

**IMPIANTO EOLICO - "Bruncu e Niada"**

**COMUNI DI BALLAO E ARMUNGIA**

**PROPONENTE**



Queequeg Renewables  
Unit 3.21 - 1110 Great West Road - TW8 OGP, London



Econergy Project 2 S.r.l.  
Milano (MI)

**STUDIO DI IMPATTO AMBIENTALE**

CODICE PROGETTO  
**WIND001**

**OGGETTO:**  
Studio del tremolio delle ombre

CODICE ELABORATO  
**SIA  
REL010**

**COORDINAMENTO**



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**TIMBRO E FIRMA REDATTORE**



**TIMBRO DEL PROPONENTE**

00	04/11/2020	Prima emissione	Bruno Manca	Queequeg Renewables	
REV.	DATA	DESCRIZIONE REVISIONE	ELABORAZIONE	VERIFICA	APPROVAZIONE

FORMATO	FILE DI ELABORAZIONE	FILE DI STAMPA	SCALA
ISO A4	VIA-WIND001.REL010.qgis	VIA-WIND001.REL010.pdf	

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## 1. ANALISI DELL'EVOLUZIONE DELL'OMBRA GIORNALIERA

Così come richiesto nello Studio per l'individuazione delle aree in cui ubicare gli impianti eolici (Allegato alla D.G.R n.3/17 del 16/01/09), si è effettuata l'analisi dell'evoluzione dell'ombra giornaliera generata dalla presenza degli aerogeneratori.

Lo studio dell'evoluzione dell'ombra giornaliera dovuta alla presenza degli aerogeneratori interessa due temi: il primo è legato al pericolo di formazione di ghiaccio sulle strade, il secondo al fenomeno dell'oscillazione dell'ombra prodotta dal rotore, comunemente conosciuto come Shadow Flicker.

### 1.1 OMBRA E FORMAZIONE DI GHIACCIO

In alcune realtà del centro Europa l'ombra provocata dagli aerogeneratori può determinare la formazione di ghiaccio, che risulta un problema specie nel caso di inserimento degli aerogeneratori nei pressi delle vie di comunicazione. In Italia sono poche le regioni che prendono in esame la problematica dell'ombra provocata dagli aerogeneratori e la eventuale formazione del ghiaccio.

D'altronde tale effetto assume importanza solo nei territori in cui vi può essere frequente formazione di ghiaccio (territori montani, pedemontani o appenninici) e in presenza di strade interessate dalla stessa ombra. Le procedure prevedono il calcolo dell'evoluzione giornaliera dell'ombra riportata sulla strada, tale da assicurare che non avvengano improvvise permanenze di gelo sulle carreggiate.

Nel caso in esame l'effetto delle ombre è confinato in piccoli tratti delle strade riportate in Fig.1.

Per poter effettuare un'analisi approfondita sull'effetto delle ombre su queste strade è stato considerato una zona di influenza cautelativa costituita da un buffer di 2 km da ogni aerogeneratore. Dalla Fig.1 si vede che non vengono intercettate strade statali o provinciali, ma solo alcuni tratti di strada comunale di accesso al sito e le strade interne al parco eolico.

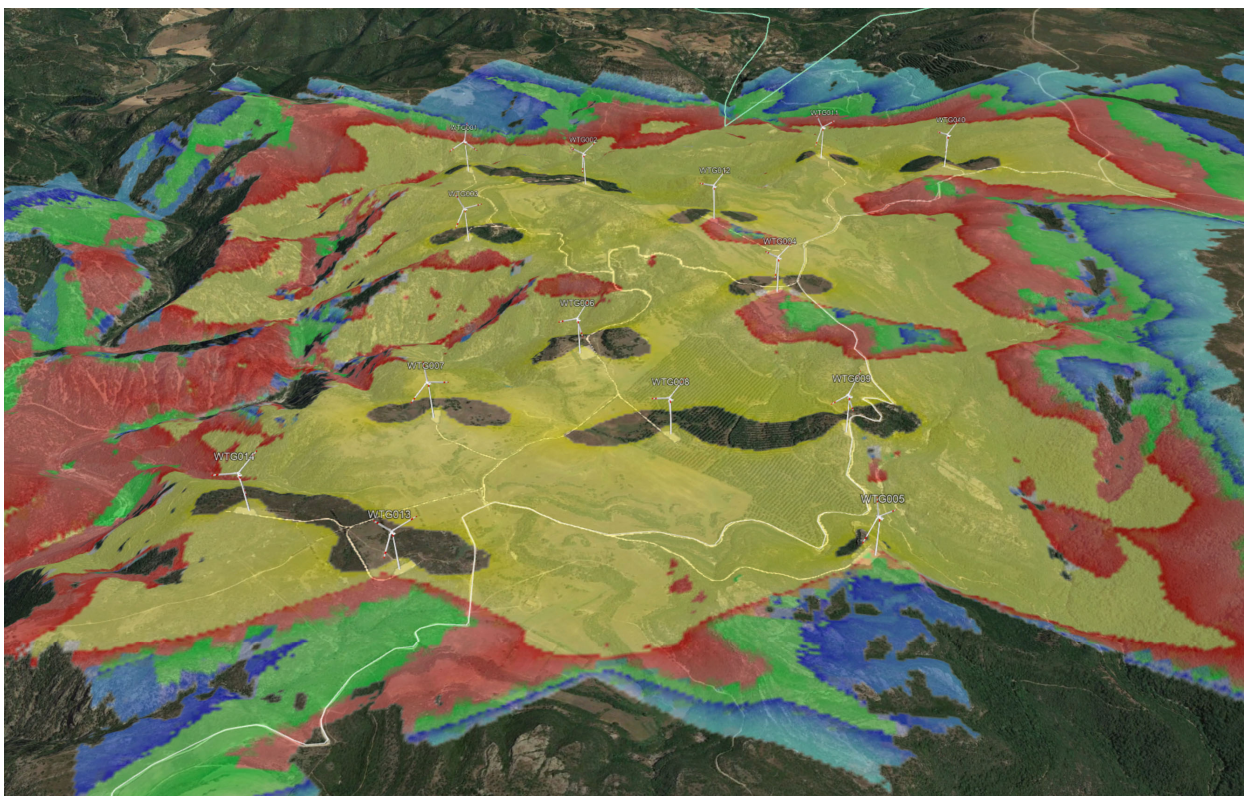


Figura 1 - Strade interessate dalle ombre

Dai risultati della simulazione emerge che la zona più critica è quella più prossima agli aerogeneratori, e per le strade prese in esame, non si raggiungono mai valori elevati.

Le ore più critiche sono quelle del mattino dei mesi invernali, tuttavia i valori di permanenza dell'ombra risultano bassi a tal punto da ritenere che tale aspetto sia del tutto trascurabile per le caratteristiche climatologiche delle aree interesse di studio.

## 1.2 SHADOW FLICKER

Questo particolare impatto è dovuto al fatto che il rotore e le pale, nel loro movimento di rotazione attorno all'asse, in funzione dell'altezza del sole sull'orizzonte, determinano un'ombra nelle località prossime al campo. Infatti è noto che il fenomeno di "flickering" è dovuto all'ombra generata quando il sole attraversa il piano di rotazione delle pale. Tale fenomeno effettua una vera e propria "frustata" sia in termini di velocità che di allungamento sulla superficie terrestre.

L'occupazione spaziale di tale fenomeno dipende dall'altezza delle torri, dal diametro delle pale, dalla sezione geometrica della torre, dall'altezza del sole e dalle relative variazioni stagionali, dalla presenza o meno di ostacoli orografici, dall'orientamento del rotore rispetto al vento.

Attualmente a livello nazionale non esistono riferimenti normativi in merito a tale impatto.



In assenza di riferimenti normativi nazionali e regionali, si sono prese come riferimento le linee guida tedesche, che sono tipicamente utilizzate come riferimento dagli stati che non hanno ancora legiferato in materia.

Al momento infatti solo la Germania, paese europeo con il maggior numero di aerogeneratori installati sul territorio nazionale e avente la maggiore potenza eolica in funzione, possiede linee-guida dettagliate sui limiti e sulle condizioni per il calcolo dell'impatto dell'ombra. Queste sono consultabili nel documento "Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windenergieanlagen" (WEA-Shattenwurf-Hinweise).

Secondo le direttive tedesche, il limite di ombra è determinato da due fattori:

- L'angolo del sole sopra l'orizzonte deve essere almeno 3°;
- La pala della turbina eolica deve coprire almeno il 20% del sole.

Il massimo ombreggiamento su un edificio secondo tali linee-guida deve essere:

- massimo 30 ore all'anno di ombra astronomica;
- massimo 30 minuti al giorno di ombra astronomica.

È necessario far notare che **le linee guida tedesche prevedono che gli ombreggiamenti di cui sopra debbano essere rispettati in corrispondenza di recettori comportanti attività residenziali e lavorative stabili** ("... è augurabile – 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" – estratto dalle linee guida tedesche).

L'indicazione delle attività lavorative statiche è ovviamente legato al fatto che all'interno di un edificio adibito a uso uffici, le postazioni di lavoro sono generalmente fisse, pertanto se l'edificio con pareti finestrate risulta prospiciente all'impianto eolico, è chiaro che il tremolio delle ombre oltre certi limiti può rappresentare un problema per quei lavoratori che si ritrovino con le loro postazioni di lavoro proprio di fronte alle pareti vetrate. Il problema del tremolio dell'ombra assume una rilevanza trascurabile per tutte quelle attività che non richiedono l'assidua presenza in una postazione fissa di lavoro, quali ad esempio le **attività agricole** o **agropastorali** in genere, in cui il personale addetto si muove in continuazione all'interno dei terreni dell'azienda per seguire le varie mansioni.

Esistono degli studi nella letteratura scientifica medica<sup>1</sup> che mettono in correlazione possibili attacchi epilettici in soggetti con fotosensibilità a causa dell'effetto stroboscopico dovuto allo sfarfallio dell'ombra.

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<sup>1</sup> Si veda a tal proposito "*Wind turbines, flicker, and photosensitive epilepsy: Characterizing the flashing that may precipitate seizures and optimizing guidelines to prevent them*" - Graham Harding, Pamela Harding, and †Arnold Wilkins

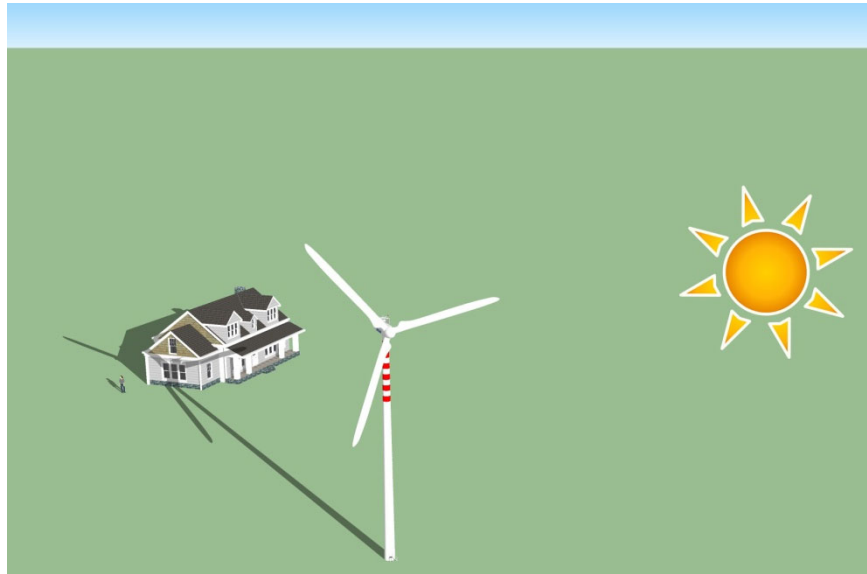


Figura 2 - Rappresentazione grafica del fenomeno

Da queste analisi emerge che tale effetto non diminuisce tanto con l'allontanarsi dalla turbina, quanto con la riduzione della frequenza. In conclusione il rischio potenziale di crisi epilettiche di questo tipo si ha per frequenze d'interruzione o riflessione della luce solare compresa tra i 3 e i 5 Hz. E' importante pertanto tenere la rotazione delle pale inferiore a tale valore minimo. Per avere una frequenza d'interruzione di 3 Hz, una turbina con rotore tripala dovrebbe compiere una rotazione al secondo, il che significa 60 giri al minuto. Tuttavia le grandi macchine hanno regimi di rotazione inferiori a questo valore, ed in particolare la turbina in progetto per il parco eolico, la Siemens-Gamesa SG 6.0-170 - 6,6 MW, ha una velocità di rotazione massima di 12 giri/minuto.

Rotor	SG170
Diameter	170
Swept Area	22.697 m <sup>2</sup>
Max root speed	11 rpm
Rotational Direction	Clockwise (front view)
Orientation	Upwind
No. of Blades	3

Tabella 1 - Principali dati tecnici della turbina Siemens-Gamesa SG 6.0-170 - 6,0 MW

Questo vuol dire che essendo tripala, nella peggiore delle ipotesi di velocità di rotazione massima, il rotore interrompe la linea di vista dell'osservatore col sole con una frequenza di 0,55 Hz, cioè meno di un quinto di quella critica di 3 Hz.

In linea di principio, per raggiungere questo valore di soglia il generico recettore dovrebbe incontrare nella sua linea di vista, il disco di almeno di 5 aerogeneratori che si sovrappongono in condizioni molto particolari (allineamento Recettore-WTG-Sole).

La turbina in oggetto per eliminare il problema del flickering alla fonte, in casi particolari, può essere dotata di un sistema che viene integrato nel sistema di controllo della turbina, e consente di fermarla nei momenti critici evidenziati dallo studio dello shadow flickering per particolari recettori prossimi alla turbina stessa.

L'analisi dell'effetto flickering generato dagli aerogeneratori del parco eolico è stata effettuata con l'utilizzo del modulo SHADOW del software WindPro 2.8. Il programma esegue una simulazione completa del percorso del sole durante un intero anno.

SHADOW è il modulo di WindPRO, che calcola quanto spesso e in che intervallo di tempo un dato edificio o area ricevono l'ombra generata da una o più turbine eoliche. L'ombreggiamento si verifica quando le pale di una turbina tagliano la linea di vista tra un punto specifico ed il sole.

I calcoli sono basati su due scenari, quello più sfavorevole, e quello realistico.

Il software WindPro è in grado di analizzare in dettaglio (vedi Allegati) per ogni giorno e ora dell'anno l'evoluzione delle ombre generate dalle singole turbine eoliche, e rappresentarle in due modalità differenti, tabellare e grafico, sia per i recettori sia per gli aerogeneratori.

