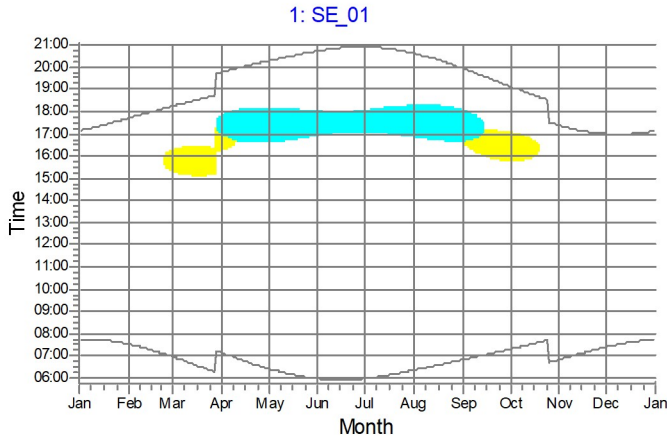
Bruno Manca / ingbrunomanca@gmail.com

Calculated:

2023-12-19 11:53/2.8.579

SHADOW - Calendar per WTG, graphical

Calculation: shadow flickering Seui - progetto



Shadow receptors

| | | | | |
|--|--|--|---|--|
|  B: R02 |  D: R04 |  F: R06 |  H: R08 |  L: R12 |
|  C: R03 |  E: R05 |  G: R07 |  K: R11 |  M: R13 |

Project:

windpro Seui - flickering

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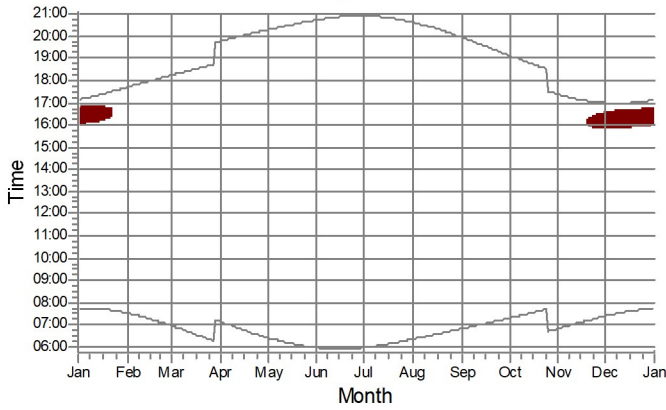
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2023-12-19 11:53/2.8.579

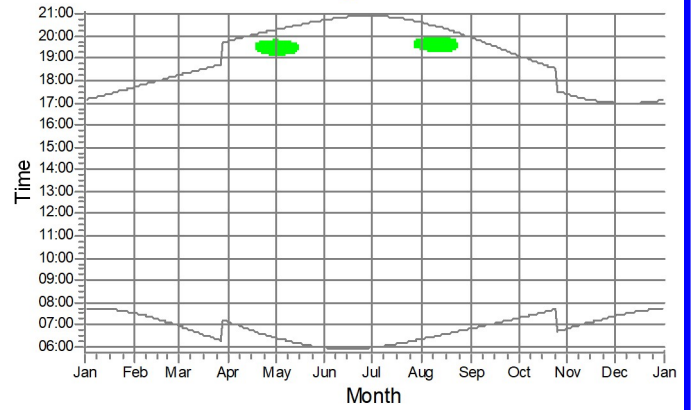
SHADOW - Calendar per WTG, graphical

Calculation: shadow flickering Seui - progetto

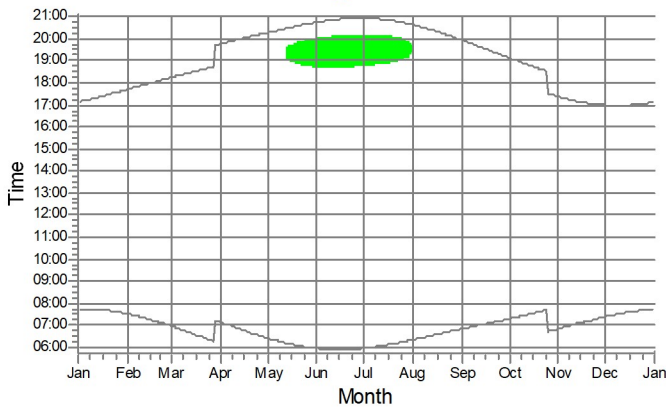
7: SE_07



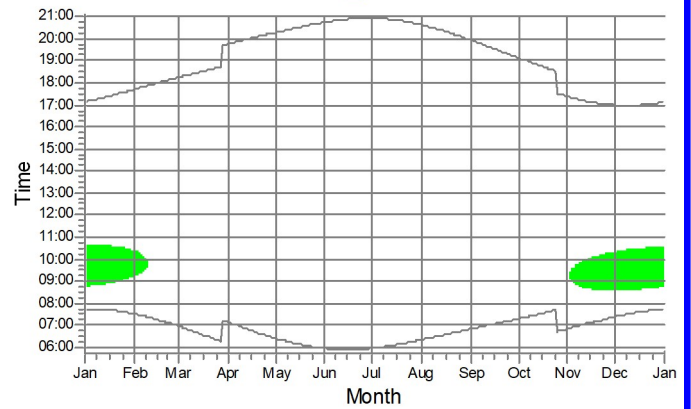
8: SE_08



9: SE_09



10: SE_10



Shadow receptors

H: R08 I: R09

Project:
windpro Seui - flickering

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+390702358125
Bruno Manca / ingbrunomanca@gmail.com
Calculated:
2023-12-19 11:53/2.8.579

SHADOW - Calendar

Calculation: shadow flickering Seui - progetto Shadow receptor: A - R01

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

| | January | February | March | April | May | June | July | August | September | October | November | December |
|---------------------|---------|----------|-------|-------|-------|-------|-------|--------|-----------|---------|----------|----------|
| 1 | 07:44 | 07:32 | 06:58 | 07:09 | 06:25 | 05:57 | 05:58 | 06:21 | 06:50 | 07:18 | 06:51 | 07:24 |
| | 17:09 | 17:42 | 18:14 | 19:46 | 20:16 | 20:45 | 20:55 | 20:37 | 19:56 | 19:07 | 17:22 | 16:59 |
| 2 | 07:44 | 07:31 | 06:56 | 07:07 | 06:24 | 05:57 | 05:59 | 06:22 | 06:51 | 07:19 | 06:52 | 07:25 |
| | 17:09 | 17:43 | 18:15 | 19:47 | 20:17 | 20:45 | 20:55 | 20:36 | 19:54 | 19:05 | 17:21 | 16:59 |
| 3 | 07:45 | 07:30 | 06:55 | 07:06 | 06:22 | 05:57 | 05:59 | 06:23 | 06:52 | 07:20 | 06:53 | 07:26 |
| | 17:10 | 17:44 | 18:16 | 19:48 | 20:18 | 20:46 | 20:55 | 20:35 | 19:53 | 19:04 | 17:20 | 16:59 |
| 4 | 07:45 | 07:29 | 06:53 | 07:04 | 06:21 | 05:56 | 06:00 | 06:24 | 06:53 | 07:21 | 06:54 | 07:27 |
| | 17:11 | 17:45 | 18:17 | 19:49 | 20:19 | 20:47 | 20:55 | 20:34 | 19:51 | 19:02 | 17:19 | 16:59 |
| 5 | 07:45 | 07:28 | 06:52 | 07:02 | 06:20 | 05:56 | 06:00 | 06:25 | 06:54 | 07:22 | 06:55 | 07:28 |
| | 17:12 | 17:46 | 18:18 | 19:50 | 20:20 | 20:47 | 20:55 | 20:33 | 19:50 | 19:01 | 17:18 | 16:58 |
| 6 | 07:45 | 07:27 | 06:50 | 07:01 | 06:19 | 05:56 | 06:01 | 06:26 | 06:55 | 07:23 | 06:56 | 07:29 |
| | 17:13 | 17:48 | 18:20 | 19:51 | 20:21 | 20:48 | 20:54 | 20:32 | 19:48 | 18:59 | 17:17 | 16:58 |
| 7 | 07:45 | 07:26 | 06:49 | 06:59 | 06:18 | 05:55 | 06:01 | 06:27 | 06:56 | 07:24 | 06:58 | 07:30 |
| | 17:14 | 17:49 | 18:21 | 19:52 | 20:22 | 20:49 | 20:54 | 20:31 | 19:46 | 18:57 | 17:15 | 16:58 |
| 8 | 07:45 | 07:25 | 06:47 | 06:58 | 06:16 | 05:55 | 06:02 | 06:27 | 06:57 | 07:25 | 06:59 | 07:31 |
| | 17:15 | 17:50 | 18:22 | 19:53 | 20:23 | 20:49 | 20:54 | 20:30 | 19:45 | 18:56 | 17:14 | 16:58 |
| 9 | 07:44 | 07:24 | 06:46 | 06:56 | 06:15 | 05:55 | 06:03 | 06:28 | 06:58 | 07:26 | 07:00 | 07:32 |
| | 17:16 | 17:51 | 18:23 | 19:54 | 20:24 | 20:50 | 20:53 | 20:28 | 19:43 | 18:54 | 17:13 | 16:58 |
| 10 | 07:44 | 07:23 | 06:44 | 06:55 | 06:14 | 05:55 | 06:03 | 06:29 | 06:58 | 07:27 | 07:01 | 07:33 |
| | 17:17 | 17:52 | 18:24 | 19:55 | 20:25 | 20:50 | 20:53 | 20:27 | 19:41 | 18:53 | 17:12 | 16:58 |
| 11 | 07:44 | 07:22 | 06:42 | 06:53 | 06:13 | 05:54 | 06:04 | 06:30 | 06:59 | 07:28 | 07:02 | 07:33 |
| | 17:18 | 17:54 | 18:25 | 19:56 | 20:26 | 20:51 | 20:53 | 20:26 | 19:40 | 18:51 | 17:12 | 16:58 |
| 12 | 07:44 | 07:21 | 06:41 | 06:52 | 06:12 | 05:54 | 06:05 | 06:31 | 07:00 | 07:29 | 07:03 | 07:34 |
| | 17:19 | 17:55 | 18:26 | 19:57 | 20:27 | 20:51 | 20:52 | 20:25 | 19:38 | 18:50 | 17:11 | 16:59 |
| 13 | 07:44 | 07:19 | 06:39 | 06:50 | 06:11 | 05:54 | 06:05 | 06:32 | 07:01 | 07:30 | 07:04 | 07:35 |
| | 17:20 | 17:56 | 18:27 | 19:58 | 20:28 | 20:52 | 20:52 | 20:23 | 19:37 | 18:48 | 17:10 | 16:59 |
| 14 | 07:43 | 07:18 | 06:38 | 06:49 | 06:10 | 05:54 | 06:06 | 06:33 | 07:02 | 07:31 | 07:06 | 07:36 |
| | 17:21 | 17:57 | 18:28 | 19:59 | 20:29 | 20:52 | 20:51 | 20:22 | 19:35 | 18:47 | 17:09 | 16:59 |
| 15 | 07:43 | 07:17 | 06:36 | 06:47 | 06:09 | 05:54 | 06:07 | 06:34 | 07:03 | 07:32 | 07:07 | 07:36 |
| | 17:22 | 17:58 | 18:29 | 20:00 | 20:30 | 20:53 | 20:51 | 20:21 | 19:33 | 18:45 | 17:08 | 16:59 |
| 16 | 07:43 | 07:16 | 06:35 | 06:46 | 06:08 | 05:54 | 06:07 | 06:35 | 07:04 | 07:33 | 07:08 | 07:37 |
| | 17:23 | 17:59 | 18:30 | 20:01 | 20:31 | 20:53 | 20:50 | 20:19 | 19:32 | 18:44 | 17:07 | 16:59 |
| 17 | 07:42 | 07:14 | 06:33 | 06:44 | 06:07 | 05:54 | 06:08 | 06:36 | 07:05 | 07:34 | 07:09 | 07:38 |
| | 17:24 | 18:01 | 18:31 | 20:02 | 20:32 | 20:53 | 20:50 | 20:18 | 19:30 | 18:42 | 17:06 | 17:00 |
| 18 | 07:42 | 07:13 | 06:31 | 06:43 | 06:07 | 05:54 | 06:09 | 06:37 | 07:06 | 07:35 | 07:10 | 07:39 |
| | 17:25 | 18:02 | 18:32 | 20:03 | 20:33 | 20:54 | 20:49 | 20:17 | 19:28 | 18:41 | 17:06 | 17:00 |
| 19 | 07:41 | 07:12 | 06:30 | 06:41 | 06:06 | 05:54 | 06:10 | 06:38 | 07:07 | 07:36 | 07:11 | 07:39 |
| | 17:26 | 18:03 | 18:33 | 20:04 | 20:34 | 20:54 | 20:48 | 20:15 | 19:27 | 18:39 | 17:05 | 17:00 |
| 20 | 07:41 | 07:10 | 06:28 | 06:40 | 06:05 | 05:55 | 06:11 | 06:39 | 07:08 | 07:38 | 07:12 | 07:40 |
| | 17:28 | 18:04 | 18:34 | 20:05 | 20:35 | 20:54 | 20:48 | 20:14 | 19:25 | 18:38 | 17:04 | 17:01 |
| 21 | 07:40 | 07:09 | 06:27 | 06:38 | 06:04 | 05:55 | 06:11 | 06:40 | 07:09 | 07:39 | 07:13 | 07:40 |
| | 17:29 | 18:05 | 18:35 | 20:06 | 20:36 | 20:54 | 20:47 | 20:12 | 19:23 | 18:36 | 17:04 | 17:01 |
| 22 | 07:40 | 07:08 | 06:25 | 06:37 | 06:03 | 05:55 | 06:12 | 06:41 | 07:10 | 07:40 | 07:15 | 07:41 |
| | 17:30 | 18:06 | 18:36 | 20:07 | 20:36 | 20:55 | 20:46 | 20:11 | 19:22 | 18:35 | 17:03 | 17:02 |
| 23 | 07:39 | 07:06 | 06:23 | 06:35 | 06:03 | 05:55 | 06:13 | 06:42 | 07:11 | 07:41 | 07:16 | 07:41 |
| | 17:31 | 18:07 | 18:37 | 20:08 | 20:37 | 20:55 | 20:45 | 20:09 | 19:20 | 18:34 | 17:03 | 17:02 |
| 24 | 07:38 | 07:05 | 06:22 | 06:34 | 06:02 | 05:55 | 06:14 | 06:43 | 07:12 | 07:42 | 07:17 | 07:42 |
| | 17:32 | 18:09 | 18:38 | 20:09 | 20:38 | 20:55 | 20:45 | 20:08 | 19:18 | 18:32 | 17:02 | 17:03 |
| 25 | 07:38 | 07:04 | 06:20 | 06:33 | 06:01 | 05:56 | 06:15 | 06:43 | 07:13 | 07:43 | 07:18 | 07:42 |
| | 17:33 | 18:10 | 18:39 | 20:10 | 20:39 | 20:55 | 20:44 | 20:07 | 19:17 | 17:31 | 17:01 | 17:03 |
| 26 | 07:37 | 07:02 | 06:18 | 06:31 | 06:01 | 05:56 | 06:16 | 06:44 | 07:13 | 07:44 | 07:19 | 07:43 |
| | 17:34 | 18:11 | 18:40 | 20:11 | 20:40 | 20:55 | 20:43 | 20:05 | 19:15 | 17:30 | 17:01 | 17:04 |
| 27 | 07:36 | 07:01 | 06:17 | 06:30 | 06:00 | 05:56 | 06:16 | 06:45 | 07:14 | 07:45 | 07:20 | 07:43 |
| | 17:36 | 18:12 | 18:41 | 20:12 | 20:41 | 20:55 | 20:42 | 20:04 | 19:14 | 17:28 | 17:01 | 17:05 |
| 28 | 07:35 | 06:59 | 06:15 | 06:29 | 05:59 | 05:57 | 06:17 | 06:46 | 07:15 | 07:46 | 07:21 | 07:43 |
| | 17:37 | 18:13 | 18:42 | 20:13 | 20:41 | 20:55 | 20:41 | 20:02 | 19:12 | 17:27 | 17:00 | 17:05 |
| 29 | 07:35 | | 07:14 | 06:27 | 05:59 | 05:57 | 06:18 | 06:47 | 07:16 | 07:47 | 07:22 | 07:44 |
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| 30 | 07:34 | | 07:12 | 06:26 | 05:58 | 05:58 | 06:19 | 06:48 | 07:17 | 07:48 | 07:23 | 07:44 |
| | 17:39 | | 19:44 | 20:15 | 20:43 | 20:55 | 20:39 | 19:59 | 19:09 | 17:25 | 17:00 | 17:07 |
| 31 | 07:33 | | 07:10 | | 05:58 | | 06:20 | 06:49 | | 06:50 | | 07:44 |
| | 17:40 | | 19:45 | | 20:44 | | 20:38 | 19:57 | | 17:23 | | 17:07 |
| Potential sun hours | 301 | 299 | 370 | 397 | 445 | 448 | 455 | 426 | 374 | 347 | 301 | 292 |
| 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) | 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) |

Project:

windpro Seui - flickering

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Calculated:
2023-12-19 11:53/2.8.579

SHADOW - Calendar

Calculation: shadow flickering Seui - progetto Shadow receptor: C - R03

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

| | January | February | March | April | May | June | July | August | September | October | November | December | | | |
|---------------------|----------------|----------------|----------------|------------------------|------------------------|----------------|------------------------|----------------|----------------|----------------|--------------------|------------------------|--------------------|----------------|----------------|
| 1 | 07:44 17:09 | 07:32 17:42 | 06:58 18:14 | 07:09 19:46 | 17:47 (3) 18:25 (3) | 06:25 20:16 | 17:50 (3) 20:44 | 05:57 20:37 | 05:58 20:55 | 06:21 20:37 | 06:50 19:56 | 17:36 (3) 18:29 (3) | 07:18 19:07 | 06:51 17:22 | 07:24 16:59 |
| 2 | 07:44 17:09 | 07:31 17:43 | 06:56 18:15 | 07:07 19:47 | 17:45 (3) 18:26 (3) | 06:23 20:17 | 17:51 (3) 20:45 | 05:59 20:55 | 06:22 20:55 | 06:22 20:36 | 06:51 19:54 | 17:36 (3) 18:28 (3) | 07:19 19:05 | 06:52 17:21 | 07:25 16:59 |
| 3 | 07:44 17:10 | 07:30 17:44 | 06:55 18:16 | 07:06 19:48 | 17:44 (3) 18:27 (3) | 06:22 20:18 | 17:54 (3) 18:09 (3) | 05:56 20:46 | 06:23 20:55 | 06:23 20:35 | 06:52 19:53 | 17:36 (3) 18:28 (3) | 07:20 19:04 | 06:53 17:20 | 07:26 16:59 |
| 4 | 07:45 17:11 | 07:29 17:45 | 06:53 18:17 | 07:04 19:49 | 17:43 (3) 18:28 (3) | 06:21 20:19 | 18:09 (3) 20:46 | 05:58 20:55 | 06:00 20:34 | 06:24 20:34 | 06:53 19:51 | 17:36 (3) 18:27 (3) | 07:21 19:02 | 06:54 17:19 | 07:27 16:59 |
| 5 | 07:45 17:12 | 07:28 17:46 | 06:52 18:18 | 07:02 19:50 | 17:42 (3) 18:29 (3) | 06:20 20:20 | 18:09 (3) 20:47 | 05:56 20:54 | 06:00 20:33 | 06:25 20:33 | 06:54 19:49 | 17:36 (3) 18:26 (3) | 07:22 19:01 | 06:55 17:18 | 07:28 16:58 |
| 6 | 07:45 17:13 | 07:27 17:48 | 06:50 18:19 | 07:01 19:51 | 17:41 (3) 18:29 (3) | 06:19 20:21 | 18:09 (3) 20:48 | 05:55 20:54 | 06:01 20:32 | 06:26 20:32 | 06:55 19:48 | 17:37 (3) 18:25 (3) | 07:23 18:59 | 06:56 17:16 | 07:29 16:58 |
| 7 | 07:44 17:14 | 07:26 17:49 | 06:49 18:21 | 06:59 19:52 | 17:39 (3) 18:29 (3) | 06:18 20:22 | 18:09 (3) 20:48 | 05:55 20:54 | 06:01 20:31 | 06:26 20:31 | 06:56 19:46 | 17:37 (3) 18:24 (3) | 07:24 18:57 | 06:57 17:15 | 07:30 16:58 |
| 8 | 07:44 17:15 | 07:25 17:50 | 06:47 18:22 | 06:58 19:53 | 17:39 (3) 18:30 (3) | 06:16 20:23 | 18:09 (3) 20:49 | 05:55 20:54 | 06:02 20:29 | 06:27 20:29 | 06:57 19:45 | 17:38 (3) 18:23 (3) | 07:25 18:56 | 06:59 17:14 | 07:31 16:58 |
| 9 | 07:44 17:16 | 07:24 17:51 | 06:46 18:23 | 06:56 19:54 | 17:38 (3) 18:30 (3) | 06:15 20:24 | 18:09 (3) 20:50 | 05:55 20:53 | 06:02 20:28 | 06:28 20:28 | 06:57 18:15 (3) | 17:37 (3) 19:43 | 07:26 18:54 | 07:00 17:13 | 07:32 16:58 |
| 10 | 07:44 17:17 | 07:23 17:52 | 06:44 18:24 | 06:55 19:55 | 17:38 (3) 18:30 (3) | 06:14 20:25 | 18:09 (3) 20:50 | 05:55 20:53 | 06:03 20:27 | 06:29 20:27 | 06:58 18:19 (3) | 17:38 (3) 19:41 | 07:27 18:53 | 07:01 17:12 | 07:32 16:58 |
| 11 | 07:44 17:18 | 07:22 17:53 | 06:42 18:25 | 06:53 19:56 | 17:37 (3) 18:30 (3) | 06:13 20:26 | 18:09 (3) 20:51 | 05:54 20:53 | 06:04 20:26 | 06:30 20:26 | 06:59 18:21 (3) | 17:39 (3) 19:40 | 07:28 18:51 | 07:02 17:11 | 07:33 16:58 |
| 12 | 07:44 17:19 | 07:20 17:55 | 06:41 18:26 | 06:51 19:57 | 17:38 (3) 18:30 (3) | 06:12 20:27 | 18:09 (3) 20:51 | 05:54 20:52 | 06:04 20:24 | 06:31 20:24 | 07:00 18:23 (3) | 17:41 (3) 19:38 | 07:29 18:50 | 07:03 17:11 | 07:34 16:58 |
| 13 | 07:43 17:20 | 07:19 17:56 | 06:39 18:27 | 06:50 19:58 | 17:37 (3) 18:30 (3) | 06:11 20:28 | 18:09 (3) 20:52 | 05:54 20:52 | 06:05 20:23 | 06:32 20:23 | 07:01 18:24 (3) | 17:55 (3) 19:37 | 07:30 18:13 (3) | 07:04 17:10 | 07:35 16:59 |
| 14 | 07:43 17:21 | 07:18 17:57 | 06:38 18:28 | 06:48 19:59 | 17:37 (3) 18:30 (3) | 06:10 20:29 | 18:09 (3) 20:52 | 05:54 20:51 | 06:06 20:22 | 06:33 20:22 | 07:02 18:26 (3) | 17:45 (3) 19:35 | 07:31 18:10 (3) | 07:05 17:09 | 07:36 16:59 |
| 15 | 07:43 17:22 | 07:17 17:58 | 06:36 18:29 | 06:47 20:00 | 17:37 (3) 18:29 (3) | 06:09 20:30 | 18:09 (3) 20:52 | 05:54 20:51 | 06:07 20:21 | 06:34 20:21 | 07:03 18:27 (3) | 17:51 (3) 19:33 | 07:32 18:06 (3) | 07:07 17:08 | 07:36 16:59 |
| 16 | 07:42 17:23 | 07:16 17:59 | 06:34 18:30 | 06:45 20:01 | 18:29 (3) 18:29 (3) | 06:08 20:31 | 18:09 (3) 20:53 | 05:54 20:50 | 06:07 20:19 | 06:35 20:19 | 07:04 18:28 (3) | 17:50 (3) 19:32 | 07:33 17:58 (3) | 07:08 18:44 | 07:37 16:59 |
| 17 | 07:42 17:24 | 07:14 18:01 | 06:33 18:31 | 06:44 20:02 | 17:37 (3) 18:28 (3) | 06:07 20:32 | 18:09 (3) 20:53 | 05:54 20:50 | 06:08 20:18 | 06:36 20:18 | 07:05 18:29 (3) | 17:49 (3) 19:30 | 07:34 18:42 | 07:09 17:06 | 07:38 17:00 |
| 18 | 07:42 17:25 | 07:13 18:02 | 06:31 18:32 | 06:43 20:03 | 17:37 (3) 18:28 (3) | 06:07 20:33 | 18:09 (3) 20:54 | 05:54 20:49 | 06:09 20:16 | 06:37 20:16 | 07:06 18:30 (3) | 17:48 (3) 19:28 | 07:35 18:41 | 07:10 17:06 | 07:39 17:00 |
| 19 | 07:41 17:26 | 07:12 18:03 | 06:30 18:33 | 06:41 20:04 | 17:37 (3) 18:27 (3) | 06:06 20:34 | 18:09 (3) 20:54 | 05:54 20:48 | 06:10 20:15 | 06:38 20:15 | 07:07 18:30 (3) | 17:46 (3) 19:27 | 07:36 18:39 | 07:11 17:05 | 07:39 17:00 |
| 20 | 07:41 17:27 | 07:10 18:04 | 06:28 18:34 | 06:40 20:05 | 17:38 (3) 18:27 (3) | 06:05 20:35 | 18:09 (3) 20:54 | 05:55 20:48 | 06:11 20:14 | 06:39 20:14 | 07:08 18:31 (3) | 17:45 (3) 19:25 | 07:37 18:38 | 07:12 17:04 | 07:40 17:01 |
| 21 | 07:40 17:29 | 07:09 18:05 | 06:26 18:35 | 06:38 20:06 | 17:39 (3) 18:27 (3) | 06:04 20:35 | 18:09 (3) 20:54 | 05:55 20:47 | 06:11 20:12 | 06:40 20:12 | 07:09 18:30 (3) | 17:43 (3) 19:23 | 07:39 18:36 | 07:13 17:04 | 07:40 17:01 |
| 22 | 07:40 17:30 | 07:08 18:06 | 06:25 18:36 | 06:37 20:07 | 17:39 (3) 18:25 (3) | 06:03 20:36 | 18:09 (3) 20:55 | 05:55 20:46 | 06:12 20:11 | 06:41 20:11 | 07:10 18:31 (3) | 17:42 (3) 19:22 | 07:40 18:35 | 07:14 17:03 | 07:41 17:02 |
| 23 | 07:39 17:31 | 07:06 18:07 | 06:23 18:37 | 06:35 20:08 | 17:40 (3) 18:25 (3) | 06:03 20:37 | 18:09 (3) 20:55 | 05:55 20:45 | 06:13 20:09 | 06:42 20:09 | 07:11 18:31 (3) | 17:42 (3) 19:20 | 07:41 18:34 | 07:16 17:02 | 07:41 17:02 |
| 24 | 07:38 17:32 | 07:05 18:08 | 06:22 18:38 | 06:34 20:09 | 17:41 (3) 18:24 (3) | 06:02 20:38 | 18:09 (3) 20:55 | 05:55 20:45 | 06:14 20:08 | 06:42 20:08 | 07:11 18:31 (3) | 17:41 (3) 19:18 | 07:42 18:32 | 07:17 17:03 | 07:42 17:03 |
| 25 | 07:38 17:33 | 07:03 18:10 | 06:20 18:39 | 06:33 20:10 | 17:41 (3) 18:23 (3) | 06:01 20:39 | 18:09 (3) 20:55 | 05:56 20:44 | 06:15 20:06 | 06:43 20:06 | 07:12 18:30 (3) | 17:40 (3) 19:17 | 07:43 17:31 | 07:18 17:01 | 07:42 17:03 |
| 26 | 07:37 17:34 | 07:02 18:11 | 06:18 18:40 | 06:31 20:11 | 17:42 (3) 18:22 (3) | 06:01 20:40 | 18:09 (3) 20:55 | 05:56 20:43 | 06:16 20:05 | 06:44 20:05 | 07:13 18:31 (3) | 17:40 (3) 19:15 | 07:44 17:30 | 07:19 17:01 | 07:42 17:04 |
| 27 | 07:36 17:36 | 07:01 18:12 | 06:17 18:41 | 06:30 20:12 | 17:44 (3) 18:21 (3) | 06:00 20:41 | 18:09 (3) 20:55 | 05:56 20:42 | 06:16 20:03 | 06:45 20:03 | 07:14 18:31 (3) | 17:39 (3) 19:13 | 07:45 17:28 | 07:20 17:01 | 07:43 17:05 |
| 28 | 07:35 17:37 | 06:59 18:13 | 06:15 18:42 | 16:58 (3) 17:15 (3) | 06:29 20:13 | 05:59 20:13 | 18:09 (3) 20:55 | 05:57 20:41 | 06:17 20:02 | 06:46 20:02 | 07:15 18:31 (3) | 17:39 (3) 19:12 | 07:46 17:27 | 07:21 17:05 | 07:43 17:05 |
| 29 | 07:35 17:38 | 07:14 18:13 | 06:14 18:42 | 17:55 (3) 17:55 (3) | 06:27 20:14 | 05:59 20:14 | 18:09 (3) 20:55 | 05:57 20:40 | 06:18 20:00 | 06:47 20:00 | 07:16 18:31 (3) | 17:38 (3) 19:10 | 07:47 17:26 | 07:22 17:06 | 07:43 17:06 |
| 30 | 07:34 17:39 | 07:12 18:14 | 06:13 18:43 | 18:19 (3) 17:52 (3) | 20:14 20:15 | 05:58 20:15 | 18:09 (3) 20:55 | 05:58 20:39 | 06:19 19:59 | 06:48 19:59 | 07:17 18:31 (3) | 17:38 (3) 19:09 | 07:48 17:25 | 07:23 16:59 | 07:44 17:07 |
| 31 | 07:33 17:40 | 07:01 18:15 | 06:12 18:44 | 18:19 (3) 18:24 (3) | 20:14 20:44 | 05:58 20:44 | 18:09 (3) 20:55 | 05:58 20:38 | 06:20 19:57 | 06:49 19:57 | 07:17 18:29 (3) | 17:36 (3) 19:09 | 07:49 17:23 | 07:44 17:07 | 07:44 17:07 |
| Potential sun hours | 301 | 299 | 370 | 397 | 445 | 448 | 455 | 425 | 374 | 631 | 347 | 301 | 292 | | |
| Total, worst case | | | 104 | 1380 | 60 | | | | 939 | 631 | | | | | |
| Sun reduction | | | 0.49 | 0.53 | 0.59 | | | | 0.73 | 0.65 | | | | | |
| Oper. time red. | | | 0.30 | 0.30 | 0.30 | | | | 0.30 | 0.30 | | | | | |
| Wind dir. red. | | | 0.80 | 0.80 | 0.80 | | | | 0.80 | 0.80 | | | | | |
| Total reduction | | | 0.12 | 0.13 | 0.14 | | | | 0.17 | 0.15 | | | | | |
| Total, real | | | 12 | 173 | 8 | | | | 163 | 97 | | | | | |

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) |

Project:
windpro Seui - flickering

Printed/Page
2023-12-20 10:52 / 5
Licensed user:
Ing. Bruno Manca
Via Vittorio Veneto 231
IT-09028 Sestu
+390702358125
Bruno Manca / ingbrunomanca@gmail.com
Calculated:
2023-12-19 11:53/2.8.579

SHADOW - Calendar

Calculation: shadow flickering Seui - progetto Shadow receptor: E - R05

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

| | January | February | March | April | May | June | July | August | September | October | November | December | | |
|---------------------|----------------|----------------|----------------|----------------|-----------------|-----------------|----------------|----------------|--------------------|----------------|-----------------|----------------|----------------|----------------|
| 1 | 07:44 17:09 | 07:32 17:42 | 06:58 18:14 | 07:09 19:46 | 06:25 20:16 | 50 17:56 (3) | 05:57 20:44 | 05:58 20:55 | 06:21 18:11 (3) | 06:50 19:56 | 22 18:33 (3) | 07:18 19:07 | 06:51 17:22 | 07:24 16:59 |
| 2 | 07:44 17:09 | 07:31 17:43 | 06:56 18:15 | 07:07 19:47 | 06:23 20:17 | 50 17:55 (3) | 05:57 20:45 | 05:59 20:55 | 06:22 18:10 (3) | 06:51 19:54 | 15 18:14 (3) | 07:19 19:05 | 06:52 17:21 | 07:25 16:59 |
| 3 | 07:44 17:10 | 07:30 17:44 | 06:55 18:16 | 07:06 19:48 | 06:22 20:18 | 49 17:56 (3) | 05:56 20:46 | 05:59 20:55 | 06:23 18:10 (3) | 06:52 19:53 | | 07:20 19:04 | 06:53 17:20 | 07:26 16:59 |
| 4 | 07:45 17:11 | 07:29 17:45 | 06:53 18:17 | 07:04 19:49 | 06:21 20:19 | 48 17:56 (3) | 05:56 20:46 | 06:00 20:55 | 06:24 18:09 (3) | 06:53 19:51 | | 07:21 19:02 | 06:54 17:19 | 07:27 16:59 |
| 5 | 07:45 17:12 | 07:28 17:46 | 06:52 18:18 | 07:02 19:50 | 06:20 20:20 | 47 17:57 (3) | 05:56 20:47 | 06:00 20:54 | 06:25 18:08 (3) | 06:54 19:49 | | 07:22 19:01 | 06:55 17:18 | 07:28 16:58 |
| 6 | 07:45 17:13 | 07:27 17:48 | 06:50 18:19 | 07:01 19:51 | 06:19 20:21 | 47 17:57 (3) | 05:55 20:48 | 06:01 20:54 | 06:26 18:07 (3) | 06:55 19:48 | | 07:23 18:59 | 06:56 17:16 | 07:29 16:58 |
| 7 | 07:44 17:14 | 07:26 17:49 | 06:49 18:21 | 06:59 19:52 | 06:18 20:22 | 45 17:58 (3) | 05:55 20:48 | 06:01 20:54 | 06:26 18:03 (3) | 06:56 19:46 | | 07:24 18:57 | 06:57 17:15 | 07:30 16:58 |
| 8 | 07:44 17:15 | 07:25 17:50 | 06:47 18:22 | 06:58 19:53 | 06:16 20:23 | 44 17:59 (3) | 05:55 20:49 | 06:02 20:54 | 06:27 18:06 (3) | 06:57 19:45 | | 07:25 18:56 | 06:59 17:14 | 07:31 16:58 |
| 9 | 07:44 17:16 | 07:24 17:51 | 06:46 18:23 | 06:56 19:54 | 06:15 20:24 | 42 18:00 (3) | 05:55 20:50 | 06:02 20:53 | 06:28 18:06 (3) | 06:57 19:43 | | 07:26 18:54 | 07:00 17:13 | 07:32 16:58 |
| 10 | 07:44 17:17 | 07:23 17:52 | 06:44 18:24 | 06:55 19:55 | 15 18:16 (3) | 41 18:00 (3) | 05:55 20:50 | 06:03 20:53 | 06:29 18:05 (3) | 06:58 19:41 | | 07:27 18:53 | 07:01 17:12 | 07:33 16:58 |
| 11 | 07:44 17:18 | 07:22 17:53 | 06:42 18:25 | 06:53 19:56 | 15 18:12 (3) | 41 18:01 (3) | 05:54 20:50 | 06:04 20:53 | 06:30 18:04 (3) | 06:59 19:41 | | 07:28 18:51 | 07:02 17:11 | 07:34 16:58 |
| 12 | 07:44 17:19 | 07:20 17:55 | 06:41 18:26 | 06:51 19:57 | 23 18:09 (3) | 40 18:02 (3) | 05:54 20:51 | 06:04 20:53 | 06:31 18:04 (3) | 07:00 19:38 | | 07:29 18:50 | 07:03 17:11 | 07:34 16:58 |
| 13 | 07:43 17:20 | 07:19 17:56 | 06:39 18:27 | 06:50 19:58 | 29 18:38 (3) | 38 18:03 (3) | 05:54 20:52 | 06:05 20:52 | 06:32 18:03 (3) | 07:01 19:37 | | 07:30 18:48 | 07:04 17:10 | 07:35 16:59 |
| 14 | 07:43 17:21 | 07:18 17:57 | 06:38 18:28 | 06:48 19:59 | 32 18:39 (3) | 36 18:04 (3) | 05:54 20:52 | 06:06 20:51 | 06:33 18:03 (3) | 07:02 19:35 | | 07:31 18:47 | 07:05 17:09 | 07:36 16:59 |
| 15 | 07:43 17:22 | 07:17 17:58 | 06:36 18:29 | 06:47 20:00 | 36 18:41 (3) | 34 18:03 (3) | 05:54 20:52 | 06:07 20:51 | 06:34 18:03 (3) | 07:03 19:33 | | 07:32 18:45 | 07:07 17:08 | 07:36 16:59 |
| 16 | 07:42 17:23 | 07:16 17:59 | 06:34 18:30 | 06:45 20:01 | 38 18:02 (3) | 32 18:35 (3) | 05:54 20:53 | 06:07 20:50 | 06:35 18:02 (3) | 07:04 19:32 | | 07:33 18:44 | 07:08 17:07 | 07:37 16:59 |
| 17 | 07:42 17:24 | 07:14 18:01 | 06:33 18:31 | 06:44 20:02 | 43 18:00 (3) | 27 18:34 (3) | 05:54 20:53 | 06:08 20:50 | 06:36 18:02 (3) | 07:05 19:30 | | 07:34 18:42 | 07:09 17:06 | 07:38 17:00 |
| 18 | 07:42 17:25 | 07:13 18:02 | 06:31 18:32 | 06:43 20:03 | 44 18:00 (3) | 23 18:09 (3) | 05:54 20:54 | 06:09 20:49 | 06:37 18:02 (3) | 07:06 19:28 | | 07:35 18:41 | 07:10 17:06 | 07:38 17:00 |
| 19 | 07:41 17:26 | 07:12 18:03 | 06:30 18:33 | 06:41 20:04 | 46 17:58 (3) | 20 18:11 (3) | 05:54 20:54 | 06:10 20:48 | 06:38 18:02 (3) | 07:07 19:27 | | 07:36 18:39 | 07:11 17:05 | 07:39 17:00 |
| 20 | 07:41 17:27 | 07:10 18:04 | 06:28 18:34 | 06:40 20:05 | 47 17:58 (3) | 16 18:13 (3) | 05:55 20:54 | 06:11 20:48 | 06:39 18:02 (3) | 07:08 19:25 | | 07:37 18:38 | 07:12 17:04 | 07:40 17:01 |
| 21 | 07:40 17:29 | 07:09 18:05 | 06:26 18:35 | 06:38 20:06 | 48 17:56 (3) | 10 18:16 (3) | 05:55 20:54 | 06:11 20:47 | 06:40 18:01 (3) | 07:09 19:23 | | 07:39 18:36 | 07:13 17:04 | 07:40 17:01 |
| 22 | 07:40 17:30 | 07:08 18:06 | 06:25 18:36 | 06:37 20:07 | 50 17:56 (3) | | 05:55 20:46 | 06:12 20:46 | 06:41 18:33 (3) | 07:10 19:22 | | 07:40 18:35 | 07:14 17:03 | 07:41 17:02 |
| 23 | 07:39 17:31 | 07:06 18:07 | 06:23 18:37 | 06:35 20:08 | 50 17:56 (3) | | 05:55 20:45 | 06:13 20:45 | 06:42 18:25 (3) | 07:11 19:20 | | 07:41 18:34 | 07:16 17:02 | 07:41 17:02 |
| 24 | 07:38 17:32 | 07:05 18:08 | 06:22 18:38 | 06:34 20:09 | 51 17:56 (3) | | 05:55 20:45 | 06:14 20:45 | 06:42 18:23 (3) | 07:11 19:18 | | 07:42 18:32 | 07:17 17:02 | 07:42 17:03 |
| 25 | 07:38 17:33 | 07:03 18:10 | 06:20 18:39 | 06:33 20:10 | 51 17:55 (3) | | 05:56 20:44 | 06:15 20:44 | 06:43 18:20 (3) | 07:12 19:17 | | 07:43 18:31 | 07:18 17:01 | 07:42 17:03 |
| 26 | 07:37 17:34 | 07:02 18:11 | 06:18 18:40 | 06:31 20:11 | 51 17:55 (3) | | 05:56 20:43 | 06:16 20:43 | 06:44 18:19 (3) | 07:13 19:15 | | 07:44 18:30 | 07:19 17:01 | 07:42 17:04 |
| 27 | 07:36 17:36 | 07:01 18:12 | 06:17 18:41 | 06:30 20:12 | 51 17:56 (3) | | 05:56 20:42 | 06:16 20:42 | 06:45 18:17 (3) | 07:14 19:13 | | 07:45 18:29 | 07:20 17:01 | 07:43 17:05 |
| 28 | 07:35 17:37 | 06:59 18:13 | 06:15 18:42 | 06:29 20:13 | 51 17:55 (3) | | 05:59 20:41 | 06:17 20:41 | 06:46 18:16 (3) | 07:15 19:12 | | 07:46 18:28 | 07:21 17:00 | 07:43 17:05 |
| 29 | 07:35 17:38 | | 06:14 19:43 | 06:27 20:14 | 51 17:55 (3) | | 05:59 20:40 | 06:18 20:40 | 06:47 18:15 (3) | 07:16 19:10 | | 07:47 18:26 | 07:22 17:00 | 07:43 17:06 |
| 30 | 07:34 17:39 | | 06:12 19:44 | 06:26 20:15 | 51 17:55 (3) | | 05:58 20:39 | 06:19 20:39 | 06:48 18:14 (3) | 07:17 19:09 | | 07:48 18:23 | 07:23 17:01 | 07:44 17:07 |
| 31 | 07:33 17:40 | | 07:10 19:45 | 06:25 20:16 | 51 18:46 (3) | | 05:58 20:44 | 06:20 20:38 | 06:49 18:13 (3) | 07:18 19:07 | | 07:49 18:23 | 07:24 17:01 | 07:44 17:07 |
| Potential sun hours | 301 | 299 | 370 | 397 | 445 | 448 | 455 | 425 | 374 | 37 | | 347 | 301 | 292 |
| Total, worst case | | | | 899 | 768 | | 243 | 1402 | | 37 | | | | |
| Sun reduction | | | | 0.53 | 0.59 | | 0.74 | 0.73 | | 0.65 | | | | |
| Oper. time red. | | | | 0.30 | 0.30 | | 0.30 | 0.30 | | 0.30 | | | | |
| Wind dir. red. | | | | 0.80 | 0.80 | | 0.80 | 0.80 | | 0.80 | | | | |
| Total reduction | | | | 0.13 | 0.14 | | 0.18 | 0.17 | | 0.15 | | | | |
| Total, real | | | | 113 | 108 | | 43 | 244 | | 6 | | | | |