Nella prima modalità viene generata una tabella per ogni recettore, nella quale per ogni giorno dell'anno viene riportato l'eventuale ombreggiamento da parte di qualche turbina, così come rappresentato nelle Figg.6 e 7. Nella seconda modalità invece si ha una rappresentazione grafica delle ombre, dove è possibile vedere l'ombra generata da ogni turbina al variare dei mesi e delle ore del giorno. In Fig. 5 è riportato come esempio il calendario del recettore R06 che è soggetto in particolar modo alle ombre delle WTG 05-13-14

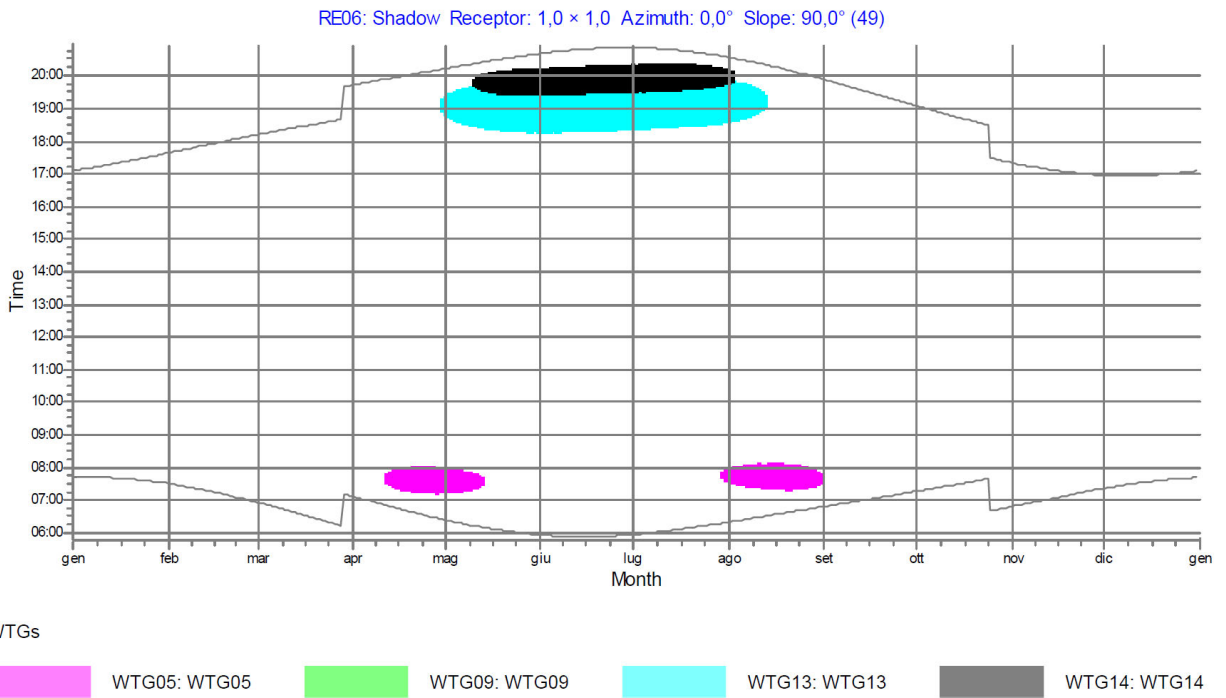


Figura 3 - Calendario grafico ombre per il recettore R22A

Nella fattispecie del recettore RE06, analizzando la tabella delle Figg. 10 e 11, si vede come l'effetto dell'ombra generata dalla WTG05 (in fucsia) inizia alle 07.32 del 12 aprile e termina il 13 maggio. Ricomincia poi alle ore 7.41 del 30 luglio e ritermina il 31 agosto.

La durata dell'ombra è variabile lungo i mesi estivi in una fascia oraria tra le 7 e le 8 circa per quanto riguarda la WTG05, mentre la WTG13 (in ciano) sullo stesso recettore agisce dalle 19.15 del 30 aprile, e non ha più effetto dopo le ore 19.21 del 13 agosto, per una fascia oraria al tramonto tra le 18.15 e le 20. Per questo recettore quindi il fenomeno rimane confinato nelle prime ore del mattino, e nelle ore del tramonto. Analoghi ragionamenti si possono fare per la WTG 14 che agisce al tramonto dal 10 maggio fino al 2 agosto

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Calculated:

04/11/2020 13:48/2.8.579

**SHADOW - Calendar**

Calculation: Ombre Recettori Rev2Shadow receptor: RE06 - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (49)

**Assumptions for shadow calculations**

Reference year for calendar

2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	07:41	07:30	06:55	07:07	06:23	07:16 (WTG05) 05:56
	17:06	17:38	18:12	19:44	20:14	19:20 (WTG13) 20:42
2	07:41	07:29	06:54	07:05	06:22	07:16 (WTG05) 05:55
	17:07	17:40	18:13	19:45	20:15	77 19:24 (WTG13) 20:42
3	07:41	07:28	06:52	07:03	06:20	07:16 (WTG05) 05:55
	17:08	17:41	18:14	19:46	20:16	81 19:26 (WTG13) 20:43
4	07:42	07:27	06:51	07:02	06:19	07:16 (WTG05) 05:54
	17:08	17:42	18:15	19:47	20:17	85 19:28 (WTG13) 20:44
5	07:42	07:26	06:49	07:00	06:18	07:17 (WTG05) 05:54
	17:09	17:43	18:16	19:48	20:18	88 19:31 (WTG13) 20:44
6	07:42	07:25	06:48	06:59	06:17	07:18 (WTG05) 05:54
	17:10	17:44	18:17	19:49	20:19	89 19:32 (WTG13) 20:45
7	07:42	07:24	06:46	06:57	06:16	07:19 (WTG05) 05:54
	17:11	17:46	18:18	19:50	20:20	91 19:34 (WTG13) 20:46
8	07:42	07:23	06:45	06:56	06:15	07:20 (WTG05) 05:53
	17:12	17:47	18:19	19:51	20:21	92 19:36 (WTG13) 20:46
9	07:42	07:22	06:43	06:54	06:13	07:21 (WTG05) 05:53
	17:13	17:48	18:20	19:52	20:22	93 19:37 (WTG13) 20:47
10	07:41	07:21	06:42	06:52	06:12	07:22 (WTG05) 05:53
	17:14	17:49	18:22	19:53	20:23	100 19:52 (WTG14) 20:47
11	07:41	07:20	06:40	06:51	06:11	07:23 (WTG05) 05:53
	17:15	17:50	18:23	19:54	20:23	108 19:56 (WTG14) 20:48
12	07:41	07:19	06:38	06:49	07:32 (WTG05) 06:10	07:25 (WTG05) 05:53
	17:16	17:51	18:24	19:55	14 07:46 (WTG05) 20:24	109 19:58 (WTG14) 20:48
13	07:41	07:18	06:37	06:48	07:29 (WTG05) 06:09	07:28 (WTG05) 05:53
	17:17	17:53	18:25	19:56	21 07:50 (WTG05) 20:25	106 20:00 (WTG14) 20:49
14	07:41	07:17	06:35	06:46	07:27 (WTG05) 06:08	18:25 (WTG13) 05:53
	17:18	17:54	18:26	19:57	25 07:52 (WTG05) 20:26	97 20:02 (WTG14) 20:49
15	07:40	07:15	06:34	06:45	07:24 (WTG05) 06:07	18:24 (WTG13) 05:53
	17:19	17:55	18:27	19:58	29 07:53 (WTG05) 20:27	99 20:03 (WTG14) 20:50
16	07:40	07:14	06:32	06:43	07:23 (WTG05) 06:07	18:24 (WTG13) 05:53
	17:20	17:56	18:28	19:59	32 07:55 (WTG05) 20:28	100 20:04 (WTG14) 20:50
17	07:40	07:13	06:31	06:42	07:21 (WTG05) 06:06	18:24 (WTG13) 05:53
	17:21	17:57	18:29	20:00	34 07:56 (WTG05) 20:29	101 20:05 (WTG14) 20:50
18	07:39	07:12	06:29	06:41	07:20 (WTG05) 06:05	18:23 (WTG13) 05:53
	17:22	17:58	18:30	20:01	36 07:56 (WTG05) 20:30	103 20:06 (WTG14) 20:51
19	07:39	07:10	06:27	06:39	07:19 (WTG05) 06:04	18:22 (WTG13) 05:53
	17:23	18:01	18:31	20:02	37 07:56 (WTG05) 20:31	104 20:06 (WTG14) 20:51
20	07:38	07:09	06:26	06:38	07:18 (WTG05) 06:03	18:21 (WTG13) 05:53
	17:25	18:01	18:32	20:03	39 07:57 (WTG05) 20:32	106 20:07 (WTG14) 20:51
21	07:38	07:08	06:24	06:36	07:18 (WTG05) 06:02	18:22 (WTG13) 05:53
	17:26	18:02	18:33	20:04	39 07:57 (WTG05) 20:33	106 20:08 (WTG14) 20:51
22	07:37	07:06	06:23	06:35	07:16 (WTG05) 06:02	18:21 (WTG13) 05:53
	17:27	18:03	18:34	20:05	41 07:57 (WTG05) 20:34	107 20:08 (WTG14) 20:52
23	07:37	07:05	06:21	06:33	07:16 (WTG05) 06:01	18:20 (WTG13) 05:54
	17:28	18:04	18:35	20:06	41 07:57 (WTG05) 20:34	109 20:09 (WTG14) 20:52
24	07:36	07:04	06:19	06:32	07:15 (WTG05) 06:00	18:21 (WTG13) 05:54
	17:29	18:05	18:36	20:07	42 07:57 (WTG05) 20:35	109 20:10 (WTG14) 20:52
25	07:35	07:02	06:18	06:31	07:15 (WTG05) 05:59	18:20 (WTG13) 05:54
	17:30	18:06	18:37	20:08	42 07:57 (WTG05) 20:36	110 20:10 (WTG14) 20:52
26	07:35	07:01	06:16	06:29	07:15 (WTG05) 05:59	18:20 (WTG13) 05:54
	17:31	18:08	18:38	20:09	42 07:57 (WTG05) 20:37	111 20:11 (WTG14) 20:52
27	07:34	07:00	06:15	06:28	07:15 (WTG05) 05:58	18:20 (WTG13) 05:55
	17:33	18:09	18:39	20:10	42 07:57 (WTG05) 20:38	111 20:11 (WTG14) 20:52
28	07:33	06:58	06:13	06:27	07:14 (WTG05) 05:58	18:19 (WTG13) 05:55
	17:34	18:10	18:40	20:11	42 07:56 (WTG05) 20:39	111 20:10 (WTG14) 20:52
29	07:33	06:57	07:11	06:25	07:15 (WTG05) 05:57	18:19 (WTG13) 05:56
	17:35	18:11	19:41	20:12	41 07:56 (WTG05) 20:39	112 20:11 (WTG14) 20:52
30	07:32		07:10	06:24	07:15 (WTG05) 05:57	18:20 (WTG13) 05:56
	17:36		19:42	20:13	61 19:15 (WTG13) 20:40	112 20:12 (WTG14) 20:52
31	07:31		07:08		05:56	18:19 (WTG13)
	17:37		19:43		20:41	113 20:12 (WTG14)
Potential sun hours	301	309	370	397	444	448
Total, worst case				700		3109
Sun reduction				0,53		0,59
Oper. time red.				0,78		0,78
Wind dir. red.				0,79		0,75
Total reduction				0,32		0,39
Total, real				227		1080

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)

WindPRO is developed by EMD International A/S, Niels Jernesvej 10, DK-9220 Aalborg Ø, Tel. +45 96 35 44 44, Fax +45 96 35 44 46, e-mail: windpro@emd.dk

Figura 4- Calendario tabellare delle ombre per il recettore R06 (Gen-Giu)



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04/11/2020 13:48/2.8.579

**SHADOW - Calendar**

Calculation: Ombre Recettori Rev2Shadow receptor: RE06 - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (49)

**Assumptions for shadow calculations**

Reference year for calendar

2020

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	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
134	282	483	550	523	510	295	242	134	107	215	403	778	1.342	591	242	6.831

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

	July	August	September	October	November	December
1	05:56	18:24 (WTG13)	06:19	07:35 (WTG05)	06:48	07:16
	20:52	115 20:19 (WTG14)	20:34	109 20:08 (WTG14)	19:53	19:05
2	05:57	18:24 (WTG13)	06:20	07:33 (WTG05)	06:49	07:17
	20:52	114 20:18 (WTG14)	20:33	107 20:06 (WTG14)	19:52	19:03
3	05:57	18:25 (WTG13)	06:21	07:31 (WTG05)	06:50	07:18
	20:52	114 20:19 (WTG14)	20:32	93 19:47 (WTG13)	19:50	19:02
4	05:58	18:25 (WTG13)	06:22	07:30 (WTG05)	06:51	07:19
	20:52	114 20:19 (WTG14)	20:31	93 19:46 (WTG13)	19:49	19:00
5	05:58	18:25 (WTG13)	06:23	07:29 (WTG05)	06:52	07:20
	20:52	114 20:19 (WTG14)	20:30	92 19:45 (WTG13)	19:47	19:00
6	05:59	18:25 (WTG13)	06:24	07:28 (WTG05)	06:53	07:21
	20:51	114 20:19 (WTG14)	20:29	91 19:43 (WTG13)	19:45	19:00
7	06:00	18:26 (WTG13)	06:25	07:27 (WTG05)	06:54	07:22
	20:51	114 20:20 (WTG14)	20:28	89 19:41 (WTG13)	19:44	19:00
8	06:00	18:26 (WTG13)	06:26	07:26 (WTG05)	06:54	07:23
	20:51	113 20:19 (WTG14)	20:27	88 19:40 (WTG13)	19:42	19:00
9	06:01	18:26 (WTG13)	06:27	07:26 (WTG05)	06:55	07:24
	20:51	114 20:20 (WTG14)	20:26	84 19:37 (WTG13)	19:41	19:00
10	06:01	18:27 (WTG13)	06:27	07:25 (WTG05)	06:56	07:25
	20:50	113 20:20 (WTG14)	20:24	80 19:35 (WTG13)	19:39	19:00
11	06:02	18:27 (WTG13)	06:28	07:25 (WTG05)	06:57	07:26
	20:50	113 20:20 (WTG14)	20:23	75 19:32 (WTG13)	19:37	19:00
12	06:03	18:27 (WTG13)	06:29	07:23 (WTG05)	06:58	07:27
	20:49	113 20:20 (WTG14)	20:22	68 19:27 (WTG13)	19:36	19:00
13	06:04	18:28 (WTG13)	06:30	07:23 (WTG05)	06:59	07:28
	20:49	112 20:20 (WTG14)	20:21	57 19:21 (WTG13)	19:34	19:00
14	06:04	18:27 (WTG13)	06:31	07:22 (WTG05)	07:00	07:29
	20:48	113 20:20 (WTG14)	20:19	42 08:04 (WTG05)	19:33	19:00
15	06:05	18:28 (WTG13)	06:32	07:22 (WTG05)	07:01	07:30
	20:48	112 20:20 (WTG14)	20:18	42 08:04 (WTG05)	19:31	19:00
16	06:06	18:29 (WTG13)	06:33	07:22 (WTG05)	07:02	07:31
	20:47	111 20:20 (WTG14)	20:17	42 08:04 (WTG05)	19:29	19:00
17	06:06	18:29 (WTG13)	06:34	07:22 (WTG05)	07:03	07:32
	20:47	111 20:20 (WTG14)	20:15	42 08:04 (WTG05)	19:28	19:00
18	06:07	18:29 (WTG13)	06:35	07:22 (WTG05)	07:04	07:33
	20:46	110 20:19 (WTG14)	20:14	42 08:04 (WTG05)	19:26	19:00
19	06:08	18:30 (WTG13)	06:36	07:22 (WTG05)	07:05	07:34
	20:45	109 20:19 (WTG14)	20:13	41 08:03 (WTG05)	19:24	19:00
20	06:09	18:30 (WTG13)	06:37	07:21 (WTG05)	07:06	07:35
	20:45	109 20:19 (WTG14)	20:11	41 08:02 (WTG05)	19:23	19:00
21	06:10	18:31 (WTG13)	06:38	07:21 (WTG05)	07:06	07:36
	20:44	108 20:19 (WTG14)	20:10	41 08:02 (WTG05)	19:21	19:00
22	06:10	18:31 (WTG13)	06:39	07:22 (WTG05)	07:07	07:37
	20:43	107 20:18 (WTG14)	20:08	39 08:01 (WTG05)	19:19	19:00
23	06:11	18:31 (WTG13)	06:40	07:22 (WTG05)	07:08	07:38
	20:43	107 20:18 (WTG14)	20:07	39 08:01 (WTG05)	19:18	19:00
24	06:12	18:32 (WTG13)	06:41	07:23 (WTG05)	07:09	07:39
	20:42	105 20:17 (WTG14)	20:05	37 08:00 (WTG05)	19:16	19:00
25	06:13	18:33 (WTG13)	06:41	07:23 (WTG05)	07:10	07:40
	20:41	104 20:17 (WTG14)	20:04	36 07:59 (WTG05)	19:15	19:00
26	06:14	18:34 (WTG13)	06:42	07:24 (WTG05)	07:11	07:41
	20:40	102 20:16 (WTG14)	20:02	34 07:58 (WTG05)	19:13	19:00
27	06:15	18:34 (WTG13)	06:43	07:25 (WTG05)	07:12	07:42
	20:39	101 20:15 (WTG14)	20:01	31 07:56 (WTG05)	19:11	19:00
28	06:16	18:34 (WTG13)	06:44	07:26 (WTG05)	07:13	07:43
	20:38	100 20:14 (WTG14)	19:59	29 07:55 (WTG05)	19:10	19:00
29	06:16	18:35 (WTG13)	06:45	07:27 (WTG05)	07:14	07:44
	20:37	98 20:13 (WTG14)	19:58	25 07:52 (WTG05)	19:08	19:00
30	06:17	07:41 (WTG05)	06:46	07:29 (WTG05)	07:15	07:45
	20:36	103 20:12 (WTG14)	19:56	20 07:49 (WTG05)	19:06	19:00
31	06:18	07:37 (WTG05)	06:47	07:32 (WTG05)	07:16	07:46
	20:35	108 20:10 (WTG14)	19:55	14 07:46 (WTG05)	19:05	19:00
Potential sun hours	455	425	374	347	301	292
Total, worst case	3395	1763				
Sun reduction	0,74	0,73				
Oper. time red.	0,78	0,78				
Wind dir. red.	0,75	0,77				
Total reduction	0,43	0,44				
Total, real	1466	779				

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

Day in month	Sun rise (hh:mm)	Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)
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Figura 5 - Calendario tabellare delle ombre per il recettore R06 (Lug-Dic)

Analoghe tabelle e diagrammi vengono generati prendendo come base non il singolo recettore, ma la singola turbina eolica, e analizzando gli ombreggiamenti sui singoli recettori generati dalla stessa. In Fig.8 si riportano ad esempio i calendari grafici delle WTG 13 e WTG14.

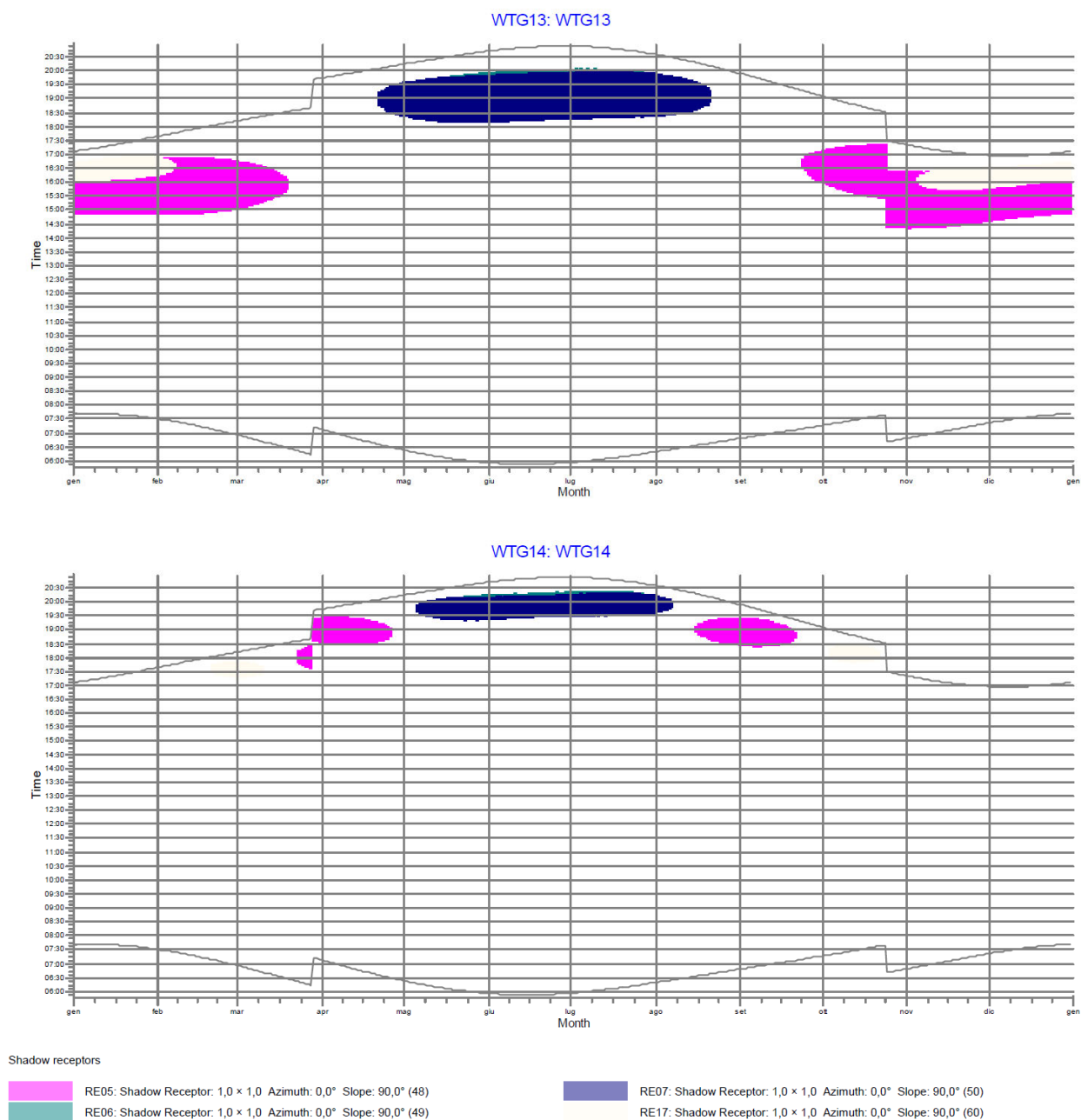


Figura 6- Calendario grafico delle ombre generate dalle WTG13 e WTG14

### 1.2.1 Caso sfavorevole (Worst case)

Il caso sfavorevole rappresenta la condizione di calcolo più conservativa, nella quale si considera:

- Il soleggiamento astronomico (ossia basata sulla posizione del sole rispetto alle turbine eoliche senza effetto della copertura nuvolosa). Il sole splende tutti i giorni dall'alba al tramonto;
- Il rotore è sempre in rotazione, ossia la turbina è costantemente operativa (disponibilità del 100%);
- Il piano del rotore è sempre perpendicolare alla linea congiungente la WTG col sole (significa che copre sempre la superficie massima possibile del sole).

In questo caso, se il cielo è coperto o c'è calma di vento, o la direzione del vento è tale da porre il piano del rotore in posizione parallela rispetto alla linea sole-edificio, la turbina eolica non produrrà ombra, ma la sua influenza apparirà comunque nei calcoli. In altre parole, il calcolo descrive lo scenario peggiore possibile, e rappresenta quindi il massimo rischio potenziale d'impatto.

Per ciascun punto di osservazione (recettore), il programma genera un calendario che indica i giorni e i periodi di tempo in cui l'ombra sarà presente. I risultati sono presentati come mappe di isolinee di tremolio orario.

La valutazione dell'impatto, dopo aver eseguito i relativi calcoli, indica la probabilità che una certa area territoriale sia interessata dal fenomeno, in termini di h (ore)/anno, e minuti/giorno.

### 1.2.2 Caso reale

Le condizioni indicate nel "caso peggiore" sono molto distanti dalla realtà, pertanto per il calcolo dell'ombreggiamento del "caso reale" si tiene conto dei diversi fattori di attenuazione, che sono presenti nella realtà fisica. Vengono considerati i seguenti parametri:

- **Reale funzionamento degli aerogeneratori** sulla base delle statistiche anemologiche del sito (ore di funzionamento attese per ogni settore angolare di orientamento del rotore). La reale distribuzione in frequenza dei venti infatti, comprende anche i periodi di non operatività del parco (in quanto la velocità del vento risulta inferiore a quella di start-up, che per le WTG considerate è di 3m/s);
- **Eliofania**, che è il parametro che misura la durata media del soleggiamento in una località o zona specifica. Abbiamo quella assoluta e quella relativa.
  - L'eliofania assoluta misura la durata effettiva dell'illuminazione solare diretta senza l'interposizione delle nuvole, in un dato periodo (giorno, mese, anno, ecc.). Generalmente viene misurata in ore.
  - L'eliofania relativa rappresenta invece il rapporto tra l'eliofania assoluta e la permanenza totale del sole sopra l'orizzonte, e pertanto viene espressa in termini percentuali.

- WindPro nel fare i calcoli tiene conto degli effetti di mascheramento delle WTG ai recettori, come rappresentato in Fig. 9. Combina infatti il calcolo ZVI<sup>2</sup> con quello SHADOW, escludendo così il contributo delle turbine invisibili ai recettori. Si pensi ad esempio al mascheramento naturale fornito dai rilievi a che tagliano la linea di vista del sole all'alba o al tramonto. Per eseguire il calcolo delle ZVI è stato predisposto un DEM<sup>3</sup> topografico, in formato ASCII con passo 10 metri, derivato da quello disponibile nel portale cartografico regionale.

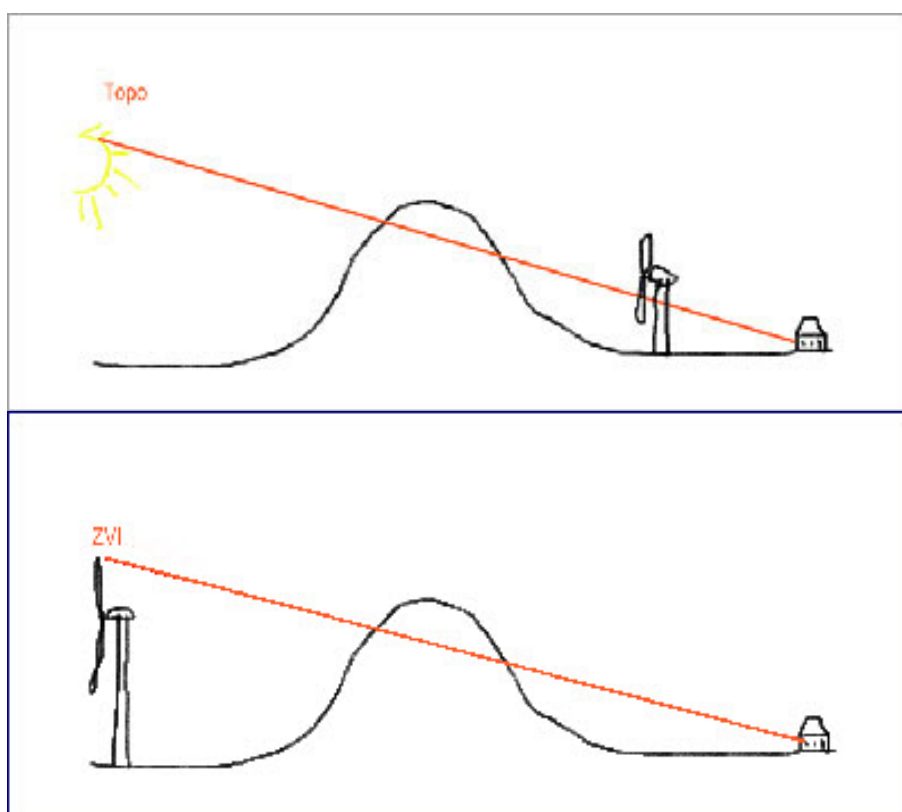


Figura 7-Effetti di oscuramento delle WTG ai recettori

- Inoltre sono stati inclusi anche oggetti areali, che definiscono ostacoli visuali, come gli eventuali filari di alberi presenti nel territorio e alcuni ingombri dei recettori adiacenti, che generano ombre sul recettore considerato.

- L'altezza dell'osservatore, impostata come altezza degli occhi, è pari a 1.6 m.
- Viene considerata una distanza di calcolo delle ombre pari a 2 km.