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:

windpro Seui - flickering

Printed/Page

2023-12-20 10:52 / 6

Licensed user:

Ing. Bruno Manca

Via Vittorio Veneto 231

IT-09028 Sestu

+390702358125

Bruno Manca / ingbrunomanca@gmail.com

Calculated:

2023-12-19 11:53/2.8.579

SHADOW - Calendar

Calculation: shadow flickering Seui - progetto Shadow receptor: F - R06

Assumptions for shadow calculations

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

| | | | | | | | | | | | |
|------|------|------|------|------|------|-------|-------|------|------|------|------|
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| 4.40 | 5.05 | 5.88 | 7.00 | 8.45 | 9.88 | 10.82 | 10.03 | 8.08 | 6.09 | 5.07 | 4.27 |

Operational time

| | | | | | | | | | | | | |
|----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-------|
| N | NNE | ENE | E | ESE | SSE | S | SSW | WSW | W | WNW | NNW | Sum |
| 86 | 55 | 78 | 159 | 368 | 188 | 65 | 104 | 357 | 605 | 339 | 206 | 2,610 |

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

| | January | February | March | April | May | June | | | | | | | | |
|---------------------|---------|-----------|-----------|-----------|-------|-----------|-------|-----------|-----------|-------|----|-----------|-------|-------|
| 1 | 07:44 | 15:16 (4) | 07:32 | 15:13 (4) | 06:58 | 07:25 (3) | 07:09 | 08:17 (3) | 06:25 | 05:57 | | | | |
| | 17:09 | 77 | 16:33 (4) | 17:42 | 104 | 16:57 (4) | 18:14 | 143 | 16:52 (4) | 19:46 | 50 | 09:07 (3) | 20:16 | 20:44 |
| 2 | 07:44 | 15:16 (4) | 07:31 | 15:13 (4) | 06:56 | 07:24 (3) | 07:07 | 08:18 (3) | 06:24 | 05:57 | | | | |
| | 17:09 | 77 | 16:33 (4) | 17:43 | 105 | 16:58 (4) | 18:15 | 143 | 16:51 (4) | 19:47 | 47 | 09:05 (3) | 20:17 | 20:45 |
| 3 | 07:44 | 15:16 (4) | 07:30 | 15:13 (4) | 06:55 | 07:22 (3) | 07:06 | 08:20 (3) | 06:22 | 05:57 | | | | |
| | 17:10 | 78 | 16:34 (4) | 17:44 | 105 | 16:58 (4) | 18:16 | 143 | 16:50 (4) | 19:48 | 43 | 09:03 (3) | 20:18 | 20:46 |
| 4 | 07:45 | 15:16 (4) | 07:29 | 15:13 (4) | 06:53 | 07:22 (3) | 07:04 | 08:21 (3) | 06:21 | 05:56 | | | | |
| | 17:11 | 79 | 16:35 (4) | 17:45 | 106 | 16:59 (4) | 18:17 | 143 | 16:49 (4) | 19:49 | 39 | 09:00 (3) | 20:19 | 20:47 |
| 5 | 07:45 | 15:16 (4) | 07:28 | 15:13 (4) | 06:52 | 07:20 (3) | 07:02 | 08:24 (3) | 06:20 | 05:56 | | | | |
| | 17:12 | 80 | 16:36 (4) | 17:46 | 106 | 16:59 (4) | 18:18 | 142 | 16:47 (4) | 19:50 | 34 | 08:58 (3) | 20:20 | 20:47 |
| 6 | 07:45 | 15:16 (4) | 07:27 | 15:13 (4) | 06:50 | 07:20 (3) | 07:01 | 08:26 (3) | 06:19 | 05:56 | | | | |
| | 17:13 | 81 | 16:37 (4) | 17:48 | 106 | 16:59 (4) | 18:20 | 140 | 16:46 (4) | 19:51 | 29 | 08:55 (3) | 20:21 | 20:48 |
| 7 | 07:45 | 15:16 (4) | 07:26 | 15:12 (4) | 06:49 | 07:18 (3) | 06:59 | 08:28 (3) | 06:18 | 05:55 | | | | |
| | 17:14 | 82 | 16:38 (4) | 17:49 | 107 | 16:59 (4) | 18:21 | 139 | 16:44 (4) | 19:52 | 22 | 08:50 (3) | 20:22 | 20:48 |
| 8 | 07:44 | 15:16 (4) | 07:25 | 15:13 (4) | 06:47 | 07:18 (3) | 06:58 | 08:34 (3) | 06:16 | 05:55 | | | | |
| | 17:15 | 83 | 16:39 (4) | 17:50 | 106 | 16:59 (4) | 18:22 | 137 | 16:43 (4) | 19:53 | 11 | 08:45 (3) | 20:23 | 20:49 |
| 9 | 07:44 | 15:16 (4) | 07:24 | 15:13 (4) | 06:46 | 07:17 (3) | 06:56 | 08:45 (3) | 06:15 | 05:55 | | | | |
| | 17:16 | 84 | 16:40 (4) | 17:51 | 106 | 16:59 (4) | 18:23 | 134 | 16:41 (4) | 19:54 | | 20:24 | 20:50 | |
| 10 | 07:44 | 15:16 (4) | 07:23 | 15:13 (4) | 06:44 | 07:15 (3) | 06:55 | 08:45 (3) | 06:14 | 05:55 | | | | |
| | 17:17 | 84 | 16:40 (4) | 17:52 | 107 | 17:00 (4) | 18:24 | 133 | 16:39 (4) | 19:55 | | 20:25 | 20:50 | |
| 11 | 07:44 | 15:16 (4) | 07:22 | 15:13 (4) | 06:42 | 07:15 (3) | 06:53 | 08:45 (3) | 06:13 | 05:55 | | | | |
| | 17:18 | 86 | 16:42 (4) | 17:54 | 107 | 17:00 (4) | 18:25 | 129 | 16:38 (4) | 19:56 | | 20:26 | 20:51 | |
| 12 | 07:44 | 15:16 (4) | 07:20 | 15:14 (4) | 06:41 | 07:14 (3) | 06:52 | 08:45 (3) | 06:12 | 05:54 | | | | |
| | 17:19 | 87 | 16:43 (4) | 17:55 | 106 | 17:00 (4) | 18:26 | 126 | 16:35 (4) | 19:57 | | 20:27 | 20:51 | |
| 13 | 07:44 | 15:15 (4) | 07:19 | 15:13 (4) | 06:39 | 07:14 (3) | 06:50 | 08:45 (3) | 06:11 | 05:54 | | | | |
| | 17:20 | 88 | 16:43 (4) | 17:56 | 106 | 16:59 (4) | 18:27 | 120 | 16:33 (4) | 19:58 | | 20:28 | 20:52 | |
| 14 | 07:43 | 15:15 (4) | 07:18 | 15:14 (4) | 06:38 | 07:14 (3) | 06:49 | 08:45 (3) | 06:10 | 05:54 | | | | |
| | 17:21 | 89 | 16:44 (4) | 17:57 | 105 | 16:59 (4) | 18:28 | 115 | 16:30 (4) | 19:59 | | 20:29 | 20:52 | |
| 15 | 07:43 | 15:16 (4) | 07:17 | 15:14 (4) | 06:36 | 07:13 (3) | 06:47 | 08:45 (3) | 06:09 | 05:54 | | | | |
| | 17:22 | 90 | 16:46 (4) | 17:58 | 106 | 17:00 (4) | 18:29 | 108 | 16:26 (4) | 20:00 | | 20:30 | 20:52 | |
| 16 | 07:43 | 15:15 (4) | 07:16 | 15:15 (4) | 06:35 | 07:13 (3) | 06:46 | 08:45 (3) | 06:08 | 05:54 | | | | |
| | 17:23 | 91 | 16:46 (4) | 17:59 | 105 | 17:00 (4) | 18:30 | 101 | 16:23 (4) | 20:01 | | 20:31 | 20:53 | |
| 17 | 07:42 | 15:15 (4) | 07:14 | 15:15 (4) | 06:33 | 07:12 (3) | 06:44 | 08:45 (3) | 06:07 | 05:54 | | | | |
| | 17:24 | 92 | 16:47 (4) | 18:01 | 104 | 16:59 (4) | 18:31 | 89 | 16:17 (4) | 20:02 | | 20:32 | 20:53 | |
| 18 | 07:42 | 15:15 (4) | 07:13 | 15:16 (4) | 06:31 | 07:13 (3) | 06:43 | 08:45 (3) | 06:07 | 05:54 | | | | |
| | 17:25 | 93 | 16:48 (4) | 18:02 | 103 | 16:59 (4) | 18:32 | 71 | 08:24 (3) | 20:03 | | 20:33 | 20:54 | |
| 19 | 07:41 | 15:15 (4) | 07:12 | 15:16 (4) | 06:30 | 07:12 (3) | 06:41 | 08:45 (3) | 06:06 | 05:55 | | | | |
| | 17:26 | 94 | 16:49 (4) | 18:03 | 103 | 16:59 (4) | 18:33 | 71 | 08:23 (3) | 20:04 | | 20:34 | 20:54 | |
| 20 | 07:41 | 15:14 (4) | 07:10 | 15:16 (4) | 06:28 | 07:12 (3) | 06:40 | 08:45 (3) | 06:05 | 05:55 | | | | |
| | 17:28 | 95 | 16:49 (4) | 18:04 | 102 | 16:58 (4) | 18:34 | 70 | 08:22 (3) | 20:05 | | 20:35 | 20:54 | |
| 21 | 07:40 | 15:14 (4) | 07:09 | 15:17 (4) | 06:27 | 07:12 (3) | 06:38 | 08:45 (3) | 06:04 | 05:55 | | | | |
| | 17:29 | 96 | 16:50 (4) | 18:05 | 108 | 16:58 (4) | 18:35 | 69 | 08:21 (3) | 20:06 | | 20:36 | 20:54 | |
| 22 | 07:40 | 15:14 (4) | 07:08 | 15:18 (4) | 06:25 | 07:12 (3) | 06:37 | 08:45 (3) | 06:03 | 05:55 | | | | |
| | 17:30 | 97 | 16:51 (4) | 18:06 | 122 | 16:57 (4) | 18:36 | 68 | 08:20 (3) | 20:07 | | 20:36 | 20:55 | |
| 23 | 07:39 | 15:14 (4) | 07:06 | 15:19 (4) | 06:23 | 07:13 (3) | 06:35 | 08:45 (3) | 06:03 | 05:55 | | | | |
| | 17:31 | 98 | 16:52 (4) | 18:07 | 128 | 16:57 (4) | 18:37 | 67 | 08:20 (3) | 20:08 | | 20:37 | 20:55 | |
| 24 | 07:38 | 15:13 (4) | 07:05 | 15:20 (4) | 06:22 | 07:13 (3) | 06:34 | 08:45 (3) | 06:02 | 05:56 | | | | |
| | 17:32 | 99 | 16:52 (4) | 18:09 | 132 | 16:56 (4) | 18:38 | 66 | 08:19 (3) | 20:09 | | 20:38 | 20:55 | |
| 25 | 07:38 | 15:14 (4) | 07:03 | 15:21 (4) | 06:20 | 07:12 (3) | 06:33 | 08:45 (3) | 06:01 | 05:56 | | | | |
| | 17:33 | 99 | 16:53 (4) | 18:10 | 135 | 16:55 (4) | 18:39 | 65 | 08:17 (3) | 20:10 | | 20:39 | 20:55 | |
| 26 | 07:37 | 15:13 (4) | 07:02 | 15:22 (4) | 06:18 | 07:13 (3) | 06:31 | 08:45 (3) | 06:01 | 05:56 | | | | |
| | 17:34 | 101 | 16:54 (4) | 18:11 | 139 | 16:55 (4) | 18:40 | 64 | 08:17 (3) | 20:11 | | 20:40 | 20:55 | |
| 27 | 07:36 | 15:13 (4) | 07:01 | 15:23 (4) | 06:17 | 07:13 (3) | 06:30 | 08:45 (3) | 06:00 | 05:56 | | | | |
| | 17:36 | 101 | 16:54 (4) | 18:12 | 141 | 16:54 (4) | 18:41 | 62 | 08:15 (3) | 20:12 | | 20:41 | 20:55 | |
| 28 | 07:35 | 15:13 (4) | 06:59 | 15:24 (4) | 06:15 | 07:14 (3) | 06:29 | 08:45 (3) | 05:59 | 05:57 | | | | |
| | 17:37 | 102 | 16:55 (4) | 18:13 | 142 | 16:53 (4) | 18:42 | 59 | 08:13 (3) | 20:13 | | 20:41 | 20:55 | |
| 29 | 07:35 | 15:13 (4) | 06:58 | 15:25 (4) | 06:14 | 08:15 (3) | 06:27 | 08:45 (3) | 05:59 | 05:57 | | | | |
| | 17:38 | 102 | 16:55 (4) | 18:14 | 142 | 16:53 (4) | 18:43 | 57 | 09:12 (3) | 20:14 | | 20:42 | 20:55 | |
| 30 | 07:34 | 15:12 (4) | 06:57 | 15:26 (4) | 06:13 | 07:12 (3) | 06:26 | 08:45 (3) | 05:58 | 05:58 | | | | |
| | 17:39 | 104 | 16:56 (4) | 18:15 | 144 | 16:54 (4) | 18:44 | 55 | 09:10 (3) | 20:15 | | 20:43 | 20:55 | |
| 31 | 07:33 | 15:13 (4) | 06:56 | 15:27 (4) | 06:12 | 07:10 (3) | 06:25 | 08:45 (3) | 05:58 | 05:58 | | | | |
| | 17:40 | 104 | 16:57 (4) | 18:16 | 144 | 16:54 (4) | 18:45 | 52 | 09:09 (3) | 20:16 | | 20:44 | 20:55 | |
| Potential sun hours | 301 | 299 | 312 | 370 | 3081 | 397 | 445 | 448 | | | | | | |
| Total, worst case | 2813 | 3152 | 3081 | 275 | | | | | | | | | | |
| Sun reduction | 0.45 | 0.47 | 0.49 | 0.53 | | | | | | | | | | |
| Oper. time red. | 0.30 | 0.30 | 0.30 | 0.30 | | | | | | | | | | |
| Wind dir. red. | 0.70 | 0.71 | 0.75 | 0.77 | | | | | | | | | | |
| Total reduction | 0.09 | 0.10 | 0.11 | 0.12 | | | | | | | | | | |
| Total, real | 265 | 312 | 337 | 33 | | | | | | | | | | |

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) |

Project:

windpro Seui - flickering

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2023-12-20 10:52 / 7

Licensed user:

Ing. Bruno Manca

Via Vittorio Veneto 231

IT-09028 Sestu

+390702358125

Bruno Manca / ingbrunomanca@gmail.com

Calculated:

2023-12-19 11:53/2.8.579

SHADOW - Calendar

Calculation: shadow flickering Seui - progetto Shadow receptor: F - R06

Assumptions for shadow calculations

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

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|------|------|------|------|------|------|-------|-------|------|------|------|------|
| 4.40 | 5.05 | 5.88 | 7.00 | 8.45 | 9.88 | 10.82 | 10.03 | 8.08 | 6.09 | 5.07 | 4.27 |

Operational time

| N | NNE | ENE | E | ESE | SSE | S | SSW | WSW | W | WNW | NNW | Sum |
|----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-------|
| 86 | 55 | 78 | 159 | 368 | 188 | 65 | 104 | 357 | 605 | 339 | 206 | 2,610 |

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

| | July | August | September | October | November | December |
|---------------------|-------|--------|-----------|-----------|-----------|-----------|
| 1 | 05:58 | 06:21 | 06:50 | 07:18 | 07:54 (3) | 06:51 |
| | 20:55 | 20:37 | 19:56 | 19:07 | 17:14 (4) | 17:22 |
| 2 | 05:59 | 06:22 | 06:51 | 07:19 | 07:54 (3) | 06:52 |
| | 20:55 | 20:36 | 19:54 | 19:05 | 17:15 (4) | 17:21 |
| 3 | 05:59 | 06:23 | 06:52 | 07:20 | 07:54 (3) | 06:53 |
| | 20:55 | 20:35 | 19:53 | 19:04 | 17:17 (4) | 17:20 |
| 4 | 06:00 | 06:24 | 06:53 | 08:31 (3) | 07:21 | 07:54 (3) |
| | 20:55 | 20:34 | 19:51 | 18:42 (3) | 19:02 | 17:18 (4) |
| 5 | 06:00 | 06:25 | 06:54 | 08:26 (3) | 07:22 | 07:54 (3) |
| | 20:55 | 20:33 | 19:50 | 18:47 (3) | 19:01 | 17:19 (4) |
| 6 | 06:01 | 06:26 | 06:55 | 08:22 (3) | 07:23 | 07:55 (3) |
| | 20:54 | 20:32 | 19:48 | 18:51 (3) | 18:59 | 17:20 (4) |
| 7 | 06:01 | 06:27 | 06:56 | 08:19 (3) | 07:24 | 07:55 (3) |
| | 20:54 | 20:31 | 19:46 | 18:53 (3) | 18:57 | 17:21 (4) |
| 8 | 06:02 | 06:27 | 06:57 | 08:16 (3) | 07:25 | 07:55 (3) |
| | 20:54 | 20:29 | 19:45 | 18:55 (3) | 18:56 | 17:22 (4) |
| 9 | 06:03 | 06:28 | 06:58 | 08:14 (3) | 07:26 | 07:56 (3) |
| | 20:53 | 20:28 | 19:43 | 18:57 (3) | 18:54 | 17:23 (4) |
| 10 | 06:03 | 06:29 | 06:58 | 08:11 (3) | 07:27 | 07:57 (3) |
| | 20:53 | 20:27 | 19:41 | 18:58 (3) | 18:53 | 17:24 (4) |
| 11 | 06:04 | 06:30 | 06:59 | 08:10 (3) | 07:28 | 07:57 (3) |
| | 20:53 | 20:26 | 19:40 | 18:59 (3) | 18:51 | 17:24 (4) |
| 12 | 06:05 | 06:31 | 07:00 | 08:08 (3) | 07:29 | 07:58 (3) |
| | 20:52 | 20:25 | 19:38 | 19:00 (3) | 18:50 | 17:25 (4) |
| 13 | 06:05 | 06:32 | 07:01 | 08:07 (3) | 07:30 | 07:59 (3) |
| | 20:52 | 20:23 | 19:37 | 19:01 (3) | 18:48 | 17:25 (4) |
| 14 | 06:06 | 06:33 | 07:02 | 08:05 (3) | 07:31 | 08:00 (3) |
| | 20:51 | 20:22 | 19:35 | 19:02 (3) | 18:47 | 17:26 (4) |
| 15 | 06:07 | 06:34 | 07:03 | 08:04 (3) | 07:32 | 08:02 (3) |
| | 20:51 | 20:21 | 19:33 | 19:03 (3) | 18:45 | 17:26 (4) |
| 16 | 06:07 | 06:35 | 07:04 | 08:03 (3) | 07:33 | 08:03 (3) |
| | 20:50 | 20:19 | 19:32 | 19:04 (3) | 18:44 | 17:27 (4) |
| 17 | 06:08 | 06:36 | 07:05 | 08:02 (3) | 07:34 | 08:05 (3) |
| | 20:50 | 20:18 | 19:30 | 19:05 (3) | 18:42 | 17:27 (4) |
| 18 | 06:09 | 06:37 | 07:06 | 08:01 (3) | 07:35 | 08:08 (3) |
| | 20:49 | 20:17 | 19:28 | 19:05 (3) | 18:41 | 17:27 (4) |
| 19 | 06:10 | 06:38 | 07:07 | 08:00 (3) | 07:36 | 08:11 (3) |
| | 20:48 | 20:15 | 19:27 | 19:06 (3) | 18:39 | 17:28 (4) |
| 20 | 06:11 | 06:39 | 07:08 | 07:58 (3) | 07:37 | 08:16 (3) |
| | 20:48 | 20:14 | 19:25 | 19:05 (3) | 18:38 | 17:28 (4) |
| 21 | 06:11 | 06:40 | 07:09 | 07:57 (3) | 07:39 | 15:48 (4) |
| | 20:47 | 20:12 | 19:23 | 19:05 (3) | 18:36 | 17:29 (4) |
| 22 | 06:12 | 06:41 | 07:10 | 07:57 (3) | 07:40 | 15:47 (4) |
| | 20:46 | 20:11 | 19:22 | 19:06 (3) | 18:35 | 17:29 (4) |
| 23 | 06:13 | 06:42 | 07:11 | 07:56 (3) | 07:41 | 15:46 (4) |
| | 20:45 | 20:09 | 19:20 | 19:06 (3) | 18:34 | 17:29 (4) |
| 24 | 06:14 | 06:43 | 07:12 | 07:56 (3) | 07:42 | 15:45 (4) |
| | 20:45 | 20:08 | 19:18 | 19:06 (3) | 18:32 | 17:29 (4) |
| 25 | 06:15 | 06:43 | 07:12 | 07:55 (3) | 06:43 | 14:44 (4) |
| | 20:44 | 20:06 | 19:17 | 19:06 (3) | 17:31 | 16:29 (4) |
| 26 | 06:16 | 06:44 | 07:13 | 07:55 (3) | 06:44 | 14:45 (4) |
| | 20:43 | 20:05 | 19:15 | 16:56 (4) | 17:30 | 16:29 (4) |
| 27 | 06:16 | 06:45 | 07:14 | 07:54 (3) | 06:45 | 14:44 (4) |
| | 20:42 | 20:03 | 19:14 | 17:03 (4) | 17:28 | 16:29 (4) |
| 28 | 06:17 | 06:46 | 07:15 | 07:54 (3) | 06:46 | 14:44 (4) |
| | 20:41 | 20:02 | 19:12 | 17:07 (4) | 17:27 | 16:29 (4) |
| 29 | 06:18 | 06:47 | 07:16 | 07:54 (3) | 06:47 | 14:43 (4) |
| | 20:40 | 20:00 | 19:10 | 17:09 (4) | 17:26 | 16:29 (4) |
| 30 | 06:19 | 06:48 | 07:17 | 07:54 (3) | 06:48 | 14:43 (4) |
| | 20:39 | 19:59 | 19:09 | 17:12 (4) | 17:25 | 16:29 (4) |
| 31 | 06:20 | 06:49 | | | 06:50 | 14:42 (4) |
| | 20:38 | 19:57 | | | 17:23 | 16:29 (4) |
| Potential sun hours | 455 | 425 | 374 | 347 | 301 | 292 |
| Total, worst case | | | 1683 | | 3854 | 2980 |
| Sun reduction | | | 0.65 | | 0.54 | 0.51 |
| Oper. time red. | | | 0.30 | | 0.30 | 0.30 |
| Wind dir. red. | | | 0.77 | | 0.72 | 0.70 |
| Total reduction | | | 0.15 | | 0.12 | 0.10 |
| Total, real | | | 248 | | 449 | 313 |

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

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

Project:
windpro Seui - flickering

Printed/Page
2023-12-20 10:52 / 8
Licensed user:
Ing. Bruno Manca
Via Vittorio Veneto 231
IT-09028 Sestu
+390702358125
Bruno Manca / ingbrunomanca@gmail.com
Calculated:
2023-12-19 11:53/2.8.579

SHADOW - Calendar

Calculation: shadow flickering Seui - progetto Shadow receptor: G - R07

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

| | January | February | March | April | May | June |
|---------------------|---------|-----------------|-----------------|-----------------|-----------------|-------|
| 1 | 07:44 | 07:32 | 16:08 (4) 06:58 | 07:37 (3) 07:09 | 08:07 (3) 06:25 | 05:57 |
| | 17:09 | 17:42 | 17:08 (4) 18:14 | 17:24 (4) 19:46 | 09:25 (3) 20:16 | 20:44 |
| 2 | 07:44 | 07:31 | 16:07 (4) 06:56 | 07:35 (3) 07:07 | 08:07 (3) 06:24 | 05:57 |
| | 17:09 | 17:43 | 17:09 (4) 18:15 | 17:25 (4) 19:47 | 09:24 (3) 20:17 | 20:45 |
| 3 | 07:44 | 07:30 | 16:06 (4) 06:55 | 07:32 (3) 07:06 | 08:07 (3) 06:22 | 05:57 |
| | 17:10 | 17:44 | 17:11 (4) 18:16 | 17:24 (4) 19:48 | 09:23 (3) 20:18 | 20:46 |
| 4 | 07:45 | 07:29 | 16:05 (4) 06:53 | 07:30 (3) 07:04 | 08:07 (3) 06:21 | 05:56 |
| | 17:11 | 17:45 | 17:12 (4) 18:17 | 17:24 (4) 19:49 | 09:22 (3) 20:19 | 20:47 |
| 5 | 07:45 | 07:28 | 16:04 (4) 06:52 | 07:27 (3) 07:02 | 08:08 (3) 06:20 | 05:56 |
| | 17:12 | 17:46 | 17:14 (4) 18:18 | 17:23 (4) 19:50 | 09:21 (3) 20:20 | 20:47 |
| 6 | 07:45 | 07:27 | 16:03 (4) 06:50 | 07:26 (3) 07:01 | 08:08 (3) 06:19 | 05:56 |
| | 17:13 | 17:48 | 17:15 (4) 18:20 | 17:23 (4) 19:51 | 09:19 (3) 20:21 | 20:48 |
| 7 | 07:45 | 07:26 | 16:01 (4) 06:49 | 07:24 (3) 06:59 | 08:08 (3) 06:18 | 05:55 |
| | 17:14 | 17:49 | 17:15 (4) 18:21 | 17:22 (4) 19:52 | 09:18 (3) 20:22 | 20:48 |
| 8 | 07:44 | 07:25 | 16:00 (4) 06:47 | 07:23 (3) 06:58 | 08:09 (3) 06:16 | 05:55 |
| | 17:15 | 17:50 | 17:16 (4) 18:22 | 17:22 (4) 19:53 | 09:17 (3) 20:23 | 20:49 |
| 9 | 07:44 | 07:24 | 16:00 (4) 06:46 | 07:21 (3) 06:56 | 08:09 (3) 06:15 | 05:55 |
| | 17:16 | 17:51 | 17:18 (4) 18:23 | 17:21 (4) 19:54 | 09:15 (3) 20:24 | 20:50 |
| 10 | 07:44 | 07:23 | 15:59 (4) 06:44 | 07:19 (3) 06:55 | 08:10 (3) 06:14 | 05:55 |
| | 17:17 | 17:52 | 17:19 (4) 18:24 | 17:20 (4) 19:55 | 09:14 (3) 20:25 | 20:50 |
| 11 | 07:44 | 07:22 | 15:58 (4) 06:42 | 07:18 (3) 06:53 | 08:11 (3) 06:13 | 05:55 |
| | 17:18 | 17:54 | 17:20 (4) 18:25 | 17:19 (4) 19:56 | 09:12 (3) 20:26 | 20:51 |
| 12 | 07:44 | 07:20 | 15:58 (4) 06:41 | 07:17 (3) 06:52 | 08:12 (3) 06:12 | 05:54 |
| | 17:19 | 17:55 | 17:21 (4) 18:26 | 17:18 (4) 19:57 | 09:11 (3) 20:27 | 20:51 |
| 13 | 07:44 | 07:19 | 15:56 (4) 06:39 | 07:16 (3) 06:50 | 08:13 (3) 06:11 | 05:54 |
| | 17:20 | 17:56 | 17:21 (4) 18:27 | 17:18 (4) 19:58 | 09:09 (3) 20:28 | 20:52 |
| 14 | 07:43 | 07:18 | 15:56 (4) 06:38 | 07:15 (3) 06:49 | 08:14 (3) 06:10 | 05:54 |
| | 17:21 | 17:57 | 17:22 (4) 18:28 | 17:16 (4) 19:59 | 09:07 (3) 20:29 | 20:52 |
| 15 | 07:43 | 07:17 | 15:56 (4) 06:36 | 07:14 (3) 06:47 | 08:15 (3) 06:09 | 05:54 |
| | 17:22 | 17:58 | 17:22 (4) 18:29 | 17:15 (4) 20:00 | 09:05 (3) 20:30 | 20:52 |
| 16 | 07:43 | 07:16 | 15:56 (4) 06:35 | 07:13 (3) 06:46 | 08:17 (3) 06:08 | 05:54 |
| | 17:23 | 17:59 | 17:23 (4) 18:30 | 17:14 (4) 20:01 | 09:03 (3) 20:31 | 20:53 |
| 17 | 07:42 | 07:14 | 15:54 (4) 06:33 | 07:12 (3) 06:44 | 08:18 (3) 06:07 | 05:54 |
| | 17:24 | 18:01 | 17:23 (4) 18:31 | 17:12 (4) 20:02 | 09:00 (3) 20:32 | 20:53 |
| 18 | 07:42 | 07:13 | 15:54 (4) 06:31 | 07:12 (3) 06:43 | 08:20 (3) 06:07 | 05:54 |
| | 17:25 | 18:02 | 17:24 (4) 18:32 | 17:11 (4) 20:03 | 08:58 (3) 20:33 | 20:54 |
| 19 | 07:41 | 07:12 | 15:54 (4) 06:30 | 07:11 (3) 06:41 | 08:22 (3) 06:06 | 05:55 |
| | 17:26 | 18:03 | 17:25 (4) 18:33 | 17:10 (4) 20:04 | 08:54 (3) 20:34 | 20:54 |
| 20 | 07:41 | 07:10 | 15:53 (4) 06:28 | 07:10 (3) 06:40 | 08:25 (3) 06:05 | 05:55 |
| | 17:28 | 18:04 | 17:24 (4) 18:34 | 17:07 (4) 20:05 | 08:51 (3) 20:35 | 20:54 |
| 21 | 07:40 | 07:09 | 15:53 (4) 06:27 | 07:10 (3) 06:38 | 08:30 (3) 06:04 | 05:55 |
| | 17:29 | 18:05 | 17:25 (4) 18:35 | 17:06 (4) 20:06 | 08:47 (3) 20:36 | 20:54 |
| 22 | 07:40 | 07:08 | 15:52 (4) 06:25 | 07:09 (3) 06:37 | 06:03 | 05:55 |
| | 17:30 | 18:06 | 17:24 (4) 18:36 | 17:04 (4) 20:07 | 20:36 | 20:55 |
| 23 | 07:39 | 16:28 (4) 07:06 | 15:53 (4) 06:23 | 07:09 (3) 06:35 | 06:03 | 05:55 |
| | 17:31 | 16:44 (4) 18:07 | 17:25 (4) 18:37 | 17:02 (4) 20:08 | 20:37 | 20:55 |
| 24 | 07:38 | 16:23 (4) 07:05 | 15:53 (4) 06:22 | 07:08 (3) 06:34 | 06:02 | 05:56 |
| | 17:32 | 16:48 (4) 18:09 | 17:25 (4) 18:38 | 17:00 (4) 20:09 | 20:38 | 20:55 |
| 25 | 07:38 | 16:21 (4) 07:03 | 15:52 (4) 06:20 | 07:08 (3) 06:33 | 06:01 | 05:56 |
| | 17:33 | 16:53 (4) 18:10 | 17:25 (4) 18:39 | 16:57 (4) 20:10 | 20:39 | 20:55 |
| 26 | 07:37 | 16:18 (4) 07:02 | 15:53 (4) 06:18 | 07:08 (3) 06:31 | 06:01 | 05:56 |
| | 17:34 | 16:55 (4) 18:11 | 17:25 (4) 18:40 | 16:54 (4) 20:11 | 20:40 | 20:55 |
| 27 | 07:36 | 16:16 (4) 07:01 | 07:46 (3) 06:17 | 07:07 (3) 06:30 | 06:00 | 05:56 |
| | 17:36 | 16:58 (4) 18:12 | 17:25 (4) 18:41 | 16:50 (4) 20:12 | 20:41 | 20:55 |
| 28 | 07:35 | 16:14 (4) 06:59 | 07:42 (3) 06:15 | 07:07 (3) 06:29 | 05:59 | 05:57 |
| | 17:37 | 17:00 (4) 18:13 | 17:25 (4) 18:42 | 16:45 (4) 20:13 | 20:41 | 20:55 |
| 29 | 07:35 | 16:12 (4) | 07:14 | 08:07 (3) 06:27 | 05:59 | 05:57 |
| | 17:38 | 17:02 (4) | 19:43 | 09:28 (3) 20:14 | 20:42 | 20:55 |
| 30 | 07:34 | 16:10 (4) | 07:12 | 08:07 (3) 06:26 | 05:58 | 05:58 |
| | 17:39 | 17:04 (4) | 19:44 | 09:27 (3) 20:15 | 20:43 | 20:55 |
| 31 | 07:33 | 16:10 (4) | 07:10 | 08:07 (3) | 05:58 | |
| | 17:40 | 17:06 (4) | 19:45 | 09:26 (3) | 20:44 | |
| Potential sun hours | 301 | 299 | 370 | 397 | 445 | 448 |
| Total, worst case | 358 | 2362 | 4200 | 1198 | | |
| Sun reduction | 0.45 | 0.47 | 0.49 | 0.53 | | |
| Oper. time red. | 0.30 | 0.30 | 0.30 | | | |
| Wind dir. red. | 0.75 | 0.75 | 0.77 | 0.78 | | |
| Total reduction | 0.10 | 0.11 | 0.11 | 0.12 | | |
| Total, real | 36 | 249 | 472 | 147 | | |

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) |

Project:
windpro Seui - flickering

Printed/Page
2023-12-20 10:52 / 9
Licensed user:
Ing. Bruno Manca
Via Vittorio Veneto 231
IT-09028 Sestu
+390702358125
Bruno Manca / ingbrunomanca@gmail.com
Calculated:
2023-12-19 11:53/2.8.579

SHADOW - Calendar

Calculation: shadow flickering Seui - progetto Shadow receptor: G - R07

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

| | July | August | September | October | November | December | | | |
|---------------------|----------------|----------------|----------------|------------------------|----------------|------------------------|----------------|------------------------|----------------|
| 1 | 05:58 20:55 | 06:21 20:37 | 06:50 19:56 | 08:10 (3) 19:11 (3) | 07:18 19:07 | 07:56 (3) 17:57 (4) | 06:51 17:22 | 15:29 (4) 16:48 (4) | 07:24 16:59 |
| 2 | 05:59 20:55 | 06:22 20:36 | 06:51 19:54 | 08:08 (3) 09:12 (3) | 07:19 19:05 | 07:57 (3) 17:58 (4) | 06:52 17:21 | 15:30 (4) 16:47 (4) | 07:25 16:59 |
| 3 | 05:59 20:55 | 06:23 20:35 | 06:52 19:53 | 08:07 (3) 09:13 (3) | 07:20 19:04 | 07:57 (3) 17:58 (4) | 06:53 17:20 | 15:30 (4) 16:46 (4) | 07:26 16:59 |
| 4 | 06:00 20:55 | 06:24 20:34 | 06:53 19:51 | 08:06 (3) 09:14 (3) | 07:21 19:02 | 07:58 (3) 17:58 (4) | 06:54 17:19 | 15:31 (4) 16:45 (4) | 07:27 16:59 |
| 5 | 06:00 20:55 | 06:25 20:33 | 06:54 19:49 | 08:05 (3) 09:15 (3) | 07:22 19:01 | 07:59 (3) 17:58 (4) | 06:55 17:18 | 15:33 (4) 16:45 (4) | 07:28 16:58 |
| 6 | 06:01 20:54 | 06:26 20:32 | 06:55 19:48 | 08:04 (3) 09:15 (3) | 07:23 18:59 | 08:00 (3) 17:58 (4) | 06:56 17:17 | 15:34 (4) 16:43 (4) | 07:29 16:58 |
| 7 | 06:01 20:54 | 06:27 20:31 | 06:56 19:46 | 08:03 (3) 09:16 (3) | 07:24 18:57 | 08:01 (3) 17:58 (4) | 06:57 17:15 | 15:35 (4) 16:42 (4) | 07:30 16:58 |
| 8 | 06:02 20:54 | 06:27 20:29 | 06:57 19:45 | 08:02 (3) 09:17 (3) | 07:25 18:56 | 08:02 (3) 17:58 (4) | 06:59 17:14 | 15:36 (4) 16:41 (4) | 07:31 16:58 |
| 9 | 06:03 20:53 | 06:28 20:28 | 06:58 19:43 | 08:02 (3) 09:17 (3) | 07:26 18:54 | 08:04 (3) 17:58 (4) | 07:00 17:13 | 15:37 (4) 16:39 (4) | 07:32 16:58 |
| 10 | 06:03 20:53 | 06:29 20:27 | 06:58 19:41 | 08:00 (3) 09:17 (3) | 07:27 18:53 | 08:05 (3) 17:58 (4) | 07:01 17:12 | 15:39 (4) 16:39 (4) | 07:32 16:58 |
| 11 | 06:04 20:53 | 06:30 20:26 | 06:59 19:40 | 07:59 (3) 09:17 (3) | 07:28 18:51 | 08:07 (3) 17:58 (4) | 07:02 17:12 | 15:41 (4) 16:37 (4) | 07:33 16:58 |
| 12 | 06:05 20:52 | 06:31 20:24 | 07:00 19:38 | 07:59 (3) 09:17 (3) | 07:29 18:50 | 08:09 (3) 17:58 (4) | 07:03 17:11 | 15:42 (4) 16:35 (4) | 07:34 16:59 |
| 13 | 06:05 20:52 | 06:32 20:23 | 07:01 19:37 | 07:58 (3) 09:18 (3) | 07:30 18:48 | 08:12 (3) 17:58 (4) | 07:04 17:10 | 15:44 (4) 16:34 (4) | 07:35 16:59 |
| 14 | 06:06 20:51 | 06:33 20:22 | 07:02 19:35 | 07:57 (3) 09:18 (3) | 07:31 18:47 | 08:16 (3) 17:58 (4) | 07:05 17:09 | 15:47 (4) 16:33 (4) | 07:36 16:59 |
| 15 | 06:07 20:51 | 06:34 20:21 | 07:03 19:33 | 07:57 (3) 17:34 (4) | 07:32 18:45 | 08:22 (3) 17:57 (4) | 07:07 17:08 | 15:49 (4) 16:31 (4) | 07:36 16:59 |
| 16 | 06:07 20:50 | 06:35 20:19 | 07:04 19:32 | 07:57 (3) 17:39 (4) | 07:33 18:44 | 16:24 (4) 17:57 (4) | 07:08 17:07 | 15:51 (4) 16:28 (4) | 07:37 16:59 |
| 17 | 06:08 20:50 | 06:36 20:18 | 07:05 19:30 | 07:56 (3) 17:42 (4) | 07:34 18:42 | 16:24 (4) 17:56 (4) | 07:09 17:06 | 15:54 (4) 16:26 (4) | 07:38 17:00 |
| 18 | 06:09 20:49 | 06:37 20:17 | 07:06 19:28 | 07:56 (3) 17:45 (4) | 07:35 18:41 | 16:23 (4) 17:56 (4) | 07:10 17:06 | 15:57 (4) 16:22 (4) | 07:38 17:00 |
| 19 | 06:10 20:48 | 06:38 20:15 | 07:07 19:27 | 07:56 (3) 17:47 (4) | 07:36 18:39 | 16:24 (4) 17:56 (4) | 07:11 17:05 | 16:03 (4) 16:19 (4) | 07:39 17:00 |
| 20 | 06:11 20:48 | 06:39 20:14 | 07:08 19:25 | 07:54 (3) 17:47 (4) | 07:37 18:38 | 16:24 (4) 17:56 (4) | 07:12 17:04 | 07:40 17:01 | 07:40 17:01 |
| 21 | 06:11 20:47 | 06:40 20:12 | 07:09 19:23 | 07:54 (3) 17:49 (4) | 07:39 18:36 | 16:24 (4) 17:55 (4) | 07:13 17:04 | 07:40 17:01 | 07:40 17:01 |
| 22 | 06:12 20:46 | 06:41 20:11 | 07:10 19:22 | 07:54 (3) 17:50 (4) | 07:40 18:35 | 16:24 (4) 17:55 (4) | 07:14 17:03 | 07:41 17:02 | 07:41 17:02 |
| 23 | 06:13 20:45 | 06:42 20:09 | 07:11 19:20 | 07:54 (3) 17:51 (4) | 07:41 18:34 | 16:24 (4) 17:54 (4) | 07:16 17:03 | 07:41 17:02 | 07:41 17:02 |
| 24 | 06:14 20:45 | 06:43 20:08 | 07:12 19:18 | 07:54 (3) 17:53 (4) | 07:42 18:32 | 16:24 (4) 17:53 (4) | 07:17 17:02 | 07:42 17:03 | 07:42 17:03 |
| 25 | 06:15 20:44 | 06:43 20:06 | 07:12 19:17 | 07:54 (3) 17:53 (4) | 07:43 17:31 | 15:24 (4) 16:53 (4) | 07:18 17:02 | 07:42 17:03 | 07:42 17:03 |
| 26 | 06:16 20:43 | 06:44 20:05 | 07:13 19:15 | 07:54 (3) 17:54 (4) | 07:44 17:30 | 15:25 (4) 16:53 (4) | 07:19 17:01 | 07:42 17:04 | 07:42 17:04 |
| 27 | 06:16 20:42 | 06:45 20:03 | 07:14 19:14 | 07:55 (3) 17:55 (4) | 07:45 17:28 | 15:26 (4) 16:52 (4) | 07:20 17:01 | 07:43 17:05 | 07:43 17:05 |
| 28 | 06:17 20:41 | 06:46 20:02 | 07:15 19:12 | 07:55 (3) 17:56 (4) | 07:46 17:27 | 15:26 (4) 16:51 (4) | 07:21 17:00 | 07:43 17:05 | 07:43 17:05 |
| 29 | 06:18 20:40 | 06:47 20:00 | 07:16 19:10 | 07:55 (3) 17:56 (4) | 07:47 17:26 | 15:26 (4) 16:50 (4) | 07:22 17:00 | 07:43 17:06 | 07:43 17:06 |
| 30 | 06:19 20:39 | 06:48 19:59 | 07:17 19:09 | 07:56 (3) 17:57 (4) | 07:48 17:25 | 15:27 (4) 16:49 (4) | 07:23 17:00 | 07:44 17:07 | 07:44 17:07 |
| 31 | 06:20 20:38 | 06:49 19:57 | 07:18 19:08 | 07:56 (3) 17:57 (4) | 07:49 17:24 | 15:27 (4) 16:48 (4) | 07:24 17:00 | 07:44 17:08 | 07:44 17:08 |
| Potential sun hours | 455 | 425 | 374 | 347 | 354 | 301 | 1058 | 292 | |
| Total, worst case | | 423 | 3204 | | 3540 | | 1058 | | |
| Sun reduction | | 0.73 | 0.65 | | 0.54 | | 0.51 | | |
| Oper. time red. | | 0.30 | 0.30 | | 0.30 | | 0.30 | | |
| Wind dir. red. | | 0.78 | 0.77 | | 0.76 | | 0.75 | | |
| Total reduction | | 0.17 | 0.15 | | 0.12 | | 0.11 | | |
| Total, real | | 72 | 476 | | 434 | | 119 | | |

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) |

Project:

windpro Seui - flickering

Printed/Page

2023-12-20 10:52 / 10

Licensed user:

Ing. Bruno Manca

Via Vittorio Veneto 231

IT-09028 Sestu

+390702358125

Bruno Manca / ingbrunomanca@gmail.com

Calculated:

2023-12-19 11:53/2.8.579

SHADOW - Calendar

Calculation: shadow flickering Seui - progetto Shadow receptor: H - R08

Assumptions for shadow calculations

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

| | | | | | | | | | | | |
|------|------|------|------|------|------|-------|-------|------|------|------|------|
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| 4.40 | 5.05 | 5.88 | 7.00 | 8.45 | 9.88 | 10.82 | 10.03 | 8.08 | 6.09 | 5.07 | 4.27 |

Operational time

| | | | | | | | | | | | | |
|----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-------|
| N | NNE | ENE | E | ESE | SSE | S | SSW | WSW | W | WNW | NNW | Sum |
| 86 | 55 | 78 | 159 | 368 | 188 | 65 | 104 | 357 | 605 | 339 | 206 | 2,610 |

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

| | January | February | March | April | May | June | | | |
|---------------------|---------|-----------|-----------|-------|-----------|-----------|-----------|-------|-------|
| 1 | 07:44 | 16:05 (7) | 07:32 | 06:58 | 07:09 | 18:19 (5) | 06:25 | 05:57 | |
| | 17:09 | 38 | 16:43 (7) | 17:42 | 18:14 | | 18:55 (5) | 20:16 | 20:44 |
| 2 | 07:44 | 16:05 (7) | 07:31 | 06:56 | 07:07 | 36 | 18:20 (5) | 06:24 | 05:57 |
| | 17:09 | 39 | 16:44 (7) | 17:43 | 18:15 | | 18:52 (5) | 20:17 | 20:45 |
| 3 | 07:44 | 16:06 (7) | 07:30 | 06:55 | 07:06 | 32 | 18:22 (5) | 06:22 | 05:57 |
| | 17:10 | 39 | 16:45 (7) | 17:44 | 18:16 | | 18:51 (5) | 20:18 | 20:46 |
| 4 | 07:45 | 16:06 (7) | 07:29 | 06:53 | 07:04 | 29 | 18:24 (5) | 06:21 | 05:56 |
| | 17:11 | 40 | 16:46 (7) | 17:45 | 18:17 | | 18:48 (5) | 20:19 | 20:47 |
| 5 | 07:45 | 16:07 (7) | 07:28 | 06:52 | 17:42 (5) | 24 | 18:27 (5) | 06:20 | 05:56 |
| | 17:12 | 39 | 16:46 (7) | 17:46 | 18:18 | | 18:45 (5) | 20:20 | 20:47 |
| 6 | 07:45 | 16:08 (7) | 07:27 | 06:50 | 17:35 (5) | 18 | 18:33 (5) | 06:19 | 05:56 |
| | 17:13 | 38 | 16:46 (7) | 17:48 | 18:20 | | 18:38 (5) | 20:21 | 20:48 |
| 7 | 07:45 | 16:09 (7) | 07:26 | 06:49 | 17:31 (5) | 5 | | 06:18 | 05:55 |
| | 17:14 | 38 | 16:47 (7) | 17:49 | 18:21 | | | 20:22 | 20:48 |
| 8 | 07:44 | 16:10 (7) | 07:25 | 06:47 | 17:29 (5) | 24 | | 06:16 | 05:55 |
| | 17:15 | 37 | 16:47 (7) | 17:50 | 18:22 | | | 20:23 | 20:49 |
| 9 | 07:44 | 16:11 (7) | 07:24 | 06:46 | 17:26 (5) | 29 | | 06:15 | 05:55 |
| | 17:16 | 36 | 16:47 (7) | 17:51 | 18:23 | | | 20:24 | 20:50 |
| 10 | 07:44 | 16:11 (7) | 07:23 | 06:44 | 17:24 (5) | 33 | | 06:14 | 05:55 |
| | 17:17 | 36 | 16:47 (7) | 17:52 | 18:24 | | | 20:25 | 20:50 |
| 11 | 07:44 | 16:12 (7) | 07:22 | 06:42 | 17:23 (5) | 36 | | 06:13 | 05:55 |
| | 17:18 | 35 | 16:47 (7) | 17:54 | 18:25 | | | 20:26 | 20:51 |
| 12 | 07:44 | 16:13 (7) | 07:20 | 06:41 | 17:21 (5) | 39 | | 06:12 | 05:54 |
| | 17:19 | 34 | 16:47 (7) | 17:55 | 18:26 | | | 20:27 | 20:51 |
| 13 | 07:44 | 16:13 (7) | 07:19 | 06:39 | 17:20 (5) | 42 | | 06:11 | 05:54 |
| | 17:20 | 33 | 16:46 (7) | 17:56 | 18:27 | | | 20:28 | 20:52 |
| 14 | 07:43 | 16:15 (7) | 07:18 | 06:38 | 17:19 (5) | 44 | | 06:10 | 05:54 |
| | 17:21 | 31 | 16:46 (7) | 17:57 | 18:28 | | | 20:29 | 20:52 |
| 15 | 07:43 | 16:16 (7) | 07:17 | 06:36 | 17:18 (5) | 45 | | 06:09 | 05:54 |
| | 17:22 | 30 | 16:46 (7) | 17:58 | 18:29 | | | 20:30 | 20:52 |
| 16 | 07:42 | 16:17 (7) | 07:16 | 06:35 | 17:17 (5) | 46 | | 06:08 | 05:54 |
| | 17:23 | 28 | 16:45 (7) | 17:59 | 18:30 | | | 20:31 | 20:53 |
| 17 | 07:42 | 16:18 (7) | 07:14 | 06:33 | 17:16 (5) | 48 | | 06:07 | 05:54 |
| | 17:24 | 27 | 16:45 (7) | 18:01 | 18:31 | | | 20:32 | 20:53 |
| 18 | 07:42 | 16:19 (7) | 07:13 | 06:31 | 17:16 (5) | 49 | | 06:07 | 05:54 |
| | 17:25 | 25 | 16:44 (7) | 18:02 | 18:32 | | | 20:33 | 20:54 |
| 19 | 07:41 | 16:22 (7) | 07:12 | 06:30 | 17:15 (5) | 50 | | 06:06 | 05:55 |
| | 17:26 | 22 | 16:44 (7) | 18:03 | 18:33 | | | 20:34 | 20:54 |
| 20 | 07:41 | 16:23 (7) | 07:10 | 06:28 | 17:15 (5) | 50 | | 06:05 | 05:55 |
| | 17:28 | 19 | 16:42 (7) | 18:04 | 18:34 | | | 20:35 | 20:54 |
| 21 | 07:40 | 16:25 (7) | 07:09 | 06:27 | 17:15 (5) | 50 | | 06:04 | 05:55 |
| | 17:29 | 15 | 16:40 (7) | 18:05 | 18:35 | | | 20:35 | 20:54 |
| 22 | 07:40 | 16:29 (7) | 07:08 | 06:25 | 17:14 (5) | 50 | | 06:03 | 05:55 |
| | 17:30 | 9 | 16:38 (7) | 18:06 | 18:36 | | | 20:36 | 20:55 |
| 23 | 07:39 | | 07:06 | 06:23 | 17:15 (5) | 50 | | 06:03 | 05:55 |
| | 17:31 | | 18:07 | 18:37 | 18:04 (5) | | | 20:37 | 20:55 |
| 24 | 07:38 | | 07:05 | 06:22 | 17:15 (5) | 49 | | 06:02 | 05:56 |
| | 17:32 | | 18:09 | 18:38 | 18:03 (5) | | | 20:38 | 20:55 |
| 25 | 07:38 | | 07:03 | 06:20 | 17:14 (5) | 48 | | 06:01 | 05:56 |
| | 17:33 | | 18:10 | 18:39 | 18:02 (5) | | | 20:39 | 20:55 |
| 26 | 07:37 | | 07:02 | 06:18 | 17:15 (5) | 48 | | 06:01 | 05:56 |
| | 17:34 | | 18:11 | 18:40 | 18:02 (5) | | | 20:40 | 20:55 |
| 27 | 07:36 | | 07:01 | 06:17 | 17:15 (5) | 47 | | 06:00 | 05:56 |
| | 17:36 | | 18:12 | 18:41 | 18:01 (5) | | | 20:41 | 20:55 |
| 28 | 07:35 | | 06:59 | 06:15 | 17:15 (5) | 46 | | 05:59 | 05:57 |
| | 17:37 | | 18:13 | 18:42 | 18:00 (5) | | | 20:42 | 20:55 |
| 29 | 07:35 | | | 07:14 | 18:16 (5) | 45 | | 05:59 | 05:57 |
| | 17:38 | | | 19:43 | 18:59 (5) | | | 20:43 | 20:55 |
| 30 | 07:34 | | | 07:12 | 18:17 (5) | 43 | | 05:58 | 05:58 |
| | 17:39 | | | 19:44 | 18:57 (5) | | | 20:44 | 20:55 |
| 31 | 07:33 | | | 07:10 | 18:18 (5) | 40 | | 05:58 | |
| | 17:40 | | | 19:45 | 18:57 (5) | | | 20:44 | |
| Potential sun hours | 301 | 299 | 370 | 397 | 445 | 448 | | | |
| Total, worst case | 688 | | 1111 | 144 | | | | | |
| Sun reduction | 0.45 | | 0.49 | 0.53 | | | | | |
| Oper. time red. | 0.30 | | 0.30 | 0.30 | | | | | |
| Wind dir. red. | 0.69 | | 0.79 | 0.79 | | | | | |
| Total reduction | 0.09 | | 0.12 | 0.12 | | | | | |
| Total, real | 63 | | 129 | 18 | | | | | |

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) |

Project:
windpro Seui - flickering

Printed/Page
2023-12-20 10:52 / 11
Licensed user:
Ing. Bruno Manca
Via Vittorio Veneto 231
IT-09028 Sestu
+390702358125
Bruno Manca / ingbrunomanca@gmail.com
Calculated:
2023-12-19 11:53/2.8.579

SHADOW - Calendar

Calculation: shadow flickering Seui - progetto Shadow receptor: H - R08

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

| | July | August | September | October | November | December |
|---------------------|----------------|----------------|----------------|------------------------|------------------------|------------------------|
| 1 | 05:58 20:55 | 06:21 20:37 | 06:50 19:56 | 07:18 19:07 | 18:00 (5) 18:43 (5) | 06:51 17:22 |
| 2 | 05:59 20:55 | 06:22 20:36 | 06:51 19:54 | 07:19 19:05 | 18:01 (5) 18:41 (5) | 06:52 17:21 |
| 3 | 05:59 20:55 | 06:23 20:35 | 06:52 19:53 | 07:20 19:04 | 18:02 (5) 18:40 (5) | 06:53 17:20 |
| 4 | 06:00 20:55 | 06:24 20:34 | 06:53 19:51 | 07:21 19:02 | 18:03 (5) 18:38 (5) | 06:54 17:19 |
| 5 | 06:00 20:54 | 06:25 20:33 | 06:54 19:49 | 07:22 19:01 | 18:04 (5) 18:36 (5) | 06:55 17:18 |
| 6 | 06:01 20:54 | 06:26 20:32 | 06:55 19:48 | 18:29 (5) 18:33 (5) | 07:23 18:06 (5) | 06:56 17:17 |
| 7 | 06:01 20:54 | 06:27 20:31 | 06:56 19:46 | 18:23 (5) 18:40 (5) | 07:24 18:09 (5) | 06:57 17:15 |
| 8 | 06:02 20:54 | 06:27 20:29 | 06:57 19:45 | 18:19 (5) 18:43 (5) | 07:25 18:04 (5) | 06:59 17:14 |
| 9 | 06:03 20:53 | 06:28 20:28 | 06:58 19:43 | 18:16 (5) 18:45 (5) | 07:26 17:13 | 07:00 16:58 |
| 10 | 06:03 20:53 | 06:29 20:27 | 06:58 19:41 | 18:13 (5) 18:45 (5) | 07:27 17:12 | 07:01 16:58 |
| 11 | 06:04 20:53 | 06:30 20:26 | 06:59 19:40 | 18:11 (5) 18:47 (5) | 07:28 17:12 | 07:02 16:58 |
| 12 | 06:05 20:52 | 06:31 20:24 | 07:00 19:38 | 18:10 (5) 18:48 (5) | 07:29 17:11 | 07:03 16:59 |
| 13 | 06:05 20:52 | 06:32 20:23 | 07:01 19:37 | 18:08 (5) 18:48 (5) | 07:30 17:10 | 07:04 16:59 |
| 14 | 06:06 20:51 | 06:33 20:22 | 07:02 19:35 | 18:07 (5) 18:49 (5) | 07:31 17:09 | 07:05 16:59 |
| 15 | 06:07 20:51 | 06:34 20:21 | 07:03 19:33 | 18:06 (5) 18:50 (5) | 07:32 17:08 | 07:06 16:59 |
| 16 | 06:07 20:50 | 06:35 20:19 | 07:04 19:32 | 18:04 (5) 18:50 (5) | 07:33 17:07 | 07:07 16:59 |
| 17 | 06:08 20:50 | 06:36 20:18 | 07:05 19:30 | 18:04 (5) 18:50 (5) | 07:34 17:06 | 07:08 17:00 |
| 18 | 06:09 20:49 | 06:37 20:17 | 07:06 19:28 | 18:03 (5) 18:51 (5) | 07:35 17:06 | 07:09 17:00 |
| 19 | 06:10 20:48 | 06:38 20:15 | 07:07 19:27 | 18:02 (5) 18:51 (5) | 07:36 17:05 | 07:10 17:00 |
| 20 | 06:11 20:48 | 06:39 20:14 | 07:08 19:25 | 18:00 (5) 18:50 (5) | 07:37 17:04 | 16:04 (7) 16:13 (7) |
| 21 | 06:11 20:47 | 06:40 20:12 | 07:09 19:23 | 18:00 (5) 18:50 (5) | 07:39 17:04 | 16:01 (7) 16:16 (7) |
| 22 | 06:12 20:46 | 06:41 20:11 | 07:10 19:22 | 17:59 (5) 18:49 (5) | 07:40 17:03 | 15:59 (7) 16:18 (7) |
| 23 | 06:13 20:45 | 06:42 20:09 | 07:11 19:20 | 17:59 (5) 18:49 (5) | 07:41 17:03 | 15:58 (7) 16:20 (7) |
| 24 | 06:14 20:45 | 06:43 20:08 | 07:12 19:18 | 17:59 (5) 18:49 (5) | 07:42 17:02 | 15:56 (7) 16:21 (7) |
| 25 | 06:15 20:44 | 06:43 20:06 | 07:12 19:17 | 17:59 (5) 18:48 (5) | 06:43 17:31 | 15:57 (7) 16:23 (7) |
| 26 | 06:16 20:43 | 06:44 20:05 | 07:13 19:15 | 17:59 (5) 18:47 (5) | 06:44 17:30 | 15:56 (7) 16:24 (7) |
| 27 | 06:16 20:42 | 06:45 20:03 | 07:14 19:14 | 17:59 (5) 18:47 (5) | 06:45 17:28 | 15:55 (7) 16:25 (7) |
| 28 | 06:17 20:41 | 06:46 20:02 | 07:15 19:12 | 17:59 (5) 18:46 (5) | 06:46 17:27 | 15:55 (7) 16:26 (7) |
| 29 | 06:18 20:40 | 06:47 20:00 | 07:16 19:10 | 17:59 (5) 18:45 (5) | 06:47 17:26 | 15:54 (7) 16:27 (7) |
| 30 | 06:19 20:39 | 06:48 19:59 | 07:17 19:09 | 18:00 (5) 18:44 (5) | 06:48 17:25 | 15:54 (7) 16:28 (7) |
| 31 | 06:20 20:38 | 06:49 19:57 | 06:49 19:09 | 06:50 17:23 | 17:00 | 07:44 17:08 |
| Potential sun hours | 455 | 425 | 374 | 347 | 301 | 292 |
| Total, worst case | | | 1027 | 249 | 272 | 1162 |
| Sun reduction | | | 0.65 | 0.54 | 0.51 | 0.45 |
| Oper. time red. | | | 0.30 | 0.30 | 0.30 | 0.30 |
| Wind dir. red. | | | 0.79 | 0.79 | 0.69 | 0.69 |
| Total reduction | | | 0.15 | 0.13 | 0.10 | 0.09 |
| Total, real | | | 156 | 32 | 28 | 107 |

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

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

Project:
windpro Seui - flickering

Printed/Page
2023-12-20 10:52 / 12

Licensed user:
Ing. Bruno Manca
Via Vittorio Veneto 231
IT-09028 Sestu
+390702358125
Bruno Manca / ingbrunomanca@gmail.com
Calculated:
2023-12-19 11:53/2.8.579

SHADOW - Calendar

Calculation: shadow flickering Seui - progetto Shadow receptor: I - R09

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

| | January | February | March | April | May | June | |
|---------------------|---------|------------------|------------------|-------|-------|-----------------|-----------|
| 1 | 07:44 | 08:50 (10) 07:32 | 09:19 (10) 06:58 | 07:09 | 06:25 | 19:14 (8) 05:57 | 18:47 (9) |
| | 17:09 | 10:31 (10) 17:42 | 10:18 (10) 18:14 | 19:46 | 20:16 | 19:46 (8) 20:44 | 19:55 (9) |
| 2 | 07:44 | 08:51 (10) 07:31 | 09:21 (10) 06:56 | 07:07 | 06:24 | 19:13 (8) 05:57 | 18:47 (9) |
| | 17:09 | 10:31 (10) 17:43 | 10:16 (10) 18:15 | 19:47 | 20:17 | 19:45 (8) 20:45 | 19:56 (9) |
| 3 | 07:44 | 08:51 (10) 07:30 | 09:23 (10) 06:55 | 07:06 | 06:22 | 19:13 (8) 05:57 | 18:48 (9) |
| | 17:10 | 10:32 (10) 17:44 | 10:13 (10) 18:16 | 19:48 | 20:18 | 19:45 (8) 20:46 | 19:57 (9) |
| 4 | 07:44 | 08:52 (10) 07:29 | 09:25 (10) 06:53 | 07:04 | 06:21 | 19:14 (8) 05:56 | 18:47 (9) |
| | 17:11 | 10:32 (10) 17:45 | 10:11 (10) 18:17 | 19:49 | 20:19 | 19:45 (8) 20:46 | 19:57 (9) |
| 5 | 07:45 | 08:53 (10) 07:28 | 09:28 (10) 06:52 | 07:02 | 06:20 | 19:14 (8) 05:56 | 18:47 (9) |
| | 17:12 | 10:32 (10) 17:46 | 10:08 (10) 18:18 | 19:50 | 20:20 | 19:44 (8) 20:47 | 19:58 (9) |
| 6 | 07:45 | 08:53 (10) 07:27 | 09:31 (10) 06:50 | 07:01 | 06:19 | 19:14 (8) 05:56 | 18:47 (9) |
| | 17:13 | 10:32 (10) 17:48 | 10:03 (10) 18:20 | 19:51 | 20:21 | 19:44 (8) 20:48 | 19:59 (9) |
| 7 | 07:44 | 08:54 (10) 07:26 | 09:35 (10) 06:49 | 06:59 | 06:18 | 19:15 (8) 05:55 | 18:47 (9) |
| | 17:14 | 10:33 (10) 17:49 | 09:59 (10) 18:21 | 19:52 | 20:22 | 19:43 (8) 20:48 | 19:59 (9) |
| 8 | 07:44 | 08:55 (10) 07:25 | 09:43 (10) 06:47 | 06:58 | 06:16 | 19:16 (8) 05:55 | 18:46 (9) |
| | 17:15 | 10:33 (10) 17:50 | 09:51 (10) 18:22 | 19:53 | 20:23 | 19:43 (8) 20:49 | 19:59 (9) |
| 9 | 07:44 | 08:55 (10) 07:24 | 06:46 | 06:56 | 06:15 | 19:16 (8) 05:55 | 18:46 (9) |
| | 17:16 | 10:32 (10) 17:51 | 18:23 | 19:54 | 20:24 | 19:42 (8) 20:50 | 20:00 (9) |
| 10 | 07:44 | 08:56 (10) 07:23 | 06:44 | 06:55 | 06:14 | 19:17 (8) 05:55 | 18:46 (9) |
| | 17:17 | 10:32 (10) 17:52 | 18:24 | 19:55 | 20:25 | 19:41 (8) 20:50 | 20:00 (9) |
| 11 | 07:44 | 08:57 (10) 07:22 | 06:42 | 06:53 | 06:13 | 19:18 (8) 05:55 | 18:47 (9) |
| | 17:18 | 10:33 (10) 17:54 | 18:25 | 19:56 | 20:26 | 19:40 (8) 20:51 | 20:01 (9) |
| 12 | 07:44 | 08:58 (10) 07:20 | 06:41 | 06:52 | 06:12 | 19:19 (8) 05:54 | 18:47 (9) |
| | 17:19 | 10:33 (10) 17:55 | 18:26 | 19:57 | 20:27 | 19:39 (8) 20:51 | 20:01 (9) |
| 13 | 07:43 | 08:58 (10) 07:19 | 06:39 | 06:50 | 06:11 | 19:13 (9) 05:54 | 18:47 (9) |
| | 17:20 | 10:32 (10) 17:56 | 18:27 | 19:58 | 20:28 | 19:37 (8) 20:52 | 20:02 (9) |
| 14 | 07:43 | 08:59 (10) 07:18 | 06:38 | 06:49 | 06:10 | 19:08 (9) 05:54 | 18:47 (9) |
| | 17:21 | 10:32 (10) 17:57 | 18:28 | 19:59 | 20:29 | 19:35 (8) 20:52 | 20:02 (9) |
| 15 | 07:43 | 09:00 (10) 07:17 | 06:36 | 06:47 | 06:09 | 19:05 (9) 05:54 | 18:47 (9) |
| | 17:22 | 10:33 (10) 17:58 | 18:29 | 20:00 | 20:30 | 19:35 (9) 20:52 | 20:02 (9) |
| 16 | 07:42 | 09:00 (10) 07:16 | 06:35 | 06:46 | 06:08 | 19:02 (9) 05:54 | 18:47 (9) |
| | 17:23 | 10:32 (10) 17:59 | 18:30 | 20:01 | 20:31 | 19:38 (9) 20:53 | 20:02 (9) |
| 17 | 07:42 | 09:02 (10) 07:14 | 06:33 | 06:44 | 06:07 | 19:00 (9) 05:54 | 18:47 (9) |
| | 17:24 | 10:32 (10) 18:01 | 18:31 | 20:02 | 20:32 | 19:40 (9) 20:53 | 20:03 (9) |
| 18 | 07:42 | 09:02 (10) 07:13 | 06:31 | 06:43 | 06:07 | 18:59 (9) 05:54 | 18:47 (9) |
| | 17:25 | 10:31 (10) 18:02 | 18:32 | 20:03 | 20:33 | 19:42 (9) 20:53 | 20:03 (9) |
| 19 | 07:41 | 09:03 (10) 07:12 | 06:30 | 06:41 | 06:06 | 18:57 (9) 05:55 | 18:47 (9) |
| | 17:26 | 10:31 (10) 18:03 | 18:33 | 20:04 | 20:34 | 19:44 (9) 20:54 | 20:03 (9) |
| 20 | 07:41 | 09:04 (10) 07:10 | 06:28 | 06:40 | 06:05 | 18:56 (9) 05:55 | 18:47 (9) |
| | 17:28 | 10:30 (10) 18:04 | 18:34 | 20:05 | 20:35 | 19:45 (9) 20:54 | 20:03 (9) |
| 21 | 07:40 | 09:05 (10) 07:09 | 06:26 | 06:38 | 06:04 | 18:54 (9) 05:55 | 18:48 (9) |
| | 17:29 | 10:29 (10) 18:05 | 18:35 | 20:06 | 20:35 | 19:46 (9) 20:54 | 20:04 (9) |
| 22 | 07:39 | 09:06 (10) 07:08 | 06:25 | 06:37 | 06:03 | 18:54 (9) 05:55 | 18:48 (9) |
| | 17:30 | 10:29 (10) 18:06 | 18:36 | 20:07 | 20:36 | 19:48 (9) 20:55 | 20:04 (9) |
| 23 | 07:39 | 09:07 (10) 07:06 | 06:23 | 06:35 | 06:03 | 18:53 (9) 05:55 | 18:48 (9) |
| | 17:31 | 10:28 (10) 18:07 | 18:37 | 20:08 | 20:37 | 19:48 (9) 20:55 | 20:04 (9) |
| 24 | 07:38 | 09:08 (10) 07:05 | 06:22 | 06:34 | 06:02 | 18:52 (9) 05:56 | 18:48 (9) |
| | 17:32 | 10:27 (10) 18:09 | 18:38 | 20:09 | 20:38 | 19:49 (9) 20:55 | 20:04 (9) |
| 25 | 07:38 | 09:09 (10) 07:03 | 06:20 | 06:33 | 06:01 | 18:51 (9) 05:56 | 18:49 (9) |
| | 17:33 | 10:27 (10) 18:10 | 18:39 | 20:10 | 20:39 | 19:51 (9) 20:55 | 20:05 (9) |
| 26 | 07:37 | 09:10 (10) 07:02 | 06:18 | 06:31 | 06:01 | 18:50 (9) 05:56 | 18:49 (9) |
| | 17:34 | 10:26 (10) 18:11 | 18:40 | 20:11 | 20:40 | 19:51 (9) 20:55 | 20:05 (9) |
| 27 | 07:36 | 09:11 (10) 07:01 | 06:17 | 06:30 | 06:00 | 18:50 (9) 05:57 | 18:49 (9) |
| | 17:36 | 10:25 (10) 18:12 | 18:41 | 20:12 | 20:41 | 19:53 (9) 20:55 | 20:04 (9) |
| 28 | 07:35 | 09:13 (10) 06:59 | 06:15 | 06:29 | 05:59 | 18:49 (9) 05:57 | 18:50 (9) |
| | 17:37 | 10:23 (10) 18:13 | 18:42 | 20:13 | 20:41 | 19:53 (9) 20:55 | 20:05 (9) |
| 29 | 07:35 | 09:14 (10) | 07:14 | 06:27 | 05:59 | 18:49 (9) 05:57 | 18:50 (9) |
| | 17:38 | 10:22 (10) | 19:43 | 20:14 | 20:42 | 19:54 (9) 20:55 | 20:05 (9) |
| 30 | 07:34 | 09:15 (10) | 07:12 | 06:26 | 05:58 | 18:48 (9) 05:58 | 18:51 (9) |
| | 17:39 | 10:20 (10) | 19:44 | 20:15 | 20:43 | 19:54 (9) 20:55 | 20:05 (9) |
| 31 | 07:33 | 09:18 (10) | 07:10 | 06:25 | 05:58 | 18:48 (9) | |
| | 17:40 | 10:19 (10) | 19:45 | 20:16 | 20:44 | 19:55 (9) | |
| Potential sun hours | 301 | 299 | 370 | 397 | 445 | 448 | |
| Total, worst case | | 2725 | 314 | | 279 | 1294 | 2219 |
| Sun reduction | | 0.45 | 0.47 | | 0.53 | 0.59 | 0.66 |
| Oper. time red. | | 0.30 | 0.30 | | 0.30 | 0.30 | 0.30 |
| Wind dir. red. | | 0.59 | 0.59 | | 0.77 | 0.76 | 0.75 |
| Total reduction | | 0.08 | 0.08 | | 0.12 | 0.13 | 0.14 |
| Total, real | | 212 | 25 | | 33 | 168 | 320 |

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) |

Project:

windpro Seui - flickering

Printed/Page

2023-12-20 10:52 / 13

Licensed user:

Ing. Bruno Manca

Via Vittorio Veneto 231

IT-09028 Sestu

+390702358125

Bruno Manca / ingbrunomanca@gmail.com

Calculated:

2023-12-19 11:53/2.8.579

SHADOW - Calendar

Calculation: shadow flickering Seui - progetto Shadow receptor: I - R09

Assumptions for shadow calculations

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

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|------|------|------|------|------|------|-------|-------|------|------|------|------|
| 4.40 | 5.05 | 5.88 | 7.00 | 8.45 | 9.88 | 10.82 | 10.03 | 8.08 | 6.09 | 5.07 | 4.27 |

Operational time

| N | NNE | ENE | E | ESE | SSE | S | SSW | WSW | W | WNW | NNW | Sum |
|----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-------|
| 86 | 55 | 78 | 159 | 368 | 188 | 65 | 104 | 357 | 605 | 339 | 206 | 2,610 |

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

| | July | August | September | October | November | December |
|---------------------|-------|--------------------|--------------------|---------|----------|---------------------|
| 1 | 05:58 | 18:51 (9) 06:21 | 19:29 (8) 06:50 | 07:18 | 06:51 | 07:24 |
| | 20:55 | 74 20:05 (9) 20:37 | 21 19:50 (8) 19:56 | 19:07 | 17:22 | 16:59 |
| 2 | 05:59 | 18:51 (9) 06:22 | 19:27 (8) 06:51 | 07:19 | 06:52 | 07:25 |
| | 20:55 | 74 20:05 (9) 20:36 | 23 19:50 (8) 19:54 | 19:05 | 17:21 | 16:59 |
| 3 | 05:59 | 18:51 (9) 06:23 | 19:26 (8) 06:52 | 07:20 | 06:53 | 09:11 (10) 07:26 |
| | 20:55 | 74 20:05 (9) 20:35 | 25 19:51 (8) 19:53 | 19:04 | 17:20 | 12 09:23 (10) 16:59 |
| 4 | 06:00 | 18:52 (9) 06:24 | 19:26 (8) 06:53 | 07:21 | 06:54 | 09:04 (10) 07:27 |
| | 20:55 | 73 20:05 (9) 20:34 | 26 19:52 (8) 19:51 | 19:02 | 17:19 | 26 09:30 (10) 16:59 |
| 5 | 06:00 | 18:52 (9) 06:25 | 19:25 (8) 06:54 | 07:22 | 06:55 | 09:00 (10) 07:28 |
| | 20:54 | 73 20:05 (9) 20:33 | 28 19:53 (8) 19:49 | 19:01 | 17:18 | 34 09:34 (10) 16:58 |
| 6 | 06:01 | 18:53 (9) 06:26 | 19:24 (8) 06:55 | 07:23 | 06:56 | 08:58 (10) 07:29 |
| | 20:54 | 72 20:05 (9) 20:32 | 29 19:53 (8) 19:48 | 18:59 | 17:17 | 40 09:38 (10) 16:58 |
| 7 | 06:01 | 18:53 (9) 06:27 | 19:24 (8) 06:56 | 07:24 | 06:57 | 08:55 (10) 07:30 |
| | 20:54 | 71 20:04 (9) 20:31 | 30 19:54 (8) 19:46 | 18:57 | 17:15 | 46 09:41 (10) 16:58 |
| 8 | 06:02 | 18:54 (9) 06:27 | 19:24 (8) 06:57 | 07:25 | 06:59 | 08:53 (10) 07:31 |
| | 20:54 | 71 20:05 (9) 20:29 | 30 19:54 (8) 19:45 | 18:56 | 17:14 | 50 09:43 (10) 16:58 |
| 9 | 06:03 | 18:55 (9) 06:28 | 19:23 (8) 06:58 | 07:26 | 07:00 | 08:51 (10) 07:32 |
| | 20:53 | 70 20:05 (9) 20:28 | 31 19:54 (8) 19:43 | 18:54 | 17:13 | 55 09:46 (10) 16:58 |
| 10 | 06:03 | 18:54 (9) 06:29 | 19:23 (8) 06:58 | 07:27 | 07:01 | 08:50 (10) 07:32 |
| | 20:53 | 70 20:04 (9) 20:27 | 32 19:55 (8) 19:41 | 18:53 | 17:12 | 59 09:49 (10) 16:58 |
| 11 | 06:04 | 18:55 (9) 06:30 | 19:22 (8) 06:59 | 07:28 | 07:02 | 08:48 (10) 07:33 |
| | 20:53 | 69 20:04 (9) 20:26 | 32 19:54 (8) 19:40 | 18:51 | 17:12 | 62 09:50 (10) 16:58 |
| 12 | 06:05 | 18:56 (9) 06:31 | 19:22 (8) 07:00 | 07:29 | 07:03 | 08:47 (10) 07:34 |
| | 20:52 | 68 20:04 (9) 20:24 | 32 19:54 (8) 19:38 | 18:50 | 17:11 | 65 09:52 (10) 16:59 |
| 13 | 06:05 | 18:56 (9) 06:32 | 19:22 (8) 07:01 | 07:30 | 07:04 | 08:46 (10) 07:35 |
| | 20:52 | 67 20:03 (9) 20:23 | 31 19:53 (8) 19:37 | 18:48 | 17:10 | 68 09:54 (10) 16:59 |
| 14 | 06:06 | 18:57 (9) 06:33 | 19:22 (8) 07:02 | 07:31 | 07:05 | 08:44 (10) 07:36 |
| | 20:51 | 66 20:03 (9) 20:22 | 31 19:53 (8) 19:35 | 18:47 | 17:09 | 71 09:55 (10) 16:59 |
| 15 | 06:07 | 18:58 (9) 06:34 | 19:22 (8) 07:03 | 07:32 | 07:07 | 08:44 (10) 07:36 |
| | 20:51 | 64 20:02 (9) 20:21 | 31 19:53 (8) 19:33 | 18:45 | 17:08 | 74 09:58 (10) 16:59 |
| 16 | 06:07 | 18:58 (9) 06:35 | 19:22 (8) 07:04 | 07:33 | 07:08 | 08:43 (10) 07:37 |
| | 20:50 | 63 20:01 (9) 20:19 | 30 19:52 (8) 19:32 | 18:44 | 17:07 | 76 09:59 (10) 16:59 |
| 17 | 06:08 | 18:59 (9) 06:36 | 19:23 (8) 07:05 | 07:34 | 07:09 | 08:42 (10) 07:38 |
| | 20:49 | 62 20:01 (9) 20:18 | 28 19:51 (8) 19:30 | 18:42 | 17:06 | 78 10:00 (10) 17:00 |
| 18 | 06:09 | 19:00 (9) 06:37 | 19:23 (8) 07:06 | 07:35 | 07:10 | 08:42 (10) 07:38 |
| | 20:49 | 60 20:00 (9) 20:16 | 28 19:51 (8) 19:28 | 18:41 | 17:06 | 79 10:01 (10) 17:00 |
| 19 | 06:10 | 19:01 (9) 06:38 | 19:24 (8) 07:07 | 07:36 | 07:11 | 08:41 (10) 07:39 |
| | 20:48 | 59 20:00 (9) 20:15 | 26 19:50 (8) 19:27 | 18:39 | 17:05 | 81 10:02 (10) 17:00 |
| 20 | 06:11 | 19:02 (9) 06:39 | 19:25 (8) 07:08 | 07:37 | 07:12 | 08:41 (10) 07:40 |
| | 20:48 | 56 19:58 (9) 20:14 | 23 19:48 (8) 19:25 | 18:38 | 17:04 | 83 10:04 (10) 17:01 |
| 21 | 06:11 | 19:03 (9) 06:40 | 19:27 (8) 07:09 | 07:39 | 07:13 | 08:41 (10) 07:40 |
| | 20:47 | 55 19:58 (9) 20:12 | 20 19:47 (8) 19:23 | 18:36 | 17:04 | 84 10:05 (10) 17:01 |
| 22 | 06:12 | 19:04 (9) 06:41 | 19:27 (8) 07:10 | 07:40 | 07:14 | 08:40 (10) 07:41 |
| | 20:46 | 53 19:57 (9) 20:11 | 17 19:44 (8) 19:22 | 18:35 | 17:03 | 86 10:06 (10) 17:02 |
| 23 | 06:13 | 19:06 (9) 06:42 | 19:30 (8) 07:11 | 07:41 | 07:16 | 08:39 (10) 07:41 |
| | 20:45 | 50 19:56 (9) 20:09 | 10 19:40 (8) 19:20 | 18:34 | 17:03 | 88 10:07 (10) 17:02 |
| 24 | 06:14 | 19:07 (9) 06:43 | 07:12 | 07:42 | 07:17 | 08:39 (10) 07:42 |
| | 20:45 | 48 19:55 (9) 20:08 | 19:18 | 18:32 | 17:02 | 89 10:08 (10) 17:03 |
| 25 | 06:15 | 19:09 (9) 06:43 | 07:12 | 06:43 | 07:18 | 08:39 (10) 07:42 |
| | 20:44 | 44 19:53 (9) 20:06 | 19:17 | 17:31 | 17:02 | 90 10:09 (10) 17:03 |
| 26 | 06:16 | 19:10 (9) 06:44 | 07:13 | 06:44 | 07:19 | 08:39 (10) 07:42 |
| | 20:43 | 41 19:51 (9) 20:05 | 19:15 | 17:30 | 17:01 | 92 10:11 (10) 17:04 |
| 27 | 06:17 | 19:12 (9) 06:45 | 07:14 | 06:45 | 07:20 | 08:39 (10) 07:43 |
| | 20:42 | 37 19:49 (9) 20:03 | 19:14 | 17:28 | 17:01 | 93 10:12 (10) 17:05 |
| 28 | 06:17 | 19:14 (9) 06:46 | 07:15 | 06:46 | 07:21 | 08:39 (10) 07:43 |
| | 20:41 | 33 19:47 (9) 20:02 | 19:12 | 17:27 | 17:00 | 93 10:12 (10) 17:05 |
| 29 | 06:18 | 19:17 (9) 06:47 | 07:16 | 06:47 | 07:22 | 08:39 (10) 07:43 |
| | 20:40 | 28 19:45 (9) 20:00 | 19:10 | 17:26 | 17:00 | 94 10:13 (10) 17:06 |
| 30 | 06:19 | 19:20 (9) 06:48 | 07:17 | 06:48 | 07:23 | 08:39 (10) 07:44 |
| | 20:39 | 27 19:47 (8) 19:59 | 19:09 | 17:25 | 17:00 | 95 10:14 (10) 17:07 |
| 31 | 06:20 | 19:27 (9) 06:49 | 07:18 | 06:49 | 07:24 | 07:44 |
| | 20:38 | 22 19:49 (8) 19:57 | 17:23 | 17:23 | 17:08 | 101 10:31 (10) |
| Potential sun hours | 455 | 425 | 374 | 347 | 301 | 292 |
| Total, worst case | 1794 | 614 | 1963 | 3126 | | |
| Sun reduction | 0.74 | 0.73 | 0.51 | 0.45 | | |
| Oper. time red. | 0.30 | 0.30 | 0.30 | 0.30 | | |
| Wind dir. red. | 0.75 | 0.77 | 0.59 | 0.59 | | |
| Total reduction | 0.16 | 0.16 | 0.09 | 0.08 | | |
| Total, real | 288 | 101 | 170 | 243 | | |

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) |

Project:
windpro Seui - flickering

Printed/Page
2023-12-20 10:52 / 14
Licensed user:
Ing. Bruno Manca
Via Vittorio Veneto 231
IT-09028 Sestu
+390702358125
Bruno Manca / ingbrunomanca@gmail.com
Calculated:
2023-12-19 11:53/2.8.579