<sup>2</sup> Zone Visual Impact

<sup>3</sup> Acronimo di Digital Elevation Model



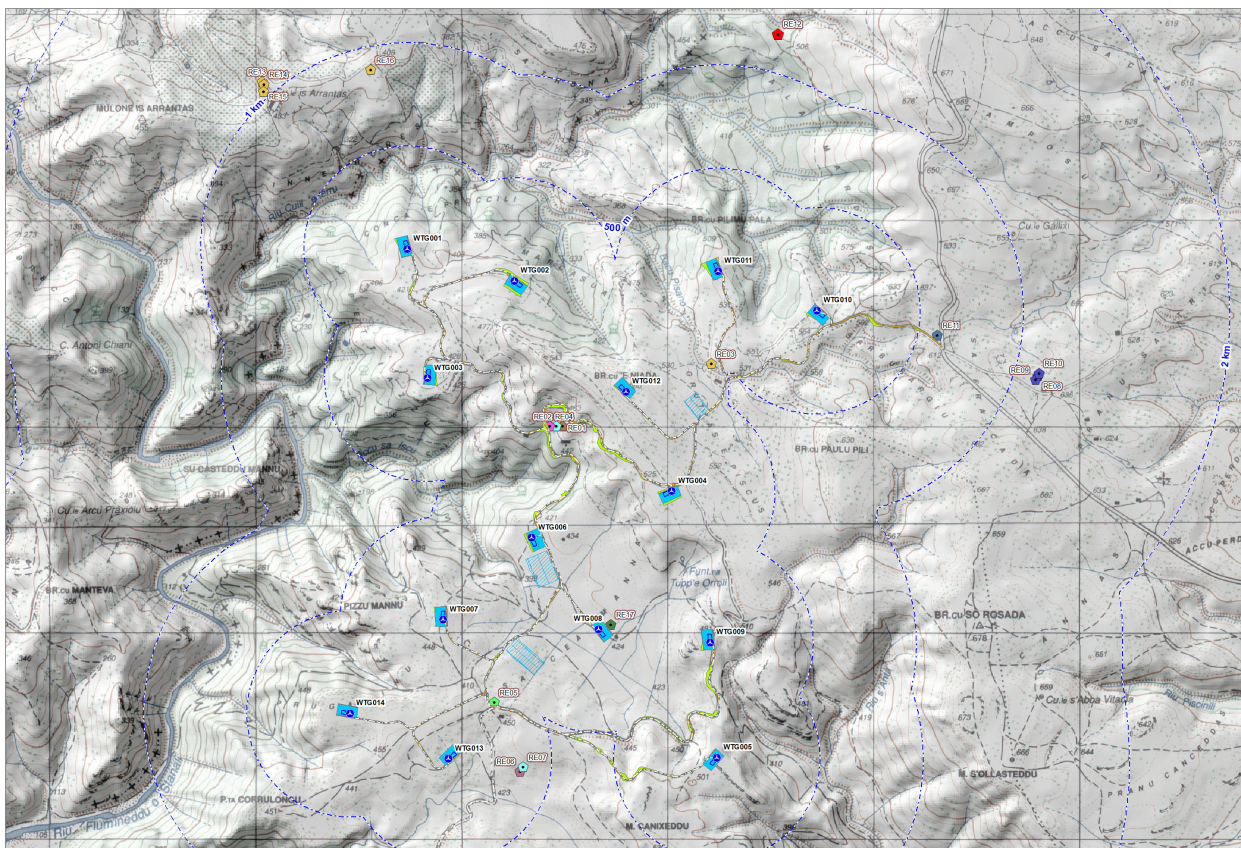


Figura 8-Inquadramento su IGM su DEM 10m

Per il primo aspetto sono stati utilizzati i dati statistici di lungo termine, così come descritti nella relazione anemologica.

### 200m Graphs

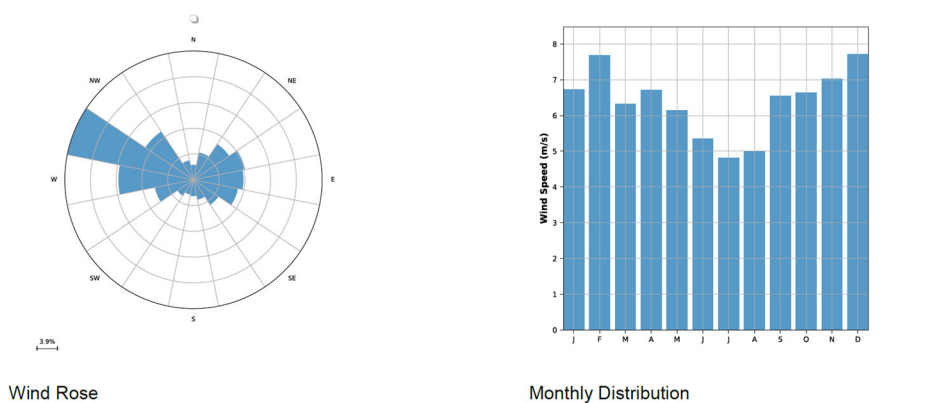


Figura 9 - Rosa dei venti anemometro di riferimento

Dall'analisi ne discende una distribuzione per ciascun settore del tempo operativo del parco così come riportato in Tab.2:



## Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
134	282	483	550	523	510	295	242	134	107	215	403	778	1342	591	242

Tabella 2 - Tempo operativo medio del parco eolico

Quanto al secondo aspetto, per l'analisi dell'eliofania, si hanno a disposizione i dati di tre stazioni che ne riportano il valore giornaliero: Elmas ed Alghero dell'Aeronautica Militare e Santa Lucia (a nord di Oristano) dell'Università di Sassari.

L'esiguo numero di stazioni tuttavia non pone limitazioni, perché questa grandezza è influenzata da due soli fattori: la lunghezza del dì (inteso come numero di ore comprese fra l'alba e il tramonto) e la copertura nuvolosa. Come è ben noto la prima varia con continuità nell'arco dell'anno, senza apprezzabili distinzioni fra le diverse aree della Sardegna; la seconda, pur essendo diversa da zona a zona nel breve periodo, è tuttavia essenzialmente legata a fenomeni a grande scala che influenzano in media la nostra Isola in modo sostanzialmente uniforme.

Ne consegue che **il valore climatologico dell'eliofania è da considerarsi lo stesso su tutta la Sardegna<sup>4</sup>**. In virtù di questo sono stati utilizzati i dati dell'eliofania media giornaliera, rilevati dalla stazione meteorologica di Elmas, che vengono riportati nella Tab.3

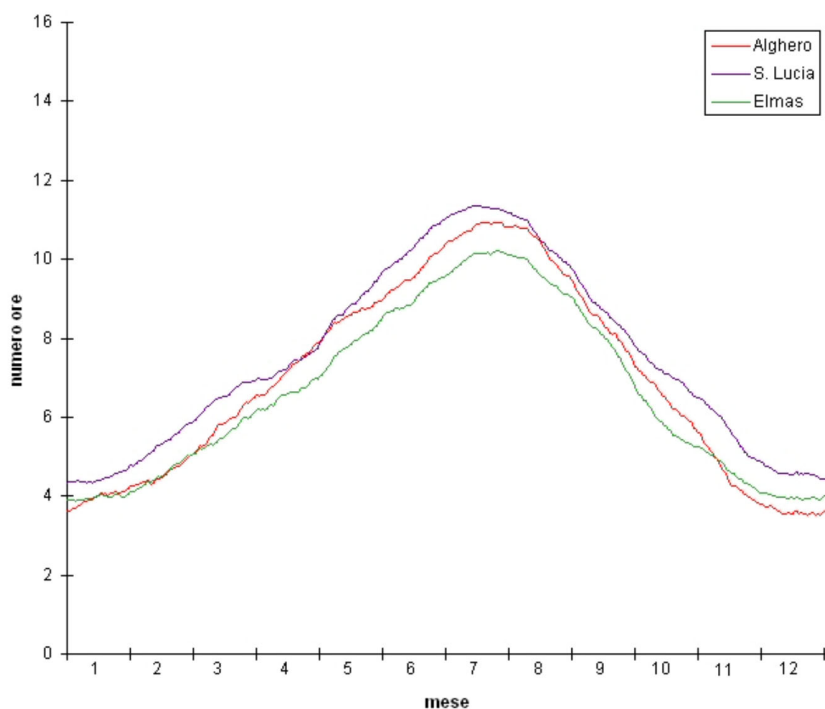


Tabella 3 - Valori statistici Eliofofania stazione meteo di Elmas (Fonte ARPAS)

<sup>4</sup> Fonte Arpa Sardegna

### 1.3 RECETTORI

Per il presente studio, oltre alle strade sono stati presi in considerazione 17 recettori presenti in un buffer di circa 1 km dalle WTG, dei quali uno solo risulta accatastato come abitazione (R12), ed i restanti come edifici rurali.

Per il dettaglio sulle interdistanze tra i recettori e le WTG si veda la Tab.4.

E' stata fatta una prima simulazione in cui tutti i recettori sono stati considerati con esposizione conservativa del tipo "Greenhouse" (Serra). In questo caso il recettore viene considerato come completamente trasparente e non sarà orientato in una particolare direzione, ma sarà piuttosto omnidirezionale. Questo calcolo non è realistico, ma è cautelativo e mette il recettore nelle condizioni peggiori possibili giacché è visto dalla WTG come un'unica superficie vetrata.

Questo approccio è utile in questa fase in cui non sono note nel dettaglio tutte le caratteristiche dimensionali del recettore.

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

Dalla simulazione software delle ombre emergono i risultati riportati in Tab.4. Da questo primo calcolo emerge che per l'unico recettore di tipo abitativo (R12) non vengono rilevati valori di ombreggiamento a causa della grande distanza (1127 metri dalla turbina più vicina, la WTG11), mentre per qualche fabbricato rurale tale soglia viene superata, ma come detto, per essi il fenomeno non risulta critico in quanto non si fa riferimento ad ambienti in cui il lavoratore rimane fisso in una determinata posizione rispetto alle WTG, pertanto non si procede con l'analisi di dettaglio.

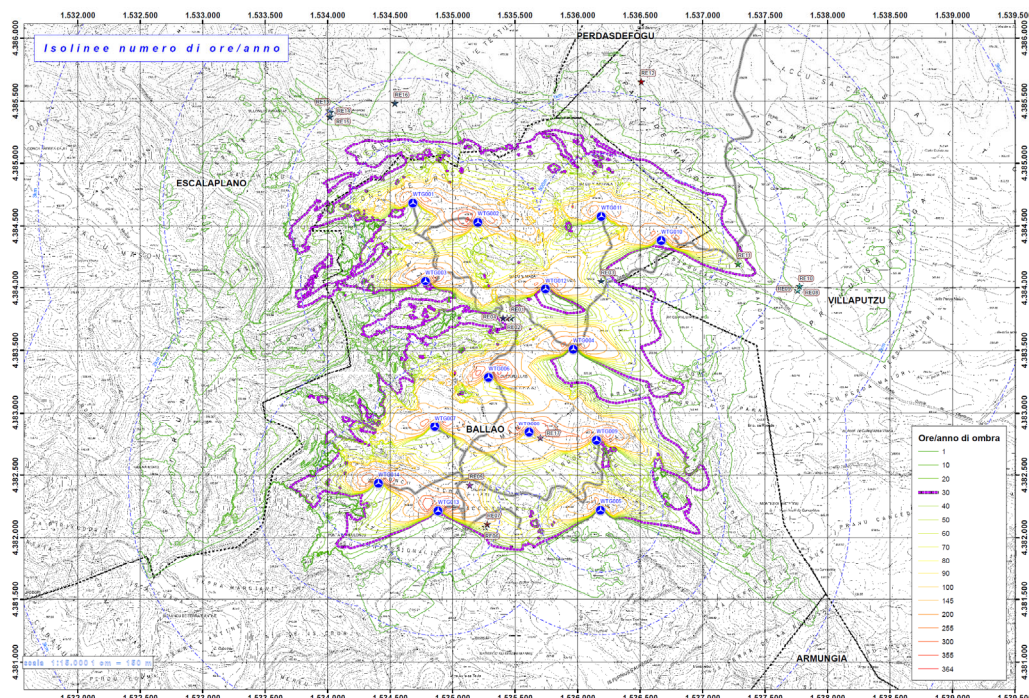


Fig. Isolinee del numero di ore/anno di ombreggiamento

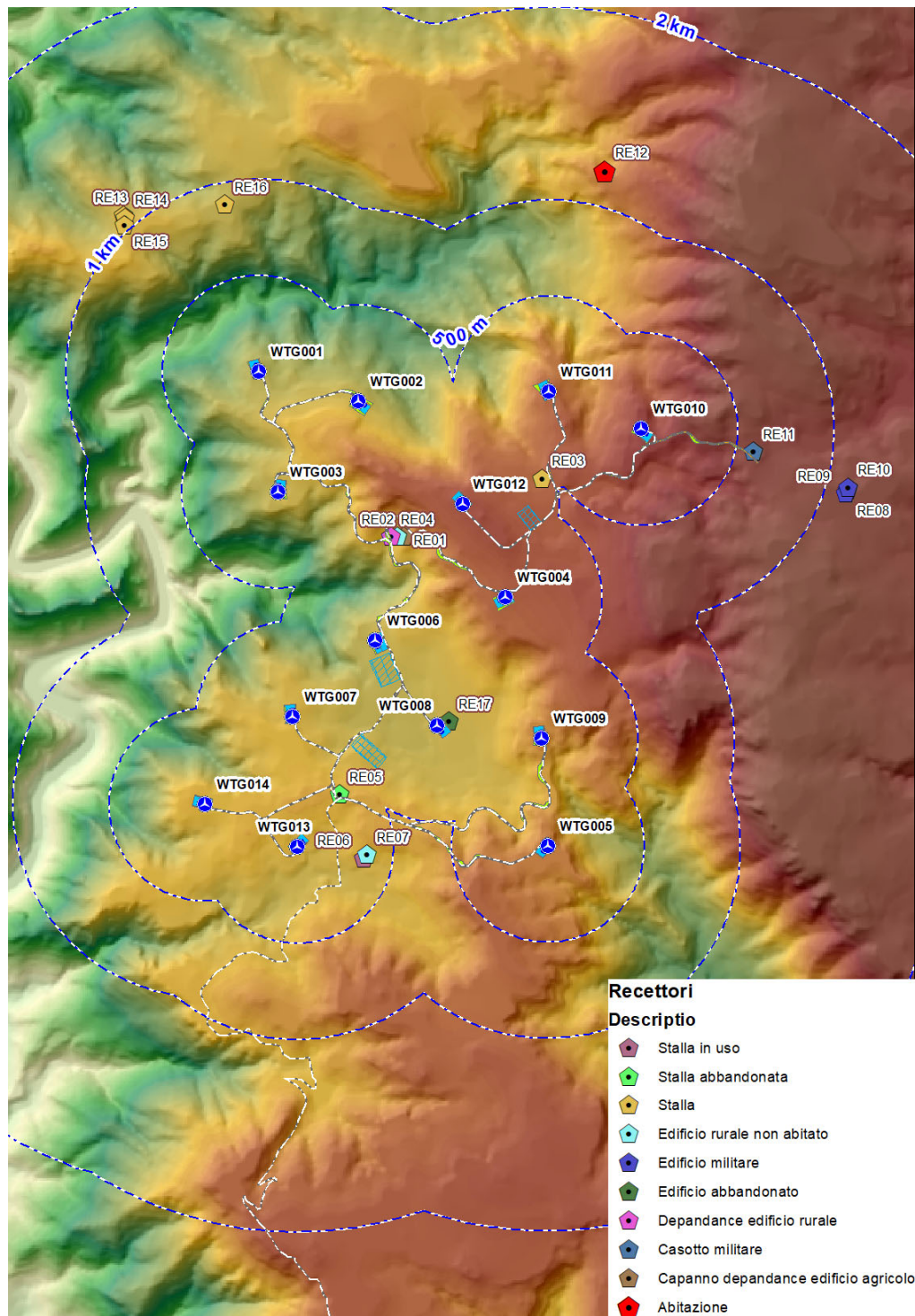


Figura 10-Planimetria dei recettori su DEM



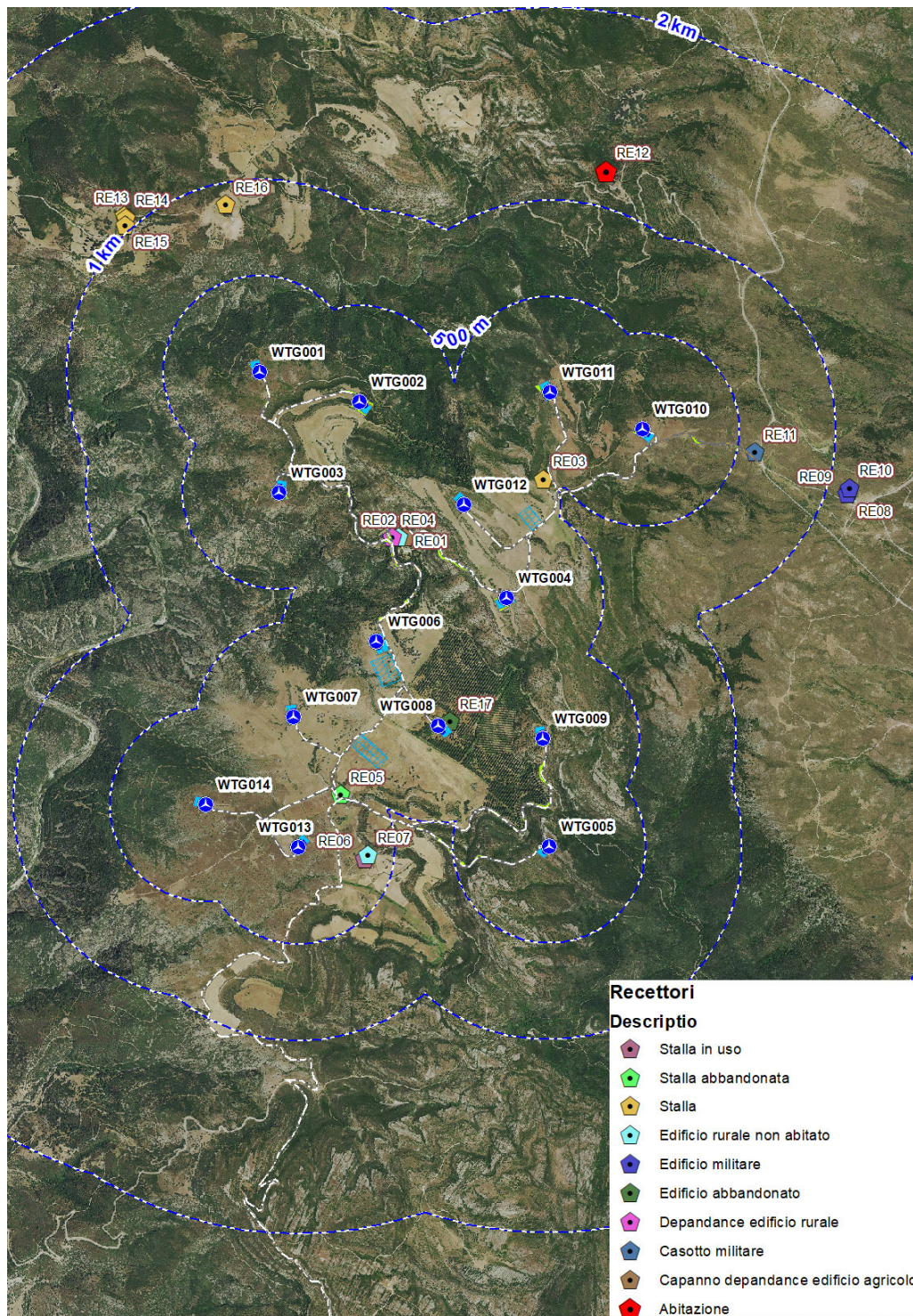


Figura 11-Planimetria dei recettori su ortofoto

## RIEPILOGO RISULTATI OMBREGGIAMENTO PARCO EOLICO "Brunco e Niada"

Recettore	Tipologia	Gauss Boaga EST	Gauss Boaga NORD	Quota s.l.m.	Ombre caso peggiore	Ombre caso peggiore	Ombre attese (caso reale)	Turbina più vicina	Distanza [m]
				[m]	[h/anno]	[h/giorno]	[h/anno]		
RE01	Capanno depandance edificio agricolo	1535467	4383758	442,1	136:17:00	01:04	46:36:00	WTG012	361
RE02	Edificio rurale non abitato	1535437	4383757	442,1	125:46:00	01:02	43:08:00	WTG012	386
RE03	Stalla	1536188	4384059	525,8	133:14:00	01:25	49:04:00	WTG011	516
RE04	Depandance edificio rurale	1535404	4383757	437,3	113:52:00	00:59	39:10:00	WTG006	487
RE05	Stalla abbandonata	1535137	4382419	446,8	407:54:00	01:56	120:05:00	WTG013	327
RE06	Stalla in uso	1535261	4382086	430	206:35:00	01:55	81:19:00	WTG013	399
RE07	Edificio rurale non abitato	1535276	4382106	430	237:18:00	02:02	93:44:00	WTG013	407
RE08	Edificio militare	1537770	4384000	630	22:43	00:29	08:45	WTG010	1166
RE09	Edificio militare	1537760	4383982	630	25:34:00	00:29	09:52	WTG010	1163
RE10	Edificio militare	1537776	4384013	630	21:26	00:29	08:16	WTG010	1167
RE11	Casotto militare	1537284	4384198	610	120:04:00	01:08	46:26:00	WTG010	642
RE12	Abitazione	1536510	4385655	500,2	00:00	00:00	00:00	WTG011	1127
RE13	Stalla	1534012	4385426	430	18:50	00:27	04:29	WTG001	1002
RE14	Stalla	1534021	4385413	430	20:21	00:28	04:51	WTG001	986
RE15	Stalla	1534018	4385377	430	24:46:00	00:29	06:00	WTG001	962
RE16	Stalla	1534537	4385483	410	10:12	00:22	02:44	WTG001	814
RE17	Edificio abbandonato	1535702	4382796	420	505:43:00	03:11	175:41:00	WTG008	101

Tabella 4 - Interdistanze dei recettori dalle WTG e sintesi dei risultati

Per il dettaglio su ciascuno di essi, si vedano i calendari tabellari, i grafici in appendice e la tavola "VIA-SIA-WIND001.ELB007 Studio delle ombre".



## 2.0 EFFETTI CUMULATIVI

Per quanto riguarda altre iniziative da fonte eolica presentati nella medesima area, non si è tenuto conto dei parchi eolici esistenti, indicati in Figura 12 in quanto troppo distanti dal parco in proposta per avere degli effetti cumulative misurabili.

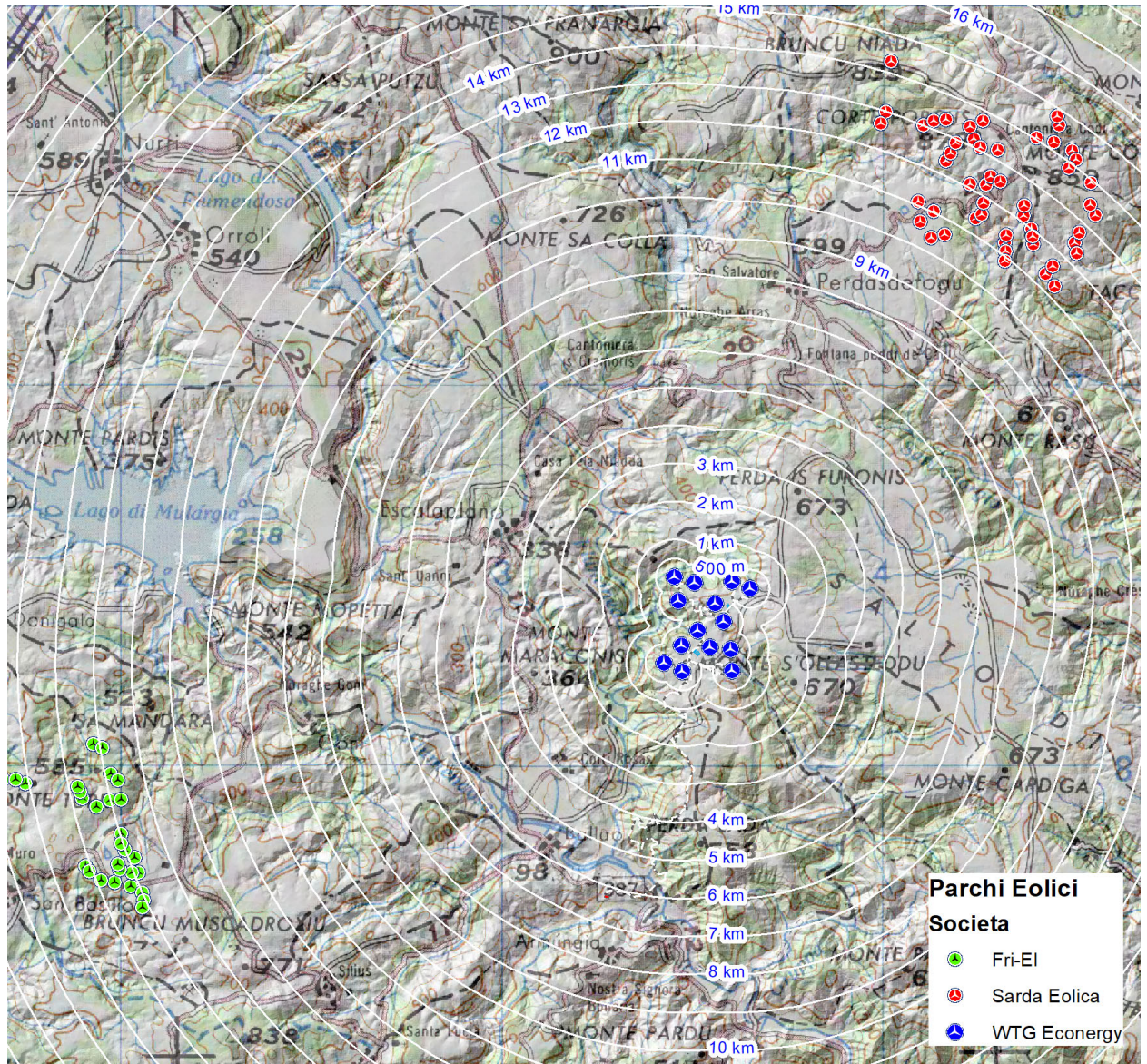


Figura 12 - Parchi eolici nell'area di studio

Il parco eolico più prossimo a quello proposto è quello della società Sarda Eolica la cui distanza media è superiore ai 10 km.

### *3.0 Conclusioni*

A conclusione di quanto riportato si dimostra che il parco eolico in proposta non genera un effetto di shadow flickering sui recettori di tipo abitativo, e che tale effetto è riscontrabile perlopiù sui recettori ritenuti non sensibili.

**APPENDICE - RISULTATI DI DETTAGLIO**

*WINDPRO 2.8*

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Project:  
**Bruncu e Niada**

Printed/Page  
04/11/2020 15:45 / 1  
Licensed user:  
**Ing. Bruno Manca**  
Via Vittorio Veneto 231  
IT-09028 Sestu  
+390702358125  
Bruno Manca / ingbrunomanca@gmail.com  
Calculated:  
04/11/2020 13:48/2.8.579

**SHADOW - Calendar**

**Calculation:** Ombre Recettori Rev2Shadow receptor: RE01 - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (44)

**Assumptions for shadow calculations**

Reference year for calendar 2020

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	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
134	282	483	550	523	510	295	242	134	107	215	403	778	1.342	591	242	6.831