SHADOW - Calendar

Calculation: shadow flickering Seui - progetto Shadow receptor: J - R10

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

| | January | February | March | April | May | June | July | August | September | October | November | December |
|---------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 1 | 07:44 17:09 | 07:32 17:42 | 06:58 18:14 | 07:09 19:46 | 06:25 20:16 | 05:57 20:44 | 05:58 20:55 | 06:21 20:37 | 06:50 19:56 | 07:18 19:07 | 06:51 17:22 | 07:24 16:59 |
| 2 | 07:44 17:09 | 07:31 17:43 | 06:56 18:15 | 07:07 19:47 | 06:24 20:17 | 05:57 20:45 | 05:59 20:55 | 06:22 20:36 | 06:51 19:54 | 07:19 19:05 | 06:52 17:21 | 07:25 16:59 |
| 3 | 07:44 17:10 | 07:30 17:44 | 06:55 18:16 | 07:06 19:48 | 06:22 20:18 | 05:57 20:46 | 05:59 20:55 | 06:23 20:35 | 06:52 19:53 | 07:20 19:04 | 06:53 17:20 | 07:26 16:59 |
| 4 | 07:44 17:11 | 07:29 17:45 | 06:53 18:17 | 07:04 19:49 | 06:21 20:19 | 05:56 20:46 | 06:00 20:55 | 06:24 20:34 | 06:53 19:51 | 07:21 19:02 | 06:54 17:19 | 07:27 16:59 |
| 5 | 07:44 17:12 | 07:28 17:46 | 06:52 18:18 | 07:02 19:50 | 06:20 20:20 | 05:56 20:47 | 06:00 20:54 | 06:25 20:33 | 06:54 19:49 | 07:22 19:01 | 06:55 17:18 | 07:28 16:58 |
| 6 | 07:44 17:13 | 07:27 17:48 | 06:50 18:19 | 07:01 19:51 | 06:19 20:21 | 05:56 20:48 | 06:01 20:54 | 06:26 20:32 | 06:55 19:48 | 07:23 18:59 | 06:56 17:17 | 07:29 16:58 |
| 7 | 07:44 17:14 | 07:26 17:49 | 06:49 18:21 | 06:59 19:52 | 06:18 20:22 | 05:55 20:48 | 06:01 20:54 | 06:27 20:31 | 06:56 19:46 | 07:24 18:57 | 06:57 17:15 | 07:30 16:58 |
| 8 | 07:44 17:15 | 07:25 17:50 | 06:47 18:22 | 06:58 19:53 | 06:16 20:23 | 05:55 20:49 | 06:02 20:54 | 06:27 20:29 | 06:57 19:45 | 07:25 18:56 | 06:58 17:14 | 07:31 16:58 |
| 9 | 07:44 17:16 | 07:24 17:51 | 06:46 18:23 | 06:56 19:54 | 06:15 20:24 | 05:55 20:49 | 06:03 20:53 | 06:28 20:28 | 06:57 19:43 | 07:26 18:54 | 07:00 17:13 | 07:32 16:58 |
| 10 | 07:44 17:17 | 07:23 17:52 | 06:44 18:24 | 06:55 19:55 | 06:14 20:25 | 05:55 20:50 | 06:03 20:53 | 06:29 20:27 | 06:58 19:41 | 07:27 18:53 | 07:01 17:12 | 07:32 16:58 |
| 11 | 07:44 17:18 | 07:22 17:54 | 06:42 18:25 | 06:53 19:56 | 06:13 20:26 | 05:55 20:51 | 06:04 20:52 | 06:30 20:26 | 06:59 19:40 | 07:28 18:51 | 07:02 17:12 | 07:33 16:58 |
| 12 | 07:44 17:19 | 07:20 17:55 | 06:41 18:26 | 06:52 19:57 | 06:12 20:27 | 05:54 20:51 | 06:05 20:52 | 06:31 20:24 | 07:00 19:38 | 07:29 18:50 | 07:03 17:11 | 07:34 16:59 |
| 13 | 07:43 17:20 | 07:19 17:56 | 06:39 18:27 | 06:50 19:58 | 06:11 20:28 | 05:54 20:51 | 06:05 20:52 | 06:32 20:23 | 07:01 19:36 | 07:30 18:48 | 07:04 17:10 | 07:35 16:59 |
| 14 | 07:43 17:21 | 07:18 17:57 | 06:38 18:28 | 06:48 19:59 | 06:10 20:29 | 05:54 20:52 | 06:06 20:51 | 06:33 20:22 | 07:02 19:35 | 07:31 18:47 | 07:05 17:09 | 07:36 16:59 |
| 15 | 07:43 17:22 | 07:17 17:58 | 06:36 18:29 | 06:47 20:00 | 06:09 20:30 | 05:54 20:52 | 06:07 20:51 | 06:34 20:20 | 07:03 19:33 | 07:32 18:45 | 07:06 17:08 | 07:36 16:59 |
| 16 | 07:42 17:23 | 07:16 17:59 | 06:34 18:30 | 06:45 20:01 | 06:08 20:31 | 05:54 20:53 | 06:07 20:50 | 06:35 20:19 | 07:04 19:32 | 07:33 18:44 | 07:08 17:07 | 07:37 16:59 |
| 17 | 07:42 17:24 | 07:14 18:01 | 06:33 18:31 | 06:44 20:02 | 06:07 20:32 | 05:54 20:53 | 06:08 20:49 | 06:36 20:18 | 07:05 19:30 | 07:34 18:42 | 07:09 17:06 | 07:38 17:00 |
| 18 | 07:42 17:25 | 07:13 18:02 | 06:31 18:32 | 06:43 20:03 | 06:07 20:33 | 05:54 20:53 | 06:09 20:49 | 06:37 20:16 | 07:06 19:28 | 07:35 18:41 | 07:10 17:06 | 07:38 17:00 |
| 19 | 07:41 17:26 | 07:12 18:03 | 06:30 18:33 | 06:41 20:04 | 06:06 20:34 | 05:55 20:54 | 06:10 20:48 | 06:38 20:15 | 07:07 19:27 | 07:36 18:39 | 07:11 17:05 | 07:39 17:00 |
| 20 | 07:41 17:28 | 07:10 18:04 | 06:28 18:34 | 06:40 20:05 | 06:05 20:34 | 05:55 20:54 | 06:11 20:47 | 06:39 20:14 | 07:08 19:25 | 07:37 18:38 | 07:12 17:04 | 07:39 17:01 |
| 21 | 07:40 17:29 | 07:09 18:05 | 06:26 18:35 | 06:38 20:06 | 06:04 20:35 | 05:55 20:54 | 06:11 20:47 | 06:40 20:12 | 07:09 19:23 | 07:38 18:36 | 07:13 17:04 | 07:40 17:01 |
| 22 | 07:39 17:30 | 07:08 18:06 | 06:25 18:36 | 06:37 20:07 | 06:03 20:36 | 05:55 20:54 | 06:12 20:46 | 06:41 20:11 | 07:10 19:22 | 07:40 18:35 | 07:14 17:03 | 07:41 17:02 |
| 23 | 07:39 17:31 | 07:06 18:07 | 06:23 18:37 | 06:35 20:08 | 06:03 20:37 | 05:55 20:55 | 06:13 20:45 | 06:42 20:09 | 07:11 19:20 | 07:41 18:34 | 07:15 17:03 | 07:41 17:02 |
| 24 | 07:38 17:32 | 07:05 18:09 | 06:22 18:38 | 06:34 20:09 | 06:02 20:38 | 05:56 20:55 | 06:14 20:44 | 06:43 20:08 | 07:11 19:18 | 07:42 18:32 | 07:17 17:02 | 07:42 17:03 |
| 25 | 07:38 17:33 | 07:03 18:10 | 06:20 18:39 | 06:33 20:10 | 06:01 20:39 | 05:56 20:55 | 06:15 20:44 | 06:43 20:06 | 07:12 19:17 | 07:43 17:31 | 07:18 17:02 | 07:42 17:03 |
| 26 | 07:37 17:34 | 07:02 18:11 | 06:18 18:40 | 06:31 20:11 | 06:01 20:40 | 05:56 20:55 | 06:16 20:43 | 06:44 20:05 | 07:13 19:15 | 07:44 17:30 | 07:19 17:01 | 07:42 17:04 |
| 27 | 07:36 17:36 | 07:01 18:12 | 06:17 18:41 | 06:30 20:12 | 06:00 20:40 | 05:56 20:55 | 06:16 20:42 | 06:45 20:03 | 07:14 19:13 | 07:45 17:28 | 07:20 17:01 | 07:43 17:05 |
| 28 | 07:35 17:37 | 06:59 18:13 | 06:15 18:42 | 06:29 20:13 | 05:59 20:41 | 05:57 20:55 | 06:17 20:41 | 06:46 20:02 | 07:15 19:12 | 07:46 17:27 | 07:21 17:00 | 07:43 17:05 |
| 29 | 07:34 17:38 | | 07:14 19:43 | 06:27 20:14 | 05:59 20:42 | 05:57 20:55 | 06:18 20:40 | 06:47 20:00 | 07:16 19:10 | 07:47 17:26 | 07:22 17:00 | 07:43 17:06 |
| 30 | 07:34 17:39 | | 07:12 19:44 | 06:26 20:15 | 05:58 20:43 | 05:58 20:55 | 06:19 20:39 | 06:48 19:59 | 07:17 19:09 | 07:48 17:25 | 07:23 17:00 | 07:44 17:07 |
| 31 | 07:33 17:40 | | 07:10 19:45 | | 05:58 20:44 | | 06:20 20:38 | 06:49 19:57 | | 06:49 17:23 | | 07:44 17:08 |
| Potential sun hours | 301 | 299 | 370 | 397 | 445 | 448 | 455 | 425 | 374 | 347 | 301 | 292 |
| 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) | 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) |

Project:

windpro Seui - flickering

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2023-12-20 10:52 / 15

Licensed user:

Ing. Bruno Manca

Via Vittorio Veneto 231

IT-09028 Sestu

+390702358125

Bruno Manca / ingbrunomanca@gmail.com

Calculated:

2023-12-19 11:53/2.8.579

SHADOW - Calendar

Calculation: shadow flickering Seui - progetto Shadow receptor: K - R11

Assumptions for shadow calculations

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

| | | | | | | | | | | | |
|------|------|------|------|------|------|-------|-------|------|------|------|------|
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| 4.40 | 5.05 | 5.88 | 7.00 | 8.45 | 9.88 | 10.82 | 10.03 | 8.08 | 6.09 | 5.07 | 4.27 |

Operational time

| | | | | | | | | | | | | |
|----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-------|
| N | NNE | ENE | E | ESE | SSE | S | SSW | WSW | W | WNW | NNW | Sum |
| 86 | 55 | 78 | 159 | 368 | 188 | 65 | 104 | 357 | 605 | 339 | 206 | 2,610 |

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

| | January | February | March | April | May | June |
|---------------------|---------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 1 | 07:44 | 16:04 (5) 07:32 | 08:34 (3) 06:58 | 07:56 (3) 07:09 | 08:42 (3) 06:25 | 08:56 (3) 05:57 |
| | 17:09 | 16:41 (5) 17:42 | 09:44 (3) 18:14 | 17:53 (4) 19:46 | 11:04 (3) 20:16 | 10:16 (3) 20:44 |
| 2 | 07:44 | 16:05 (5) 07:31 | 08:32 (3) 06:56 | 07:56 (3) 07:07 | 08:42 (3) 06:24 | 08:56 (3) 05:57 |
| | 17:09 | 16:41 (5) 17:43 | 09:47 (3) 18:15 | 17:54 (4) 19:47 | 11:02 (3) 20:17 | 10:13 (3) 20:45 |
| 3 | 07:44 | 16:05 (5) 07:30 | 08:30 (3) 06:55 | 07:54 (3) 07:06 | 08:42 (3) 06:22 | 08:58 (3) 05:57 |
| | 17:10 | 16:41 (5) 17:44 | 09:49 (3) 18:16 | 17:53 (4) 19:48 | 11:01 (3) 20:18 | 10:12 (3) 20:46 |
| 4 | 07:45 | 16:06 (5) 07:29 | 08:28 (3) 06:53 | 07:54 (3) 07:04 | 08:42 (3) 06:21 | 08:59 (3) 05:56 |
| | 17:11 | 16:41 (5) 17:45 | 09:52 (3) 18:17 | 17:54 (4) 19:49 | 10:59 (3) 20:19 | 10:10 (3) 20:47 |
| 5 | 07:45 | 16:07 (5) 07:28 | 08:26 (3) 06:52 | 07:53 (3) 07:02 | 08:43 (3) 06:20 | 09:00 (3) 05:56 |
| | 17:12 | 16:42 (5) 17:46 | 09:54 (3) 18:18 | 17:53 (4) 19:50 | 10:58 (3) 20:20 | 10:08 (3) 20:47 |
| 6 | 07:45 | 16:08 (5) 07:27 | 08:24 (3) 06:50 | 07:53 (3) 07:01 | 08:42 (3) 06:19 | 09:02 (3) 05:56 |
| | 17:13 | 16:42 (5) 17:48 | 09:56 (3) 18:20 | 17:53 (4) 19:51 | 10:56 (3) 20:21 | 10:07 (3) 20:48 |
| 7 | 07:45 | 16:09 (5) 07:26 | 08:22 (3) 06:49 | 07:51 (3) 06:59 | 08:42 (3) 06:18 | 09:03 (3) 05:55 |
| | 17:14 | 16:42 (5) 17:49 | 09:57 (3) 18:21 | 17:52 (4) 19:52 | 10:54 (3) 20:22 | 10:05 (3) 20:48 |
| 8 | 07:44 | 16:10 (5) 07:25 | 08:20 (3) 06:47 | 07:51 (3) 06:58 | 08:43 (3) 06:16 | 09:04 (3) 05:55 |
| | 17:15 | 16:42 (5) 17:50 | 09:59 (3) 18:22 | 17:52 (4) 19:53 | 10:53 (3) 20:23 | 10:03 (3) 20:49 |
| 9 | 07:44 | 16:11 (5) 07:24 | 08:19 (3) 06:46 | 07:50 (3) 06:56 | 08:43 (3) 06:15 | 09:06 (3) 05:55 |
| | 17:16 | 16:42 (5) 17:51 | 10:01 (3) 18:23 | 17:51 (4) 19:54 | 10:51 (3) 20:24 | 10:01 (3) 20:50 |
| 10 | 07:44 | 16:11 (5) 07:23 | 08:18 (3) 06:44 | 07:49 (3) 06:55 | 08:43 (3) 06:14 | 09:08 (3) 05:55 |
| | 17:17 | 16:41 (5) 17:52 | 10:03 (3) 18:24 | 17:50 (4) 19:55 | 10:50 (3) 20:25 | 10:00 (3) 20:50 |
| 11 | 07:44 | 16:12 (5) 07:22 | 08:16 (3) 06:42 | 07:49 (3) 06:53 | 08:43 (3) 06:13 | 09:09 (3) 05:55 |
| | 17:18 | 16:41 (5) 17:54 | 10:05 (3) 18:25 | 17:50 (4) 19:56 | 10:48 (3) 20:26 | 09:58 (3) 20:51 |
| 12 | 07:44 | 16:14 (5) 07:20 | 08:15 (3) 06:41 | 07:48 (3) 06:52 | 08:44 (3) 06:12 | 09:11 (3) 05:54 |
| | 17:19 | 16:41 (5) 17:55 | 10:04 (3) 18:26 | 17:49 (4) 19:57 | 10:47 (3) 20:27 | 09:55 (3) 20:51 |
| 13 | 07:44 | 16:14 (5) 07:19 | 08:13 (3) 06:39 | 07:48 (3) 06:50 | 08:44 (3) 06:11 | 09:13 (3) 05:54 |
| | 17:20 | 16:40 (5) 17:56 | 10:03 (3) 18:27 | 17:48 (4) 19:58 | 10:45 (3) 20:28 | 09:53 (3) 20:52 |
| 14 | 07:43 | 16:16 (5) 07:18 | 08:12 (3) 06:38 | 07:47 (3) 06:49 | 08:45 (3) 06:10 | 09:15 (3) 05:54 |
| | 17:21 | 16:40 (5) 17:57 | 10:04 (3) 18:28 | 17:47 (4) 19:59 | 10:44 (3) 20:29 | 09:51 (3) 20:52 |
| 15 | 07:43 | 16:18 (5) 07:17 | 08:11 (3) 06:36 | 07:46 (3) 06:47 | 08:44 (3) 06:09 | 09:17 (3) 05:54 |
| | 17:22 | 16:40 (5) 17:58 | 10:05 (3) 18:29 | 17:45 (4) 20:00 | 10:42 (3) 20:30 | 09:48 (3) 20:52 |
| 16 | 07:43 | 16:19 (5) 07:16 | 08:10 (3) 06:35 | 07:47 (3) 06:46 | 08:45 (3) 06:08 | 09:20 (3) 05:54 |
| | 17:23 | 16:38 (5) 17:59 | 10:06 (3) 18:30 | 17:44 (4) 20:01 | 10:40 (3) 20:31 | 09:45 (3) 20:53 |
| 17 | 07:42 | 16:22 (5) 07:14 | 08:08 (3) 06:33 | 07:46 (3) 06:44 | 08:45 (3) 06:07 | 09:24 (3) 05:54 |
| | 17:24 | 16:37 (5) 18:01 | 10:07 (3) 18:31 | 17:42 (4) 20:02 | 10:38 (3) 20:32 | 09:41 (3) 20:53 |
| 18 | 07:42 | 16:25 (5) 07:13 | 08:07 (3) 06:31 | 07:46 (3) 06:43 | 08:46 (3) 06:07 | 09:25 (3) 05:54 |
| | 17:25 | 16:34 (5) 18:02 | 10:08 (3) 18:32 | 17:41 (4) 20:03 | 10:37 (3) 20:33 | 09:42 (3) 20:54 |
| 19 | 07:41 | 16:26 (5) 07:12 | 08:06 (3) 06:30 | 07:45 (3) 06:41 | 08:46 (3) 06:06 | 09:26 (3) 05:55 |
| | 17:26 | 16:35 (5) 18:03 | 10:09 (3) 18:33 | 17:39 (4) 20:04 | 10:35 (3) 20:34 | 09:43 (3) 20:54 |
| 20 | 07:41 | 16:27 (5) 07:11 | 08:05 (3) 06:28 | 07:44 (3) 06:40 | 08:47 (3) 06:05 | 09:27 (3) 05:55 |
| | 17:28 | 16:34 (5) 18:04 | 10:10 (3) 18:34 | 17:36 (4) 20:05 | 10:33 (3) 20:35 | 09:46 (3) 20:54 |
| 21 | 07:40 | 16:28 (5) 07:09 | 08:04 (3) 06:27 | 07:45 (3) 06:38 | 08:48 (3) 06:04 | 09:28 (3) 05:55 |
| | 17:29 | 16:35 (5) 18:05 | 10:11 (3) 18:35 | 17:34 (4) 20:06 | 10:32 (3) 20:35 | 09:47 (3) 20:54 |
| 22 | 07:40 | 16:29 (5) 07:08 | 08:02 (3) 06:25 | 07:44 (3) 06:37 | 08:48 (3) 06:03 | 09:29 (3) 05:55 |
| | 17:30 | 16:36 (5) 18:06 | 10:12 (3) 18:36 | 17:31 (4) 20:07 | 10:30 (3) 20:36 | 09:48 (3) 20:55 |
| 23 | 07:39 | 16:30 (5) 07:06 | 08:02 (3) 06:23 | 07:43 (3) 06:35 | 08:49 (3) 06:03 | 09:30 (3) 05:55 |
| | 17:31 | 16:38 (5) 18:07 | 10:13 (3) 18:37 | 17:26 (4) 20:08 | 10:29 (3) 20:37 | 09:49 (3) 20:55 |
| 24 | 07:38 | 16:32 (5) 07:05 | 08:01 (3) 06:22 | 07:44 (3) 06:34 | 08:50 (3) 06:02 | 09:31 (3) 05:56 |
| | 17:32 | 16:40 (5) 18:09 | 10:14 (3) 18:38 | 17:24 (4) 20:09 | 10:27 (3) 20:38 | 09:50 (3) 20:55 |
| 25 | 07:38 | 08:59 (3) 07:03 | 08:00 (3) 06:20 | 07:43 (3) 06:33 | 08:50 (3) 06:01 | 09:32 (3) 05:56 |
| | 17:33 | 16:41 (5) 18:10 | 10:15 (3) 18:39 | 17:23 (4) 20:10 | 10:25 (3) 20:39 | 09:51 (3) 20:55 |
| 26 | 07:37 | 08:52 (3) 07:02 | 07:59 (3) 06:18 | 07:43 (3) 06:31 | 08:51 (3) 06:01 | 09:33 (3) 05:56 |
| | 17:34 | 16:42 (5) 18:11 | 10:16 (3) 18:40 | 17:22 (4) 20:11 | 10:24 (3) 20:40 | 09:52 (3) 20:55 |
| 27 | 07:36 | 08:47 (3) 07:01 | 07:58 (3) 06:17 | 07:43 (3) 06:30 | 08:52 (3) 06:00 | 09:34 (3) 05:56 |
| | 17:36 | 16:43 (5) 18:12 | 10:17 (3) 18:41 | 17:21 (4) 20:12 | 10:22 (3) 20:41 | 09:53 (3) 20:55 |
| 28 | 07:35 | 08:44 (3) 06:59 | 07:57 (3) 06:15 | 07:42 (3) 06:29 | 08:52 (3) 05:59 | 09:35 (3) 05:57 |
| | 17:37 | 16:44 (5) 18:13 | 10:18 (3) 18:42 | 17:20 (4) 20:13 | 10:20 (3) 20:41 | 09:54 (3) 20:55 |
| 29 | 07:35 | 08:40 (3) 07:00 | 07:56 (3) 06:14 | 07:41 (3) 06:27 | 08:53 (3) 05:59 | 09:36 (3) 05:57 |
| | 17:38 | 16:45 (5) 18:14 | 10:19 (3) 18:43 | 17:19 (4) 20:14 | 10:18 (3) 20:42 | 09:55 (3) 20:55 |
| 30 | 07:34 | 08:38 (3) 07:01 | 07:55 (3) 06:13 | 07:40 (3) 06:26 | 08:54 (3) 05:58 | 09:37 (3) 05:58 |
| | 17:39 | 16:46 (5) 18:15 | 10:20 (3) 18:44 | 17:18 (4) 20:15 | 10:17 (3) 20:43 | 09:56 (3) 20:55 |
| 31 | 07:33 | 08:36 (3) 07:02 | 07:54 (3) 06:12 | 07:39 (3) 06:25 | 08:55 (3) 05:59 | 09:38 (3) 05:58 |
| | 17:40 | 16:47 (5) 18:16 | 10:21 (3) 18:45 | 17:17 (4) 20:16 | 10:16 (3) 20:44 | 09:57 (3) 20:55 |
| Potential sun hours | 301 | 299 | 370 | 397 | 445 | 448 |
| Total, worst case | 824 | 3896 | 5819 | 3439 | 905 | |
| Sun reduction | 0.45 | 0.47 | 0.49 | 0.53 | 0.59 | |
| Oper. time red. | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | |
| Wind dir. red. | 0.70 | 0.74 | 0.74 | 0.73 | 0.73 | |
| Total reduction | 0.09 | 0.10 | 0.11 | 0.12 | 0.13 | |
| Total, real | 78 | 406 | 633 | 397 | 116 | |

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) |

Project:

windpro Seui - flickering

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2023-12-20 10:52 / 16

Licensed user:

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IT-09028 Sestu

+390702358125

Bruno Manca / ingbrunomanca@gmail.com

Calculated:

2023-12-19 11:53/2.8.579

SHADOW - Calendar

Calculation: shadow flickering Seui - progetto Shadow receptor: K - R11

Assumptions for shadow calculations

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

| | | | | | | | | | | | |
|------|------|------|------|------|------|-------|-------|------|------|------|------|
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| 4.40 | 5.05 | 5.88 | 7.00 | 8.45 | 9.88 | 10.82 | 10.03 | 8.08 | 6.09 | 5.07 | 4.27 |

Operational time

| | | | | | | | | | | | | |
|----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-------|
| N | NNE | ENE | E | ESE | SSE | S | SSW | WSW | W | WNW | NNW | Sum |
| 86 | 55 | 78 | 159 | 368 | 188 | 65 | 104 | 357 | 605 | 339 | 206 | 2,610 |

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

| | July | August | September | October | November | December | |
|---------------------|-------|--------------------|-----------------|-----------------|---------------------|-----------------|------|
| 1 | 05:58 | 06:21 | 09:21 (3) 06:50 | 08:42 (3) 07:18 | 08:28 (3) 06:51 | 07:48 (3) 07:24 | |
| | 20:55 | 20:37 | 10:07 (3) 19:56 | 10:47 (3) 19:07 | 18:28 (4) 17:22 | 09:32 (3) 16:59 | |
| 2 | 05:59 | 06:22 | 09:18 (3) 06:51 | 08:41 (3) 07:19 | 08:28 (3) 06:52 | 07:49 (3) 07:25 | |
| | 20:55 | 20:36 | 10:08 (3) 19:54 | 10:48 (3) 19:05 | 18:28 (4) 17:21 | 09:30 (3) 16:59 | |
| 3 | 05:59 | 06:23 | 09:17 (3) 06:52 | 08:41 (3) 07:20 | 08:28 (3) 06:53 | 07:50 (3) 07:26 | |
| | 20:55 | 20:35 | 10:10 (3) 19:53 | 10:49 (3) 19:04 | 18:29 (4) 17:20 | 09:29 (3) 16:59 | |
| 4 | 06:00 | 06:24 | 09:15 (3) 06:53 | 08:40 (3) 07:21 | 08:28 (3) 06:54 | 07:52 (3) 07:27 | |
| | 20:55 | 20:34 | 10:12 (3) 19:51 | 10:50 (3) 19:02 | 18:29 (4) 17:19 | 09:27 (3) 16:59 | |
| 5 | 06:00 | 06:25 | 09:14 (3) 06:54 | 08:39 (3) 07:22 | 08:28 (3) 06:55 | 07:54 (3) 07:28 | |
| | 20:55 | 20:33 | 10:14 (3) 19:49 | 10:51 (3) 19:01 | 18:29 (4) 17:18 | 09:26 (3) 16:58 | |
| 6 | 06:01 | 06:26 | 09:12 (3) 06:55 | 08:38 (3) 07:23 | 08:28 (3) 06:56 | 07:56 (3) 07:29 | |
| | 20:54 | 20:32 | 10:15 (3) 19:48 | 10:52 (3) 18:59 | 18:29 (4) 17:17 | 09:23 (3) 16:58 | |
| 7 | 06:01 | 06:27 | 09:11 (3) 06:56 | 08:38 (3) 07:24 | 08:28 (3) 06:57 | 07:58 (3) 07:30 | |
| | 20:54 | 20:31 | 10:17 (3) 19:46 | 10:53 (3) 18:57 | 18:29 (4) 17:15 | 09:21 (3) 16:58 | |
| 8 | 06:02 | 06:27 | 09:09 (3) 06:57 | 08:37 (3) 07:25 | 08:28 (3) 06:59 | 08:00 (3) 07:31 | |
| | 20:54 | 20:29 | 10:19 (3) 19:45 | 10:54 (3) 18:56 | 18:28 (4) 17:14 | 09:19 (3) 16:58 | |
| 9 | 06:03 | 06:28 | 09:08 (3) 06:58 | 08:37 (3) 07:26 | 08:28 (3) 07:00 | 08:02 (3) 07:32 | |
| | 20:53 | 20:28 | 10:20 (3) 19:43 | 10:55 (3) 18:54 | 18:28 (4) 17:13 | 09:17 (3) 16:58 | |
| 10 | 06:03 | 06:29 | 09:07 (3) 06:58 | 08:35 (3) 07:27 | 08:29 (3) 07:01 | 08:05 (3) 07:32 | |
| | 20:53 | 20:27 | 10:22 (3) 19:41 | 10:55 (3) 18:53 | 18:28 (4) 17:12 | 09:15 (3) 16:58 | |
| 11 | 06:04 | 06:30 | 09:05 (3) 06:59 | 08:35 (3) 07:28 | 08:29 (3) 07:02 | 08:07 (3) 07:33 | |
| | 20:53 | 20:26 | 10:22 (3) 19:40 | 10:56 (3) 18:51 | 18:27 (4) 17:12 | 09:12 (3) 16:58 | |
| 12 | 06:05 | 06:31 | 09:03 (3) 07:00 | 08:34 (3) 07:29 | 08:29 (3) 07:03 | 08:10 (3) 07:34 | |
| | 20:52 | 20:24 | 10:24 (3) 19:38 | 10:57 (3) 18:50 | 18:27 (4) 17:11 | 09:10 (3) 16:59 | |
| 13 | 06:05 | 06:32 | 09:02 (3) 07:01 | 08:33 (3) 07:30 | 08:30 (3) 07:04 | 08:13 (3) 07:35 | |
| | 20:52 | 20:23 | 10:25 (3) 19:37 | 10:58 (3) 18:48 | 18:26 (4) 17:10 | 09:06 (3) 16:59 | |
| 14 | 06:06 | 06:33 | 09:01 (3) 07:02 | 08:33 (3) 07:31 | 08:30 (3) 07:05 | 08:17 (3) 07:36 | |
| | 20:51 | 20:22 | 10:27 (3) 19:35 | 10:58 (3) 18:47 | 18:24 (4) 17:09 | 09:04 (3) 16:59 | |
| 15 | 06:07 | 06:34 | 09:00 (3) 07:03 | 08:33 (3) 07:32 | 08:30 (3) 07:07 | 08:20 (3) 07:36 | |
| | 20:51 | 20:21 | 10:28 (3) 19:33 | 10:59 (3) 18:45 | 18:22 (4) 17:08 | 09:00 (3) 16:59 | |
| 16 | 06:07 | 06:35 | 08:59 (3) 07:04 | 08:32 (3) 07:33 | 08:31 (3) 07:08 | 08:25 (3) 07:37 | |
| | 20:50 | 20:19 | 10:29 (3) 19:32 | 11:00 (3) 18:44 | 18:21 (4) 17:07 | 09:05 (3) 16:59 | |
| 17 | 06:08 | 06:36 | 08:58 (3) 07:05 | 08:32 (3) 07:34 | 08:31 (3) 07:09 | 08:32 (3) 07:38 | |
| | 20:50 | 20:18 | 10:31 (3) 19:30 | 11:00 (3) 18:42 | 18:19 (4) 17:06 | 16:08 (3) 17:00 | |
| 18 | 06:09 | 06:37 | 08:57 (3) 07:06 | 08:31 (3) 07:35 | 08:32 (3) 07:10 | 07:38 | |
| | 20:49 | 20:17 | 10:32 (3) 19:28 | 11:01 (3) 18:41 | 18:18 (4) 17:06 | 17:00 | |
| 19 | 06:10 | 06:38 | 08:56 (3) 07:07 | 08:31 (3) 07:36 | 08:34 (3) 07:11 | 07:39 | |
| | 20:48 | 20:15 | 10:33 (3) 19:27 | 11:01 (3) 18:39 | 18:17 (4) 17:05 | 17:00 | |
| 20 | 06:11 | 06:39 | 08:55 (3) 07:08 | 08:30 (3) 07:37 | 08:34 (3) 07:12 | 07:40 | |
| | 20:48 | 20:14 | 10:35 (3) 19:25 | 18:11 (4) 18:38 | 18:15 (4) 17:04 | 17:01 | |
| 21 | 06:11 | 06:40 | 08:54 (3) 07:09 | 08:29 (3) 07:39 | 08:35 (3) 07:13 | 07:40 | |
| | 20:47 | 20:12 | 10:36 (3) 19:23 | 18:15 (4) 18:36 | 18:14 (4) 17:04 | 17:01 | |
| 22 | 06:12 | 06:41 | 08:52 (3) 07:10 | 08:29 (3) 07:40 | 08:36 (3) 07:14 | 07:41 | |
| | 20:46 | 20:11 | 10:36 (3) 19:22 | 18:18 (4) 18:35 | 18:12 (4) 17:03 | 17:02 | |
| 23 | 06:13 | 06:42 | 08:51 (3) 07:11 | 08:29 (3) 07:41 | 08:36 (3) 07:16 | 07:41 | |
| | 20:45 | 20:09 | 10:38 (3) 19:20 | 18:20 (4) 18:34 | 18:11 (4) 17:03 | 17:02 | |
| 24 | 06:14 | 06:43 | 08:50 (3) 07:12 | 08:28 (3) 07:42 | 08:37 (3) 07:17 | 16:02 (5) 07:42 | |
| | 20:45 | 20:08 | 10:39 (3) 19:18 | 18:22 (4) 18:32 | 18:09 (4) 17:02 | 16:11 (5) 17:03 | |
| 25 | 06:15 | 06:43 | 08:49 (3) 07:12 | 08:28 (3) 07:43 | 07:38 (3) 07:18 | 16:00 (5) 07:42 | |
| | 20:44 | 20:06 | 10:40 (3) 19:17 | 18:23 (4) 17:31 | 17:08 (4) 17:01 | 15:15 (5) 17:03 | |
| 26 | 06:16 | 09:37 (3) 06:44 | 08:48 (3) 07:13 | 08:28 (3) 07:44 | 07:40 (3) 07:19 | 15:59 (5) 07:42 | |
| | 20:43 | 11 09:48 (3) 20:05 | 10:41 (3) 19:15 | 18:24 (4) 17:30 | 17:07 (4) 17:01 | 16:17 (5) 17:04 | |
| 27 | 06:16 | 09:33 (3) 06:45 | 08:47 (3) 07:14 | 08:28 (3) 07:45 | 07:41 (3) 07:20 | 15:57 (5) 07:43 | |
| | 20:42 | 20 09:53 (3) 20:03 | 10:42 (3) 19:14 | 18:25 (4) 17:28 | 17:06 (4) 17:01 | 16:19 (5) 17:05 | |
| 28 | 06:17 | 09:29 (3) 06:46 | 08:46 (3) 07:15 | 08:28 (3) 07:46 | 07:42 (3) 07:21 | 15:56 (5) 07:43 | |
| | 20:41 | 28 09:57 (3) 20:02 | 10:44 (3) 19:12 | 18:26 (4) 17:27 | 17:04 (4) 17:00 | 16:20 (5) 17:05 | |
| 29 | 06:18 | 09:27 (3) 06:47 | 08:45 (3) 07:16 | 08:28 (3) 07:47 | 07:43 (3) 07:22 | 15:56 (5) 07:43 | |
| | 20:40 | 33 10:00 (3) 20:00 | 10:45 (3) 19:10 | 18:27 (4) 17:26 | 17:03 (4) 17:00 | 16:21 (5) 17:06 | |
| 30 | 06:19 | 09:25 (3) 06:48 | 08:45 (3) 07:17 | 08:28 (3) 07:48 | 07:44 (3) 07:23 | 15:55 (5) 07:44 | |
| | 20:39 | 37 10:02 (3) 19:59 | 10:46 (3) 19:09 | 18:28 (4) 17:25 | 17:00 (4) 17:00 | 16:22 (5) 17:07 | |
| 31 | 06:20 | 09:23 (3) 06:49 | 08:43 (3) 07:18 | 08:27 (3) 07:49 | 07:45 (3) 07:24 | 15:55 (5) 07:44 | |
| | 20:38 | 42 10:05 (3) 19:57 | 10:46 (3) 19:08 | 17:23 | 108 09:33 (3) 17:08 | 37 16:41 (5) | |
| Potential sun hours | 455 | 425 | 374 | 347 | 301 | 292 | |
| Total, worst case | | 171 | 2745 | 4747 | 5711 | 1336 | 1121 |
| Sun reduction | | 0.74 | 0.73 | 0.65 | 0.54 | 0.51 | 0.45 |
| Oper. time red. | | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Wind dir. red. | | 0.73 | 0.73 | 0.74 | 0.74 | 0.73 | 0.68 |
| Total reduction | | 0.16 | 0.16 | 0.14 | 0.12 | 0.11 | 0.09 |
| Total, real | | 28 | 438 | 674 | 689 | 146 | 103 |

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:

windpro Seui - flickering

Printed/Page

2023-12-20 10:52 / 17

Licensed user:

Ing. Bruno Manca

Via Vittorio Veneto 231

IT-09028 Sestu

+390702358125

Bruno Manca / ingbrunomanca@gmail.com

Calculated:

2023-12-19 11:53/2.8.579

SHADOW - Calendar

Calculation: shadow flickering Seui - progetto Shadow receptor: L - R12

Assumptions for shadow calculations

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

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|------|------|------|------|------|------|-------|-------|------|------|------|------|
| 4.40 | 5.05 | 5.88 | 7.00 | 8.45 | 9.88 | 10.82 | 10.03 | 8.08 | 6.09 | 5.07 | 4.27 |

Operational time

| N | NNE | ENE | E | ESE | SSE | S | SSW | WSW | W | WNW | NNW | Sum |
|----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-------|
| 86 | 55 | 78 | 159 | 368 | 188 | 65 | 104 | 357 | 605 | 339 | 206 | 2,610 |

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

| | January | | February | | March | | April | | May | | June | |
|---------------------|---------|--------------|----------|--------------|-------|---------------|--------------|---------------|---------------|---------------|---------------|--|
| 1 | 07:44 | 15:31 (5) | 07:32 | 15:51 (5) | 06:58 | 07:09 | 06:25 | 07:14 (3) | 05:57 | 07:03 (3) | | |
| | 17:09 | 60 16:31 (5) | 17:42 | 44 16:35 (5) | 18:14 | 19:46 | 20:16 | 169 19:09 (4) | 20:44 | 185 19:12 (4) | | |
| 2 | 07:44 | 15:32 (5) | 07:31 | 15:53 (5) | 06:56 | 07:07 | 06:24 | 07:12 (3) | 05:57 | 07:04 (3) | | |
| | 17:09 | 60 16:32 (5) | 17:43 | 41 16:34 (5) | 18:15 | 19:47 | 20:17 | 171 19:08 (4) | 20:45 | 184 19:12 (4) | | |
| 3 | 07:44 | 15:32 (5) | 07:30 | 15:54 (5) | 06:55 | 07:06 | 18:15 (4) | 06:22 | 07:11 (3) | 05:57 | 07:04 (3) | |
| | 17:10 | 60 16:32 (5) | 17:44 | 38 16:32 (5) | 18:16 | 19:48 | 8 18:23 (4) | 20:18 | 174 19:09 (4) | 20:46 | 183 19:12 (4) | |
| 4 | 07:45 | 15:32 (5) | 07:29 | 15:56 (5) | 06:53 | 07:04 | 18:04 (4) | 06:21 | 07:10 (3) | 05:56 | 07:04 (3) | |
| | 17:11 | 61 16:33 (5) | 17:45 | 35 16:31 (5) | 18:17 | 19:49 | 29 18:33 (4) | 20:19 | 175 19:09 (4) | 20:47 | 183 19:12 (4) | |
| 5 | 07:45 | 15:33 (5) | 07:28 | 15:58 (5) | 06:52 | 07:02 | 17:59 (4) | 06:20 | 07:09 (3) | 05:56 | 07:04 (3) | |
| | 17:12 | 60 16:33 (5) | 17:46 | 31 16:29 (5) | 18:18 | 19:50 | 39 18:38 (4) | 20:20 | 178 19:10 (4) | 20:47 | 183 19:12 (4) | |
| 6 | 07:45 | 15:33 (5) | 07:27 | 16:01 (5) | 06:50 | 07:01 | 17:54 (4) | 06:19 | 07:08 (3) | 05:56 | 07:05 (3) | |
| | 17:13 | 61 16:34 (5) | 17:48 | 26 16:27 (5) | 18:20 | 19:51 | 47 18:41 (4) | 20:21 | 180 19:10 (4) | 20:48 | 181 19:12 (4) | |
| 7 | 07:45 | 15:34 (5) | 07:26 | 16:03 (5) | 06:49 | 06:59 | 17:50 (4) | 06:18 | 07:08 (3) | 05:55 | 07:05 (3) | |
| | 17:14 | 60 16:34 (5) | 17:49 | 21 16:24 (5) | 18:21 | 19:52 | 54 18:44 (4) | 20:22 | 180 19:10 (4) | 20:48 | 182 19:13 (4) | |
| 8 | 07:44 | 15:34 (5) | 07:25 | 16:07 (5) | 06:47 | 06:58 | 17:48 (4) | 06:16 | 07:07 (3) | 05:55 | 07:05 (3) | |
| | 17:15 | 61 16:35 (5) | 17:50 | 13 16:20 (5) | 18:22 | 19:53 | 59 18:47 (4) | 20:23 | 182 19:10 (4) | 20:49 | 181 19:12 (4) | |
| 9 | 07:44 | 15:35 (5) | 07:24 | 16:46 | 06:56 | 06:56 | 17:45 (4) | 06:15 | 07:06 (3) | 05:55 | 07:05 (3) | |
| | 17:16 | 61 16:36 (5) | 17:51 | 18:23 | 19:54 | 64 18:49 (4) | 20:24 | 184 19:11 (4) | 20:50 | 181 19:12 (4) | | |
| 10 | 07:44 | 15:35 (5) | 07:23 | 16:44 | 06:55 | 06:55 | 17:43 (4) | 06:14 | 07:06 (3) | 05:55 | 07:05 (3) | |
| | 17:17 | 60 16:35 (5) | 17:52 | 18:24 | 19:55 | 68 18:51 (4) | 20:25 | 185 19:11 (4) | 20:50 | 181 19:13 (4) | | |
| 11 | 07:44 | 15:35 (5) | 07:22 | 16:42 | 06:53 | 06:53 | 17:40 (4) | 06:13 | 07:05 (3) | 05:55 | 07:06 (3) | |
| | 17:18 | 61 16:36 (5) | 17:54 | 18:25 | 19:56 | 73 18:53 (4) | 20:26 | 186 19:11 (4) | 20:51 | 180 19:13 (4) | | |
| 12 | 07:44 | 15:36 (5) | 07:20 | 16:41 | 06:52 | 06:52 | 17:38 (4) | 06:12 | 07:05 (3) | 05:54 | 07:06 (3) | |
| | 17:19 | 61 16:37 (5) | 17:55 | 18:26 | 19:57 | 77 18:55 (4) | 20:27 | 186 19:11 (4) | 20:51 | 179 19:13 (4) | | |
| 13 | 07:44 | 15:36 (5) | 07:19 | 16:39 | 06:50 | 06:50 | 17:36 (4) | 06:11 | 07:04 (3) | 05:54 | 07:06 (3) | |
| | 17:20 | 60 16:36 (5) | 17:56 | 18:27 | 19:58 | 80 18:56 (4) | 20:28 | 187 19:11 (4) | 20:52 | 180 19:13 (4) | | |
| 14 | 07:43 | 15:37 (5) | 07:18 | 16:38 | 06:49 | 06:49 | 17:35 (4) | 06:10 | 07:04 (3) | 05:54 | 07:07 (3) | |
| | 17:21 | 60 16:37 (5) | 17:57 | 18:28 | 19:59 | 82 18:57 (4) | 20:29 | 187 19:11 (4) | 20:52 | 179 19:13 (4) | | |
| 15 | 07:43 | 15:38 (5) | 07:17 | 16:36 | 06:47 | 06:47 | 17:32 (4) | 06:09 | 07:04 (3) | 05:54 | 07:07 (3) | |
| | 17:22 | 60 16:38 (5) | 17:58 | 18:29 | 20:00 | 86 18:58 (4) | 20:30 | 188 19:11 (4) | 20:52 | 178 19:13 (4) | | |
| 16 | 07:43 | 15:38 (5) | 07:16 | 16:35 | 06:46 | 06:46 | 17:31 (4) | 06:08 | 07:03 (3) | 05:54 | 07:07 (3) | |
| | 17:23 | 59 16:37 (5) | 17:59 | 18:30 | 20:01 | 89 19:00 (4) | 20:31 | 189 19:11 (4) | 20:53 | 179 19:14 (4) | | |
| 17 | 07:42 | 15:39 (5) | 07:14 | 16:33 | 06:44 | 06:44 | 17:30 (4) | 06:07 | 07:03 (3) | 05:54 | 07:07 (3) | |
| | 17:24 | 59 16:38 (5) | 18:01 | 18:31 | 20:02 | 90 19:00 (4) | 20:32 | 188 19:11 (4) | 20:53 | 179 19:14 (4) | | |
| 18 | 07:42 | 15:39 (5) | 07:13 | 16:31 | 06:43 | 06:43 | 17:29 (4) | 06:07 | 07:03 (3) | 05:54 | 07:07 (3) | |
| | 17:25 | 59 16:38 (5) | 18:02 | 18:32 | 20:03 | 92 19:01 (4) | 20:33 | 189 19:12 (4) | 20:54 | 179 19:14 (4) | | |
| 19 | 07:41 | 15:40 (5) | 07:12 | 16:30 | 06:41 | 06:41 | 17:27 (4) | 06:06 | 07:03 (3) | 05:55 | 07:07 (3) | |
| | 17:26 | 59 16:39 (5) | 18:03 | 18:33 | 20:04 | 95 19:02 (4) | 20:34 | 188 19:11 (4) | 20:54 | 179 19:14 (4) | | |
| 20 | 07:41 | 15:40 (5) | 07:10 | 16:28 | 06:40 | 06:40 | 17:26 (4) | 06:05 | 07:03 (3) | 05:55 | 07:08 (3) | |
| | 17:28 | 58 16:38 (5) | 18:04 | 18:34 | 20:05 | 97 19:03 (4) | 20:35 | 188 19:11 (4) | 20:54 | 178 19:14 (4) | | |
| 21 | 07:40 | 15:40 (5) | 07:09 | 16:27 | 06:38 | 06:38 | 17:24 (4) | 06:04 | 07:02 (3) | 05:55 | 07:09 (3) | |
| | 17:29 | 58 16:38 (5) | 18:05 | 18:35 | 20:06 | 109 19:04 (4) | 20:35 | 189 19:11 (4) | 20:54 | 178 19:15 (4) | | |
| 22 | 07:40 | 15:41 (5) | 07:08 | 16:25 | 06:37 | 06:37 | 17:23 (4) | 06:03 | 07:03 (3) | 05:55 | 07:09 (3) | |
| | 17:30 | 57 16:38 (5) | 18:06 | 18:36 | 20:07 | 123 19:04 (4) | 20:36 | 189 19:12 (4) | 20:55 | 178 19:15 (4) | | |
| 23 | 07:39 | 15:42 (5) | 07:06 | 16:23 | 06:35 | 06:35 | 17:22 (4) | 06:03 | 07:03 (3) | 05:55 | 07:08 (3) | |
| | 17:31 | 56 16:38 (5) | 18:07 | 18:37 | 20:08 | 132 19:05 (4) | 20:37 | 187 19:11 (4) | 20:55 | 179 19:15 (4) | | |
| 24 | 07:38 | 15:42 (5) | 07:05 | 16:22 | 06:34 | 06:34 | 17:21 (4) | 06:02 | 07:02 (3) | 05:56 | 07:08 (3) | |
| | 17:32 | 56 16:38 (5) | 18:09 | 18:38 | 20:09 | 139 19:06 (4) | 20:38 | 188 19:11 (4) | 20:55 | 179 19:15 (4) | | |
| 25 | 07:38 | 15:44 (5) | 07:03 | 16:20 | 06:33 | 06:33 | 17:23 (3) | 06:01 | 07:03 (3) | 05:56 | 07:09 (3) | |
| | 17:33 | 54 16:38 (5) | 18:10 | 18:39 | 20:10 | 146 19:06 (4) | 20:39 | 188 19:12 (4) | 20:55 | 179 19:16 (4) | | |
| 26 | 07:37 | 15:44 (5) | 07:02 | 16:18 | 06:31 | 06:31 | 17:21 (3) | 06:01 | 07:03 (3) | 05:56 | 07:09 (3) | |
| | 17:34 | 54 16:38 (5) | 18:11 | 18:40 | 20:11 | 151 19:07 (4) | 20:40 | 186 19:11 (4) | 20:55 | 179 19:16 (4) | | |
| 27 | 07:36 | 15:45 (5) | 07:01 | 16:17 | 06:30 | 06:30 | 17:20 (3) | 06:00 | 07:03 (3) | 05:56 | 07:09 (3) | |
| | 17:36 | 52 16:37 (5) | 18:12 | 18:41 | 20:12 | 155 19:07 (4) | 20:41 | 187 19:12 (4) | 20:55 | 178 19:15 (4) | | |
| 28 | 07:35 | 15:46 (5) | 06:59 | 16:15 | 06:29 | 06:29 | 17:17 (3) | 05:59 | 07:03 (3) | 05:57 | 07:10 (3) | |
| | 17:37 | 51 16:37 (5) | 18:13 | 18:42 | 20:13 | 160 19:07 (4) | 20:41 | 186 19:12 (4) | 20:55 | 179 19:16 (4) | | |
| 29 | 07:35 | 15:47 (5) | | 16:14 | 06:27 | 06:27 | 17:16 (3) | 05:59 | 07:03 (3) | 05:57 | 07:10 (3) | |
| | 17:38 | 49 16:36 (5) | | 18:43 | 20:14 | 163 19:08 (4) | 20:42 | 186 19:12 (4) | 20:55 | 179 19:16 (4) | | |
| 30 | 07:34 | 15:48 (5) | | 16:12 | 06:26 | 06:26 | 17:15 (3) | 05:58 | 07:03 (3) | 05:58 | 07:10 (3) | |
| | 17:39 | 47 16:35 (5) | | 18:44 | 20:15 | 165 19:08 (4) | 20:43 | 185 19:12 (4) | 20:55 | 180 19:17 (4) | | |
| 31 | 07:33 | 15:50 (5) | | 16:10 | | | 17:14 | 05:58 | 07:04 (3) | | | |
| | 17:40 | 45 16:35 (5) | | 18:45 | | | 20:44 | 185 19:12 (4) | | | | |
| Potential sun hours | 301 | | 299 | | 370 | 397 | | 445 | | 448 | | |
| Total, worst case | | 1779 | | 249 | | 2672 | | 5710 | | 5402 | | |
| Sun reduction | | 0.45 | | 0.47 | | 0.53 | | 0.59 | | 0.66 | | |
| Oper. time red. | | 0.30 | | 0.30 | | 0.30 | | 0.30 | | 0.30 | | |
| Wind dir. red. | | 0.67 | | 0.67 | | 0.79 | | 0.79 | | 0.79 | | |
| Total reduction | | 0.09 | | 0.09 | | 0.12 | | 0.14 | | 0.15 | | |
| Total, real | | 160 | | 23 | | 332 | | 786 | | 835 | | |