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

	January	February	March	April	May	June	
1	07:41 17:06	07:30 17:38	06:55 18:12	08:17 (WTG04) 09:19 (WTG04)	07:07 19:44	06:23 20:14	
2	07:41 17:07	07:29 17:40	06:54 18:13	08:16 (WTG04) 09:19 (WTG04)	07:05 19:45	06:22 20:15	05:56 20:42
3	07:42 17:08	07:28 17:41	06:52 18:14	08:16 (WTG04) 09:20 (WTG04)	07:03 19:46	06:20 20:16	51 20:20
4	07:42 17:08	07:27 17:42	06:51 18:15	08:15 (WTG04) 09:19 (WTG04)	07:02 19:47	06:19 20:17	51 20:20
5	07:42 17:09	07:26 17:43	06:49 18:16	08:15 (WTG04) 09:19 (WTG04)	07:00 19:48	06:18 20:18	53 20:22
6	07:42 17:10	07:25 17:44	06:48 18:17	08:15 (WTG04) 09:19 (WTG04)	06:59 19:49	06:17 20:19	53 20:22
7	07:42 17:11	07:24 17:46	06:46 18:18	08:15 (WTG04) 09:19 (WTG04)	06:57 19:50	06:16 20:20	54 20:23
8	07:42 17:12	07:23 17:47	06:45 18:19	08:14 (WTG04) 09:18 (WTG04)	06:56 19:51	06:15 20:21	54 20:23
9	07:42 17:13	07:22 17:48	06:43 18:20	08:14 (WTG04) 09:17 (WTG04)	06:54 19:52	06:13 20:22	11 19:49 (WTG03)
10	07:41 17:14	07:21 17:49	06:42 18:22	08:14 (WTG04) 09:17 (WTG04)	06:52 19:53	06:12 20:23	19 20:00 (WTG03)
11	07:41 17:15	07:20 17:50	06:40 18:23	08:14 (WTG04) 09:15 (WTG04)	06:51 19:54	06:11 20:23	19 20:02 (WTG03)
12	07:41 17:16	07:19 17:51	06:38 18:24	08:14 (WTG04) 09:15 (WTG04)	06:49 19:55	06:10 20:24	23 20:03 (WTG03)
13	07:41 17:17	07:18 17:53	06:37 18:25	08:14 (WTG04) 09:14 (WTG04)	06:48 19:56	06:09 20:25	24 20:03 (WTG03)
14	07:41 17:18	07:17 17:54	06:35 18:26	08:15 (WTG04) 09:13 (WTG04)	06:46 19:57	06:08 20:26	29 20:05 (WTG03)
15	07:40 17:19	07:15 17:55	06:34 18:27	08:15 (WTG04) 09:12 (WTG04)	06:45 19:58	06:07 20:27	31 20:06 (WTG03)
16	07:40 17:20	07:14 17:56	06:32 18:28	08:15 (WTG04) 09:10 (WTG04)	06:43 19:59	06:06 20:28	33 20:07 (WTG03)
17	07:40 17:21	07:13 17:57	06:31 18:29	08:16 (WTG04) 09:09 (WTG04)	06:42 20:00	06:06 20:29	34 20:08 (WTG03)
18	07:39 17:22	07:12 17:58	06:29 18:30	08:16 (WTG04) 09:07 (WTG04)	06:40 20:01	06:05 20:30	36 20:09 (WTG03)
19	07:39 17:23	07:10 18:00	06:27 18:31	08:16 (WTG04) 09:05 (WTG04)	06:39 20:02	06:04 20:31	38 20:10 (WTG03)
20	07:38 17:24	07:09 18:01	06:26 18:32	08:18 (WTG04) 09:04 (WTG04)	06:38 20:03	06:03 20:32	39 20:10 (WTG03)
21	07:38 17:26	07:08 18:02	06:24 18:33	08:18 (WTG04) 09:02 (WTG04)	06:36 20:04	06:02 20:33	41 20:12 (WTG03)
22	07:37 17:27	07:06 18:03	06:23 18:34	08:20 (WTG04) 09:00 (WTG04)	06:35 20:05	06:02 20:34	42 20:12 (WTG03)
23	07:37 17:28	07:05 18:04	06:21 18:35	08:21 (WTG04) 08:57 (WTG04)	06:33 20:06	06:01 20:34	43 20:13 (WTG03)
24	07:36 17:29	07:04 18:05	06:19 18:36	08:22 (WTG04) 08:54 (WTG04)	06:32 20:07	06:00 20:35	44 20:14 (WTG03)
25	07:36 17:30	07:02 18:06	06:18 18:37	08:25 (WTG04) 08:51 (WTG04)	06:31 20:08	05:59 20:36	45 20:14 (WTG03)
26	07:35 17:31	07:01 18:07	06:16 18:38	08:28 (WTG04) 08:47 (WTG04)	06:29 20:09	05:59 20:37	46 20:15 (WTG03)
27	07:34 17:33	07:00 18:09	06:15 18:39	08:37 (WTG04) 08:38 (WTG04)	06:28 20:10	05:58 20:38	47 20:16 (WTG03)
28	07:33 17:34	06:58 18:10	06:13 18:40	08:19 (WTG04) 09:19 (WTG04)	06:27 20:11	05:58 20:39	47 20:16 (WTG03)
29	07:33 17:35	06:57 18:11	07:11 19:41	08:18 (WTG04) 09:19 (WTG04)	06:25 20:12	05:57 20:39	49 20:18 (WTG03)
30	07:32 17:36		07:10 19:42		06:24 20:13	05:57 20:40	50 20:19 (WTG03)
31	07:31 17:37		07:08 19:43			05:56 20:41	50 20:19 (WTG03)
Potential sun hours	301	309	370	397	445	448	
Total, worst case		691	1385		864	1653	
Sun reduction		0,47	0,49		0,59	0,66	
Oper. time red.		0,78	0,78		0,78	0,78	
Wind dir. red.		0,72	0,72		0,74	0,74	
Total reduction		0,27	0,28		0,34	0,38	
Total, real		184	385		292	628	

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

**Brunco e Niada**

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Calculated:  
04/11/2020 13:48/2.8.579

**SHADOW - Calendar**

Calculation: Ombre Recettori Rev2Shadow receptor: RE01 - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (44)

**Assumptions for shadow calculations**

Reference year for calendar

2020

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	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
134	282	483	550	523	510	295	242	134	107	215	403	778	1.342	591	242	6.831

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

	July	August	September	October	November	December
1	05:56	19:35 (WTG03)	06:19	19:50 (WTG03)	06:48	07:21
	20:52	55 20:30 (WTG03)	20:34	24 20:14 (WTG03)	19:53	19:05
2	05:57	19:34 (WTG03)	06:20	19:52 (WTG03)	06:49	07:17
	20:52	56 20:30 (WTG03)	20:33	21 20:13 (WTG03)	19:52	19:03
3	05:57	19:35 (WTG03)	06:21	19:53 (WTG03)	06:50	07:18
	20:52	55 20:30 (WTG03)	20:32	18 20:11 (WTG03)	19:50	19:02
4	05:58	19:35 (WTG03)	06:22	19:56 (WTG03)	06:51	07:19
	20:52	54 20:29 (WTG03)	20:31	14 20:10 (WTG03)	19:49	19:00
5	05:58	19:36 (WTG03)	06:23	20:01 (WTG03)	06:52	07:20
	20:52	54 20:30 (WTG03)	20:30	7 20:08 (WTG03)	19:47	18:58
6	05:59	19:35 (WTG03)	06:24	06:53	07:21	06:54
	20:51	54 20:29 (WTG03)	20:29	19:45	18:57	18:57
7	06:00	19:36 (WTG03)	06:25	06:53	07:22	06:55
	20:51	53 20:29 (WTG03)	20:28	19:44	18:55	18:55
8	06:00	19:35 (WTG03)	06:26	06:54	07:23	06:56
	20:51	53 20:28 (WTG03)	20:27	19:42	18:54	18:54
9	06:01	19:36 (WTG03)	06:26	06:55	07:24	06:57
	20:51	52 20:28 (WTG03)	20:26	19:41	18:52	18:52
10	06:01	19:37 (WTG03)	06:27	06:56	07:25	06:58
	20:50	51 20:28 (WTG03)	20:24	19:39	18:51	18:51
11	06:02	19:36 (WTG03)	06:28	06:57	07:26	06:59
	20:50	51 20:27 (WTG03)	20:23	19:37	18:49	18:49
12	06:03	19:37 (WTG03)	06:29	06:58	07:27	07:00
	20:49	50 20:27 (WTG03)	20:22	19:36	18:47	18:47
13	06:03	19:37 (WTG03)	06:30	06:59	07:28	07:02
	20:49	50 20:27 (WTG03)	20:21	19:34	18:46	18:46
14	06:04	19:37 (WTG03)	06:31	07:00	07:29	07:03
	20:48	49 20:26 (WTG03)	20:19	19:33	18:44	18:44
15	06:05	19:38 (WTG03)	06:32	07:01	07:30	07:04
	20:48	48 20:26 (WTG03)	20:18	19:31	18:43	18:43
16	06:06	19:38 (WTG03)	06:33	07:02	07:31	07:05
	20:47	48 20:26 (WTG03)	20:17	19:29	18:42	18:42
17	06:06	19:38 (WTG03)	06:34	07:03	09:17 (WTG04)	07:32
	20:47	46 20:24 (WTG03)	20:15	19:28	17 09:34 (WTG04)	18:40
18	06:07	19:39 (WTG03)	06:35	07:04	09:13 (WTG04)	07:33
	20:46	45 20:24 (WTG03)	20:14	19:26	25 09:38 (WTG04)	18:39
19	06:08	19:39 (WTG03)	06:36	07:05	09:10 (WTG04)	07:34
	20:45	45 20:24 (WTG03)	20:13	19:24	31 09:41 (WTG04)	18:37
20	06:09	19:40 (WTG03)	06:37	07:06	09:08 (WTG04)	07:35
	20:45	43 20:23 (WTG03)	20:11	19:23	35 09:43 (WTG04)	18:36
21	06:10	19:41 (WTG03)	06:38	07:06	09:06 (WTG04)	07:36
	20:44	42 20:23 (WTG03)	20:10	19:21	39 09:45 (WTG04)	18:34
22	06:10	19:40 (WTG03)	06:39	07:07	09:04 (WTG04)	07:37
	20:43	41 20:21 (WTG03)	20:08	19:19	42 09:46 (WTG04)	18:33
23	06:11	19:41 (WTG03)	06:40	07:08	09:02 (WTG04)	07:38
	20:43	40 20:21 (WTG03)	20:07	19:18	46 09:48 (WTG04)	18:32
24	06:12	19:42 (WTG03)	06:41	07:09	09:01 (WTG04)	07:39
	20:42	38 20:20 (WTG03)	20:05	19:16	48 09:49 (WTG04)	18:30
25	06:13	19:43 (WTG03)	06:41	07:10	09:00 (WTG04)	06:40
	20:41	37 20:20 (WTG03)	20:04	19:14	50 09:50 (WTG04)	17:29
26	06:14	19:44 (WTG03)	06:42	07:11	08:57 (WTG04)	06:41
	20:40	35 20:19 (WTG03)	20:02	19:13	53 09:50 (WTG04)	17:28
27	06:15	19:44 (WTG03)	06:43	07:12	08:56 (WTG04)	06:42
	20:39	34 20:18 (WTG03)	20:01	19:11	55 09:51 (WTG04)	17:26
28	06:16	19:45 (WTG03)	06:44	07:13	08:55 (WTG04)	06:44
	20:38	32 20:17 (WTG03)	19:59	19:10	57 09:52 (WTG04)	17:25
29	06:16	19:46 (WTG03)	06:45	07:14	08:54 (WTG04)	06:45
	20:37	30 20:16 (WTG03)	19:58	19:08	58 09:52 (WTG04)	17:24
30	06:17	19:47 (WTG03)	06:46	07:15	08:54 (WTG04)	06:46
	20:36	28 20:15 (WTG03)	19:56	19:06	59 09:53 (WTG04)	17:23
31	06:18	19:48 (WTG03)	06:47	06:47	06:47	06:47
	20:35	27 20:15 (WTG03)	19:55	17:21	17:21	17:06
Potential sun hours	455	425	374	347	301	292
Total, worst case	1396	84	615	1489		
Sun reduction	0,74	0,73	0,65	0,54		
Oper. time red.	0,78	0,78	0,78	0,78		
Wind dir. red.	0,74	0,74	0,72	0,72		
Total reduction	0,42	0,42	0,36	0,31		
Total, real	591	35	224	457		

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:

**Brunco e Niada**

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04/11/2020 15:45 / 3

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Calculated:  
04/11/2020 13:48/2.8.579

**SHADOW - Calendar**

**Calculation:** Ombre Recettori Rev2Shadow receptor: RE02 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (45)

**Assumptions for shadow calculations**

Reference year for calendar 2020

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	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
134	282	483	550	523	510	295	242	134	107	215	403	778	1.342	591	242	6.831