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

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

Project:
windpro Seui - flickering

Printed/Page
2023-12-20 10:52 / 18

Licensed user:
Ing. Bruno Manca
Via Vittorio Veneto 231
IT-09028 Sestu
+390702358125
Bruno Manca / ingbrunomanca@gmail.com
Calculated:
2023-12-19 11:53/2.8.579

SHADOW - Calendar

Calculation: shadow flickering Seui - progetto Shadow receptor: L - R12

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

| | July | August | September | October | November | December |
|---------------------|--------------------|----------------------------------|---------------------------------|------------------------------|----------------|-----------------------------|
| 1 | 05:58 20:55 180 | 07:10 (3) 19:17 (4) 20:37 187 | 07:16 (3) 19:22 (4) 19:56 73 | 17:39 (4) 18:52 (4) 19:07 | 07:18 17:22 | 06:51 16:59 61 |
| 2 | 05:59 20:55 180 | 07:11 (3) 19:18 (4) 20:36 185 | 07:15 (3) 19:20 (4) 19:54 68 | 17:41 (4) 18:49 (4) 19:05 | 07:19 17:21 | 06:52 16:59 60 |
| 3 | 05:59 20:55 181 | 07:10 (3) 19:17 (4) 20:35 184 | 07:16 (3) 19:20 (4) 19:53 64 | 17:43 (4) 18:47 (4) 19:04 | 07:20 17:20 | 06:53 15:36 (5) 16:59 61 |
| 4 | 06:00 20:55 181 | 07:11 (3) 19:18 (4) 20:34 184 | 07:16 (3) 19:20 (4) 19:51 59 | 17:45 (4) 18:44 (4) 19:02 | 07:21 17:19 | 06:54 15:54 (5) 16:59 61 |
| 5 | 06:00 20:55 183 | 07:10 (3) 19:18 (4) 20:33 182 | 07:17 (3) 19:20 (4) 19:49 54 | 17:47 (4) 18:41 (4) 19:01 | 06:55 17:18 | 06:55 15:58 (5) 16:58 61 |
| 6 | 06:01 20:54 182 | 07:11 (3) 19:19 (4) 20:32 181 | 07:18 (3) 19:20 (4) 19:48 48 | 17:50 (4) 18:38 (4) 18:59 | 06:56 17:17 | 07:29 16:00 (5) 16:58 61 |
| 7 | 06:01 20:54 182 | 07:11 (3) 19:18 (4) 20:31 180 | 07:18 (3) 19:20 (4) 19:46 40 | 17:54 (4) 18:34 (4) 18:57 | 06:57 17:15 | 07:30 16:01 (5) 16:58 60 |
| 8 | 06:02 20:54 183 | 07:11 (3) 19:19 (4) 20:29 178 | 07:19 (3) 19:19 (4) 19:45 29 | 17:59 (4) 18:28 (4) 18:56 | 06:59 17:14 | 07:31 16:02 (5) 16:58 61 |
| 9 | 06:03 20:53 183 | 07:12 (3) 19:20 (4) 20:28 176 | 07:20 (3) 19:19 (4) 19:43 11 | 18:08 (4) 18:19 (4) 18:54 | 07:00 17:13 | 07:32 15:22 (5) 16:58 60 |
| 10 | 06:03 20:53 184 | 07:11 (3) 19:19 (4) 20:27 173 | 07:21 (3) 19:18 (4) 19:41 | 07:27 18:53 | 07:01 17:12 | 07:32 16:06 (5) 16:58 60 |
| 11 | 06:04 20:53 185 | 07:11 (3) 19:20 (4) 20:26 171 | 07:21 (3) 19:17 (4) 19:40 | 07:28 18:51 | 07:02 17:12 | 07:33 16:06 (5) 16:58 60 |
| 12 | 06:05 20:52 184 | 07:12 (3) 19:20 (4) 20:24 168 | 07:22 (3) 19:17 (4) 19:38 | 07:29 18:50 | 07:03 17:11 | 07:34 15:20 (5) 16:59 60 |
| 13 | 06:05 20:52 186 | 07:11 (3) 19:20 (4) 20:23 165 | 07:23 (3) 19:16 (4) 19:37 | 07:30 18:48 | 07:04 17:10 | 07:35 15:19 (5) 16:59 60 |
| 14 | 06:06 20:51 185 | 07:12 (3) 19:20 (4) 20:22 161 | 07:24 (3) 19:15 (4) 19:35 | 07:31 18:47 | 07:05 17:09 | 07:36 15:19 (5) 16:59 60 |
| 15 | 06:07 20:51 187 | 07:12 (3) 19:21 (4) 20:21 159 | 07:25 (3) 19:15 (4) 19:33 | 07:32 18:45 | 07:07 17:08 | 07:36 16:10 (5) 16:59 60 |
| 16 | 06:07 20:50 186 | 07:12 (3) 19:20 (4) 20:19 154 | 07:27 (3) 19:14 (4) 19:32 | 07:33 18:44 | 07:08 17:07 | 07:37 15:17 (5) 16:59 60 |
| 17 | 06:08 20:50 187 | 07:12 (3) 19:21 (4) 20:18 149 | 07:28 (3) 19:13 (4) 19:30 | 07:34 18:42 | 07:09 17:06 | 07:38 16:11 (5) 17:00 60 |
| 18 | 06:09 20:49 187 | 07:12 (3) 19:21 (4) 20:17 145 | 07:30 (3) 19:13 (4) 19:28 | 07:35 18:41 | 07:10 17:06 | 07:38 15:16 (5) 17:00 59 |
| 19 | 06:10 20:48 186 | 07:13 (3) 19:21 (4) 20:15 139 | 07:33 (3) 19:12 (4) 19:27 | 07:36 18:39 | 07:11 17:05 | 07:39 15:17 (5) 17:00 59 |
| 20 | 06:11 20:48 188 | 07:12 (3) 19:21 (4) 20:14 130 | 07:36 (3) 19:11 (4) 19:25 | 07:37 18:38 | 07:12 17:04 | 07:40 15:16 (5) 17:01 59 |
| 21 | 06:11 20:47 188 | 07:12 (3) 19:21 (4) 20:12 121 | 07:40 (3) 19:10 (4) 19:23 | 07:39 18:36 | 07:13 17:04 | 07:40 15:16 (5) 17:01 59 |
| 22 | 06:12 20:46 187 | 07:13 (3) 19:21 (4) 20:11 104 | 07:46 (3) 19:08 (4) 19:22 | 07:40 18:35 | 07:14 17:03 | 07:41 15:16 (5) 17:02 59 |
| 23 | 06:13 20:45 189 | 07:13 (3) 19:22 (4) 20:09 97 | 07:50 (4) 19:07 (4) 19:20 | 07:41 18:34 | 07:16 17:03 | 07:41 15:16 (5) 17:02 59 |
| 24 | 06:14 20:45 189 | 07:13 (3) 19:22 (4) 20:08 94 | 07:51 (4) 19:05 (4) 19:18 | 07:42 18:32 | 07:17 17:02 | 07:42 15:16 (5) 17:03 59 |
| 25 | 06:15 20:44 188 | 07:14 (3) 19:22 (4) 20:06 92 | 07:52 (4) 19:04 (4) 19:17 | 07:43 17:31 | 07:18 17:02 | 07:42 15:17 (5) 17:03 59 |
| 26 | 06:16 20:43 188 | 07:13 (3) 19:21 (4) 20:05 90 | 07:53 (4) 19:03 (4) 19:15 | 07:44 17:30 | 07:19 17:01 | 07:42 15:17 (5) 17:04 59 |
| 27 | 06:16 20:42 187 | 07:14 (3) 19:21 (4) 20:03 88 | 07:54 (4) 19:01 (4) 19:14 | 07:45 17:28 | 07:20 17:01 | 07:43 15:17 (5) 17:05 60 |
| 28 | 06:17 20:41 187 | 07:14 (3) 19:21 (4) 20:02 86 | 07:54 (4) 19:00 (4) 19:12 | 07:46 17:27 | 07:21 17:00 | 07:43 15:17 (5) 17:05 60 |
| 29 | 06:18 20:40 188 | 07:14 (3) 19:22 (4) 20:00 82 | 07:56 (4) 18:58 (4) 19:10 | 07:47 17:26 | 07:22 17:00 | 07:43 16:17 (5) 17:06 60 |
| 30 | 06:19 20:39 187 | 07:15 (3) 19:22 (4) 19:59 80 | 07:57 (4) 18:57 (4) 19:09 | 07:48 17:25 | 07:23 17:00 | 07:44 16:18 (5) 17:07 59 |
| 31 | 06:20 20:38 187 | 07:15 (3) 19:22 (4) 19:57 77 | 07:58 (4) 18:55 (4) | 06:50 17:23 | 07:24 17:08 | 07:44 16:31 (5) |
| Potential sun hours | 455 | 425 | 374 | 347 | 301 | 292 |
| Total, worst case | 5745 | 4362 | 446 | 1370 | 1856 | |
| Sun reduction | 0.74 | 0.73 | 0.65 | 0.51 | 0.45 | |
| Oper. time red. | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | |
| Wind dir. red. | 0.79 | 0.79 | 0.80 | 0.67 | 0.67 | |
| Total reduction | 0.17 | 0.17 | 0.15 | 0.10 | 0.09 | |
| Total, real | 990 | 747 | 68 | 138 | 167 | |

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

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

Project:
windpro Seui - flickering

Printed/Page
2023-12-20 10:52 / 19

Licensed user:
Ing. Bruno Manca
Via Vittorio Veneto 231
IT-09028 Sestu
+390702358125
Bruno Manca / ingbrunomanca@gmail.com
Calculated:
2023-12-19 11:53/2.8.579

SHADOW - Calendar

Calculation: shadow flickering Seui - progetto Shadow receptor: M - R13

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

| | January | February | March | April | May | June | | | | | |
|---------------------|---------|----------|-------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1 | 07:44 | 07:32 | 06:58 | 07:09 | 17:05 (1) | 06:25 | 16:40 (1) | 05:57 | 16:59 (1) | | |
| | 17:09 | 17:42 | 18:14 | 19:46 | 17:45 (1) | 20:16 | 86 | 18:06 (1) | 20:44 | 58 | 17:57 (1) |
| 2 | 07:44 | 07:31 | 06:56 | 07:07 | 17:01 (1) | 06:24 | 16:40 (1) | 05:57 | 17:00 (1) | | |
| | 17:09 | 17:43 | 18:15 | 19:47 | 17:47 (1) | 20:17 | 85 | 18:05 (1) | 20:45 | 57 | 17:57 (1) |
| 3 | 07:45 | 07:30 | 06:55 | 07:06 | 16:59 (1) | 06:22 | 16:40 (1) | 05:57 | 17:01 (1) | | |
| | 17:10 | 17:44 | 18:16 | 19:48 | 17:50 (1) | 20:18 | 85 | 18:05 (1) | 20:46 | 56 | 17:57 (1) |
| 4 | 07:45 | 07:29 | 06:53 | 07:04 | 16:56 (1) | 06:21 | 16:41 (1) | 05:56 | 17:01 (1) | | |
| | 17:11 | 17:45 | 18:17 | 19:49 | 17:52 (1) | 20:19 | 84 | 18:05 (1) | 20:47 | 55 | 17:56 (1) |
| 5 | 07:45 | 07:28 | 06:52 | 07:02 | 16:55 (1) | 06:20 | 16:41 (1) | 05:56 | 17:02 (1) | | |
| | 17:12 | 17:46 | 18:18 | 19:50 | 17:54 (1) | 20:20 | 84 | 18:05 (1) | 20:47 | 54 | 17:56 (1) |
| 6 | 07:45 | 07:27 | 06:50 | 07:01 | 16:52 (1) | 06:19 | 16:42 (1) | 05:56 | 17:03 (1) | | |
| | 17:13 | 17:48 | 18:20 | 19:51 | 17:55 (1) | 20:21 | 83 | 18:05 (1) | 20:48 | 53 | 17:56 (1) |
| 7 | 07:45 | 07:26 | 06:49 | 06:59 | 16:50 (1) | 06:18 | 16:43 (1) | 05:55 | 17:03 (1) | | |
| | 17:14 | 17:49 | 18:21 | 19:52 | 17:56 (1) | 20:22 | 82 | 18:05 (1) | 20:48 | 52 | 17:55 (1) |
| 8 | 07:45 | 07:25 | 06:47 | 06:58 | 16:49 (1) | 06:16 | 16:43 (1) | 05:55 | 17:03 (1) | | |
| | 17:15 | 17:50 | 18:22 | 19:53 | 17:58 (1) | 20:23 | 82 | 18:05 (1) | 20:49 | 52 | 17:55 (1) |
| 9 | 07:44 | 07:24 | 06:46 | 06:56 | 16:47 (1) | 06:15 | 16:44 (1) | 05:55 | 17:04 (1) | | |
| | 17:16 | 17:51 | 18:23 | 19:54 | 17:58 (1) | 20:24 | 80 | 18:04 (1) | 20:50 | 51 | 17:55 (1) |
| 10 | 07:44 | 07:23 | 06:44 | 06:55 | 16:47 (1) | 06:14 | 16:44 (1) | 05:55 | 17:05 (1) | | |
| | 17:17 | 17:52 | 18:24 | 19:55 | 18:00 (1) | 20:25 | 80 | 18:04 (1) | 20:50 | 50 | 17:55 (1) |
| 11 | 07:44 | 07:22 | 06:42 | 06:53 | 16:45 (1) | 06:13 | 16:45 (1) | 05:54 | 17:06 (1) | | |
| | 17:18 | 17:54 | 18:25 | 19:56 | 18:00 (1) | 20:26 | 79 | 18:04 (1) | 20:51 | 49 | 17:55 (1) |
| 12 | 07:44 | 07:21 | 06:41 | 06:52 | 16:44 (1) | 06:12 | 16:45 (1) | 05:54 | 17:06 (1) | | |
| | 17:19 | 17:55 | 18:26 | 19:57 | 18:01 (1) | 20:27 | 79 | 18:04 (1) | 20:51 | 49 | 17:55 (1) |
| 13 | 07:44 | 07:19 | 06:39 | 06:50 | 16:43 (1) | 06:11 | 16:46 (1) | 05:54 | 17:07 (1) | | |
| | 17:20 | 17:56 | 18:27 | 19:58 | 18:02 (1) | 20:28 | 77 | 18:03 (1) | 20:52 | 48 | 17:55 (1) |
| 14 | 07:43 | 07:18 | 06:38 | 06:49 | 16:43 (1) | 06:10 | 16:46 (1) | 05:54 | 17:07 (1) | | |
| | 17:21 | 17:57 | 18:28 | 19:59 | 18:03 (1) | 20:29 | 77 | 18:03 (1) | 20:52 | 48 | 17:55 (1) |
| 15 | 07:43 | 07:17 | 06:36 | 06:47 | 16:42 (1) | 06:09 | 16:47 (1) | 05:54 | 17:08 (1) | | |
| | 17:22 | 17:58 | 18:29 | 20:00 | 18:03 (1) | 20:30 | 76 | 18:03 (1) | 20:53 | 47 | 17:55 (1) |
| 16 | 07:43 | 07:16 | 06:35 | 06:46 | 16:41 (1) | 06:08 | 16:47 (1) | 05:54 | 17:08 (1) | | |
| | 17:23 | 17:59 | 18:30 | 20:01 | 18:04 (1) | 20:31 | 75 | 18:02 (1) | 20:53 | 47 | 17:55 (1) |
| 17 | 07:42 | 07:14 | 06:33 | 06:44 | 16:40 (1) | 06:07 | 16:48 (1) | 05:54 | 17:08 (1) | | |
| | 17:24 | 18:01 | 18:31 | 20:02 | 18:04 (1) | 20:32 | 74 | 18:02 (1) | 20:53 | 47 | 17:55 (1) |
| 18 | 07:42 | 07:13 | 06:31 | 06:43 | 16:40 (1) | 06:07 | 16:49 (1) | 05:54 | 17:08 (1) | | |
| | 17:25 | 18:02 | 18:32 | 20:03 | 18:04 (1) | 20:33 | 73 | 18:02 (1) | 20:54 | 47 | 17:55 (1) |
| 19 | 07:41 | 07:12 | 06:30 | 06:41 | 16:39 (1) | 06:06 | 16:50 (1) | 05:54 | 17:09 (1) | | |
| | 17:26 | 18:03 | 18:33 | 20:04 | 18:04 (1) | 20:34 | 72 | 18:02 (1) | 20:54 | 46 | 17:55 (1) |
| 20 | 07:41 | 07:10 | 06:28 | 06:40 | 16:40 (1) | 06:05 | 16:50 (1) | 05:55 | 17:09 (1) | | |
| | 17:28 | 18:04 | 18:34 | 20:05 | 18:05 (1) | 20:35 | 71 | 18:01 (1) | 20:54 | 46 | 17:55 (1) |
| 21 | 07:40 | 07:09 | 06:27 | 06:38 | 16:40 (1) | 06:04 | 16:51 (1) | 05:55 | 17:10 (1) | | |
| | 17:29 | 18:05 | 18:35 | 20:06 | 18:06 (1) | 20:36 | 69 | 18:00 (1) | 20:54 | 46 | 17:56 (1) |
| 22 | 07:40 | 07:08 | 06:25 | 06:37 | 16:39 (1) | 06:03 | 16:52 (1) | 05:55 | 17:10 (1) | | |
| | 17:30 | 18:06 | 18:36 | 20:07 | 18:05 (1) | 20:36 | 69 | 18:01 (1) | 20:55 | 46 | 17:56 (1) |
| 23 | 07:39 | 07:06 | 06:23 | 06:35 | 16:39 (1) | 06:03 | 16:53 (1) | 05:55 | 17:10 (1) | | |
| | 17:31 | 18:07 | 18:37 | 20:08 | 18:06 (1) | 20:37 | 67 | 18:00 (1) | 20:55 | 46 | 17:56 (1) |
| 24 | 07:38 | 07:05 | 06:22 | 06:34 | 16:39 (1) | 06:02 | 16:53 (1) | 05:55 | 17:10 (1) | | |
| | 17:32 | 18:09 | 18:38 | 20:09 | 18:06 (1) | 20:38 | 66 | 17:59 (1) | 20:55 | 46 | 17:56 (1) |
| 25 | 07:38 | 07:04 | 06:20 | 06:33 | 16:39 (1) | 06:01 | 16:54 (1) | 05:56 | 17:10 (1) | | |
| | 17:33 | 18:10 | 18:39 | 20:10 | 18:06 (1) | 20:39 | 66 | 18:00 (1) | 20:55 | 47 | 17:57 (1) |
| 26 | 07:37 | 07:02 | 06:18 | 06:31 | 16:39 (1) | 06:01 | 16:55 (1) | 05:56 | 17:10 (1) | | |
| | 17:34 | 18:11 | 18:40 | 20:11 | 18:06 (1) | 20:40 | 64 | 17:59 (1) | 20:55 | 47 | 17:57 (1) |
| 27 | 07:36 | 07:01 | 06:17 | 06:30 | 16:40 (1) | 06:00 | 16:56 (1) | 05:56 | 17:10 (1) | | |
| | 17:36 | 18:12 | 18:41 | 20:12 | 18:06 (1) | 20:41 | 63 | 17:59 (1) | 20:55 | 47 | 17:57 (1) |
| 28 | 07:35 | 06:59 | 06:15 | 06:29 | 16:39 (1) | 05:59 | 16:56 (1) | 05:57 | 17:10 (1) | | |
| | 17:37 | 18:13 | 18:42 | 20:13 | 18:05 (1) | 20:41 | 62 | 17:58 (1) | 20:55 | 48 | 17:58 (1) |
| 29 | 07:35 | 07:14 | 06:14 | 06:27 | 16:39 (1) | 05:59 | 16:57 (1) | 05:57 | 17:10 (1) | | |
| | 17:38 | 18:14 | 18:43 | 20:14 | 18:06 (1) | 20:42 | 62 | 17:59 (1) | 20:55 | 48 | 17:58 (1) |
| 30 | 07:34 | 07:12 | 06:13 | 17:14 (1) | 06:26 | 16:40 (1) | 05:58 | 16:57 (1) | 05:58 | 17:10 (1) | |
| | 17:39 | 18:14 | 18:43 | 22 | 17:36 (1) | 20:15 | 86 | 18:06 (1) | 20:43 | 61 | 17:58 (1) |
| 31 | 07:33 | 07:10 | 06:12 | 17:09 (1) | 06:25 | 16:40 (1) | 05:58 | 16:59 (1) | 17:10 (1) | | |
| | 17:40 | 18:15 | 18:44 | 33 | 17:42 (1) | 20:14 | 59 | 17:58 (1) | 20:44 | 59 | 17:58 (1) |
| Potential sun hours | 301 | 299 | 370 | 397 | 445 | 448 | 1482 | | | | |
| Total, worst case | | | 55 | 2272 | 2292 | 0.66 | | | | | |
| Sun reduction | | | 0.49 | 0.53 | 0.59 | 0.30 | | | | | |
| Oper. time red. | | | 0.30 | 0.30 | 0.30 | 0.79 | | | | | |
| Wind dir. red. | | | 0.79 | 0.79 | 0.79 | 0.16 | | | | | |
| Total reduction | | | 0.12 | 0.13 | 0.14 | 0.232 | | | | | |
| Total, real | | | 6 | 285 | 319 | 232 | | | | | |

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

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

Project:

windpro Seui - flickering

Printed/Page

2023-12-20 10:52 / 20

Licensed user:

Ing. Bruno Manca

Via Vittorio Veneto 231

IT-09028 Sestu

+390702358125

Bruno Manca / ingbrunomanca@gmail.com

Calculated:

2023-12-19 11:53/2.8.579

SHADOW - Calendar

Calculation: shadow flickering Seui - progetto Shadow receptor: M - R13

Assumptions for shadow calculations

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

| | | | | | | | | | | | |
|------|------|------|------|------|------|-------|-------|------|------|------|------|
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| 4.40 | 5.05 | 5.88 | 7.00 | 8.45 | 9.88 | 10.82 | 10.03 | 8.08 | 6.09 | 5.07 | 4.27 |

Operational time

| | | | | | | | | | | | | |
|----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-------|
| N | NNE | ENE | E | ESE | SSE | S | SSW | WSW | W | WNW | NNW | Sum |
| 86 | 55 | 78 | 159 | 368 | 188 | 65 | 104 | 357 | 605 | 339 | 206 | 2,610 |

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

| | July | August | September | October | November | December |
|---------------------|-------|--------------------|--------------------|--------------------|----------|----------|
| 1 | 05:58 | 17:10 (1) 06:21 | 16:56 (1) 06:50 | 16:44 (1) 07:18 | 06:51 | 07:24 |
| | 20:55 | 49 17:59 (1) 20:37 | 78 18:14 (1) 19:56 | 75 17:59 (1) 19:07 | 17:22 | 16:59 |
| 2 | 05:59 | 17:10 (1) 06:22 | 16:54 (1) 06:51 | 16:45 (1) 07:19 | 06:52 | 07:25 |
| | 20:55 | 50 18:00 (1) 20:36 | 80 18:14 (1) 19:54 | 73 17:58 (1) 19:05 | 17:21 | 16:59 |
| 3 | 05:59 | 17:09 (1) 06:23 | 16:54 (1) 06:52 | 16:45 (1) 07:20 | 06:53 | 07:26 |
| | 20:55 | 51 18:00 (1) 20:35 | 80 18:14 (1) 19:53 | 71 17:56 (1) 19:04 | 17:20 | 16:59 |
| 4 | 06:00 | 17:10 (1) 06:24 | 16:53 (1) 06:53 | 16:46 (1) 07:21 | 06:54 | 07:27 |
| | 20:55 | 51 18:01 (1) 20:34 | 81 18:14 (1) 19:51 | 69 17:55 (1) 19:02 | 17:19 | 16:59 |
| 5 | 06:00 | 17:09 (1) 06:25 | 16:53 (1) 06:54 | 16:47 (1) 07:22 | 06:55 | 07:28 |
| | 20:55 | 52 18:01 (1) 20:33 | 81 18:14 (1) 19:50 | 66 17:53 (1) 19:01 | 17:18 | 16:58 |
| 6 | 06:01 | 17:09 (1) 06:26 | 16:52 (1) 06:55 | 16:48 (1) 07:23 | 06:56 | 07:29 |
| | 20:54 | 53 18:02 (1) 20:32 | 83 18:15 (1) 19:48 | 63 17:51 (1) 18:59 | 17:17 | 16:58 |
| 7 | 06:01 | 17:08 (1) 06:27 | 16:52 (1) 06:56 | 16:50 (1) 07:24 | 06:57 | 07:30 |
| | 20:54 | 54 18:02 (1) 20:31 | 83 18:15 (1) 19:46 | 59 17:49 (1) 18:57 | 17:15 | 16:58 |
| 8 | 06:02 | 17:08 (1) 06:27 | 16:51 (1) 06:57 | 16:51 (1) 07:25 | 06:59 | 07:31 |
| | 20:54 | 55 18:03 (1) 20:29 | 84 18:15 (1) 19:45 | 56 17:47 (1) 18:56 | 17:14 | 16:58 |
| 9 | 06:03 | 17:08 (1) 06:28 | 16:50 (1) 06:58 | 16:53 (1) 07:26 | 07:00 | 07:32 |
| | 20:53 | 56 18:04 (1) 20:28 | 85 18:15 (1) 19:43 | 51 17:44 (1) 18:54 | 17:13 | 16:58 |
| 10 | 06:03 | 17:07 (1) 06:29 | 16:50 (1) 06:58 | 16:54 (1) 07:27 | 07:01 | 07:33 |
| | 20:53 | 57 18:04 (1) 20:27 | 85 18:15 (1) 19:41 | 47 17:41 (1) 18:53 | 17:12 | 16:58 |
| 11 | 06:04 | 17:07 (1) 06:30 | 16:48 (1) 06:59 | 16:57 (1) 07:28 | 07:02 | 07:33 |
| | 20:53 | 58 18:05 (1) 20:26 | 86 18:14 (1) 19:40 | 40 17:37 (1) 18:51 | 17:12 | 16:58 |
| 12 | 06:05 | 17:06 (1) 06:31 | 16:48 (1) 07:00 | 17:00 (1) 07:29 | 07:03 | 07:34 |
| | 20:52 | 59 18:05 (1) 20:25 | 86 18:14 (1) 19:38 | 33 17:33 (1) 18:50 | 17:11 | 16:59 |
| 13 | 06:05 | 17:06 (1) 06:32 | 16:47 (1) 07:01 | 17:05 (1) 07:30 | 07:04 | 07:35 |
| | 20:52 | 60 18:06 (1) 20:23 | 87 18:14 (1) 19:37 | 23 17:28 (1) 18:48 | 17:10 | 16:59 |
| 14 | 06:06 | 17:06 (1) 06:33 | 16:47 (1) 07:02 | 07:31 | 07:05 | 07:36 |
| | 20:51 | 61 18:07 (1) 20:22 | 86 18:13 (1) 19:35 | 18:47 | 17:09 | 16:59 |
| 15 | 06:07 | 17:06 (1) 06:34 | 16:47 (1) 07:03 | 07:32 | 07:07 | 07:36 |
| | 20:51 | 62 18:08 (1) 20:21 | 86 18:13 (1) 19:33 | 18:45 | 17:08 | 16:59 |
| 16 | 06:07 | 17:04 (1) 06:35 | 16:46 (1) 07:04 | 07:33 | 07:08 | 07:37 |
| | 20:50 | 63 18:07 (1) 20:19 | 87 18:13 (1) 19:32 | 18:44 | 17:07 | 16:59 |
| 17 | 06:08 | 17:04 (1) 06:36 | 16:46 (1) 07:05 | 07:34 | 07:09 | 07:38 |
| | 20:50 | 64 18:08 (1) 20:18 | 87 18:13 (1) 19:30 | 18:42 | 17:06 | 17:00 |
| 18 | 06:09 | 17:04 (1) 06:37 | 16:46 (1) 07:06 | 07:35 | 07:10 | 07:38 |
| | 20:49 | 65 18:09 (1) 20:17 | 86 18:12 (1) 19:28 | 18:41 | 17:06 | 17:00 |
| 19 | 06:10 | 17:04 (1) 06:38 | 16:45 (1) 07:07 | 07:36 | 07:11 | 07:39 |
| | 20:48 | 66 18:10 (1) 20:15 | 87 18:12 (1) 19:27 | 18:39 | 17:05 | 17:00 |
| 20 | 06:11 | 17:02 (1) 06:39 | 16:45 (1) 07:08 | 07:38 | 07:12 | 07:40 |
| | 20:48 | 67 18:09 (1) 20:14 | 86 18:11 (1) 19:25 | 18:38 | 17:04 | 17:01 |
| 21 | 06:11 | 17:02 (1) 06:40 | 16:45 (1) 07:09 | 07:39 | 07:13 | 07:40 |
| | 20:47 | 68 18:10 (1) 20:12 | 86 18:11 (1) 19:23 | 18:36 | 17:04 | 17:01 |
| 22 | 06:12 | 17:02 (1) 06:41 | 16:43 (1) 07:10 | 07:40 | 07:15 | 07:41 |
| | 20:46 | 69 18:11 (1) 20:11 | 86 18:09 (1) 19:22 | 18:35 | 17:03 | 17:02 |
| 23 | 06:13 | 17:01 (1) 06:42 | 16:43 (1) 07:11 | 07:41 | 07:16 | 07:41 |
| | 20:45 | 70 18:11 (1) 20:09 | 86 18:09 (1) 19:20 | 18:34 | 17:03 | 17:02 |
| 24 | 06:14 | 17:01 (1) 06:43 | 16:43 (1) 07:12 | 07:42 | 07:17 | 07:42 |
| | 20:45 | 71 18:12 (1) 20:08 | 85 18:08 (1) 19:18 | 18:32 | 17:02 | 17:03 |
| 25 | 06:15 | 16:59 (1) 06:43 | 16:43 (1) 07:12 | 06:43 | 07:18 | 07:42 |
| | 20:44 | 72 18:11 (1) 20:06 | 84 18:07 (1) 19:17 | 17:31 | 17:01 | 17:03 |
| 26 | 06:16 | 16:59 (1) 06:44 | 16:43 (1) 07:13 | 06:44 | 07:19 | 07:43 |
| | 20:43 | 73 18:12 (1) 20:05 | 83 18:06 (1) 19:15 | 17:30 | 17:01 | 17:04 |
| 27 | 06:16 | 16:58 (1) 06:45 | 16:43 (1) 07:14 | 06:45 | 07:20 | 07:43 |
| | 20:42 | 74 18:12 (1) 20:04 | 83 18:06 (1) 19:14 | 17:28 | 17:01 | 17:05 |
| 28 | 06:17 | 16:58 (1) 06:46 | 16:43 (1) 07:15 | 06:46 | 07:21 | 07:43 |
| | 20:41 | 75 18:13 (1) 20:02 | 82 18:05 (1) 19:12 | 17:27 | 17:00 | 17:05 |
| 29 | 06:18 | 16:57 (1) 06:47 | 16:44 (1) 07:16 | 06:47 | 07:22 | 07:44 |
| | 20:40 | 76 18:13 (1) 20:00 | 80 18:04 (1) 19:10 | 17:26 | 17:00 | 17:06 |
| 30 | 06:19 | 16:57 (1) 06:48 | 16:44 (1) 07:17 | 06:48 | 07:23 | 07:44 |
| | 20:39 | 77 18:14 (1) 19:59 | 79 18:03 (1) 19:09 | 17:25 | 17:00 | 17:07 |
| 31 | 06:20 | 16:56 (1) 06:49 | 16:44 (1) 07:18 | 06:50 | 07:24 | 07:44 |
| | 20:38 | 78 18:14 (1) 19:57 | 77 18:01 (1) 19:07 | 17:23 | 17:00 | 17:07 |
| Potential sun hours | 455 | 426 | 374 | 347 | 301 | 292 |
| Total, worst case | 1956 | 2595 | 726 | | | |
| Sun reduction | 0.74 | 0.73 | 0.65 | | | |
| Oper. time red. | 0.30 | 0.30 | 0.30 | | | |
| Wind dir. red. | 0.79 | 0.79 | 0.79 | | | |
| Total reduction | 0.17 | 0.17 | 0.15 | | | |
| Total, real | 341 | 449 | 111 | | | |

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) |

Project:
windpro Seui - flickering

Printed/Page
2023-12-20 10:54 / 1
Licensed user:
Ing. Bruno Manca
Via Vittorio Veneto 231
IT-09028 Sestu
+390702358125
Bruno Manca / ingbrunomanca@gmail.com
Calculated:
2023-12-19 11:53/2.8.579

SHADOW - Calendar per WTG

Calculation: shadow flickering Seui - progettoWTG: 1 - SE_01

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

| | January | February | March | April | May | June |
|-----------------------------|----------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| 1 | 07:44 17:09 | 07:32 17:42 | 06:58 15:23-16:10/47 18:14 | 07:09 16:19-17:45/86 19:46 | 06:25 16:40-18:06/86 20:16 | 05:57 16:59-17:57/58 20:44 |
| 2 | 07:44 17:09 | 07:31 17:43 | 06:56 15:21-16:12/51 18:15 | 07:07 16:20-17:47/87 19:47 | 06:24 16:40-18:05/85 20:17 | 05:57 17:00-17:57/57 20:45 |
| 3 | 07:45 17:10 | 07:30 17:44 | 06:55 15:19-16:13/54 18:16 | 07:06 16:22-17:50/88 19:48 | 06:22 16:40-18:05/85 20:18 | 05:57 17:01-17:57/56 20:46 |
| 4 | 07:45 17:11 | 07:29 17:45 | 06:53 15:18-16:15/57 18:17 | 07:04 16:23-17:52/89 19:49 | 06:21 16:41-18:05/84 20:19 | 05:56 17:01-17:56/55 20:47 |
| 5 | 07:45 17:12 | 07:28 17:46 | 06:52 15:17-16:16/59 18:18 | 07:02 16:25-17:54/89 19:50 | 06:20 16:41-18:05/84 20:20 | 05:56 17:02-17:56/54 20:47 |
| 6 | 07:45 17:13 | 07:27 17:48 | 06:50 15:16-16:17/61 18:20 | 07:01 16:27-17:55/88 19:51 | 06:19 16:42-18:05/83 20:21 | 05:56 17:03-17:56/53 20:48 |
| 7 | 07:45 17:14 | 07:26 17:49 | 06:49 15:14-16:18/64 18:21 | 06:59 16:29-17:56/87 19:52 | 06:18 16:43-18:05/82 20:22 | 05:55 17:03-17:55/52 20:48 |
| 8 | 07:45 17:15 | 07:25 17:50 | 06:47 15:14-16:19/65 18:22 | 06:58 16:32-17:58/86 19:53 | 06:16 16:43-18:05/82 20:23 | 05:55 17:03-17:55/52 20:49 |
| 9 | 07:44 17:16 | 07:24 17:51 | 06:46 15:13-16:19/66 18:23 | 06:56 16:35-17:58/83 19:54 | 06:15 16:44-18:04/80 20:24 | 05:55 17:04-17:55/51 20:50 |
| 10 | 07:44 17:17 | 07:23 17:52 | 06:44 15:12-16:19/67 18:24 | 06:55 16:41-18:00/79 19:55 | 06:14 16:44-18:04/80 20:25 | 05:55 17:05-17:55/50 20:50 |
| 11 | 07:44 17:18 | 07:22 17:54 | 06:42 15:12-16:20/68 18:25 | 06:53 16:45-18:00/75 19:56 | 06:13 16:45-18:04/79 20:26 | 05:55 17:06-17:55/49 20:51 |
| 12 | 07:44 17:19 | 07:21 17:55 | 06:41 15:11-16:20/69 18:26 | 06:52 16:44-18:01/77 19:57 | 06:12 16:45-18:04/79 20:27 | 05:54 17:06-17:55/49 20:51 |
| 13 | 07:44 17:20 | 07:19 17:56 | 06:39 15:11-16:21/70 18:27 | 06:50 16:43-18:02/79 19:58 | 06:11 16:46-18:03/77 20:28 | 05:54 17:07-17:55/48 20:52 |
| 14 | 07:43 17:21 | 07:18 17:57 | 06:38 15:10-16:21/71 18:28 | 06:49 16:43-18:03/80 19:59 | 06:10 16:46-18:03/77 20:29 | 05:54 17:07-17:55/48 20:52 |
| 15 | 07:43 17:22 | 07:17 17:58 | 06:36 15:09-16:20/71 18:29 | 06:47 16:42-18:03/81 20:00 | 06:09 16:47-18:03/76 20:30 | 05:54 17:08-17:55/47 20:53 |
| 16 | 07:43 17:23 | 07:16 17:59 | 06:35 15:10-16:21/71 18:30 | 06:46 16:41-18:04/83 20:01 | 06:08 16:47-18:02/75 20:31 | 05:54 17:08-17:55/47 20:53 |
| 17 | 07:42 17:24 | 07:14 18:01 | 06:33 15:09-16:21/72 18:31 | 06:44 16:40-18:04/84 20:02 | 06:07 16:48-18:02/74 20:32 | 05:54 17:08-17:55/47 20:53 |
| 18 | 07:42 17:25 | 07:13 18:02 | 06:31 15:10-16:21/71 18:32 | 06:43 16:40-18:04/84 20:03 | 06:07 16:49-18:02/73 20:33 | 05:54 17:08-17:55/47 20:54 |
| 19 | 07:41 17:26 | 07:12 18:03 | 06:30 15:10-16:21/71 18:33 | 06:41 16:39-18:04/85 20:04 | 06:06 16:50-18:02/72 20:34 | 05:55 17:09-17:55/46 20:54 |
| 20 | 07:41 17:28 | 07:10 18:04 | 06:28 15:09-16:20/71 18:34 | 06:40 16:40-18:05/85 20:05 | 06:05 16:50-18:01/71 20:35 | 05:55 17:09-17:55/46 20:54 |
| 21 | 07:40 17:29 | 07:09 18:05 | 06:27 15:10-16:20/70 18:35 | 06:38 16:40-18:06/86 20:06 | 06:04 16:51-18:00/69 20:36 | 05:55 17:10-17:56/46 20:54 |
| 22 | 07:40 17:30 | 07:08 18:06 | 06:25 15:10-16:19/69 18:36 | 06:37 16:39-18:05/86 20:07 | 06:03 16:52-18:01/69 20:36 | 05:55 17:10-17:56/46 20:55 |
| 23 | 07:39 17:31 | 07:06 18:07 | 06:23 15:11-16:20/69 18:37 | 06:35 16:39-18:06/87 20:08 | 06:03 16:53-18:00/67 20:37 | 05:55 17:10-17:56/46 20:55 |
| 24 | 07:38 17:32 | 07:05 15:40-15:56/16 18:09 | 06:22 15:11-16:19/68 18:38 | 06:34 16:39-18:06/87 20:09 | 06:02 16:53-17:59/66 20:38 | 05:56 17:10-17:56/46 20:55 |
| 25 | 07:38 17:33 | 07:04 15:34-16:00/26 18:10 | 06:20 15:12-16:18/66 18:39 | 06:33 16:39-18:06/87 20:10 | 06:01 16:54-18:00/66 20:39 | 05:56 17:10-17:57/47 20:55 |
| 26 | 07:37 17:34 | 07:02 15:31-16:04/33 18:11 | 06:18 15:13-16:18/65 18:40 | 06:31 16:39-18:06/87 20:11 | 06:01 16:55-17:59/64 20:40 | 05:56 17:10-17:57/47 20:55 |
| 27 | 07:36 17:36 | 07:01 15:27-16:06/39 18:12 | 06:17 15:13-16:17/64 18:41 | 06:30 16:40-18:06/86 20:12 | 06:00 16:56-17:59/63 20:41 | 05:56 17:10-17:57/47 20:55 |
| 28 | 07:35 17:37 | 06:59 15:25-16:09/44 18:13 | 06:15 15:14-16:15/61 18:42 | 06:29 16:39-18:05/86 20:13 | 05:59 16:56-17:58/62 20:41 | 05:57 17:10-17:58/48 20:55 |
| 29 | 07:35 17:38 | | 07:14 16:15-17:15/60 19:43 | 06:27 16:39-18:06/87 20:14 | 05:59 16:57-17:59/62 20:42 | 05:57 17:10-17:58/48 20:55 |
| 30 | 07:34 17:39 | | 07:12 16:16-17:36/80 19:44 | 06:26 16:40-18:06/86 20:15 | 05:58 16:57-17:58/61 20:43 | 05:58 17:10-17:59/49 20:55 |
| 31 | 07:33 17:40 | | 07:10 16:18-17:42/84 19:45 | | 05:58 16:59-17:58/59 20:44 | |
| Potential sun hours | 301 | 299 | 370 | 397 | 445 | 448 |
| Sum of minutes with flicker | 0 | 158 | 2052 | 2540 | 2292 | 1482 |

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:
windpro Seui - flickering

Printed/Page
2023-12-20 10:54 / 2
Licensed user:
Ing. Bruno Manca
Via Vittorio Veneto 231
IT-09028 Sestu
+390702358125
Bruno Manca / ingbrunomanca@gmail.com
Calculated:
2023-12-19 11:53/2.8.579

SHADOW - Calendar per WTG

Calculation: shadow flickering Seui - progettoWTG: 1 - SE_01

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

| | July | August | September | October | November | December |
|-----------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|----------------------|----------------------|
| 1 | 05:58 17:10-17:59/49 20:55 | 06:21 16:56-18:14/78 20:37 | 06:50 16:44-17:59/75 19:56 | 07:18 15:50-17:00/70 19:07 | 06:51 17:22 16:59 | 07:24 16:59 07:25 |
| 2 | 05:59 17:10-18:00/50 20:55 | 06:22 16:54-18:14/80 20:36 | 06:51 16:39-17:58/79 19:54 | 07:19 15:50-16:59/69 19:05 | 06:52 17:21 16:59 | 07:26 16:59 07:26 |
| 3 | 05:59 17:09-18:00/51 20:55 | 06:23 16:54-18:14/80 20:35 | 06:52 16:33-17:56/83 19:53 | 07:20 15:50-16:58/68 19:04 | 06:53 17:20 16:59 | 07:26 16:59 07:26 |
| 4 | 06:00 17:10-18:01/51 20:55 | 06:24 16:53-18:14/81 20:34 | 06:53 16:29-17:55/86 19:51 | 07:21 15:50-16:57/67 19:02 | 06:54 17:19 16:59 | 07:27 16:59 07:30 |
| 5 | 06:00 17:09-18:01/52 20:55 | 06:25 16:53-18:14/81 20:33 | 06:54 16:26-17:53/87 19:50 | 07:22 15:50-16:56/66 19:01 | 06:55 17:18 16:58 | 07:28 16:58 07:31 |
| 6 | 06:01 17:09-18:02/53 20:54 | 06:26 16:52-18:15/83 20:32 | 06:55 16:23-17:51/88 19:48 | 07:23 15:51-16:55/64 18:59 | 06:56 17:17 16:58 | 07:29 16:58 07:30 |
| 7 | 06:01 17:08-18:02/54 20:54 | 06:27 16:52-18:15/83 20:31 | 06:56 16:20-17:49/89 19:46 | 07:24 15:51-16:53/62 18:57 | 06:57 17:15 16:58 | 07:30 16:58 07:31 |
| 8 | 06:02 17:08-18:03/55 20:54 | 06:27 16:51-18:15/84 20:29 | 06:57 16:18-17:47/89 19:45 | 07:25 15:52-16:52/60 18:56 | 06:59 17:14 16:58 | 07:31 16:58 07:32 |
| 9 | 06:03 17:08-18:04/56 20:53 | 06:28 16:50-18:15/85 20:28 | 06:58 16:16-17:44/88 19:43 | 07:26 15:52-16:50/58 18:54 | 07:00 17:13 16:58 | 07:32 16:58 07:33 |
| 10 | 06:03 17:07-18:04/57 20:53 | 06:29 16:50-18:15/85 20:27 | 06:58 16:13-17:41/88 19:41 | 07:27 15:53-16:49/56 18:53 | 07:01 17:12 16:58 | 07:33 16:58 07:33 |
| 11 | 06:04 17:07-18:05/58 20:53 | 06:30 16:48-18:14/86 20:26 | 06:59 16:11-17:37/86 19:40 | 07:28 15:54-16:47/53 18:51 | 07:02 17:12 16:58 | 07:33 16:58 07:34 |
| 12 | 06:05 17:06-18:05/59 20:52 | 06:31 16:48-18:14/86 20:25 | 07:00 16:09-17:33/84 19:38 | 07:29 15:56-16:45/49 18:50 | 07:03 17:11 16:59 | 07:34 16:59 07:35 |
| 13 | 06:05 17:06-18:06/60 20:52 | 06:32 16:47-18:14/87 20:23 | 07:01 16:07-17:28/81 19:37 | 07:30 15:57-16:43/46 18:48 | 07:04 17:10 16:59 | 07:35 16:59 07:36 |
| 14 | 06:06 17:06-18:07/61 20:51 | 06:33 16:47-18:13/86 20:22 | 07:02 16:06-17:05/59 19:35 | 07:31 15:59-16:40/41 18:47 | 07:05 17:09 16:59 | 07:36 16:59 07:36 |
| 15 | 06:07 17:06-18:08/62 20:51 | 06:34 16:47-18:13/86 20:21 | 07:03 16:04-17:05/61 19:33 | 07:32 16:01-16:38/37 18:45 | 07:07 17:08 16:59 | 07:37 16:59 07:37 |
| 16 | 06:07 17:04-18:07/63 20:50 | 06:35 16:46-18:13/87 20:19 | 07:04 16:03-17:06/63 19:32 | 07:33 16:04-16:34/30 18:44 | 07:08 17:07 16:59 | 07:37 16:59 07:38 |
| 17 | 06:08 17:04-18:08/64 20:50 | 06:36 16:46-18:13/87 20:18 | 07:05 16:01-17:06/65 19:30 | 07:34 16:07-16:30/23 18:42 | 07:09 17:06 17:00 | 07:38 17:00 07:38 |
| 18 | 06:09 17:04-18:09/65 20:49 | 06:37 16:46-18:12/86 20:17 | 07:06 16:00-17:06/66 19:28 | 07:35 16:15-16:24/9 18:41 | 07:10 17:06 17:00 | 07:38 17:00 07:39 |
| 19 | 06:10 17:04-18:10/66 20:48 | 06:38 16:45-18:12/87 20:15 | 07:07 15:59-17:06/67 19:27 | 07:36 16:07-16:30/23 18:39 | 07:11 17:05 17:00 | 07:39 17:00 07:40 |
| 20 | 06:11 17:02-18:09/67 20:48 | 06:39 16:45-18:11/86 20:14 | 07:08 15:57-17:05/68 19:25 | 07:38 16:04-16:34/30 18:38 | 07:12 17:04 17:01 | 07:40 17:01 07:40 |
| 21 | 06:11 17:02-18:10/68 20:47 | 06:40 16:45-18:11/86 20:12 | 07:09 15:56-17:05/69 19:23 | 07:39 16:07-16:30/23 18:36 | 07:13 17:04 17:01 | 07:40 17:01 07:41 |
| 22 | 06:12 17:02-18:11/69 20:46 | 06:41 16:43-18:09/86 20:11 | 07:10 15:55-17:05/70 19:22 | 07:40 16:07-16:30/23 18:35 | 07:15 17:03 17:02 | 07:41 17:02 07:41 |
| 23 | 06:13 17:01-18:11/70 20:45 | 06:42 16:43-18:09/86 20:09 | 07:11 15:54-17:04/70 19:20 | 07:41 16:07-16:30/23 18:34 | 07:16 17:03 17:02 | 07:41 17:02 07:42 |
| 24 | 06:14 17:01-18:12/71 20:45 | 06:43 16:43-18:08/85 20:08 | 07:12 15:53-17:04/71 19:18 | 07:42 16:07-16:30/23 18:32 | 07:17 17:02 17:03 | 07:42 17:03 07:42 |
| 25 | 06:15 16:59-18:11/72 20:44 | 06:43 16:43-18:07/84 20:07 | 07:13 15:52-17:04/72 19:17 | 07:43 16:07-16:30/23 17:31 | 07:18 17:02 17:03 | 07:42 17:03 07:43 |
| 26 | 06:16 16:59-18:12/73 20:43 | 06:44 16:43-18:06/83 20:05 | 07:13 15:52-17:03/71 19:15 | 07:44 16:07-16:30/23 17:30 | 07:19 17:01 17:04 | 07:43 17:04 07:43 |
| 27 | 06:16 16:58-18:12/74 20:42 | 06:45 16:43-18:06/83 20:04 | 07:14 15:51-17:03/72 19:14 | 07:45 16:07-16:30/23 17:28 | 07:20 17:01 17:05 | 07:43 17:05 07:43 |
| 28 | 06:17 16:58-18:13/75 20:41 | 06:46 16:43-18:05/82 20:02 | 07:15 15:51-17:02/71 19:12 | 07:46 16:07-16:30/23 17:27 | 07:21 17:00 17:05 | 07:43 17:05 07:44 |
| 29 | 06:18 16:57-18:13/76 20:40 | 06:47 16:44-18:04/80 20:00 | 07:16 15:50-17:01/71 19:10 | 07:47 16:07-16:30/23 17:26 | 07:22 17:00 17:06 | 07:44 17:06 07:44 |
| 30 | 06:19 16:57-18:14/77 20:39 | 06:48 16:44-18:03/79 19:59 | 07:17 15:50-17:01/71 19:09 | 07:48 16:07-16:30/23 17:25 | 07:23 17:00 17:07 | 07:44 17:07 07:44 |
| 31 | 06:20 16:56-18:14/78 20:38 | 06:49 16:44-18:01/77 19:57 | | 06:50 17:23 17:23 | | 07:44 17:08 07:08 |
| Potential sun hours | 455 | 426 | 374 | 347 | 301 | 292 |
| Sum of minutes with flicker | 1956 | 2595 | 2260 | 928 | 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:
windpro Seui - flickering

Printed/Page
2023-12-20 10:54 / 3
Licensed user:
Ing. Bruno Manca
Via Vittorio Veneto 231
IT-09028 Sestu
+390702358125
Bruno Manca / ingbrunomanca@gmail.com
Calculated:
2023-12-19 11:53/2.8.579

SHADOW - Calendar per WTG

Calculation: shadow flickering Seui - progettoWTG: 2 - SE 02

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

| | January | February | March | April | May | June | July | August | September | October | November | December |
|-----------------------------|---------|----------|-------|-------|-------|-------|-------|--------|-----------|---------|----------|----------|
| 1 | 07:44 | 07:32 | 06:58 | 07:09 | 06:25 | 05:57 | 05:58 | 06:21 | 06:50 | 07:18 | 06:51 | 07:24 |
| | 17:09 | 17:42 | 18:14 | 19:46 | 20:16 | 20:44 | 20:55 | 20:37 | 19:56 | 19:07 | 17:22 | 16:59 |
| 2 | 07:44 | 07:31 | 06:56 | 07:07 | 06:24 | 05:57 | 05:59 | 06:22 | 06:51 | 07:19 | 06:52 | 07:25 |
| | 17:09 | 17:43 | 18:15 | 19:47 | 20:17 | 20:45 | 20:55 | 20:36 | 19:54 | 19:05 | 17:21 | 16:59 |
| 3 | 07:45 | 07:30 | 06:55 | 07:06 | 06:22 | 05:57 | 05:59 | 06:23 | 06:52 | 07:20 | 06:53 | 07:26 |
| | 17:10 | 17:44 | 18:16 | 19:48 | 20:18 | 20:46 | 20:55 | 20:35 | 19:53 | 19:04 | 17:20 | 16:59 |
| 4 | 07:45 | 07:29 | 06:53 | 07:04 | 06:21 | 05:56 | 06:00 | 06:24 | 06:53 | 07:21 | 06:54 | 07:27 |
| | 17:11 | 17:45 | 18:17 | 19:49 | 20:19 | 20:47 | 20:55 | 20:34 | 19:51 | 19:02 | 17:19 | 16:59 |
| 5 | 07:45 | 07:28 | 06:52 | 07:02 | 06:20 | 05:56 | 06:00 | 06:25 | 06:54 | 07:22 | 06:55 | 07:28 |
| | 17:12 | 17:46 | 18:18 | 19:50 | 20:20 | 20:47 | 20:55 | 20:33 | 19:50 | 19:01 | 17:18 | 16:58 |
| 6 | 07:45 | 07:27 | 06:50 | 07:01 | 06:19 | 05:56 | 06:01 | 06:26 | 06:55 | 07:23 | 06:56 | 07:29 |
| | 17:13 | 17:48 | 18:20 | 19:51 | 20:21 | 20:48 | 20:54 | 20:32 | 19:48 | 18:59 | 17:17 | 16:58 |
| 7 | 07:45 | 07:26 | 06:49 | 06:59 | 06:18 | 05:55 | 06:01 | 06:27 | 06:56 | 07:24 | 06:57 | 07:30 |
| | 17:14 | 17:49 | 18:21 | 19:52 | 20:22 | 20:48 | 20:54 | 20:31 | 19:46 | 18:57 | 17:15 | 16:58 |
| 8 | 07:44 | 07:25 | 06:47 | 06:58 | 06:16 | 05:55 | 06:02 | 06:27 | 06:57 | 07:25 | 06:59 | 07:31 |
| | 17:15 | 17:50 | 18:22 | 19:53 | 20:23 | 20:49 | 20:54 | 20:29 | 19:45 | 18:56 | 17:14 | 16:58 |
| 9 | 07:44 | 07:24 | 06:46 | 06:56 | 06:15 | 05:55 | 06:03 | 06:28 | 06:58 | 07:26 | 07:00 | 07:32 |
| | 17:16 | 17:51 | 18:23 | 19:54 | 20:24 | 20:50 | 20:53 | 20:28 | 19:43 | 18:54 | 17:13 | 16:58 |
| 10 | 07:44 | 07:23 | 06:44 | 06:55 | 06:14 | 05:55 | 06:03 | 06:29 | 06:58 | 07:27 | 07:01 | 07:33 |
| | 17:17 | 17:52 | 18:24 | 19:55 | 20:25 | 20:50 | 20:53 | 20:27 | 19:41 | 18:53 | 17:12 | 16:58 |
| 11 | 07:44 | 07:22 | 06:42 | 06:53 | 06:13 | 05:55 | 06:04 | 06:30 | 06:59 | 07:28 | 07:02 | 07:33 |
| | 17:18 | 17:54 | 18:25 | 19:56 | 20:26 | 20:51 | 20:53 | 20:26 | 19:40 | 18:51 | 17:12 | 16:58 |
| 12 | 07:44 | 07:21 | 06:41 | 06:52 | 06:12 | 05:54 | 06:05 | 06:31 | 07:00 | 07:29 | 07:03 | 07:34 |
| | 17:19 | 17:55 | 18:26 | 19:57 | 20:27 | 20:51 | 20:52 | 20:25 | 19:38 | 18:50 | 17:11 | 16:59 |
| 13 | 07:44 | 07:19 | 06:39 | 06:50 | 06:11 | 05:54 | 06:05 | 06:32 | 07:01 | 07:30 | 07:04 | 07:35 |
| | 17:20 | 17:56 | 18:27 | 19:58 | 20:28 | 20:52 | 20:52 | 20:23 | 19:37 | 18:48 | 17:10 | 16:59 |
| 14 | 07:43 | 07:18 | 06:38 | 06:49 | 06:10 | 05:54 | 06:06 | 06:33 | 07:02 | 07:31 | 07:05 | 07:36 |
| | 17:21 | 17:57 | 18:28 | 19:59 | 20:29 | 20:52 | 20:51 | 20:22 | 19:35 | 18:47 | 17:09 | 16:59 |
| 15 | 07:43 | 07:17 | 06:36 | 06:47 | 06:09 | 05:54 | 06:07 | 06:34 | 07:03 | 07:32 | 07:07 | 07:36 |
| | 17:22 | 17:58 | 18:29 | 20:00 | 20:30 | 20:53 | 20:51 | 20:21 | 19:33 | 18:45 | 17:08 | 16:59 |
| 16 | 07:43 | 07:16 | 06:35 | 06:46 | 06:08 | 05:54 | 06:07 | 06:35 | 07:04 | 07:33 | 07:08 | 07:37 |
| | 17:23 | 17:59 | 18:30 | 20:01 | 20:31 | 20:53 | 20:50 | 20:19 | 19:32 | 18:44 | 17:07 | 16:59 |
| 17 | 07:42 | 07:14 | 06:33 | 06:44 | 06:07 | 05:54 | 06:08 | 06:36 | 07:05 | 07:34 | 07:09 | 07:38 |
| | 17:24 | 18:01 | 18:31 | 20:02 | 20:32 | 20:53 | 20:50 | 20:18 | 19:30 | 18:42 | 17:06 | 17:00 |
| 18 | 07:42 | 07:13 | 06:31 | 06:43 | 06:07 | 05:54 | 06:09 | 06:37 | 07:06 | 07:35 | 07:10 | 07:38 |
| | 17:25 | 18:02 | 18:32 | 20:03 | 20:33 | 20:54 | 20:49 | 20:17 | 19:28 | 18:41 | 17:06 | 17:00 |
| 19 | 07:41 | 07:12 | 06:30 | 06:41 | 06:06 | 05:55 | 06:10 | 06:38 | 07:07 | 07:36 | 07:11 | 07:39 |
| | 17:26 | 18:03 | 18:33 | 20:04 | 20:34 | 20:54 | 20:48 | 20:15 | 19:27 | 18:39 | 17:05 | 17:00 |
| 20 | 07:41 | 07:10 | 06:28 | 06:40 | 06:05 | 05:55 | 06:11 | 06:39 | 07:08 | 07:38 | 07:12 | 07:40 |
| | 17:28 | 18:04 | 18:34 | 20:05 | 20:35 | 20:54 | 20:48 | 20:14 | 19:25 | 18:38 | 17:04 | 17:01 |
| 21 | 07:40 | 07:09 | 06:27 | 06:38 | 06:04 | 05:55 | 06:11 | 06:40 | 07:09 | 07:39 | 07:13 | 07:40 |
| | 17:29 | 18:05 | 18:35 | 20:06 | 20:36 | 20:54 | 20:47 | 20:12 | 19:23 | 18:36 | 17:04 | 17:01 |
| 22 | 07:40 | 07:08 | 06:25 | 06:37 | 06:03 | 05:55 | 06:12 | 06:41 | 07:10 | 07:40 | 07:14 | 07:41 |
| | 17:30 | 18:06 | 18:36 | 20:07 | 20:36 | 20:55 | 20:46 | 20:11 | 19:22 | 18:35 | 17:03 | 17:02 |
| 23 | 07:39 | 07:06 | 06:23 | 06:35 | 06:03 | 05:55 | 06:13 | 06:42 | 07:11 | 07:41 | 07:16 | 07:41 |
| | 17:31 | 18:07 | 18:37 | 20:08 | 20:37 | 20:55 | 20:45 | 20:09 | 19:20 | 18:34 | 17:03 | 17:02 |
| 24 | 07:38 | 07:05 | 06:22 | 06:34 | 06:02 | 05:56 | 06:14 | 06:43 | 07:12 | 07:42 | 07:17 | 07:42 |
| | 17:32 | 18:09 | 18:38 | 20:09 | 20:38 | 20:55 | 20:45 | 20:08 | 19:18 | 18:32 | 17:02 | 17:03 |
| 25 | 07:38 | 07:03 | 06:20 | 06:33 | 06:01 | 05:56 | 06:15 | 06:43 | 07:13 | 06:43 | 07:18 | 07:42 |
| | 17:33 | 18:10 | 18:39 | 20:10 | 20:39 | 20:55 | 20:44 | 20:06 | 19:17 | 17:31 | 17:02 | 17:03 |
| 26 | 07:37 | 07:02 | 06:18 | 06:31 | 06:01 | 05:56 | 06:16 | 06:44 | 07:13 | 06:44 | 07:19 | 07:43 |
| | 17:34 | 18:11 | 18:40 | 20:11 | 20:40 | 20:55 | 20:43 | 20:05 | 19:15 | 17:30 | 17:01 | 17:04 |
| 27 | 07:36 | 07:01 | 06:17 | 06:30 | 06:00 | 05:56 | 06:16 | 06:45 | 07:14 | 06:45 | 07:20 | 07:43 |
| | 17:36 | 18:12 | 18:41 | 20:12 | 20:41 | 20:55 | 20:42 | 20:03 | 19:14 | 17:28 | 17:01 | 17:05 |
| 28 | 07:35 | 06:59 | 06:15 | 06:29 | 05:59 | 05:57 | 06:17 | 06:46 | 07:15 | 06:46 | 07:21 | 07:43 |
| | 17:37 | 18:13 | 18:42 | 20:13 | 20:41 | 20:55 | 20:41 | 20:02 | 19:12 | 17:27 | 17:00 | 17:05 |
| 29 | 07:35 | | 07:14 | 06:27 | 05:59 | 05:57 | 06:18 | 06:47 | 07:16 | 06:47 | 07:22 | 07:44 |
| | 17:38 | | 19:43 | 20:14 | 20:42 | 20:55 | 20:40 | 20:00 | 19:10 | 17:26 | 17:00 | 17:06 |
| 30 | 07:34 | | 07:12 | 06:26 | 05:58 | 05:58 | 06:19 | 06:48 | 07:17 | 06:48 | 07:23 | 07:44 |
| | 17:39 | | 19:44 | 20:15 | 20:43 | 20:55 | 20:39 | 19:59 | 19:09 | 17:25 | 17:00 | 17:07 |
| 31 | 07:33 | | 07:10 | | 05:58 | | 06:20 | 06:49 | | 06:50 | | 07:44 |
| | 17:40 | | 19:45 | | 20:44 | | 20:38 | 19:57 | | 17:23 | | 17:08 |
| Potential sun hours | 301 | 299 | 370 | 397 | 445 | 448 | 455 | 426 | 374 | 347 | 301 | 292 |
| Sum of minutes with flicker | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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

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

Project:
windpro Seui - flickering

Printed/Page
2023-12-20 10:54 / 4
Licensed user:
Ing. Bruno Manca
Via Vittorio Veneto 231
IT-09028 Sestu
+390702358125
Bruno Manca / ingbrunomanca@gmail.com
Calculated:
2023-12-19 11:53/2.8.579

SHADOW - Calendar per WTG

Calculation: shadow flickering Seui - progettoWTG: 3 - SE 03

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

| | January | February | March | April | May | June | |
|----|-----------------------------------|--|---|---|---|-------------------------------|--|
| 1 | 07:44 17:09 | 07:32 08:34-09:44/70 17:42 | 06:58 07:25-10:21/176 18:14 | 07:09 08:07-11:04/177 19:46 17:36-18:25/49 | 06:25 07:14-08:14/60 17:50-18:46/56 20:16 08:56-10:16/80 | 05:57 07:03-08:20/77 20:44 | |
| 2 | 07:44 17:09 | 07:31 08:32-09:47/75 17:43 | 06:56 07:24-10:22/178 18:15 | 07:07 08:07-11:02/175 19:47 17:35-18:26/51 | 06:24 07:12-08:14/62 17:51-18:45/54 20:17 08:56-10:13/77 | 05:57 07:04-08:21/77 20:45 | |
| 3 | 07:44 17:10 | 07:30 08:30-09:49/79 17:44 | 06:55 07:22-10:22/180 18:16 | 07:06 08:07-11:01/174 19:48 17:35-18:27/52 | 06:22 07:11-08:15/64 17:54-18:45/51 20:18 08:58-10:12/74 | 05:57 07:04-08:21/77 20:46 | |
| 4 | 07:45 17:11 | 07:29 08:28-09:52/84 17:45 | 06:53 07:22-10:23/181 18:17 | 07:04 08:07-10:59/172 19:49 17:34-18:28/54 | 06:21 07:10-08:15/65 17:56-18:44/48 20:19 08:59-10:10/71 | 05:56 07:04-08:20/76 20:47 | |
| 5 | 07:45 17:12 | 07:28 08:26-09:54/88 17:46 | 06:52 07:20-10:23/183 18:18 | 07:02 08:08-10:58/170 19:50 17:34-18:29/55 | 06:20 07:09-08:16/67 17:57-18:44/47 20:20 09:00-10:08/68 | 05:56 07:04-08:21/77 20:47 | |
| 6 | 07:45 17:13 | 07:27 08:24-09:56/92 17:48 | 06:50 07:20-10:23/183 18:19 | 07:01 08:08-10:56/168 19:51 17:34-18:29/55 | 06:19 07:08-08:17/69 17:57-18:44/47 20:21 09:02-10:07/65 | 05:56 07:05-08:21/76 20:48 | |
| 7 | 07:45 17:14 | 07:26 08:22-09:57/95 17:49 | 06:49 07:18-10:23/185 18:21 | 06:59 08:08-10:54/166 19:52 17:33-18:29/56 | 06:18 07:08-08:17/69 17:58-18:43/45 20:22 09:03-10:05/62 | 05:55 07:05-08:21/76 20:48 | |
| 8 | 07:44 17:15 | 07:25 08:20-09:59/99 17:50 | 06:47 07:18-10:23/185 18:22 | 06:58 08:09-10:53/164 19:53 17:34-18:30/56 | 06:16 07:07-08:18/71 17:59-18:43/44 20:23 09:04-10:03/59 | 05:55 07:05-08:21/76 20:49 | |
| 9 | 07:44 17:16 | 07:24 08:19-10:01/102 17:51 | 06:46 07:17-10:23/186 18:23 | 06:56 08:09-10:51/162 19:54 17:34-18:30/56 | 06:15 07:06-08:18/72 18:00-18:42/42 20:24 09:06-10:01/55 | 05:55 07:05-08:21/76 20:50 | |
| 10 | 07:44 17:17 | 07:23 08:18-10:03/105 17:52 | 06:44 07:15-10:22/187 18:24 | 06:54 08:10-10:50/160 19:55 17:35-18:31/56 | 06:14 07:06-08:19/73 18:00-18:41/41 20:25 09:08-10:00/52 | 05:55 07:05-08:21/76 20:50 | |
| 11 | 07:44 17:18 | 07:22 08:16-10:05/109 17:54 | 06:42 07:15-10:23/188 18:25 | 06:53 08:11-10:48/157 19:56 17:35-18:35/60 | 06:13 07:05-08:19/74 18:01-18:41/40 20:26 09:09-09:58/49 | 05:54 07:06-08:21/75 20:51 | |
| 12 | 07:44 17:19 | 07:20 08:15-10:06/111 17:55 | 06:41 07:14-10:22/188 18:26 | 06:52 08:12-10:47/155 19:57 17:36-18:38/62 | 06:12 07:05-08:19/74 18:02-18:40/38 20:27 09:11-09:55/44 | 05:54 07:06-08:21/75 20:51 | |
| 13 | 07:44 17:20 | 07:19 08:13-10:07/114 17:56 | 06:39 07:14-10:22/188 18:27 | 06:50 08:13-10:45/152 19:58 17:36-18:39/63 | 06:11 07:04-08:19/75 18:03-18:39/36 20:28 09:13-09:53/40 | 05:54 07:06-08:22/76 20:52 | |
| 14 | 07:43 17:21 | 07:18 08:12-10:09/117 17:57 | 06:38 07:14-10:22/188 18:28 | 06:48 08:14-10:44/150 19:59 17:37-18:41/64 | 06:10 07:04-08:19/75 18:04-18:38/34 20:29 09:15-09:51/36 | 05:54 07:07-08:22/75 20:52 | |
| 15 | 07:43 17:22 | 07:17 08:11-10:10/119 17:58 | 06:36 07:13-10:21/188 18:29 | 06:47 08:15-10:42/147 20:00 17:37-18:41/64 | 06:09 07:04-08:20/76 18:05-18:37/32 20:30 09:17-09:48/31 | 05:54 07:07-08:22/75 20:52 | |
| 16 | 07:42 17:23 | 07:16 08:10-10:12/122 17:59 | 06:35 07:13-10:21/188 18:30 | 06:45 08:17-10:40/143 20:01 17:37-18:43/66 | 06:08 07:03-08:20/77 18:06-18:35/29 20:31 09:20-09:45/25 | 05:54 07:07-08:22/75 20:53 | |
| 17 | 07:42 17:24 | 07:14 08:08-10:12/124 18:01 | 06:33 07:12-10:20/188 18:31 | 06:44 08:18-10:38/140 20:02 17:37-18:43/66 | 06:07 07:03-08:19/76 18:07-18:34/27 20:32 09:24-09:41/17 | 05:54 07:07-08:22/75 20:53 | |
| 18 | 07:42 17:25 | 07:13 08:07-10:14/127 18:02 | 06:31 07:12-10:20/188 18:32 | 06:43 08:20-10:37/137 20:03 17:37-18:44/67 | 06:06 07:03-08:20/77 20:33 18:09-18:32/23 | 05:54 07:07-08:22/75 20:54 | |
| 19 | 07:41 17:26 | 07:12 08:06-10:15/129 18:03 | 06:30 07:11-10:19/188 18:33 | 06:41 08:22-10:35/133 20:04 17:37-18:44/67 | 06:06 07:03-08:20/77 20:34 18:11-18:31/20 | 05:55 07:07-08:22/75 20:54 | |
| 20 | 07:41 17:28 | 07:10 08:05-10:15/130 18:04 | 06:28 07:10-10:17/187 18:34 | 06:40 08:25-10:33/128 20:05 17:38-18:45/67 | 06:05 07:03-08:20/77 20:35 18:13-18:29/16 | 05:55 07:08-08:22/74 20:54 | |
| 21 | 07:40 17:29 | 07:09 07:50-07:57/7 18:05 08:04-10:17/133 | 06:26 07:10-10:17/187 18:35 16:54-17:12/18 | 06:38 07:40-07:51/11 08:48-10:32/104 20:06 08:30-08:47/17 17:39-18:46/67 | 06:04 07:02-08:20/78 20:35 18:16-18:26/10 | 05:55 07:09-08:23/74 20:54 | |
| 22 | 07:40 17:30 | 07:08 07:42-10:17/155 18:06 | 06:25 07:09-10:16/187 18:36 16:50-17:14/24 | 06:37 07:33-07:56/23 17:39-18:46/67 20:07 08:48-10:30/102 | 06:03 07:03-08:21/78 20:36 | 05:55 07:09-08:23/74 20:55 | |
| 23 | 07:39 17:31 | 07:06 07:39-10:18/159 18:07 | 06:23 07:09-10:14/185 18:37 16:47-17:16/29 | 06:35 07:29-08:00/31 17:40-18:46/66 20:08 08:49-10:29/100 | 06:03 07:03-08:20/77 20:37 | 05:55 07:08-08:23/75 20:55 | |
| 24 | 07:38 17:32 | 07:05 07:36-10:19/163 18:09 | 06:22 07:08-10:14/186 18:38 16:45-17:19/34 | 06:34 07:27-08:03/36 17:41-18:47/66 20:09 08:50-10:27/97 | 06:02 07:02-08:20/78 20:38 | 05:56 07:08-08:23/75 20:55 | |
| 25 | 07:38 08:59-09:15/16 17:33 | 07:03 07:33-10:19/166 18:10 | 06:20 07:08-10:13/185 18:39 16:43-17:20/37 | 06:33 07:23-08:05/42 17:41-18:46/65 20:10 08:50-10:25/95 | 06:01 07:03-08:21/78 20:39 | 05:56 07:09-08:24/75 20:55 | |
| 26 | 07:37 08:52-09:22/30 17:34 | 07:02 07:31-10:21/170 18:11 | 06:18 07:08-10:12/184 18:40 16:42-17:21/39 | 06:31 07:21-08:07/46 17:42-18:46/64 20:11 08:51-10:24/93 | 06:01 07:03-08:20/77 20:40 | 05:56 07:09-08:24/75 20:55 | |
| 27 | 07:36 08:47-09:27/40 17:36 | 07:01 07:29-10:21/172 18:12 | 06:17 07:07-10:11/184 18:41 16:40-17:22/42 | 06:30 07:20-08:09/49 17:44-18:47/63 20:12 08:52-10:22/90 | 06:00 07:03-08:21/78 20:41 | 05:56 07:09-08:24/75 20:55 | |
| 28 | 07:35 08:44-09:31/47 17:37 | 06:59 07:27-10:22/175 18:13 | 06:15 07:07-10:09/182 18:42 16:38-17:22/44 | 06:29 07:17-08:10/53 17:44-18:46/62 20:13 08:52-10:20/88 | 05:59 07:03-08:20/77 20:41 | 05:57 07:10-08:25/75 20:55 | |
| 29 | 07:35 08:40-09:35/55 17:38 | | 07:14 08:07-11:08/181 19:43 17:38-18:23/45 | 06:27 07:16-08:11/55 17:46-18:46/60 20:14 08:54-10:18/84 | 05:59 07:03-08:21/78 20:42 | 05:57 07:10-08:25/75 20:55 | |
| 30 | 07:34 08:38-09:38/60 17:39 | | 07:12 08:07-11:07/180 19:44 17:37-18:23/46 | 06:26 07:15-08:12/57 17:47-18:46/59 20:15 08:55-10:17/82 | 05:58 07:03-08:20/77 20:43 | 05:58 07:10-08:26/76 20:55 | |
| 31 | 07:33 08:36-09:42/66 17:40 | | 07:10 08:07-11:06/179 19:45 17:37-18:24/47 | | 05:58 07:04-08:21/77 20:44 | | |
| | Potential sun hours 301 | 299 | 370 | 397 | 445 | 448 | |
| | Sum of minutes with flicker 314 | 3391 | 6128 | 6310 | 3968 | 2263 | |

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:

windpro Seui - flickering

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2023-12-20 10:54 / 5

Licensed user:

Ing. Bruno Manca

Via Vittorio Veneto 231

IT-09028 Sestu

+390702358125

Bruno Manca / ingbrunomanca@gmail.com

Calculated:

2023-12-19 11:53/2.8.579

SHADOW - Calendar per WTG

Calculation: shadow flickering Seui - progetto WTG: 3 - SE_03

Assumptions for shadow calculations

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

| | | | | | | | | | | | |
|------|------|------|------|------|------|-------|-------|------|------|------|------|
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| 4.40 | 5.05 | 5.88 | 7.00 | 8.45 | 9.88 | 10.82 | 10.03 | 8.08 | 6.09 | 5.07 | 4.27 |

Operational time

| | | | | | | | | | | | | |
|----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-------|
| N | NNE | ENE | E | ESE | SSE | S | SSW | WSW | W | WNW | NNW | Sum |
| 86 | 55 | 78 | 159 | 368 | 188 | 65 | 104 | 357 | 605 | 339 | 206 | 2,610 |

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

| | July | August | September | October | November | December |
|----|--|-------------------------------------|-----------------------|-----------------------|-----------------------|----------|
| 1 | 05:58 07:10-08:25/75 20:55 | 06:21 07:16-08:30/74 18:11-18:50/39 | 06:50 08:10-10:47/157 | 07:18 07:54-11:02/188 | 06:51 07:48-09:32/104 | 07:24 |
| 2 | 05:59 07:11-08:26/75 20:55 | 06:22 07:15-08:28/73 18:10-18:50/40 | 06:51 08:08-10:48/160 | 07:19 07:54-11:01/187 | 06:52 07:49-09:30/101 | 07:25 |
| 3 | 05:59 07:10-08:26/76 20:55 | 06:23 07:16-08:28/72 18:10-18:51/41 | 06:52 08:07-10:49/162 | 07:20 07:54-11:01/187 | 06:53 07:50-09:29/99 | 07:26 |
| 4 | 06:00 07:11-08:27/76 20:55 | 06:24 07:16-08:28/72 18:09-18:52/43 | 06:53 08:06-10:50/164 | 07:21 07:54-11:01/187 | 06:54 07:52-09:27/95 | 07:27 |
| 5 | 06:00 07:10-08:27/77 20:54 | 06:25 07:17-08:27/70 18:08-18:52/44 | 06:54 08:05-10:51/166 | 07:22 07:54-11:00/186 | 06:55 07:54-09:26/92 | 07:28 |
| 6 | 06:01 07:11-08:27/76 20:54 | 06:26 07:18-08:27/69 18:08-18:53/45 | 06:55 08:04-10:52/168 | 07:23 07:55-11:00/185 | 06:56 07:56-09:23/87 | 07:29 |
| 7 | 06:01 07:11-08:27/76 20:54 | 06:27 07:18-08:26/68 18:07-18:53/46 | 06:56 08:03-10:53/170 | 07:24 07:55-10:59/184 | 06:57 07:58-09:21/83 | 07:30 |
| 8 | 06:02 07:11-08:28/77 20:54 | 06:27 07:19-08:26/67 18:06-18:54/48 | 06:57 08:02-10:54/172 | 07:25 07:55-10:59/184 | 06:59 08:00-09:19/79 | 07:31 |
| 9 | 06:03 07:12-08:28/76 20:53 | 06:28 07:20-08:25/65 18:06-18:54/48 | 06:58 08:02-10:55/173 | 07:26 07:56-10:58/182 | 07:00 08:02-09:17/75 | 07:32 |
| 10 | 06:03 07:11-08:28/77 20:53 | 06:29 07:21-08:24/63 18:03-18:54/51 | 06:58 08:00-10:55/175 | 07:27 07:57-10:57/180 | 07:01 08:05-09:15/70 | 07:32 |
| 11 | 06:04 07:11-08:29/78 20:53 | 06:30 07:21-08:22/61 17:59-18:54/55 | 06:59 07:59-10:56/177 | 07:28 07:57-10:56/179 | 07:02 08:07-09:12/65 | 07:33 |
| 12 | 06:05 07:12-08:29/77 20:52 | 06:31 07:22-08:21/59 17:57-18:54/57 | 07:00 07:59-10:57/178 | 07:29 07:58-10:56/178 | 07:03 08:10-09:10/60 | 07:34 |
| 13 | 06:05 07:11-08:29/78 20:52 | 06:32 07:23-08:20/57 17:55-18:54/59 | 07:01 07:58-10:58/180 | 07:30 07:59-10:55/176 | 07:04 08:13-09:06/53 | 07:35 |
| 14 | 06:06 07:12-08:29/77 20:51 | 06:33 07:24-08:18/54 17:53-18:54/61 | 07:02 07:57-10:58/181 | 07:31 08:00-10:54/174 | 07:05 08:17-09:04/47 | 07:36 |
| 15 | 06:07 07:12-08:30/78 20:51 | 06:34 07:25-08:17/52 17:51-18:54/63 | 07:03 07:57-10:59/182 | 07:32 08:02-10:53/171 | 07:07 08:20-09:00/40 | 07:36 |
| 16 | 06:07 07:12-08:29/77 20:50 | 06:35 07:27-08:15/48 17:50-18:53/63 | 07:04 07:57-11:00/183 | 07:33 08:03-10:52/169 | 07:08 08:25-08:55/30 | 07:37 |
| 17 | 06:08 07:12-08:30/78 20:50 | 06:36 07:28-08:13/45 17:49-18:53/64 | 07:05 07:56-11:00/184 | 07:34 08:05-10:51/166 | 07:09 08:32-08:48/16 | 07:38 |
| 18 | 06:09 07:12-08:30/78 20:49 | 06:37 07:30-08:11/41 17:48-18:53/65 | 07:06 07:56-11:01/185 | 07:35 08:08-10:50/162 | 07:10 | 07:38 |
| 19 | 06:10 07:13-08:30/77 20:48 | 06:38 07:33-08:09/36 17:46-18:52/66 | 07:07 07:56-11:01/185 | 07:36 08:11-10:49/158 | 07:11 | 07:39 |
| 20 | 06:11 07:12-08:30/78 20:48 | 06:39 07:36-08:05/29 17:45-18:52/67 | 07:08 07:54-11:01/187 | 07:37 08:16-10:48/152 | 07:12 | 07:40 |
| 21 | 06:11 07:12-08:30/78 20:47 | 06:40 07:40-08:01/21 17:43-18:50/67 | 07:09 07:54-11:01/187 | 07:39 08:35-10:47/132 | 07:13 | 07:40 |
| 22 | 06:12 07:13-08:30/77 20:46 | 06:41 07:46-07:52/6 17:42-18:50/68 | 07:10 07:54-11:01/187 | 07:40 08:36-10:46/130 | 07:14 | 07:41 |
| 23 | 06:13 07:13-08:31/78 20:45 | 06:42 08:29-10:38/129 | 07:11 07:54-11:02/188 | 07:41 08:36-10:44/128 | 07:16 | 07:41 |
| 24 | 06:14 07:13-08:31/78 20:45 | 06:43 08:26-10:39/133 | 07:12 07:54-11:02/188 | 07:42 08:37-10:43/126 | 07:17 | 07:42 |
| 25 | 06:15 07:14-08:31/77 20:44 | 06:44 08:23-10:40/137 | 07:13 07:54-11:02/188 | 07:43 08:38-10:42/124 | 07:18 | 07:42 |
| 26 | 06:16 07:13-08:30/77 18:19-18:43/24 20:43 | 06:45 08:19-10:42/143 | 07:14 07:54-11:02/188 | 07:44 07:40-09:41/121 | 07:19 | 07:42 |
| 27 | 06:16 07:14-08:30/76 18:17-18:45/28 20:42 | 06:46 08:17-10:44/147 | 07:15 07:54-11:02/188 | 07:45 07:41-09:40/119 | 07:20 | 07:43 |
| 28 | 06:17 07:14-08:30/76 18:16-18:46/30 20:41 | 06:47 08:15-10:45/150 | 07:16 07:54-11:02/188 | 07:46 07:43-09:36/113 | 07:22 | 07:43 |
| 29 | 06:18 07:14-08:30/76 18:15-18:48/33 20:40 | 06:48 08:14-10:46/152 | 07:17 07:54-11:02/188 | 07:47 07:44-09:35/111 | 07:23 | 07:44 |
| 30 | 06:19 07:15-08:30/75 18:14-18:49/35 20:39 | 06:49 08:11-10:46/155 | 07:18 07:54-11:02/188 | 07:48 07:45-09:33/108 | 07:24 | 07:44 |
| 31 | 06:20 07:15-08:30/75 18:13-18:50/37 20:38 | 06:50 08:10-10:47/157 | 07:19 07:54-11:02/188 | 07:49 07:46-09:34/106 | 07:25 | 07:44 |
| | Potential sun hours 455 | 425 | 374 | 347 | 301 | 292 |
| | Sum of minutes with flicker 2794 | 6001 | 6388 | 4863 | 1196 | 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:
windpro Seui - flickering