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

	January	February	March	April	May	June											
1	07:41 17:06	07:30 17:38	06:55 18:12	08:13 (WTG04) 09:11 (WTG04)	07:07 19:44	06:23 20:14	05:56 20:42	49	19:31 (WTG03) 20:20 (WTG03)								
2	07:41 17:07	07:29 17:40	06:54 18:13	08:12 (WTG04) 09:11 (WTG04)	07:05 19:45	06:22 20:15	05:55 20:42	50	19:30 (WTG03) 20:20 (WTG03)								
3	07:42 17:08	07:28 17:41	06:52 18:14	08:11 (WTG04) 09:12 (WTG04)	07:03 19:46	06:20 20:16	05:55 20:43	50	19:31 (WTG03) 20:21 (WTG03)								
4	07:42 17:08	07:27 17:42	06:51 18:15	08:10 (WTG04) 09:11 (WTG04)	07:02 19:47	06:19 20:17	05:54 20:44	51	19:31 (WTG03) 20:22 (WTG03)								
5	07:42 17:09	07:26 17:43	06:49 18:16	08:10 (WTG04) 09:12 (WTG04)	07:00 19:48	06:18 20:18	05:54 20:44	52	19:30 (WTG03) 20:22 (WTG03)								
6	07:42 17:10	07:25 17:44	06:48 18:17	08:10 (WTG04) 09:11 (WTG04)	06:59 19:49	06:17 20:19	05:54 20:45	52	19:31 (WTG03) 20:23 (WTG03)								
7	07:42 17:11	07:24 17:46	06:46 18:18	08:10 (WTG04) 09:11 (WTG04)	06:57 19:50	06:16 20:20	05:54 20:46	52	19:31 (WTG03) 20:23 (WTG03)								
8	07:42 17:12	07:23 17:47	06:45 18:19	08:09 (WTG04) 09:10 (WTG04)	06:56 19:51	06:15 20:21	05:53 20:46	53	19:31 (WTG03) 20:24 (WTG03)								
9	07:42 17:13	07:22 17:48	06:43 18:20	08:08 (WTG04) 09:09 (WTG04)	06:54 19:52	06:13 20:22	05:53 20:47	54	19:31 (WTG03) 20:25 (WTG03)								
10	07:41 17:14	07:21 17:49	06:42 18:22	08:09 (WTG04) 09:09 (WTG04)	06:52 19:53	06:12 20:23	05:53 20:47	53	19:32 (WTG03) 20:25 (WTG03)								
11	07:41 17:15	07:20 17:50	06:40 18:23	08:08 (WTG04) 09:08 (WTG04)	06:51 19:54	06:11 20:23	05:53 20:48	54	19:31 (WTG03) 20:25 (WTG03)								
12	07:41 17:16	07:19 17:51	06:38 18:24	08:09 (WTG04) 09:08 (WTG04)	06:49 19:55	06:10 20:24	05:53 20:48	54	19:31 (WTG03) 20:25 (WTG03)								
13	07:41 17:17	07:18 17:53	06:37 18:25	08:09 (WTG04) 09:07 (WTG04)	06:48 19:56	06:09 20:25	05:53 20:49	55	19:31 (WTG03) 20:26 (WTG03)								
14	07:41 17:18	07:17 17:54	06:35 18:26	08:09 (WTG04) 09:06 (WTG04)	06:46 19:57	06:08 20:26	05:53 20:49	55	19:31 (WTG03) 20:26 (WTG03)								
15	07:40 17:19	07:15 17:55	06:34 18:27	08:09 (WTG04) 09:05 (WTG04)	06:45 19:58	06:07 20:27	05:53 20:50	56	19:31 (WTG03) 20:27 (WTG03)								
16	07:40 17:20	07:14 17:56	06:32 18:28	08:09 (WTG04) 09:03 (WTG04)	06:43 19:59	06:06 20:28	05:53 20:50	55	19:33 (WTG03) 20:28 (WTG03)								
17	07:40 17:21	07:13 17:57	06:31 18:29	08:10 (WTG04) 09:02 (WTG04)	06:42 20:00	06:06 20:29	05:53 20:50	55	19:33 (WTG03) 20:28 (WTG03)								
18	07:39 17:22	07:12 17:58	06:29 18:30	08:10 (WTG04) 09:01 (WTG04)	06:40 20:01	06:05 20:30	05:53 20:51	56	19:33 (WTG03) 20:29 (WTG03)								
19	07:39 17:23	07:10 18:00	06:27 18:31	08:11 (WTG04) 08:59 (WTG04)	06:39 20:02	06:04 20:31	05:53 20:51	56	19:33 (WTG03) 20:29 (WTG03)								
20	07:38 17:24	07:09 18:01	06:26 18:32	08:12 (WTG04) 08:57 (WTG04)	06:38 20:03	06:03 20:32	05:53 20:51	56	19:33 (WTG03) 20:29 (WTG03)								
21	07:38 17:26	07:08 18:02	06:24 18:33	08:13 (WTG04) 08:55 (WTG04)	06:36 20:04	06:02 20:33	05:53 20:52	56	19:33 (WTG03) 20:29 (WTG03)								
22	07:37 17:27	07:06 18:03	06:23 18:34	08:14 (WTG04) 08:54 (WTG04)	06:35 20:05	06:02 20:34	05:53 20:52	56	19:33 (WTG03) 20:29 (WTG03)								
23	07:37 17:28	07:05 18:04	06:21 18:35	08:15 (WTG04) 08:51 (WTG04)	06:33 20:06	06:01 20:34	05:54 20:52	56	19:34 (WTG03) 20:30 (WTG03)								
24	07:36 17:29	07:04 18:05	06:19 18:36	08:17 (WTG04) 08:48 (WTG04)	06:32 20:07	06:00 20:35	05:54 20:52	56	19:34 (WTG03) 20:30 (WTG03)								
25	07:36 17:30	07:02 18:06	06:18 18:37	08:20 (WTG04) 08:45 (WTG04)	06:31 20:08	05:59 20:36	05:54 20:52	55	19:34 (WTG03) 20:29 (WTG03)								
26	07:35 17:31	07:01 18:07	06:16 18:38	08:22 (WTG04) 08:41 (WTG04)	06:29 20:09	05:59 20:37	05:54 20:52	55	19:35 (WTG03) 20:30 (WTG03)								
27	07:34 17:33	07:00 18:09	06:15 18:39	08:30 (WTG04) 08:33 (WTG04)	06:28 20:10	05:58 20:38	05:55 20:52	55	19:35 (WTG03) 20:30 (WTG03)								
28	07:33 17:34	06:58 18:10	06:13 18:40	08:14 (WTG04) 09:11 (WTG04)	06:27 20:11	05:58 20:39	05:55 20:52	56	19:34 (WTG03) 20:30 (WTG03)								
29	07:33 17:35	06:57 18:11	06:11 19:41	08:13 (WTG04) 09:11 (WTG04)	07:11 20:12	05:57 20:39	05:56 20:52	55	19:35 (WTG03) 20:30 (WTG03)								
30	07:32 17:36		07:10 19:42		06:24 20:13	05:57 20:40	05:56 20:52	55	19:35 (WTG03) 20:30 (WTG03)								
31	07:31 17:37		07:08 19:43			05:56 20:41		48	19:31 (WTG03) 20:19 (WTG03)								
Potential sun hours	301	309	370		397	445		448									
Total, worst case		574	1341			733		1623									
Sun reduction		0,47	0,49			0,59		0,66									
Oper. time red.		0,78	0,78			0,78		0,78									
Wind dir. red.		0,73	0,73			0,73		0,73									
Total reduction		0,27	0,28			0,34		0,38									
Total, real		154	376			247		613									

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:

**Brunco e Niada**

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04/11/2020 15:45 / 4

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Calculated:  
04/11/2020 13:48/2.8.579

**SHADOW - Calendar**

**Calculation:** Ombre Recettori Rev2Shadow receptor: RE02 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (45)

**Assumptions for shadow calculations**

Reference year for calendar

2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	05:56	19:36 (WTG03)	06:19	19:58 (WTG03)	06:48	07:21
	20:52	54 20:30 (WTG03)	20:34	16 20:14 (WTG03)	19:53	16:57
2	05:57	19:36 (WTG03)	06:20	20:03 (WTG03)	06:49	07:22
	20:52	54 20:30 (WTG03)	20:33	9 20:12 (WTG03)	19:52	16:57
3	05:57	19:36 (WTG03)	06:21	06:50	07:18	07:23
	20:52	54 20:30 (WTG03)	20:32	19:50	19:02	16:57
4	05:58	19:36 (WTG03)	06:22	06:51	07:19	07:24
	20:52	53 20:29 (WTG03)	20:31	19:49	19:00	16:57
5	05:58	19:37 (WTG03)	06:23	06:52	07:20	07:25
	20:52	53 20:30 (WTG03)	20:30	19:47	18:58	16:57
6	05:59	19:37 (WTG03)	06:24	06:53	07:21	07:26
	20:51	52 20:29 (WTG03)	20:29	19:45	18:57	16:57
7	06:00	19:37 (WTG03)	06:25	06:53	07:22	07:27
	20:51	52 20:29 (WTG03)	20:28	19:44	18:55	16:56
8	06:00	19:37 (WTG03)	06:26	06:54	07:23	07:28
	20:51	51 20:28 (WTG03)	20:27	19:42	18:54	16:56
9	06:01	19:38 (WTG03)	06:26	06:55	07:24	07:29
	20:51	50 20:28 (WTG03)	20:26	19:41	18:52	16:56
10	06:01	19:38 (WTG03)	06:27	06:56	07:25	07:30
	20:50	50 20:28 (WTG03)	20:24	19:39	18:51	16:56
11	06:02	19:38 (WTG03)	06:28	06:57	07:26	07:30
	20:50	49 20:27 (WTG03)	20:23	19:37	18:49	16:57
12	06:03	19:39 (WTG03)	06:29	06:58	07:27	07:31
	20:49	48 20:27 (WTG03)	20:22	19:36	18:47	16:57
13	06:03	19:40 (WTG03)	06:30	06:59	07:28	07:32
	20:49	47 20:27 (WTG03)	20:21	19:34	18:46	16:57
14	06:04	19:39 (WTG03)	06:31	07:00	07:29	07:33
	20:48	47 20:26 (WTG03)	20:19	19:33	18:44	16:57
15	06:05	19:40 (WTG03)	06:32	07:01	07:30	07:34
	20:48	46 20:26 (WTG03)	20:18	19:31	18:43	16:57
16	06:06	19:41 (WTG03)	06:33	07:02	07:31	07:34
	20:47	45 20:26 (WTG03)	20:17	19:29	18:42	16:58
17	06:06	19:40 (WTG03)	06:34	07:03	09:11 (WTG04)	07:35
	20:47	44 20:24 (WTG03)	20:15	19:28	17 09:28 (WTG04)	16:58
18	06:07	19:41 (WTG03)	06:35	07:04	09:07 (WTG04)	07:36
	20:46	43 20:24 (WTG03)	20:14	19:26	25 09:32 (WTG04)	16:58
19	06:08	19:42 (WTG03)	06:36	07:05	09:05 (WTG04)	07:36
	20:45	42 20:24 (WTG03)	20:13	19:24	29 09:34 (WTG04)	16:59
20	06:09	19:43 (WTG03)	06:37	07:06	09:02 (WTG04)	07:37
	20:45	40 20:23 (WTG03)	20:11	19:23	35 09:37 (WTG04)	16:59
21	06:10	19:44 (WTG03)	06:38	07:06	09:00 (WTG04)	07:37
	20:44	39 20:23 (WTG03)	20:10	19:21	38 09:38 (WTG04)	16:59
22	06:10	19:44 (WTG03)	06:39	07:07	08:58 (WTG04)	07:38
	20:43	37 20:21 (WTG03)	20:08	19:19	42 09:40 (WTG04)	17:00
23	06:11	19:45 (WTG03)	06:40	07:08	08:57 (WTG04)	07:38
	20:43	36 20:21 (WTG03)	20:07	19:18	44 09:41 (WTG04)	17:00
24	06:12	19:46 (WTG03)	06:41	07:09	08:55 (WTG04)	07:39
	20:42	34 20:20 (WTG03)	20:05	19:16	48 09:43 (WTG04)	17:01
25	06:13	19:47 (WTG03)	06:41	07:10	08:54 (WTG04)	07:39
	20:41	33 20:20 (WTG03)	20:04	19:14	50 09:44 (WTG04)	17:02
26	06:14	19:48 (WTG03)	06:42	07:11	08:52 (WTG04)	07:40
	20:40	31 20:19 (WTG03)	20:02	19:13	51 09:43 (WTG04)	17:02
27	06:15	19:48 (WTG03)	06:43	07:12	08:51 (WTG04)	07:40
	20:39	30 20:18 (WTG03)	20:01	19:11	53 09:44 (WTG04)	17:03
28	06:16	19:50 (WTG03)	06:44	07:13	08:50 (WTG04)	07:40
	20:38	27 20:17 (WTG03)	19:59	19:10	55 09:45 (WTG04)	17:03
29	06:16	19:51 (WTG03)	06:45	07:14	08:49 (WTG04)	07:41
	20:37	25 20:16 (WTG03)	19:58	19:08	56 09:45 (WTG04)	17:04
30	06:17	19:53 (WTG03)	06:46	07:15	08:48 (WTG04)	07:41
	20:36	22 20:15 (WTG03)	19:56	19:06	58 09:46 (WTG04)	17:05
31	06:18	19:55 (WTG03)	06:47			07:41
	20:35	20 20:15 (WTG03)	19:55			17:06
Potential sun hours	455	425	374	347	301	292
Total, worst case	1308	25	601	1341		
Sun reduction	0,74	0,73	0,65	0,54		
Oper. time red.	0,78	0,78	0,78	0,78		
Wind dir. red.	0,73	0,73	0,73	0,73		
Total reduction	0,42	0,42	0,37	0,31		
Total, real	551	10	222	416		

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:

**Brunco e Niada**

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Calculated:

04/11/2020 13:48/2.8.579

### SHADOW - Calendar

Calculation: Ombre Recettori Rev2Shadow receptor: RE03 - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (46)

#### Assumptions for shadow calculations

Reference year for calendar 2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	
1	07:41 17:06	07:30 17:38	06:55 18:12	07:07 19:44	17:25 (WTG12) 20:14	06:23 18:18 (WTG12)	20:06 (WTG02) 20:20 (WTG02)
2	07:41 17:07	07:29 17:40	06:54 18:13	07:05 19:45	17:26 (WTG12) 20:15	17:49 (WTG12) 20:42	20:05 (WTG02) 20:20 (WTG02)
3	07:41 17:07	07:28 17:41	06:52 18:14	07:03 19:46	17:25 (WTG12) 20:16	17:52 (WTG12) 20:43	20:06 (WTG02) 20:21 (WTG02)
4	07:42 17:08	07:27 17:42	06:51 18:15	07:02 19:47	17:25 (WTG12) 20:17	17:59 (WTG12) 20:44	20:07 (WTG02) 20:22 (WTG02)
5	07:42 17:09	07:26 17:43	06:49 18:16	07:00 19:48	17:25 (WTG12) 20:18	18:04 (WTG12) 20:44	20:06 (WTG02) 20:22 (WTG02)
6	07:42 17:10	07:25 17:44	06:48 18:17	06:59 19:49	17:25 (WTG12) 20:19	06:17 20:45	20:07 (WTG02) 20:23 (WTG02)
7	07:42 17:11	07:24 17:46	06:46 18:18	06:57 19:50	17:25 (WTG12) 20:20	06:16 20:20	20:08 (WTG02) 20:23 (WTG02)
8	07:42 17:12	07:23 17:47	06:45 18:19	06:56 19:51	17:25 (WTG12) 20:21	06:15 20:21	20:08 (WTG02) 20:24 (WTG02)
9	07:42 17:13	07:22 17:48	06:43 18:20	06:54 19:52	17:25 (WTG12) 20:22	06:13 20:22	20:09 (WTG02) 20:25 (WTG02)
10	07:41 17:14	07:21 17:49	06:42 18:21	06:52 19:53	17:25 (WTG12) 20:23	06:12 20:23	20:09 (WTG02) 20:25 (WTG02)
11	07:41 17:15	07:20 17:50	06:40 18:23	06:51 19:54	17:26 (WTG12) 20:23	06:11 20:23	20:09 (WTG02) 20:25 (WTG02)
12	07:41 17:16	07:19 17:51	06:38 18:24	06:49 19:55	17:25 (WTG12) 20:24	06:10 20:24	20:09 (WTG02) 20:26 (WTG02)
13	07:41 17:17	07:18 17:53	06:37 18:25	06:48 19:56	17:26 (WTG12) 20:25	06:09 20:25	20:10 (WTG02) 20:26 (WTG02)
14	07:41 17:18	07:17 17:54	06:35 18:26	06:46 19:57	17:26 (WTG12) 20:26	06:08 20:26	20:10 (WTG02) 20:26 (WTG02)
15	07:40 17:19	07:15 17:55	06:34 18:27	06:45 19:58	17:27 (WTG12) 20:27	06:07 20:27	20:11 (WTG02) 20:27 (WTG02)
16	07:40 17:20	07:14 17:56	06:32 18:28	06:43 19:59	17:28 (WTG12) 20:28	06:06 20:28	20:11 (WTG02) 20:27 (WTG02)
17	07:40 17:21	07:13 17:57	06:31 18:29	06:42 20:00	17:28 (WTG12) 20:29	06:06 20:29	20:12 (WTG02) 20:28 (WTG02)
18	07:39 17:22	07:12 17:58	06:29 18:30	06:40 20:01	17:29 (WTG12) 20:30	06:05 20:30	20:12 (WTG02) 20:29 (WTG02)
19	07:39 17:23	07:10 18:00	06:27 18:31	06:39 20:02	17:30 (WTG12) 20:31	06:04 20:31	20:12 (WTG02) 20:29 (WTG02)
20	07:38 17:24	07:09 18:01	06:26 18:32	06:38 20:03	17:31 (WTG12) 20:32	06:03 20:32	20:13 (WTG02) 20:29 (WTG02)
21	07:38 17:26	07:08 18:02	06:24 18:33	06:36 20:04	17:31 (WTG12) 20:33	06:02 20:33	20:13 (WTG02) 20:29 (WTG02)
22	07:37 17:27	07:06 18:03	06:23 18:34	06:35 20:05	17:32 (WTG12) 20:34	06:01 20:34	20:13 (WTG02) 20:29 (WTG02)
23	07:37 17:28	07:05 18:04	06:21 18:35	06:33 20:06	17:34 (WTG12) 20:34	06:01 20:34	20:14 (WTG02) 20:30 (WTG02)
24	07:36 17:29	07:04 18:05	06:19 18:36	06:32 20:07	17:34 (WTG12) 20:35	06:00 20:35	20:13 (WTG02) 20:30 (WTG02)
25	07:35 17:30	07:02 18:06	06:18 18:37	06:31 20:08	17:36 (WTG12) 20:36	05:59 20:36	20:13 (WTG02) 20:29 (WTG02)
26	07:35 17:31	07:01 18:07	06:16 18:38	06:29 20:09	17:37 (WTG12) 20:37	05:59 20:37	20:14 (WTG02) 20:30 (WTG02)
27	07:34 17:32	07:00 18:09	06:15 18:39	06:28 20:10	17:39 (WTG12) 20:38	05:58 20:38	20:14 (WTG02) 20:30 (WTG02)
28	07:33 17:34	06:58 18:10	06:13 18:40	06:27 20:11	17:40 (WTG12) 20:39	05:58 20:39	20:13 (WTG02) 20:30 (WTG02)
29	07:33 17:35	06:57 18:11	07:11 19:41	06:25 20:12	17:42 (WTG12) 20:39	05:57 20:39	20:14 (WTG02) 20:30 (WTG02)
30	07:32 17:36	07:10 19:42	07:10 19:42	06:24 20:13	17:44 (WTG12) 20:40	05:56 20:40	20:14 (WTG02) 20:30 (WTG02)
31	07:31 17:37	07:08 19:43	07:08 19:43	06:23 20:13	17:46 (WTG12) 20:41	05:56 20:41	20:14 (WTG02) 20:30 (WTG02)
Potential sun hours	301	309	370	397	445	448	479
Total, worst case			1394	2014	240		479
Sun reduction			0,49	0,53	0,59		0,66
Oper. time red.			0,78	0,78	0,78		0,78
Wind dir. red.			0,79	0,79	0,75		0,73
Total reduction			0,30	0,33	0,34		0,38
Total, real			422	655	83		180