Printed/Page
2023-12-20 10:54 / 6
Licensed user:
Ing. Bruno Manca
Via Vittorio Veneto 231
IT-09028 Sestu
+390702358125
Bruno Manca / ingbrunomanca@gmail.com
Calculated:
2023-12-19 11:53/2.8.579

SHADOW - Calendar per WTG

Calculation: shadow flickering Seui - progettoWTG: 4 - SE_04

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

| | January | February | March | April | May | June | |
|-----------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|--|
| 1 | 07:44 15:16-16:33/77 17:09 | 07:32 15:13-17:08/115 17:42 | 06:58 15:23-17:53/150 18:14 | 07:09 19:46 | 06:25 17:20-19:09/109 20:16 | 05:57 17:24-19:12/108 20:44 | |
| 2 | 07:44 15:16-16:33/77 17:09 | 07:31 15:13-17:09/116 17:43 | 06:56 15:25-17:54/149 18:15 | 07:07 19:47 | 06:24 17:19-19:08/109 20:17 | 05:57 17:25-19:12/107 20:45 | |
| 3 | 07:44 15:16-16:34/78 17:10 | 07:30 15:13-17:11/118 17:44 | 06:55 15:26-17:53/147 18:16 | 07:06 18:15-18:23/8 19:48 | 06:22 17:19-19:09/110 20:18 | 05:57 17:26-19:12/106 20:46 | |
| 4 | 07:45 15:16-16:35/79 17:11 | 07:29 15:13-17:12/119 17:45 | 06:53 15:27-17:54/147 18:17 | 07:04 18:04-18:33/29 19:49 | 06:21 17:19-19:09/110 20:19 | 05:56 17:25-19:12/107 20:47 | |
| 5 | 07:45 15:16-16:36/80 17:12 | 07:28 15:13-17:14/121 17:46 | 06:52 15:28-17:53/145 18:18 | 07:02 17:59-18:38/39 19:50 | 06:20 17:19-19:10/111 20:20 | 05:56 17:26-19:12/106 20:47 | |
| 6 | 07:45 15:16-16:37/81 17:13 | 07:27 15:13-17:15/122 17:48 | 06:50 15:30-17:53/143 18:20 | 07:01 17:54-18:41/47 19:51 | 06:19 17:19-19:10/111 20:21 | 05:56 17:27-19:12/105 20:48 | |
| 7 | 07:45 15:16-16:38/82 17:14 | 07:26 15:12-17:15/123 17:49 | 06:49 15:31-17:52/141 18:21 | 06:59 17:50-18:44/54 19:52 | 06:18 17:19-19:10/111 20:22 | 05:55 17:27-19:13/106 20:48 | |
| 8 | 07:44 15:16-16:39/83 17:15 | 07:25 15:13-17:16/123 17:50 | 06:47 15:33-17:52/139 18:22 | 06:58 17:48-18:47/59 19:53 | 06:16 17:19-19:10/111 20:23 | 05:55 17:27-19:12/105 20:49 | |
| 9 | 07:44 15:16-16:40/84 17:16 | 07:24 15:13-17:18/125 17:51 | 06:46 15:35-17:51/136 18:23 | 06:56 17:45-18:49/64 19:54 | 06:15 17:19-19:11/112 20:24 | 05:55 17:27-19:12/105 20:50 | |
| 10 | 07:44 15:16-16:40/84 17:17 | 07:23 15:13-17:19/126 17:52 | 06:44 15:36-17:50/134 18:24 | 06:55 17:43-18:51/68 19:55 | 06:14 17:19-19:11/112 20:25 | 05:55 17:28-19:13/105 20:50 | |
| 11 | 07:44 15:16-16:42/86 17:18 | 07:22 15:13-17:20/127 17:54 | 06:42 15:39-17:50/131 18:25 | 06:53 17:40-18:53/73 19:56 | 06:13 17:19-19:11/112 20:26 | 05:55 17:28-19:13/105 20:51 | |
| 12 | 07:44 15:16-16:43/87 17:19 | 07:21 15:14-17:33/139 17:55 | 06:41 15:40-17:49/129 18:26 | 06:52 17:38-18:55/77 19:57 | 06:12 17:19-19:11/112 20:27 | 05:54 17:29-19:13/104 20:51 | |
| 13 | 07:44 15:15-16:43/88 17:20 | 07:19 15:13-17:33/140 17:56 | 06:39 15:44-17:48/124 18:27 | 06:50 17:36-18:56/80 19:58 | 06:11 17:19-19:11/112 20:28 | 05:54 17:29-19:13/104 20:52 | |
| 14 | 07:43 15:15-16:44/89 17:21 | 07:18 15:14-17:35/141 17:57 | 06:38 15:46-17:47/121 18:28 | 06:49 17:35-18:57/82 19:59 | 06:10 17:19-19:11/112 20:29 | 05:54 17:29-19:13/104 20:52 | |
| 15 | 07:43 15:16-16:46/90 17:22 | 07:17 15:14-17:36/142 17:58 | 06:36 15:49-17:45/116 18:29 | 06:47 17:32-18:58/86 20:00 | 06:09 17:19-19:11/112 20:30 | 05:54 17:30-19:13/103 20:52 | |
| 16 | 07:43 15:15-16:46/91 17:23 | 07:16 15:15-17:38/143 17:59 | 06:35 15:53-17:44/111 18:30 | 06:46 17:31-19:00/89 20:01 | 06:08 17:19-19:11/112 20:31 | 05:54 17:30-19:14/104 20:53 | |
| 17 | 07:42 15:15-16:47/92 17:24 | 07:14 15:15-17:38/143 18:01 | 06:33 15:59-17:42/103 18:31 | 06:44 17:30-19:00/90 20:02 | 06:07 17:19-19:11/112 20:32 | 05:54 17:30-19:14/104 20:53 | |
| 18 | 07:42 15:15-16:48/93 17:25 | 07:13 15:16-17:40/144 18:02 | 06:31 16:03-17:41/98 18:32 | 06:43 17:29-19:01/92 20:03 | 06:07 17:20-19:12/112 20:33 | 05:54 17:30-19:14/104 20:54 | |
| 19 | 07:41 15:15-16:49/94 17:26 | 07:12 15:16-17:42/146 18:03 | 06:30 16:04-17:39/95 18:33 | 06:41 17:27-19:02/95 20:04 | 06:06 17:20-19:11/111 20:34 | 05:55 17:30-19:14/104 20:54 | |
| 20 | 07:41 15:14-16:49/95 17:28 | 07:10 15:16-17:42/146 18:04 | 06:28 16:05-17:36/91 18:34 | 06:40 17:26-19:03/97 20:05 | 06:05 17:20-19:11/111 20:35 | 05:55 17:30-19:14/104 20:54 | |
| 21 | 07:40 15:14-16:50/96 17:29 | 07:09 15:17-17:44/147 18:05 | 06:27 16:07-17:34/87 18:35 | 06:38 17:26-19:04/98 20:06 | 06:04 17:20-19:11/111 20:36 | 05:55 17:31-19:15/104 20:54 | |
| 22 | 07:40 15:14-16:51/97 17:30 | 07:08 15:17-17:44/147 18:06 | 06:25 16:08-17:04/56 18:36 | 06:37 17:24-19:04/100 20:07 | 06:03 17:21-19:12/111 20:36 | 05:55 17:31-19:15/104 20:55 | |
| 23 | 07:39 15:14-16:45/91 17:31 | 07:06 15:18-17:46/148 18:07 | 06:23 16:11-17:02/51 18:37 | 06:35 17:24-19:05/101 20:08 | 06:03 17:21-19:11/110 20:37 | 05:55 17:31-19:15/104 20:55 | |
| 24 | 07:38 15:13-16:49/96 17:32 | 07:05 15:19-17:48/149 18:09 | 06:22 16:12-17:00/48 18:38 | 06:34 17:23-19:06/103 20:09 | 06:02 17:21-19:11/110 20:38 | 05:56 17:31-19:15/104 20:55 | |
| 25 | 07:38 15:14-16:53/99 17:33 | 07:03 15:20-17:48/148 18:10 | 06:20 16:14-16:57/43 18:39 | 06:33 17:22-19:06/104 20:10 | 06:01 17:22-19:12/110 20:39 | 05:56 17:32-19:16/104 20:55 | |
| 26 | 07:37 15:13-16:55/102 17:34 | 07:02 15:21-17:50/149 18:11 | 06:18 16:18-16:54/36 18:40 | 06:31 17:22-19:07/105 20:11 | 06:01 17:22-19:11/109 20:40 | 05:56 17:32-19:16/104 20:55 | |
| 27 | 07:36 15:13-16:58/105 17:36 | 07:01 15:21-17:50/149 18:12 | 06:17 16:21-16:50/29 18:41 | 06:30 17:21-19:07/106 20:12 | 06:00 17:23-19:12/109 20:41 | 05:56 17:32-19:15/103 20:55 | |
| 28 | 07:35 15:13-17:00/107 17:37 | 06:59 15:23-17:52/149 18:13 | 06:15 16:25-16:45/20 18:42 | 06:29 17:20-19:07/107 20:13 | 05:59 17:23-19:12/109 20:41 | 05:57 17:32-19:16/104 20:55 | |
| 29 | 07:35 15:13-17:02/109 17:38 | | 06:14 17:10-17:26/16 19:43 | 06:27 17:20-19:08/108 20:14 | 05:59 17:24-19:12/108 20:42 | 05:57 17:32-19:16/104 20:55 | |
| 30 | 07:34 15:12-17:04/112 17:39 | | 06:13 17:10-17:26/16 19:44 | 06:26 17:20-19:08/108 20:15 | 05:58 17:24-19:12/108 20:43 | 05:58 17:33-19:17/104 20:55 | |
| 31 | 07:33 15:13-17:06/113 17:40 | | 06:12 17:10-17:26/16 19:45 | | 05:58 17:24-19:12/108 20:44 | | |
| Potential sun hours | 301 | 299 | 370 | 397 | 445 | 448 | |
| Sum of minutes with flicker | 2847 | 3805 | 2960 | 2269 | 3427 | 3139 | |

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:
windpro Seui - flickering

Printed/Page
2023-12-20 10:54 / 7
Licensed user:
Ing. Bruno Manca
Via Vittorio Veneto 231
IT-09028 Sestu
+390702358125
Bruno Manca / ingbrunomanca@gmail.com
Calculated:
2023-12-19 11:53/2.8.579

SHADOW - Calendar per WTG

Calculation: shadow flickering Seui - progettoWTG: 4 - SE_04

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

| | July | August | September | October | November | December |
|-----------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|-------------------------------|
| 1 | 05:58 17:32-19:17/105 20:55 | 06:21 17:29-19:22/113 20:37 | 06:50 17:39-18:52/73 19:56 | 07:18 16:21-18:28/127 19:07 | 06:51 14:43-16:48/125 17:22 | 07:24 14:58-16:24/86 16:59 |
| 2 | 05:59 17:33-19:18/105 20:55 | 06:22 17:28-19:20/112 20:36 | 06:51 17:41-18:49/68 19:54 | 07:19 16:18-18:28/130 19:05 | 06:52 14:43-16:47/124 17:21 | 07:25 14:59-16:23/84 16:59 |
| 3 | 05:59 17:32-19:17/105 20:55 | 06:23 17:28-19:20/112 20:35 | 06:52 17:43-18:47/64 19:53 | 07:20 16:16-18:29/133 19:04 | 06:53 14:42-16:46/124 17:20 | 07:26 14:59-16:23/84 16:59 |
| 4 | 06:00 17:33-19:18/105 20:55 | 06:24 17:28-19:20/112 20:34 | 06:53 17:45-18:44/59 19:51 | 07:21 16:13-18:29/136 19:02 | 06:54 14:42-16:45/123 17:19 | 07:27 15:00-16:23/83 16:59 |
| 5 | 06:00 17:32-19:18/106 20:55 | 06:25 17:28-19:20/112 20:33 | 06:54 17:47-18:41/54 19:50 | 07:22 16:11-18:29/138 19:01 | 06:55 14:43-16:45/122 17:18 | 07:28 15:01-16:23/82 16:58 |
| 6 | 06:01 17:33-19:19/106 20:54 | 06:26 17:28-19:20/112 20:32 | 06:55 17:50-18:38/48 19:48 | 07:23 16:09-18:29/140 18:59 | 06:56 14:43-16:43/120 17:17 | 07:29 15:02-16:23/81 16:58 |
| 7 | 06:01 17:32-19:18/106 20:54 | 06:27 17:28-19:20/112 20:31 | 06:56 17:54-18:34/40 19:46 | 07:24 16:07-18:29/142 18:57 | 06:57 14:43-16:42/119 17:16 | 07:30 15:03-16:23/80 16:58 |
| 8 | 06:02 17:33-19:19/106 20:54 | 06:27 17:28-19:19/111 20:29 | 06:57 17:59-18:28/29 19:45 | 07:25 16:05-18:28/143 18:56 | 06:59 14:43-16:41/118 17:14 | 07:31 15:04-16:23/79 16:58 |
| 9 | 06:03 17:33-19:20/107 20:53 | 06:28 17:28-19:19/111 20:28 | 06:58 18:08-18:19/11 19:43 | 07:26 16:03-18:28/145 18:54 | 07:00 14:43-16:39/116 17:13 | 07:32 15:05-16:23/78 16:58 |
| 10 | 06:03 17:32-19:19/107 20:53 | 06:29 17:28-19:18/110 20:27 | 06:58 19:41 19:41 | 07:27 16:01-18:28/147 18:53 | 07:01 14:44-16:39/115 17:13 | 07:33 15:06-16:24/78 16:58 |
| 11 | 06:04 17:33-19:20/107 20:53 | 06:30 17:27-19:17/110 20:26 | 06:59 19:40 19:40 | 07:28 15:59-18:27/148 18:51 | 07:02 14:44-16:37/113 17:12 | 07:33 15:06-16:23/77 16:58 |
| 12 | 06:05 17:33-19:20/107 20:52 | 06:31 17:28-19:17/109 20:25 | 07:00 19:38 19:38 | 07:29 15:58-18:27/149 18:50 | 07:03 14:44-16:35/111 17:11 | 07:34 15:07-16:23/76 16:59 |
| 13 | 06:05 17:32-19:20/108 20:52 | 06:32 17:28-19:16/108 20:23 | 07:01 19:37 19:37 | 07:30 15:56-18:26/150 18:48 | 07:04 14:45-16:34/109 17:10 | 07:35 15:08-16:23/75 16:59 |
| 14 | 06:06 17:32-19:20/108 20:51 | 06:33 17:28-19:15/107 20:22 | 07:02 19:35 19:35 | 07:31 15:55-18:24/149 18:47 | 07:05 14:46-16:33/107 17:09 | 07:36 15:09-16:24/75 16:59 |
| 15 | 06:07 17:32-19:21/109 20:51 | 06:34 17:28-19:15/107 20:21 | 07:03 17:16-17:34/18 19:33 | 07:32 15:53-18:22/149 18:45 | 07:07 14:46-16:31/105 17:08 | 07:36 15:09-16:23/74 16:59 |
| 16 | 06:07 17:31-19:20/109 20:50 | 06:35 17:28-19:14/106 20:19 | 07:04 17:11-17:39/28 19:32 | 07:33 15:52-18:21/149 18:44 | 07:08 14:46-16:28/102 17:07 | 07:37 15:10-16:24/74 16:59 |
| 17 | 06:08 17:32-19:21/109 20:50 | 06:36 17:29-19:13/104 20:18 | 07:05 17:07-17:42/35 19:30 | 07:34 15:51-18:19/148 18:42 | 07:09 14:47-16:26/99 17:06 | 07:38 15:11-16:25/74 17:00 |
| 18 | 06:09 17:32-19:21/109 20:49 | 06:37 17:29-19:13/104 20:17 | 07:06 17:03-17:45/42 19:28 | 07:35 15:50-18:18/148 18:41 | 07:10 14:47-16:23/96 17:06 | 07:38 15:11-16:24/73 17:00 |
| 19 | 06:10 17:32-19:21/109 20:48 | 06:38 17:29-19:12/103 20:15 | 07:07 17:00-17:47/47 19:27 | 07:36 15:50-18:17/147 18:39 | 07:11 14:49-16:20/91 17:05 | 07:39 15:12-16:25/73 17:00 |
| 20 | 06:11 17:31-19:21/110 20:48 | 06:39 17:30-19:11/101 20:14 | 07:08 16:57-17:47/50 19:25 | 07:38 15:49-18:15/146 18:38 | 07:12 14:49-16:26/97 17:04 | 07:40 15:12-16:25/73 17:01 |
| 21 | 06:11 17:31-19:21/110 20:47 | 06:40 17:30-19:10/100 20:12 | 07:09 16:54-17:49/55 19:23 | 07:39 15:48-18:14/146 18:36 | 07:13 14:50-16:26/96 17:04 | 07:40 15:13-16:26/73 17:01 |
| 22 | 06:12 17:31-19:21/110 20:46 | 06:41 17:30-19:08/98 20:11 | 07:10 16:52-18:18/86 19:22 | 07:40 15:47-18:12/145 18:35 | 07:14 14:50-16:25/95 17:03 | 07:41 15:13-16:26/73 17:02 |
| 23 | 06:13 17:31-19:22/111 20:45 | 06:42 17:30-19:07/97 20:09 | 07:11 16:50-18:20/90 19:20 | 07:41 15:46-18:11/145 18:34 | 07:16 14:51-16:25/94 17:03 | 07:41 15:14-16:27/73 17:02 |
| 24 | 06:14 17:31-19:22/111 20:45 | 06:43 17:31-19:05/94 20:08 | 07:12 16:48-18:22/94 19:18 | 07:42 15:45-18:09/144 18:32 | 07:17 14:52-16:25/93 17:02 | 07:42 15:14-16:27/73 17:03 |
| 25 | 06:15 17:31-19:22/111 20:44 | 06:44 17:32-19:04/92 20:06 | 07:13 16:46-18:23/97 19:17 | 06:43 14:44-17:08/144 17:31 | 07:18 14:53-16:25/92 17:02 | 07:42 15:15-16:28/73 17:03 |
| 26 | 06:16 17:30-19:21/111 20:43 | 06:44 17:33-19:03/90 20:05 | 07:13 16:44-18:24/100 19:15 | 06:44 14:45-17:07/142 17:30 | 07:19 14:54-16:25/91 17:01 | 07:43 15:15-16:28/73 17:04 |
| 27 | 06:17 17:30-19:21/111 20:42 | 06:45 17:33-19:01/88 20:03 | 07:14 16:37-18:25/108 19:14 | 06:45 14:44-17:06/142 17:28 | 07:20 14:55-16:25/90 17:01 | 07:43 15:15-16:29/74 17:05 |
| 28 | 06:17 17:30-19:21/111 20:41 | 06:46 17:34-19:00/86 20:02 | 07:15 16:32-18:26/114 19:12 | 06:46 14:44-17:04/140 17:27 | 07:21 14:55-16:24/89 17:00 | 07:43 15:15-16:29/74 17:05 |
| 29 | 06:18 17:30-19:22/112 20:40 | 06:47 17:36-18:58/82 20:00 | 07:16 16:28-18:27/119 19:10 | 06:47 14:43-17:03/140 17:26 | 07:22 14:56-16:24/88 17:00 | 07:43 15:16-16:31/75 17:06 |
| 30 | 06:19 17:30-19:22/112 20:39 | 06:48 17:37-18:57/80 19:59 | 07:17 16:24-18:28/124 19:09 | 06:48 14:43-17:00/137 17:25 | 07:23 14:57-16:24/87 17:00 | 07:44 15:16-16:31/75 17:07 |
| 31 | 06:20 17:30-19:22/112 20:38 | 06:49 17:38-18:55/77 19:57 | | 06:50 14:42-16:48/126 17:23 | | 07:44 15:16-16:32/76 17:08 |
| Potential sun hours | 455 | 425 | 374 | 347 | 301 | 292 |
| Sum of minutes with flicker | 3365 | 3160 | 1688 | 4415 | 3161 | 2371 |

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:
windpro Seui - flickering

Printed/Page
2023-12-20 10:54 / 8
Licensed user:
Ing. Bruno Manca
Via Vittorio Veneto 231
IT-09028 Sestu
+390702358125
Bruno Manca / ingbrunomanca@gmail.com
Calculated:
2023-12-19 11:53/2.8.579

SHADOW - Calendar per WTG

Calculation: shadow flickering Seui - progettoWTG: 5 - SE_05

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

| | January | February | March | April | May | June |
|-----------------------------|---|-------------------------------|-------------------------------|-------------------------------|----------------|----------------|
| 1 | 07:44 15:31-16:32/61 17:09 16:32-16:41/9 | 07:32 15:51-16:35/44 17:42 | 06:58 18:14 | 07:09 18:19-18:55/36 19:46 | 06:25 20:16 | 05:57 20:44 |
| 2 | 07:44 15:32-16:33/61 17:09 16:33-16:41/8 | 07:31 15:53-16:34/41 17:43 | 06:56 18:15 | 07:07 18:20-18:52/32 19:47 | 06:24 20:17 | 05:57 20:45 |
| 3 | 07:44 15:32-16:33/61 17:10 16:33-16:41/8 | 07:30 15:54-16:32/38 17:44 | 06:55 18:16 | 07:06 18:22-18:51/29 19:48 | 06:22 20:18 | 05:57 20:46 |
| 4 | 07:45 15:32-16:34/62 17:11 16:34-16:41/7 | 07:29 15:56-16:31/35 17:45 | 06:53 18:17 | 07:04 18:24-18:48/24 19:49 | 06:21 20:19 | 05:56 20:47 |
| 5 | 07:45 15:33-16:34/61 17:12 16:34-16:42/8 | 07:28 15:58-16:29/31 17:46 | 06:52 17:42-17:45/3 18:18 | 07:02 18:27-18:45/18 19:50 | 06:20 20:20 | 05:56 20:47 |
| 6 | 07:45 15:33-16:35/62 17:13 16:35-16:42/7 | 07:27 16:01-16:27/26 17:48 | 06:50 17:35-17:53/18 18:20 | 07:01 18:33-18:38/5 19:51 | 06:19 20:21 | 05:56 20:48 |
| 7 | 07:45 15:34-16:35/61 17:14 16:35-16:42/7 | 07:26 16:03-16:24/21 17:49 | 06:49 17:31-17:55/24 18:21 | 06:59 17:31-17:55/24 19:52 | 06:18 20:22 | 05:55 20:48 |
| 8 | 07:44 15:34-16:36/62 17:15 16:36-16:42/6 | 07:25 16:07-16:20/13 17:50 | 06:47 17:29-17:58/29 18:22 | 06:58 17:29-17:58/29 19:53 | 06:17 20:23 | 05:55 20:49 |
| 9 | 07:44 15:35-16:37/62 17:16 16:37-16:42/5 | 07:24 17:51 | 06:46 17:26-17:59/33 18:23 | 06:56 19:54 | 06:15 20:24 | 05:55 20:50 |
| 10 | 07:44 15:35-16:36/61 17:17 16:36-16:41/5 | 07:23 17:52 | 06:44 17:24-18:00/36 18:24 | 06:55 19:55 | 06:14 20:25 | 05:55 20:50 |
| 11 | 07:44 15:35-16:37/62 17:18 16:37-16:41/4 | 07:22 17:54 | 06:42 17:23-18:02/39 18:25 | 06:53 19:56 | 06:13 20:26 | 05:55 20:51 |
| 12 | 07:44 15:36-16:38/62 17:19 16:38-16:41/3 | 07:21 17:55 | 06:41 17:21-18:03/42 18:26 | 06:52 19:57 | 06:12 20:27 | 05:54 20:51 |
| 13 | 07:44 15:36-16:37/61 17:20 16:37-16:40/3 | 07:19 17:56 | 06:39 17:20-18:04/44 18:27 | 06:50 19:58 | 06:11 20:28 | 05:54 20:52 |
| 14 | 07:43 15:37-16:38/61 17:21 16:38-16:40/2 | 07:18 17:57 | 06:38 17:19-18:04/45 18:28 | 06:49 19:59 | 06:10 20:29 | 05:54 20:52 |
| 15 | 07:43 15:38-16:39/61 17:22 16:39-16:40/1 | 07:17 17:58 | 06:36 17:18-18:04/46 18:29 | 06:47 20:00 | 06:09 20:30 | 05:54 20:52 |
| 16 | 07:43 15:38-16:38/60 17:23 | 07:16 17:59 | 06:35 17:17-18:05/48 18:30 | 06:46 20:01 | 06:08 20:31 | 05:54 20:53 |
| 17 | 07:42 15:39-16:38/59 17:24 | 07:14 18:01 | 06:33 17:16-18:05/49 18:31 | 06:44 20:02 | 06:07 20:32 | 05:54 20:53 |
| 18 | 07:42 15:39-16:38/59 17:25 | 07:13 18:02 | 06:31 17:16-18:06/50 18:32 | 06:43 20:03 | 06:07 20:33 | 05:54 20:54 |
| 19 | 07:41 15:40-16:39/59 17:26 | 07:12 18:03 | 06:30 17:15-18:05/50 18:33 | 06:41 20:04 | 06:06 20:34 | 05:55 20:54 |
| 20 | 07:41 15:40-16:38/58 17:28 | 07:10 18:04 | 06:28 17:15-18:05/50 18:34 | 06:40 20:05 | 06:05 20:35 | 05:55 20:54 |
| 21 | 07:40 15:40-16:38/58 17:29 | 07:09 18:05 | 06:27 17:15-18:05/50 18:35 | 06:38 20:06 | 06:04 20:36 | 05:55 20:54 |
| 22 | 07:40 15:41-16:38/57 17:30 | 07:08 18:06 | 06:25 17:14-18:04/50 18:36 | 06:37 20:07 | 06:03 20:36 | 05:55 20:55 |
| 23 | 07:39 15:42-16:38/56 17:31 | 07:06 18:07 | 06:23 17:15-18:04/49 18:37 | 06:35 20:08 | 06:03 20:37 | 05:55 20:55 |
| 24 | 07:38 15:42-16:38/56 17:32 | 07:05 18:09 | 06:22 17:15-18:03/48 18:38 | 06:34 20:09 | 06:02 20:38 | 05:56 20:55 |
| 25 | 07:38 15:44-16:38/54 17:33 | 07:03 18:10 | 06:20 17:14-18:02/48 18:39 | 06:33 20:10 | 06:01 20:39 | 05:56 20:55 |
| 26 | 07:37 15:44-16:38/54 17:35 | 07:02 18:11 | 06:18 17:15-18:02/47 18:40 | 06:31 20:11 | 06:01 20:40 | 05:56 20:55 |
| 27 | 07:36 15:45-16:37/52 17:36 | 07:01 18:12 | 06:17 17:15-18:01/46 18:41 | 06:30 20:12 | 06:00 20:41 | 05:57 20:55 |
| 28 | 07:35 15:46-16:37/51 17:37 | 06:59 18:13 | 06:15 17:15-18:00/45 18:42 | 06:29 20:13 | 05:59 20:41 | 05:57 20:55 |
| 29 | 07:35 15:47-16:36/49 17:38 | | 07:14 18:16-18:59/43 19:43 | 06:27 20:14 | 05:59 20:42 | 05:57 20:55 |
| 30 | 07:34 15:48-16:35/47 17:39 | | 07:12 18:17-18:57/40 19:44 | 06:26 20:15 | 05:58 20:43 | 05:58 20:55 |
| 31 | 07:33 15:50-16:35/45 17:40 | | 07:10 18:18-18:57/39 19:45 | | 05:58 20:44 | |
| Potential sun hours | 301 | 299 | 370 | 397 | 445 | 448 |
| Sum of minutes with flicker | 1878 | 249 | 1111 | 144 | 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:
windpro Seui - flickering

Printed/Page
2023-12-20 10:54 / 10

Licensed user:
Ing. Bruno Manca
Via Vittorio Veneto 231
IT-09028 Sestu
+390702358125
Bruno Manca / ingbrunomanca@gmail.com
Calculated:
2023-12-19 11:53/2.8.579

SHADOW - Calendar per WTG

Calculation: shadow flickering Seui - progettoWTG: 6 - SE_06

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

| | January | February | March | April | May | June | July | August | September | October | November | December |
|-----------------------------|---------|----------|-------|-------|-------|-------|-------|--------|-----------|---------|----------|----------|
| 1 | 07:44 | 07:32 | 06:58 | 07:09 | 06:25 | 05:57 | 05:58 | 06:21 | 06:50 | 07:18 | 06:51 | 07:24 |
| | 17:09 | 17:42 | 18:14 | 19:46 | 20:16 | 20:44 | 20:55 | 20:37 | 19:56 | 19:07 | 17:22 | 16:59 |
| 2 | 07:44 | 07:31 | 06:56 | 07:07 | 06:24 | 05:57 | 05:59 | 06:22 | 06:51 | 07:19 | 06:52 | 07:25 |
| | 17:09 | 17:43 | 18:15 | 19:47 | 20:17 | 20:45 | 20:55 | 20:36 | 19:54 | 19:05 | 17:21 | 16:59 |
| 3 | 07:44 | 07:30 | 06:55 | 07:06 | 06:22 | 05:57 | 05:59 | 06:23 | 06:52 | 07:20 | 06:53 | 07:26 |
| | 17:10 | 17:44 | 18:16 | 19:48 | 20:18 | 20:46 | 20:55 | 20:35 | 19:53 | 19:04 | 17:20 | 16:59 |
| 4 | 07:45 | 07:29 | 06:53 | 07:04 | 06:21 | 05:56 | 06:00 | 06:24 | 06:53 | 07:21 | 06:54 | 07:27 |
| | 17:11 | 17:45 | 18:17 | 19:49 | 20:19 | 20:46 | 20:55 | 20:34 | 19:51 | 19:02 | 17:19 | 16:59 |
| 5 | 07:45 | 07:28 | 06:52 | 07:02 | 06:20 | 05:56 | 06:00 | 06:25 | 06:54 | 07:22 | 06:55 | 07:28 |
| | 17:12 | 17:46 | 18:18 | 19:50 | 20:20 | 20:47 | 20:54 | 20:33 | 19:49 | 19:01 | 17:18 | 16:58 |
| 6 | 07:45 | 07:27 | 06:50 | 07:01 | 06:19 | 05:56 | 06:01 | 06:26 | 06:55 | 07:23 | 06:56 | 07:29 |
| | 17:13 | 17:48 | 18:20 | 19:51 | 20:21 | 20:48 | 20:54 | 20:32 | 19:48 | 18:59 | 17:17 | 16:58 |
| 7 | 07:45 | 07:26 | 06:49 | 06:59 | 06:18 | 05:55 | 06:01 | 06:27 | 06:56 | 07:24 | 06:57 | 07:30 |
| | 17:14 | 17:49 | 18:21 | 19:52 | 20:22 | 20:48 | 20:54 | 20:31 | 19:46 | 18:57 | 17:16 | 16:58 |
| 8 | 07:44 | 07:25 | 06:47 | 06:58 | 06:16 | 05:55 | 06:02 | 06:27 | 06:57 | 07:25 | 06:59 | 07:31 |
| | 17:15 | 17:50 | 18:22 | 19:53 | 20:23 | 20:49 | 20:54 | 20:29 | 19:45 | 18:56 | 17:14 | 16:58 |
| 9 | 07:44 | 07:24 | 06:46 | 06:56 | 06:15 | 05:55 | 06:03 | 06:28 | 06:58 | 07:26 | 07:00 | 07:32 |
| | 17:16 | 17:51 | 18:23 | 19:54 | 20:24 | 20:50 | 20:53 | 20:28 | 19:43 | 18:54 | 17:13 | 16:58 |
| 10 | 07:44 | 07:23 | 06:44 | 06:55 | 06:14 | 05:55 | 06:03 | 06:29 | 06:58 | 07:27 | 07:01 | 07:32 |
| | 17:17 | 17:52 | 18:24 | 19:55 | 20:25 | 20:50 | 20:53 | 20:27 | 19:41 | 18:53 | 17:12 | 16:58 |
| 11 | 07:44 | 07:22 | 06:42 | 06:53 | 06:13 | 05:55 | 06:04 | 06:30 | 06:59 | 07:28 | 07:02 | 07:33 |
| | 17:18 | 17:54 | 18:25 | 19:56 | 20:26 | 20:51 | 20:53 | 20:26 | 19:40 | 18:51 | 17:12 | 16:58 |
| 12 | 07:44 | 07:20 | 06:41 | 06:52 | 06:12 | 05:54 | 06:05 | 06:31 | 07:00 | 07:29 | 07:03 | 07:34 |
| | 17:19 | 17:55 | 18:26 | 19:57 | 20:27 | 20:51 | 20:52 | 20:24 | 19:38 | 18:50 | 17:11 | 16:59 |
| 13 | 07:43 | 07:19 | 06:39 | 06:50 | 06:11 | 05:54 | 06:05 | 06:32 | 07:01 | 07:30 | 07:04 | 07:35 |
| | 17:20 | 17:56 | 18:27 | 19:58 | 20:28 | 20:52 | 20:52 | 20:23 | 19:37 | 18:48 | 17:10 | 16:59 |
| 14 | 07:43 | 07:18 | 06:38 | 06:49 | 06:10 | 05:54 | 06:06 | 06:33 | 07:02 | 07:31 | 07:05 | 07:36 |
| | 17:21 | 17:57 | 18:28 | 19:59 | 20:29 | 20:52 | 20:51 | 20:22 | 19:35 | 18:47 | 17:09 | 16:59 |
| 15 | 07:43 | 07:17 | 06:36 | 06:47 | 06:09 | 05:54 | 06:07 | 06:34 | 07:03 | 07:32 | 07:07 | 07:36 |
| | 17:22 | 17:58 | 18:29 | 20:00 | 20:30 | 20:52 | 20:51 | 20:21 | 19:33 | 18:45 | 17:08 | 16:59 |
| 16 | 07:42 | 07:16 | 06:35 | 06:46 | 06:08 | 05:54 | 06:07 | 06:35 | 07:04 | 07:33 | 07:08 | 07:37 |
| | 17:23 | 17:59 | 18:30 | 20:01 | 20:31 | 20:53 | 20:50 | 20:19 | 19:32 | 18:44 | 17:07 | 16:59 |
| 17 | 07:42 | 07:14 | 06:33 | 06:44 | 06:07 | 05:54 | 06:08 | 06:36 | 07:05 | 07:34 | 07:09 | 07:38 |
| | 17:24 | 18:01 | 18:31 | 20:02 | 20:32 | 20:53 | 20:50 | 20:18 | 19:30 | 18:42 | 17:06 | 17:00 |
| 18 | 07:42 | 07:13 | 06:31 | 06:43 | 06:07 | 05:54 | 06:09 | 06:37 | 07:06 | 07:35 | 07:10 | 07:38 |
| | 17:25 | 18:02 | 18:32 | 20:03 | 20:33 | 20:54 | 20:49 | 20:16 | 19:28 | 18:41 | 17:06 | 17:00 |
| 19 | 07:41 | 07:12 | 06:30 | 06:41 | 06:06 | 05:55 | 06:10 | 06:38 | 07:07 | 07:36 | 07:11 | 07:39 |
| | 17:26 | 18:03 | 18:33 | 20:04 | 20:34 | 20:54 | 20:48 | 20:15 | 19:27 | 18:39 | 17:05 | 17:00 |
| 20 | 07:41 | 07:10 | 06:28 | 06:40 | 06:05 | 05:55 | 06:11 | 06:39 | 07:08 | 07:37 | 07:12 | 07:40 |
| | 17:28 | 18:04 | 18:34 | 20:05 | 20:35 | 20:54 | 20:48 | 20:14 | 19:25 | 18:38 | 17:04 | 17:01 |
| 21 | 07:40 | 07:09 | 06:27 | 06:38 | 06:04 | 05:55 | 06:11 | 06:40 | 07:09 | 07:39 | 07:13 | 07:40 |
| | 17:29 | 18:05 | 18:35 | 20:06 | 20:35 | 20:54 | 20:47 | 20:12 | 19:23 | 18:36 | 17:04 | 17:01 |
| 22 | 07:40 | 07:08 | 06:25 | 06:37 | 06:03 | 05:55 | 06:12 | 06:41 | 07:10 | 07:40 | 07:14 | 07:41 |
| | 17:30 | 18:06 | 18:36 | 20:07 | 20:36 | 20:55 | 20:46 | 20:11 | 19:22 | 18:35 | 17:03 | 17:02 |
| 23 | 07:39 | 07:06 | 06:23 | 06:35 | 06:03 | 05:55 | 06:13 | 06:42 | 07:11 | 07:41 | 07:16 | 07:41 |
| | 17:31 | 18:07 | 18:37 | 20:08 | 20:37 | 20:55 | 20:45 | 20:09 | 19:20 | 18:34 | 17:03 | 17:02 |
| 24 | 07:38 | 07:05 | 06:22 | 06:34 | 06:02 | 05:56 | 06:14 | 06:43 | 07:12 | 07:42 | 07:17 | 07:42 |
| | 17:32 | 18:09 | 18:38 | 20:09 | 20:38 | 20:55 | 20:45 | 20:08 | 19:18 | 18:32 | 17:02 | 17:03 |
| 25 | 07:38 | 07:03 | 06:20 | 06:33 | 06:01 | 05:56 | 06:15 | 06:43 | 07:12 | 07:42 | 07:18 | 07:42 |
| | 17:33 | 18:10 | 18:39 | 20:10 | 20:39 | 20:55 | 20:44 | 20:06 | 19:17 | 17:31 | 17:02 | 17:03 |
| 26 | 07:37 | 07:02 | 06:18 | 06:31 | 06:01 | 05:56 | 06:16 | 06:44 | 07:13 | 07:43 | 07:19 | 07:42 |
| | 17:34 | 18:11 | 18:40 | 20:11 | 20:40 | 20:55 | 20:43 | 20:05 | 19:15 | 17:30 | 17:01 | 17:04 |
| 27 | 07:36 | 07:01 | 06:17 | 06:30 | 06:00 | 05:56 | 06:17 | 06:45 | 07:14 | 07:44 | 07:20 | 07:43 |
| | 17:36 | 18:12 | 18:41 | 20:12 | 20:41 | 20:55 | 20:42 | 20:03 | 19:14 | 17:28 | 17:01 | 17:05 |
| 28 | 07:35 | 06:59 | 06:15 | 06:29 | 05:59 | 05:57 | 06:17 | 06:46 | 07:15 | 07:45 | 07:21 | 07:43 |
| | 17:37 | 18:13 | 18:42 | 20:13 | 20:41 | 20:55 | 20:41 | 20:02 | 19:12 | 17:27 | 17:00 | 17:05 |
| 29 | 07:35 | | 07:14 | 06:27 | 05:59 | 05:57 | 06:18 | 06:47 | 07:16 | 07:46 | 07:22 | 07:43 |
| | 17:38 | | 19:43 | 20:14 | 20:42 | 20:55 | 20:40 | 20:00 | 19:10 | 17:26 | 17:00 | 17:06 |
| 30 | 07:34 | | 07:12 | 06:26 | 05:58 | 05:58 | 06:19 | 06:48 | 07:17 | 07:47 | 07:23 | 07:44 |
| | 17:39 | | 19:44 | 20:15 | 20:43 | 20:55 | 20:39 | 19:59 | 19:09 | 17:25 | 17:00 | 17:07 |
| 31 | 07:33 | | 07:10 | | 05:58 | | 06:20 | 06:49 | | 06:50 | | 07:44 |
| | 17:40 | | 19:45 | | 20:44 | | 20:38 | 19:57 | | 17:23 | | 17:08 |
| Potential sun hours | 301 | 299 | 370 | 397 | 445 | 448 | 455 | 425 | 374 | 347 | 301 | 292 |
| Sum of minutes with flicker | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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

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

Project: windpro Seui - flickering

Printed/Page: 2023-12-20 10:54 / 11
Licensed user: Ing. Bruno Manca
Via Vittorio Veneto 231
IT-09028 Sestu
+390702358125
Bruno Manca / ingbrunomanca@gmail.com
Calculated: 2023-12-19 11:53/2.8.579

SHADOW - Calendar per WTG

Calculation: shadow flickering Seui - progetto WTG: 7 - SE 07

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

Table with 12 columns for months (January to December) and multiple rows for each day, showing sun rise/set times and shadow flicker minutes.

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:
windpro Seui - flickering

Printed/Page
2023-12-20 10:54 / 12

Licensed user:
Ing. Bruno Manca
Via Vittorio Veneto 231
IT-09028 Sestu
+390702358125
Bruno Manca / ingbrunomanca@gmail.com
Calculated:
2023-12-19 11:53/2.8.579

SHADOW - Calendar per WTG

Calculation: shadow flickering Seui - progettoWTG: 8 - SE_08

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

| | January | February | March | April | May | June | July | August | September | October | November | December |
|-----------------------------|----------------|----------------|----------------|-------------------------------|-------------------------------|----------------|-------------------------------|-------------------------------|----------------|----------------|----------------|----------------|
| 1 | 07:44 17:09 | 07:32 17:42 | 06:58 18:14 | 07:09 19:46 | 06:25 19:14-19:46/32 20:16 | 05:57 20:44 | 05:58 20:55 | 06:21 19:29-19:50/21 20:37 | 06:50 19:56 | 07:18 19:07 | 06:51 17:22 | 07:24 16:59 |
| 2 | 07:44 17:09 | 07:31 17:43 | 06:56 18:15 | 07:07 19:47 | 06:24 19:13-19:45/32 20:17 | 05:57 20:45 | 05:59 20:55 | 06:22 19:27-19:50/23 20:36 | 06:51 19:54 | 07:19 19:05 | 06:52 17:21 | 07:25 16:59 |
| 3 | 07:44 17:10 | 07:30 17:44 | 06:55 18:16 | 07:06 19:48 | 06:22 19:13-19:45/32 20:18 | 05:57 20:46 | 05:59 20:55 | 06:23 19:26-19:51/25 20:35 | 06:52 19:53 | 07:20 19:04 | 06:53 17:20 | 07:26 16:59 |
| 4 | 07:45 17:11 | 07:29 17:45 | 06:53 18:17 | 07:04 19:49 | 06:21 19:14-19:45/31 20:19 | 05:56 20:47 | 06:00 20:55 | 06:24 19:26-19:52/26 20:34 | 06:53 19:51 | 07:21 19:02 | 06:54 17:19 | 07:27 16:59 |
| 5 | 07:45 17:12 | 07:28 17:46 | 06:52 18:18 | 07:02 19:50 | 06:20 19:14-19:44/30 20:20 | 05:56 20:47 | 06:00 20:55 | 06:25 19:25-19:53/28 20:33 | 06:54 19:50 | 07:22 19:01 | 06:55 17:18 | 07:28 16:59 |
| 6 | 07:45 17:13 | 07:27 17:48 | 06:50 18:20 | 07:01 19:51 | 06:19 19:14-19:44/30 20:21 | 05:56 20:48 | 06:01 20:54 | 06:26 19:24-19:53/29 20:32 | 06:55 19:48 | 07:23 18:59 | 06:56 17:17 | 07:29 16:58 |
| 7 | 07:45 17:14 | 07:26 17:49 | 06:49 18:21 | 06:59 19:52 | 06:18 19:15-19:43/28 20:22 | 05:55 20:48 | 06:01 20:54 | 06:27 19:24-19:54/30 20:31 | 06:56 19:46 | 07:24 18:57 | 06:57 17:16 | 07:30 16:58 |
| 8 | 07:44 17:15 | 07:25 17:50 | 06:47 18:22 | 06:58 19:53 | 06:17 19:16-19:43/27 20:23 | 05:55 20:49 | 06:02 20:54 | 06:28 19:24-19:54/30 20:29 | 06:57 19:45 | 07:25 18:56 | 06:59 17:15 | 07:31 16:58 |
| 9 | 07:44 17:16 | 07:24 17:51 | 06:46 18:23 | 06:56 19:54 | 06:15 19:16-19:42/26 20:24 | 05:55 20:50 | 06:03 20:53 | 06:28 19:23-19:54/31 20:28 | 06:58 19:43 | 07:26 18:54 | 07:00 17:14 | 07:32 16:58 |
| 10 | 07:44 17:17 | 07:23 17:52 | 06:44 18:24 | 06:55 19:55 | 06:14 19:17-19:41/24 20:25 | 05:55 20:50 | 06:03 20:53 | 06:29 19:23-19:55/32 20:27 | 06:58 19:41 | 07:27 18:53 | 07:01 17:12 | 07:32 16:58 |
| 11 | 07:44 17:18 | 07:22 17:54 | 06:42 18:25 | 06:53 19:56 | 06:13 19:18-19:40/22 20:26 | 05:55 20:51 | 06:04 20:53 | 06:30 19:22-19:54/32 20:26 | 06:59 19:40 | 07:28 18:51 | 07:02 17:12 | 07:33 16:58 |
| 12 | 07:44 17:19 | 07:21 17:55 | 06:41 18:26 | 06:52 19:57 | 06:12 19:19-19:39/20 20:27 | 05:54 20:51 | 06:05 20:52 | 06:31 19:22-19:54/32 20:25 | 07:00 19:38 | 07:29 18:50 | 07:03 17:11 | 07:34 16:59 |
| 13 | 07:44 17:20 | 07:19 17:56 | 06:39 18:27 | 06:50 19:58 | 06:11 19:21-19:37/16 20:28 | 05:54 20:52 | 06:05 20:52 | 06:32 19:22-19:53/31 20:23 | 07:01 19:37 | 07:30 18:48 | 07:04 17:10 | 07:35 16:59 |
| 14 | 07:43 17:21 | 07:18 17:57 | 06:38 18:28 | 06:49 19:59 | 06:10 19:22-19:35/13 20:29 | 05:54 20:52 | 06:06 20:51 | 06:33 19:22-19:53/31 20:22 | 07:02 19:35 | 07:31 18:47 | 07:05 17:09 | 07:36 16:59 |
| 15 | 07:43 17:22 | 07:17 17:58 | 06:36 18:29 | 06:47 20:00 | 06:09 19:25-19:32/7 20:30 | 05:54 20:52 | 06:07 20:51 | 06:34 19:22-19:53/31 20:21 | 07:03 19:33 | 07:32 18:45 | 07:07 17:08 | 07:36 16:59 |
| 16 | 07:43 17:23 | 07:16 17:59 | 06:35 18:30 | 06:46 20:01 | 06:08 20:31 | 05:54 20:53 | 06:08 20:50 | 06:35 19:22-19:52/30 20:19 | 07:04 19:32 | 07:33 18:44 | 07:08 17:07 | 07:37 16:59 |
| 17 | 07:42 17:24 | 07:14 18:01 | 06:33 18:31 | 06:44 20:02 | 06:08 20:32 | 05:54 20:53 | 06:08 20:50 | 06:36 19:23-19:51/28 20:18 | 07:05 19:30 | 07:34 18:42 | 07:09 17:07 | 07:38 17:00 |
| 18 | 07:42 17:25 | 07:13 18:02 | 06:31 18:32 | 06:43 20:03 | 06:07 20:33 | 05:54 20:54 | 06:09 20:49 | 06:37 19:23-19:51/28 20:17 | 07:06 19:28 | 07:35 18:41 | 07:10 17:06 | 07:38 17:00 |
| 19 | 07:41 17:26 | 07:12 18:03 | 06:30 18:33 | 06:41 20:04 | 06:06 20:34 | 05:55 20:54 | 06:10 20:48 | 06:38 19:24-19:50/26 20:15 | 07:07 19:27 | 07:36 18:39 | 07:11 17:05 | 07:39 17:00 |
| 20 | 07:41 17:28 | 07:10 18:04 | 06:28 18:34 | 06:40 19:26-19:37/11 20:05 | 06:05 20:35 | 05:55 20:54 | 06:11 20:48 | 06:39 19:25-19:48/23 20:14 | 07:08 19:25 | 07:38 18:38 | 07:12 17:04 | 07:40 17:01 |
| 21 | 07:40 17:29 | 07:09 18:05 | 06:27 18:35 | 06:38 19:23-19:40/17 20:06 | 06:04 20:35 | 05:55 20:54 | 06:11 20:47 | 06:40 19:27-19:47/20 20:12 | 07:09 19:23 | 07:39 18:37 | 07:13 17:04 | 07:40 17:01 |
| 22 | 07:40 17:30 | 07:08 18:06 | 06:25 18:36 | 06:37 19:20-19:41/21 20:07 | 06:03 20:36 | 05:55 20:55 | 06:12 20:46 | 06:41 19:27-19:44/17 20:11 | 07:10 19:22 | 07:40 18:35 | 07:14 17:03 | 07:41 17:02 |
| 23 | 07:39 17:31 | 07:06 18:07 | 06:23 18:37 | 06:35 19:19-19:43/24 20:08 | 06:03 20:37 | 05:55 20:55 | 06:13 20:45 | 06:42 19:30-19:40/10 20:09 | 07:11 19:20 | 07:41 18:34 | 07:16 17:03 | 07:41 17:02 |
| 24 | 07:38 17:32 | 07:05 18:09 | 06:22 18:38 | 06:34 19:18-19:44/26 20:09 | 06:02 20:38 | 05:56 20:55 | 06:14 20:45 | 06:43 19:30-19:40/10 20:08 | 07:12 19:18 | 07:42 18:32 | 07:17 17:02 | 07:42 17:03 |
| 25 | 07:38 17:33 | 07:03 18:10 | 06:20 18:39 | 06:33 19:16-19:44/28 20:10 | 06:01 20:39 | 05:56 20:55 | 06:15 20:44 | 06:44 19:30-19:40/10 20:06 | 07:13 19:17 | 06:43 17:31 | 07:18 17:02 | 07:42 17:03 |
| 26 | 07:37 17:35 | 07:02 18:11 | 06:18 18:40 | 06:31 19:16-19:45/29 20:11 | 06:01 20:40 | 05:56 20:55 | 06:16 20:43 | 06:44 19:30-19:40/10 20:05 | 07:14 19:15 | 06:44 17:30 | 07:19 17:01 | 07:42 17:04 |
| 27 | 07:36 17:36 | 07:01 18:12 | 06:17 18:41 | 06:30 19:16-19:45/29 20:12 | 06:00 20:41 | 05:57 20:55 | 06:17 20:42 | 06:45 19:30-19:40/10 20:03 | 07:14 19:14 | 06:45 17:28 | 07:20 17:01 | 07:43 17:05 |
| 28 | 07:35 17:37 | 06:59 18:13 | 06:15 18:42 | 06:29 19:14-19:45/31 20:13 | 05:59 20:41 | 05:57 20:55 | 06:17 20:41 | 06:46 19:30-19:40/10 20:02 | 07:15 19:12 | 06:46 17:27 | 07:21 17:00 | 07:43 17:05 |
| 29 | 07:35 17:38 | 07:07 18:14 | 06:14 19:43 | 06:27 19:14-19:45/31 20:14 | 05:59 20:42 | 05:57 20:55 | 06:18 19:34-19:44/10 20:40 | 06:47 19:30-19:40/10 20:00 | 07:16 19:10 | 06:47 17:26 | 07:22 17:00 | 07:43 17:06 |
| 30 | 07:34 17:39 | 07:06 18:15 | 06:13 19:44 | 06:26 19:14-19:46/32 20:15 | 05:58 20:43 | 05:58 20:55 | 06:19 19:32-19:47/15 20:39 | 06:48 19:30-19:40/10 19:59 | 07:17 19:09 | 06:48 17:25 | 07:23 17:00 | 07:44 17:07 |
| 31 | 07:33 17:40 | 07:05 18:16 | 06:12 19:45 | 06:25 19:14-19:46/32 20:16 | 05:58 20:44 | 05:58 20:55 | 06:20 19:31-19:49/18 20:38 | 06:49 19:30-19:40/10 19:57 | 07:18 19:08 | 06:50 17:23 | 07:24 17:00 | 07:44 17:08 |
| Potential sun hours | 301 | 299 | 370 | 397 | 445 | 448 | 455 | 425 | 374 | 347 | 301 | 292 |
| Sum of minutes with flicker | 0 | 0 | 0 | 279 | 370 | 0 | 43 | 614 | 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:
windpro Seui - flickering

Printed/Page
2023-12-20 10:54 / 13

Licensed user:
Ing. Bruno Manca
Via Vittorio Veneto 231
IT-09028 Sestu
+390702358125
Bruno Manca / ingbrunomanca@gmail.com
Calculated:
2023-12-19 11:53/2.8.579

SHADOW - Calendar per WTG

Calculation: shadow flickering Seui - progettoWTG: 9 - SE 09

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [CAGLIARI / ELMA S]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
4.40 5.05 5.88 7.00 8.45 9.88 10.82 10.03 8.08 6.09 5.07 4.27

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
86 55 78 159 368 188 65 104 357 605 339 206 2,610
Idle start wind speed: Cut in wind speed from power curve

| | January | February | March | April | May | June | July | August | September | October | November | December |
|-----------------------------|---------|----------|-------|-------|----------------|----------------------|----------------------|----------------------|-----------|---------|----------|----------|
| 1 | 07:44 | 07:32 | 06:58 | 07:09 | 06:25 | 05:57 18:47-19:55/68 | 05:58 18:51-20:05/74 | 06:21 | 06:50 | 07:18 | 06:51 | 07:24 |
| 17:09 | 17:42 | 18:14 | 19:46 | 20:16 | 20:44 | 20:44 | 20:55 | 20:37 | 19:56 | 19:07 | 17:22 | 16:59 |
| 2 | 07:44 | 07:31 | 06:56 | 07:07 | 06:24 | 05:57 18:47-19:56/69 | 05:59 18:51-20:05/74 | 06:22 | 06:51 | 07:19 | 06:52 | 07:25 |
| 17:09 | 17:43 | 18:15 | 19:47 | 20:17 | 20:45 | 20:45 | 20:55 | 20:36 | 19:54 | 19:05 | 17:21 | 16:59 |
| 3 | 07:44 | 07:30 | 06:55 | 07:06 | 06:22 | 05:57 18:48-19:57/69 | 05:59 18:51-20:05/74 | 06:23 | 06:52 | 07:20 | 06:53 | 07:26 |
| 17:10 | 17:44 | 18:16 | 19:48 | 20:18 | 20:46 | 20:46 | 20:55 | 20:35 | 19:53 | 19:04 | 17:20 | 16:59 |
| 4 | 07:45 | 07:29 | 06:53 | 07:04 | 06:21 | 05:56 18:47-19:57/70 | 06:00 18:52-20:05/73 | 06:24 | 06:53 | 07:21 | 06:54 | 07:27 |
| 17:11 | 17:45 | 18:17 | 19:49 | 20:19 | 20:46 | 20:46 | 20:55 | 20:34 | 19:51 | 19:02 | 17:19 | 16:59 |
| 5 | 07:45 | 07:28 | 06:52 | 07:02 | 06:20 | 05:56 18:47-19:58/71 | 06:00 18:52-20:05/73 | 06:25 | 06:54 | 07:22 | 06:55 | 07:28 |
| 17:12 | 17:46 | 18:18 | 19:50 | 20:20 | 20:47 | 20:47 | 20:54 | 20:33 | 19:49 | 19:01 | 17:18 | 16:59 |
| 6 | 07:45 | 07:27 | 06:50 | 07:01 | 06:19 | 05:56 18:47-19:59/72 | 06:01 18:53-20:05/72 | 06:26 | 06:55 | 07:23 | 06:56 | 07:29 |
| 17:13 | 17:48 | 18:20 | 19:51 | 20:21 | 20:48 | 20:48 | 20:54 | 20:32 | 19:48 | 18:59 | 17:17 | 16:58 |
| 7 | 07:44 | 07:26 | 06:49 | 06:59 | 06:18 | 05:55 18:47-19:59/72 | 06:01 18:53-20:04/71 | 06:27 | 06:56 | 07:24 | 06:57 | 07:30 |
| 17:14 | 17:49 | 18:21 | 19:52 | 20:22 | 20:48 | 20:48 | 20:54 | 20:31 | 19:46 | 18:57 | 17:16 | 16:58 |
| 8 | 07:44 | 07:25 | 06:47 | 06:58 | 06:17 | 05:55 18:46-19:59/73 | 06:02 18:54-20:05/71 | 06:27 | 06:57 | 07:25 | 06:59 | 07:31 |
| 17:15 | 17:50 | 18:22 | 19:53 | 20:23 | 20:49 | 20:49 | 20:54 | 20:29 | 19:45 | 18:56 | 17:14 | 16:58 |
| 9 | 07:44 | 07:24 | 06:46 | 06:56 | 06:15 | 05:55 18:46-20:00/74 | 06:03 18:55-20:05/70 | 06:28 | 06:58 | 07:26 | 07:00 | 07:32 |
| 17:16 | 17:51 | 18:23 | 19:54 | 20:24 | 20:50 | 20:50 | 20:53 | 20:28 | 19:43 | 18:54 | 17:13 | 16:58 |
| 10 | 07:44 | 07:23 | 06:44 | 06:55 | 06:14 | 05:55 18:46-20:00/74 | 06:03 18:54-20:04/70 | 06:29 | 06:58 | 07:27 | 07:01 | 07:32 |
| 17:17 | 17:52 | 18:24 | 19:55 | 20:25 | 20:50 | 20:50 | 20:53 | 20:27 | 19:41 | 18:53 | 17:13 | 16:58 |
| 11 | 07:44 | 07:22 | 06:42 | 06:53 | 06:13 | 05:55 18:47-20:01/74 | 06:04 18:55-20:04/69 | 06:30 | 06:59 | 07:28 | 07:02 | 07:33 |
| 17:18 | 17:54 | 18:25 | 19:56 | 20:26 | 20:51 | 20:51 | 20:53 | 20:26 | 19:40 | 18:51 | 17:12 | 16:58 |
| 12 | 07:44 | 07:20 | 06:41 | 06:52 | 06:12 | 05:54 18:47-20:01/74 | 06:05 18:56-20:04/68 | 06:31 | 07:00 | 07:29 | 07:03 | 07:34 |
| 17:19 | 17:55 | 18:26 | 19:57 | 20:27 | 20:51 | 20:51 | 20:52 | 20:24 | 19:38 | 18:50 | 17:11 | 16:59 |
| 13 | 07:43 | 07:19 | 06:39 | 06:50 | 06:11 | 19:13-19:28/15 | 05:54 18:47-20:02/75 | 06:05 18:56-20:03/67 | 06:32 | 07:01 | 07:30 | 07:04 |
| 17:20 | 17:56 | 18:27 | 19:58 | 20:28 | 20:52 | 20:52 | 20:52 | 20:23 | 19:37 | 18:48 | 17:10 | 16:59 |
| 14 | 07:43 | 07:18 | 06:38 | 06:49 | 06:10 | 19:08-19:32/24 | 05:54 18:47-20:02/75 | 06:06 18:57-20:03/66 | 06:33 | 07:02 | 07:31 | 07:05 |
| 17:21 | 17:57 | 18:28 | 19:59 | 20:29 | 20:52 | 20:52 | 20:51 | 20:22 | 19:35 | 18:47 | 17:09 | 16:59 |
| 15 | 07:43 | 07:17 | 06:36 | 06:47 | 06:09 | 19:05-19:35/30 | 05:54 18:47-20:02/75 | 06:07 18:58-20:02/64 | 06:34 | 07:03 | 07:32 | 07:07 |
| 17:22 | 17:58 | 18:29 | 20:00 | 20:30 | 20:52 | 20:52 | 20:51 | 20:21 | 19:33 | 18:45 | 17:08 | 16:59 |
| 16 | 07:42 | 07:16 | 06:35 | 06:46 | 06:08 | 19:02-19:38/36 | 05:54 18:47-20:02/75 | 06:07 18:58-20:01/63 | 06:35 | 07:04 | 07:33 | 07:08 |
| 17:23 | 17:59 | 18:30 | 20:01 | 20:31 | 20:53 | 20:53 | 20:50 | 20:19 | 19:32 | 18:44 | 17:07 | 16:59 |
| 17 | 07:42 | 07:14 | 06:33 | 06:44 | 06:07 | 19:00-19:40/40 | 05:54 18:47-20:03/76 | 06:08 18:59-20:01/62 | 06:36 | 07:05 | 07:34 | 07:09 |
| 17:24 | 18:01 | 18:31 | 20:02 | 20:32 | 20:53 | 20:53 | 20:50 | 20:18 | 19:30 | 18:42 | 17:06 | 17:00 |
| 18 | 07:42 | 07:13 | 06:31 | 06:43 | 06:07 | 18:59-19:42/43 | 05:54 18:47-20:03/76 | 06:09 19:00-20:00/60 | 06:37 | 07:06 | 07:35 | 07:10 |
| 17:25 | 18:02 | 18:32 | 20:03 | 20:33 | 20:54 | 20:54 | 20:49 | 20:16 | 19:28 | 18:41 | 17:06 | 17:00 |
| 19 | 07:41 | 07:12 | 06:30 | 06:41 | 06:06 | 18:57-19:44/47 | 05:55 18:47-20:03/76 | 06:10 19:01-20:00/59 | 06:38 | 07:07 | 07:36 | 07:11 |
| 17:26 | 18:03 | 18:33 | 20:04 | 20:34 | 20:54 | 20:54 | 20:48 | 20:15 | 19:27 | 18:39 | 17:05 | 17:00 |
| 20 | 07:41 | 07:10 | 06:28 | 06:40 | 06:05 | 18:56-19:45/49 | 05:55 18:47-20:03/76 | 06:11 19:02-19:58/56 | 06:39 | 07:08 | 07:37 | 07:12 |
| 17:28 | 18:04 | 18:34 | 20:05 | 20:35 | 20:54 | 20:54 | 20:48 | 20:14 | 19:25 | 18:38 | 17:04 | 17:01 |
| 21 | 07:40 | 07:09 | 06:27 | 06:38 | 06:04 | 18:54-19:46/52 | 05:55 18:48-20:04/76 | 06:11 19:03-19:58/55 | 06:40 | 07:09 | 07:39 | 07:13 |
| 17:29 | 18:05 | 18:35 | 20:06 | 20:35 | 20:54 | 20:54 | 20:47 | 20:12 | 19:23 | 18:36 | 17:04 | 17:01 |
| 22 | 07:40 | 07:08 | 06:25 | 06:37 | 06:03 | 18:54-19:48/54 | 05:55 18:48-20:04/76 | 06:12 19:04-19:57/53 | 06:41 | 07:10 | 07:40 | 07:14 |
| 17:30 | 18:06 | 18:36 | 20:07 | 20:36 | 20:55 | 20:55 | 20:46 | 20:11 | 19:22 | 18:35 | 17:03 | 17:02 |
| 23 | 07:39 | 07:06 | 06:23 | 06:35 | 06:03 | 18:53-19:48/55 | 05:55 18:48-20:04/76 | 06:13 19:06-19:56/50 | 06:42 | 07:11 | 07:41 | 07:16 |
| 17:31 | 18:07 | 18:37 | 20:08 | 20:37 | 20:55 | 20:55 | 20:45 | 20:09 | 19:20 | 18:34 | 17:03 | 17:02 |
| 24 | 07:38 | 07:05 | 06:22 | 06:34 | 06:02 | 18:52-19:49/57 | 05:56 18:48-20:04/76 | 06:14 19:07-19:55/48 | 06:43 | 07:12 | 07:42 | 07:17 |
| 17:32 | 18:09 | 18:38 | 20:09 | 20:38 | 20:55 | 20:55 | 20:45 | 20:08 | 19:18 | 18:32 | 17:02 | 17:03 |
| 25 | 07:38 | 07:03 | 06:20 | 06:33 | 06:01 | 18:51-19:51/60 | 05:56 18:49-20:05/76 | 06:15 19:09-19:53/44 | 06:44 | 07:12 | 06:43 | 07:18 |
| 17:33 | 18:10 | 18:39 | 20:10 | 20:39 | 20:55 | 20:55 | 20:44 | 20:06 | 19:17 | 17:31 | 17:02 | 17:03 |
| 26 | 07:37 | 07:02 | 06:18 | 06:31 | 06:01 | 18:50-19:51/61 | 05:56 18:49-20:05/76 | 06:16 19:10-19:51/41 | 06:44 | 07:13 | 06:44 | 07:19 |
| 17:35 | 18:11 | 18:40 | 20:11 | 20:40 | 20:55 | 20:55 | 20:43 | 20:05 | 19:15 | 17:30 | 17:01 | 17:04 |
| 27 | 07:36 | 07:01 | 06:17 | 06:30 | 06:00 | 18:50-19:53/63 | 05:57 18:49-20:04/75 | 06:17 19:12-19:49/37 | 06:45 | 07:14 | 06:45 | 07:20 |
| 17:36 | 18:12 | 18:41 | 20:12 | 20:41 | 20:55 | 20:55 | 20:42 | 20:03 | 19:14 | 17:28 | 17:01 | 17:05 |
| 28 | 07:35 | 06:59 | 06:15 | 06:29 | 05:59 | 18:49-19:53/64 | 05:57 18:50-20:05/75 | 06:17 19:14-19:47/33 | 06:46 | 07:15 | 06:46 | 07:21 |
| 17:37 | 18:13 | 18:42 | 20:13 | 20:41 | 20:55 | 20:55 | 20:41 | 20:02 | 19:12 | 17:27 | 17:00 | 17:05 |
| 29 | 07:35 | 07:14 | 06:27 | 05:59 | 18:49-19:54/65 | 05:57 18:50-20:05/75 | 06:18 19:17-19:45/28 | 06:47 | 07:16 | 06:47 | 07:22 | 07:43 |
| 17:38 | 19:43 | 20:14 | 20:42 | 20:55 | 20:55 | 20:55 | 20:40 | 20:00 | 19:10 | 17:26 | 17:00 | 17:06 |
| 30 | 07:34 | 07:12 | 06:26 | 05:58 | 18:48-19:54/66 | 05:58 18:51-20:05/74 | 06:19 19:20-19:41/21 | 06:48 | 07:17 | 06:48 | 07:23 | 07:44 |
| 17:39 | 19:44 | 20:15 | 20:43 | 20:55 | 20:55 | 20:55 | 20:39 | 19:59 | 19:09 | 17:25 | 17:00 | 17:07 |
| 31 | 07:33 | 07:10 | 06:24 | 05:58 | 18:48-19:55/67 | 05:58 18:51-20:05/74 | 06:20 19:27-19:35/8 | 06:49 | 07:18 | 06:49 | 07:24 | 07:45 |
| 17:40 | 19:45 | 20:16 | 20:44 | 20:55 | 20:55 | 20:55 | 20:38 | 19:57 | 19:17 | 17:23 | 17:01 | 17:08 |
| Potential sun hours | 301 | 299 | 370 | 397 | 445 | 448 | 455 | 425 | 374 | 347 | 301 | 292 |
| Sum of minutes with flicker | 0 | 0 | 0 | 0 | 948 | 2219 | 1774 | 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:

windpro Seui - flickering

Printed/Page

2023-12-20 10:54 / 14

Licensed user:

Ing. Bruno Manca

Via Vittorio Veneto 231

IT-09028 Sestu

+390702358125

Bruno Manca / ingbrunomanca@gmail.com

Calculated:

2023-12-19 11:53/2.8.579

SHADOW - Calendar per WTG

Calculation: shadow flickering Seui - progetto WTG: 10 - SE 10

Assumptions for shadow calculations

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

| | | | | | | | | | | | |
|------|------|------|------|------|------|-------|-------|------|------|------|------|
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| 4.40 | 5.05 | 5.88 | 7.00 | 8.45 | 9.88 | 10.82 | 10.03 | 8.08 | 6.09 | 5.07 | 4.27 |

Operational time

| | | | | | | | | | | | | |
|----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-------|
| N | NNE | ENE | E | ESE | SSE | S | SSW | WSW | W | WNW | NNW | Sum |
| 86 | 55 | 78 | 159 | 368 | 188 | 65 | 104 | 357 | 605 | 339 | 206 | 2,610 |

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

| | January | February | March | April | May | June | July | August | September | October | November | December |
|-----------------------------|--------------------------------|-------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|--------------------------------|
| 1 | 07:44 08:50-10:31/101 17:09 | 07:32 09:19-10:18/59 17:42 | 06:58 07:09 18:14 | 07:09 19:46 20:16 | 06:25 20:44 20:55 | 05:57 20:37 20:55 | 05:58 06:21 20:37 | 06:50 07:18 19:56 | 06:51 07:22 19:07 | 06:51 07:22 19:07 | 06:51 07:22 19:07 | 07:24 08:39-10:15/96 16:59 |
| 2 | 07:44 08:51-10:31/100 17:09 | 07:31 09:21-10:16/55 17:43 | 06:56 18:15 19:47 | 06:24 20:17 20:55 | 05:57 20:36 20:55 | 05:57 20:36 20:55 | 06:21 20:36 20:55 | 06:51 19:54 19:05 | 06:52 17:21 17:21 | 06:52 17:21 17:21 | 06:52 17:21 17:21 | 07:25 08:39-10:15/96 16:59 |
| 3 | 07:44 08:51-10:32/101 17:10 | 07:30 09:23-10:13/50 17:44 | 06:55 18:16 19:48 | 06:22 20:18 20:55 | 05:57 20:35 20:55 | 05:57 20:35 20:55 | 06:23 20:35 19:53 | 06:52 19:04 19:04 | 06:53 07:20 19:04 | 06:53 07:20 19:04 | 06:53 07:20 19:04 | 07:26 08:39-10:16/97 16:59 |
| 4 | 07:44 08:52-10:32/100 17:11 | 07:29 09:25-10:11/46 17:45 | 06:53 18:17 19:49 | 06:21 20:19 20:55 | 05:56 20:46 20:55 | 05:56 20:46 20:55 | 06:24 20:34 19:51 | 06:53 19:02 19:02 | 06:54 17:19 17:19 | 06:54 17:19 17:19 | 06:54 17:19 17:19 | 07:27 08:39-10:17/98 16:59 |
| 5 | 07:44 08:53-10:32/99 17:12 | 07:28 09:28-10:08/40 17:46 | 06:52 18:18 19:50 | 06:20 20:20 20:55 | 05:56 20:47 20:54 | 05:56 20:47 20:54 | 06:25 20:33 19:49 | 06:54 19:01 19:01 | 06:55 17:18 17:18 | 06:55 17:18 17:18 | 06:55 17:18 17:18 | 07:28 08:39-10:18/99 16:58 |
| 6 | 07:44 08:53-10:32/99 17:13 | 07:27 09:31-10:03/32 17:48 | 06:50 18:19 19:51 | 06:19 20:21 20:55 | 05:56 20:48 20:54 | 05:56 20:48 20:54 | 06:26 20:32 19:48 | 06:55 18:59 18:59 | 06:56 17:17 17:17 | 06:56 17:17 17:17 | 06:56 17:17 17:17 | 07:29 08:39-10:18/99 16:58 |
| 7 | 07:44 08:54-10:33/99 17:14 | 07:26 09:35-09:59/24 17:49 | 06:49 18:21 19:52 | 06:18 20:22 20:55 | 05:55 20:48 20:54 | 05:55 20:48 20:54 | 06:27 20:31 19:46 | 06:56 18:57 17:15 | 06:57 17:15 17:15 | 06:57 17:15 17:15 | 06:57 17:15 17:15 | 07:30 08:40-10:19/99 16:58 |
| 8 | 07:44 08:55-10:33/98 17:15 | 07:25 09:43-09:51/8 17:50 | 06:47 18:22 19:53 | 06:16 20:23 20:55 | 05:55 20:49 20:54 | 05:55 20:49 20:54 | 06:27 20:29 19:45 | 06:57 18:56 17:14 | 06:59 17:14 17:14 | 06:59 17:14 17:14 | 06:59 17:14 17:14 | 07:31 08:40-10:20/100 16:58 |
| 9 | 07:44 08:55-10:32/97 17:16 | 07:24 17:51 18:23 | 06:46 18:23 19:54 | 06:15 20:24 20:55 | 05:55 20:50 20:53 | 05:55 20:50 20:53 | 06:28 20:28 19:43 | 06:58 18:54 17:13 | 07:00 17:13 17:13 | 07:00 17:13 17:13 | 07:00 17:13 17:13 | 07:32 08:40-10:21/101 16:58 |
| 10 | 07:44 08:56-10:32/96 17:17 | 07:23 17:52 18:24 | 06:44 18:24 19:55 | 06:14 20:25 20:55 | 05:55 20:50 20:53 | 05:55 20:50 20:53 | 06:29 20:27 19:41 | 06:58 18:53 17:12 | 07:01 17:12 17:12 | 07:01 17:12 17:12 | 07:01 17:12 17:12 | 07:32 08:40-10:21/101 16:58 |
| 11 | 07:44 08:57-10:33/96 17:18 | 07:22 17:54 18:25 | 06:42 18:25 19:56 | 06:13 20:26 20:55 | 05:55 20:51 20:53 | 05:55 20:51 20:53 | 06:30 20:26 19:40 | 06:59 18:51 17:12 | 07:02 17:12 17:12 | 07:02 17:12 17:12 | 07:02 17:12 17:12 | 07:33 08:40-10:21/101 16:58 |
| 12 | 07:44 08:58-10:33/95 17:19 | 07:20 17:55 18:26 | 06:41 18:26 19:57 | 06:12 20:27 20:55 | 05:54 20:51 20:52 | 05:54 20:51 20:52 | 06:31 20:24 19:38 | 07:00 18:50 17:11 | 07:03 17:11 17:11 | 07:03 17:11 17:11 | 07:03 17:11 17:11 | 07:34 08:41-10:22/101 16:59 |
| 13 | 07:43 08:58-10:32/94 17:20 | 07:19 17:56 18:27 | 06:39 18:27 19:58 | 06:11 20:28 20:52 | 05:54 20:52 20:52 | 05:54 20:52 20:52 | 06:32 20:23 19:37 | 07:01 18:48 17:10 | 07:04 17:10 17:10 | 07:04 17:10 17:10 | 07:04 17:10 17:10 | 07:35 08:41-10:23/102 16:59 |
| 14 | 07:43 08:59-10:32/93 17:21 | 07:18 17:57 18:28 | 06:38 18:28 19:59 | 06:10 20:29 20:52 | 05:54 20:51 20:51 | 05:54 20:51 20:51 | 06:33 20:22 19:35 | 07:02 18:47 17:09 | 07:03 17:09 17:09 | 07:03 17:09 17:09 | 07:03 17:09 17:09 | 07:36 08:42-10:24/102 16:59 |
| 15 | 07:43 09:00-10:33/93 17:22 | 07:17 17:58 18:29 | 06:36 18:29 20:00 | 06:09 20:30 20:52 | 05:54 20:51 20:51 | 05:54 20:51 20:51 | 06:34 20:21 19:33 | 07:03 18:45 17:08 | 07:07 17:08 17:08 | 07:07 17:08 17:08 | 07:07 17:08 17:08 | 07:36 08:42-10:24/102 16:59 |
| 16 | 07:42 09:00-10:32/92 17:23 | 07:16 17:59 18:30 | 06:35 18:30 20:01 | 06:08 20:31 20:53 | 05:54 20:50 20:50 | 05:54 20:50 20:50 | 06:35 20:19 19:32 | 07:04 18:44 17:07 | 07:08 17:07 17:07 | 07:08 17:07 17:07 | 07:08 17:07 17:07 | 07:37 08:42-10:25/103 16:59 |
| 17 | 07:42 09:02-10:32/90 17:24 | 07:14 18:01 18:31 | 06:33 18:31 20:02 | 06:07 20:32 20:53 | 05:54 20:49 20:49 | 05:54 20:49 20:49 | 06:36 20:18 19:30 | 07:05 18:42 17:06 | 07:09 17:06 17:06 | 07:09 17:06 17:06 | 07:09 17:06 17:06 | 07:38 08:43-10:25/102 17:00 |
| 18 | 07:42 09:02-10:31/89 17:25 | 07:13 18:02 18:32 | 06:31 18:32 20:03 | 06:07 20:33 20:53 | 05:54 20:49 20:49 | 05:54 20:49 20:49 | 06:37 20:16 19:28 | 07:06 18:41 17:06 | 07:10 17:06 17:06 | 07:10 17:06 17:06 | 07:10 17:06 17:06 | 07:38 08:43-10:25/102 17:00 |
| 19 | 07:41 09:03-10:31/88 17:26 | 07:12 18:03 18:33 | 06:30 18:33 20:04 | 06:06 20:34 20:54 | 05:55 20:48 20:48 | 05:55 20:48 20:48 | 06:38 20:15 19:27 | 07:07 18:39 17:05 | 07:11 17:05 17:05 | 07:11 17:05 17:05 | 07:11 17:05 17:05 | 07:39 08:44-10:26/102 17:00 |
| 20 | 07:41 09:04-10:30/86 17:28 | 07:10 18:04 18:34 | 06:28 18:34 20:05 | 06:05 20:35 20:54 | 05:55 20:48 20:48 | 05:55 20:48 20:48 | 06:39 20:14 19:25 | 07:08 18:38 17:04 | 07:12 17:04 17:04 | 07:12 17:04 17:04 | 07:12 17:04 17:04 | 07:40 08:44-10:26/102 17:01 |
| 21 | 07:40 09:05-10:29/84 17:29 | 07:09 18:05 18:35 | 06:26 18:35 20:06 | 06:04 20:35 20:54 | 05:55 20:47 20:47 | 05:55 20:47 20:47 | 06:40 20:12 19:23 | 07:09 18:36 17:04 | 07:13 17:04 17:04 | 07:13 17:04 17:04 | 07:13 17:04 17:04 | 07:40 08:45-10:27/102 17:01 |
| 22 | 07:39 09:06-10:29/83 17:30 | 07:08 18:06 18:36 | 06:25 18:36 20:07 | 06:03 20:36 20:54 | 05:55 20:46 20:46 | 05:55 20:46 20:46 | 06:41 20:11 19:22 | 07:10 18:35 17:03 | 07:14 17:03 17:03 | 07:14 17:03 17:03 | 07:14 17:03 17:03 | 07:41 08:45-10:27/102 17:02 |
| 23 | 07:39 09:07-10:28/81 17:31 | 07:06 18:07 18:37 | 06:23 18:37 20:08 | 06:03 20:37 20:55 | 05:55 20:45 20:45 | 05:55 20:45 20:45 | 06:42 20:09 19:20 | 07:11 18:34 17:03 | 07:15 17:03 17:03 | 07:15 17:03 17:03 | 07:15 17:03 17:03 | 07:41 08:46-10:28/102 17:02 |
| 24 | 07:38 09:08-10:27/79 17:32 | 07:05 18:09 18:38 | 06:22 18:38 20:09 | 06:02 20:38 20:55 | 05:56 20:44 20:44 | 05:56 20:44 20:44 | 06:43 20:08 19:18 | 07:12 18:32 17:02 | 07:16 17:02 17:02 | 07:16 17:02 17:02 | 07:16 17:02 17:02 | 07:42 08:46-10:28/102 17:03 |
| 25 | 07:38 09:09-10:27/78 17:33 | 07:03 18:10 18:39 | 06:20 18:39 20:10 | 06:01 20:39 20:55 | 05:56 20:44 20:44 | 05:56 20:44 20:44 | 06:43 20:06 19:17 | 07:12 17:31 17:02 | 07:18 17:02 17:02 | 07:18 17:02 17:02 | 07:18 17:02 17:02 | 07:42 08:46-10:28/102 17:03 |
| 26 | 07:37 09:10-10:26/76 17:34 | 07:02 18:11 18:40 | 06:18 18:40 20:11 | 06:01 20:40 20:55 | 05:56 20:43 20:43 | 05:56 20:43 20:43 | 06:44 20:05 19:15 | 07:13 17:30 17:01 | 07:19 17:01 17:01 | 07:19 17:01 17:01 | 07:19 17:01 17:01 | 07:42 08:47-10:29/102 17:04 |
| 27 | 07:36 09:11-10:25/74 17:36 | 07:01 18:12 18:41 | 06:17 18:41 20:12 | 06:00 20:41 20:55 | 05:57 20:42 20:42 | 05:57 20:42 20:42 | 06:45 20:03 19:14 | 07:14 17:28 17:01 | 07:20 17:01 17:01 | 07:20 17:01 17:01 | 07:20 17:01 17:01 | 07:43 08:47-10:29/102 17:05 |
| 28 | 07:35 09:13-10:23/70 17:37 | 06:59 18:13 18:42 | 06:15 18:42 20:13 | 05:59 20:41 20:55 | 05:57 20:40 20:40 | 05:57 20:40 20:40 | 06:46 20:02 19:12 | 07:15 17:27 17:00 | 07:21 17:00 17:00 | 07:21 17:00 17:00 | 07:21 17:00 17:00 | 07:43 08:48-10:30/102 17:05 |
| 29 | 07:35 09:14-10:22/68 17:38 | 06:59 18:13 18:43 | 06:15 18:43 20:14 | 05:59 20:42 20:55 | 05:57 20:40 20:40 | 05:57 20:40 20:40 | 06:47 20:00 19:10 | 07:16 17:26 17:00 | 07:22 17:00 17:00 | 07:22 17:00 17:00 | 07:22 17:00 17:00 | 07:43 08:49-10:31/102 17:06 |
| 30 | 07:34 09:15-10:20/65 17:39 | 06:59 18:13 18:44 | 06:15 18:44 20:15 | 05:59 20:43 20:55 | 05:57 20:40 20:40 | 05:57 20:40 20:40 | 06:48 20:00 19:09 | 07:17 17:25 17:00 | 07:23 17:00 17:00 | 07:23 17:00 17:00 | 07:23 17:00 17:00 | 07:44 08:49-10:31/102 17:07 |
| 31 | 07:33 09:18-10:19/61 17:40 | 06:59 18:13 18:45 | 06:15 18:45 20:16 | 05:59 20:44 20:55 | 05:57 20:40 20:40 | 05:57 20:40 20:40 | 06:49 20:00 19:57 | 07:18 17:23 17:00 | 07:24 17:00 17:00 | 07:24 17:00 17:00 | 07:24 17:00 17:00 | 07:44 08:50-10:31/101 17:08 |
| Potential sun hours | 301 | 299 | 370 | 397 | 445 | 448 | 455 | 425 | 374 | 347 | 301 | 292 |
| Sum of minutes with flicker | 2725 | 314 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1963 | 3126 |

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 |