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

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

**Brunco e Niada**

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Calculated:  
04/11/2020 13:48/2.8.579

**SHADOW - Calendar**

**Calculation: Ombre Recettori Rev2Shadow receptor: RE03 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (46)**

**Assumptions for shadow calculations**

Reference year for calendar

2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	05:56 20:14 (WTG02)	06:19 20:34 (WTG02)	06:48 19:53	17:25 (WTG12) 19:05	17:31 (WTG12) 18:08 (WTG12)	06:48 17:20
2	05:57 20:14 (WTG02)	06:20 20:33 (WTG02)	06:49 19:52	17:24 (WTG12) 19:03	17:34 (WTG12) 18:05 (WTG12)	06:49 17:19
3	05:57 20:14 (WTG02)	06:21 20:32 (WTG02)	06:50 19:50	17:23 (WTG12) 18:41 (WTG12)	17:38 (WTG12) 18:00 (WTG12)	06:50 17:18
4	05:58 20:14 (WTG02)	06:22 20:31 (WTG02)	06:51 19:49	17:22 (WTG12) 18:41 (WTG12)	17:19 19:00	06:51 17:17
5	05:58 20:14 (WTG02)	06:23 20:30 (WTG02)	06:52 19:47	17:22 (WTG12) 18:41 (WTG12)	17:20 18:58	06:52 17:16
6	05:59 20:13 (WTG02)	06:24 20:29 (WTG02)	06:53 19:45	17:20 (WTG12) 18:40 (WTG12)	17:21 18:57	06:54 17:14
7	06:00 20:14 (WTG02)	06:25 20:29 (WTG02)	06:53 19:44	17:20 (WTG12) 18:40 (WTG12)	17:22 18:55	06:55 17:13
8	06:00 20:13 (WTG02)	06:25 20:28 (WTG02)	06:54 19:42	17:19 (WTG12) 18:40 (WTG12)	17:23 18:54	06:56 17:12
9	06:01 20:13 (WTG02)	06:26 20:27 (WTG02)	06:55 19:41	17:19 (WTG12) 18:39 (WTG12)	17:24 18:52	06:57 17:11
10	06:01 20:14 (WTG02)	06:27 20:26 (WTG02)	06:56 18:06 (WTG12) 19:41	17:19 (WTG12) 18:17 (WTG12) 18:52	17:25 18:39 (WTG12) 18:52	06:58 17:10
11	06:02 20:13 (WTG02)	06:28 20:24 (WTG02)	06:57 18:22 (WTG12) 19:39	17:18 (WTG12) 18:39 (WTG12) 18:51	17:26 18:39 (WTG12) 18:51	06:59 17:10
12	06:03 20:13 (WTG02)	06:29 20:23 (WTG02)	06:58 17:56 (WTG12) 19:37	17:18 (WTG12) 18:38 (WTG12) 18:49	17:27 18:38 (WTG12) 18:49	07:00 17:10
13	06:03 20:13 (WTG02)	06:30 20:23 (WTG02)	06:59 17:54 (WTG12) 19:36	17:18 (WTG12) 18:38 (WTG12) 18:47	17:28 18:38 (WTG12) 18:47	07:02 17:09
14	06:04 20:13 (WTG02)	06:31 20:22 (WTG02)	07:00 18:28 (WTG12) 19:34	17:17 (WTG12) 18:39 (WTG12) 18:46	17:29 18:39 (WTG12) 18:46	07:03 17:08
15	06:05 20:13 (WTG02)	06:32 20:21 (WTG02)	07:01 17:49 (WTG12) 19:32	17:17 (WTG12) 18:39 (WTG12) 18:44	17:30 18:39 (WTG12) 18:44	07:04 17:07
16	06:06 20:13 (WTG02)	06:33 20:19 (WTG02)	07:02 18:30 (WTG12) 19:32	17:17 (WTG12) 18:39 (WTG12) 18:43	17:31 18:39 (WTG12) 18:43	07:05 17:06
17	06:06 20:12 (WTG02)	06:34 20:18 (WTG02)	07:03 17:46 (WTG12) 19:31	17:17 (WTG12) 18:39 (WTG12) 18:43	17:32 18:39 (WTG12) 18:43	07:06 17:05
18	06:07 20:13 (WTG02)	06:35 20:17 (WTG02)	07:04 18:33 (WTG12) 19:29	17:17 (WTG12) 18:39 (WTG12) 18:41	17:33 18:39 (WTG12) 18:41	07:07 17:05
19	06:08 20:13 (WTG02)	06:36 20:16 (WTG02)	07:05 17:42 (WTG12) 19:28	17:18 (WTG12) 18:39 (WTG12) 18:40	17:34 18:39 (WTG12) 18:40	07:08 17:04
20	06:09 20:13 (WTG02)	06:37 20:15 (WTG02)	07:05 17:41 (WTG12) 19:28	17:18 (WTG12) 18:39 (WTG12) 18:40	17:35 18:39 (WTG12) 18:40	07:09 17:04
21	06:10 20:13 (WTG02)	06:38 20:14 (WTG02)	07:06 18:37 (WTG12) 19:27	17:19 (WTG12) 18:39 (WTG12) 18:40	17:36 18:39 (WTG12) 18:40	07:11 17:03
22	06:10 20:13 (WTG02)	06:39 20:13 (WTG02)	07:07 18:37 (WTG12) 19:27	17:19 (WTG12) 18:39 (WTG12) 18:40	17:37 18:39 (WTG12) 18:40	07:12 17:03
23	06:11 20:13 (WTG02)	06:40 20:12 (WTG02)	07:08 18:36 (WTG12) 19:26	17:20 (WTG12) 18:39 (WTG12) 18:40	17:38 18:39 (WTG12) 18:40	07:13 17:03
24	06:12 20:13 (WTG02)	06:40 20:11 (WTG02)	07:09 18:35 (WTG12) 19:26	17:21 (WTG12) 18:39 (WTG12) 18:40	17:39 18:39 (WTG12) 18:40	07:14 17:03
25	06:12 20:14 (WTG02)	06:41 20:10 (WTG02)	07:10 18:34 (WTG12) 19:25	17:22 (WTG12) 18:39 (WTG12) 18:40	17:40 18:39 (WTG12) 18:40	07:15 17:03
26	06:14 20:14 (WTG02)	06:42 20:09 (WTG02)	07:11 18:33 (WTG12) 19:25	17:22 (WTG12) 18:39 (WTG12) 18:40	17:41 18:39 (WTG12) 18:40	07:16 17:03
27	06:15 20:13 (WTG02)	06:43 20:08 (WTG02)	07:12 18:32 (WTG12) 19:24	17:23 (WTG12) 18:39 (WTG12) 18:40	17:42 18:39 (WTG12) 18:40	07:17 17:03
28	06:16 20:14 (WTG02)	06:44 20:07 (WTG02)	07:13 18:31 (WTG12) 19:23	17:25 (WTG12) 18:39 (WTG12) 18:40	17:44 18:39 (WTG12) 18:40	07:18 17:03
29	06:16 20:14 (WTG02)	06:45 20:06 (WTG02)	07:14 18:30 (WTG12) 19:22	17:26 (WTG12) 18:39 (WTG12) 18:40	17:45 18:39 (WTG12) 18:40	07:19 17:03
30	06:17 20:16 (WTG02)	06:46 19:58 (WTG02)	07:15 18:29 (WTG12) 19:21	17:26 (WTG12) 18:39 (WTG12) 18:40	17:46 18:39 (WTG12) 18:40	07:20 17:03
31	06:18 20:16 (WTG02)	06:47 19:57 (WTG02)	07:16 18:28 (WTG12) 19:20	17:28 (WTG12) 18:39 (WTG12) 18:40	17:47 18:39 (WTG12) 18:40	07:21 17:03
Potential sun hours	455	425	374	347	301	292
Total, worst case	333	1243	2201	90		
Sun reduction	0,74	0,73	0,65	0,54		
Oper. time red.	0,78	0,78	0,78	0,78		
Wind dir. red.	0,73	0,79	0,79	0,79		
Total reduction	0,42	0,45	0,40	0,33		
Total, real	140	559	876	30		

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:

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Calculated:  
04/11/2020 13:48/2.8.579

**SHADOW - Calendar**

Calculation: Ombre Recettori Rev2Shadow receptor: RE04 - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (47)

**Assumptions for shadow calculations**

Reference year for calendar

2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June		
1	07:41 17:06	07:30 17:38	06:55 18:12	08:10 (WTG04) 09:04 (WTG04)	07:07 19:44	06:23 20:14	05:56 20:42	19:33 (WTG03) 47 20:20 (WTG03)
2	07:41 17:07	07:29 17:40	06:54 18:13	08:09 (WTG04) 09:04 (WTG04)	07:05 19:45	06:22 20:15	05:55 20:42	19:32 (WTG03) 48 20:20 (WTG03)
3	07:42 17:08	07:28 17:41	06:52 18:14	08:09 (WTG04) 09:05 (WTG04)	07:03 19:46	06:20 20:16	05:55 20:43	19:32 (WTG03) 49 20:21 (WTG03)
4	07:42 17:08	07:27 17:42	06:51 18:15	08:07 (WTG04) 09:05 (WTG04)	07:02 19:47	06:19 20:17	05:54 20:44	19:32 (WTG03) 50 20:22 (WTG03)
5	07:42 17:09	07:26 17:43	06:49 18:16	08:07 (WTG04) 09:05 (WTG04)	07:00 19:48	06:18 20:18	05:54 20:44	19:32 (WTG03) 50 20:22 (WTG03)
6	07:42 17:10	07:26 17:44	06:48 18:17	08:06 (WTG04) 09:05 (WTG04)	06:59 19:49	06:17 20:19	05:54 20:45	19:32 (WTG03) 51 20:23 (WTG03)
7	07:42 17:11	07:24 17:46	06:46 18:18	08:06 (WTG04) 09:05 (WTG04)	06:57 19:50	06:16 20:20	05:54 20:46	19:32 (WTG03) 51 20:23 (WTG03)
8	07:42 17:12	07:23 17:47	06:45 18:19	08:06 (WTG04) 09:04 (WTG04)	06:56 19:51	06:15 20:21	05:53 20:46	19:32 (WTG03) 52 20:24 (WTG03)
9	07:42 17:13	07:22 17:48	06:43 18:20	08:05 (WTG04) 09:03 (WTG04)	06:54 19:52	06:13 20:22	05:53 20:47	19:32 (WTG03) 53 20:25 (WTG03)
10	07:41 17:14	07:21 17:49	06:42 18:22	08:05 (WTG04) 09:03 (WTG04)	06:52 19:53	06:12 20:23	05:53 20:47	19:33 (WTG03) 52 20:25 (WTG03)
11	07:41 17:15	07:20 17:50	06:40 18:23	08:05 (WTG04) 09:02 (WTG04)	06:51 19:54	06:11 20:23	05:53 20:48	19:32 (WTG03) 53 20:25 (WTG03)
12	07:41 17:16	07:19 17:51	06:38 18:24	08:05 (WTG04) 09:02 (WTG04)	06:49 19:55	06:10 20:24	05:53 20:48	19:32 (WTG03) 53 20:25 (WTG03)
13	07:41 17:17	07:18 17:53	06:37 18:25	08:05 (WTG04) 09:01 (WTG04)	06:48 19:56	06:09 20:25	05:53 20:49	19:32 (WTG03) 54 20:26 (WTG03)
14	07:41 17:18	07:17 17:54	06:35 18:26	08:05 (WTG04) 09:01 (WTG04)	06:46 19:57	06:08 20:26	05:53 20:49	19:32 (WTG03) 54 20:26 (WTG03)
15	07:40 17:19	07:15 17:55	06:34 18:27	08:05 (WTG04) 08:59 (WTG04)	06:45 19:58	06:07 20:27	05:53 20:50	19:32 (WTG03) 55 20:27 (WTG03)
16	07:40 17:20	07:14 17:56	06:32 18:28	08:05 (WTG04) 08:58 (WTG04)	06:43 19:59	06:06 20:28	05:53 20:50	19:33 (WTG03) 55 20:28 (WTG03)
17	07:40 17:21	07:13 17:57	06:31 18:29	08:06 (WTG04) 08:57 (WTG04)	06:42 20:00	06:06 20:29	05:53 20:50	19:33 (WTG03) 55 20:28 (WTG03)
18	07:39 17:22	07:12 17:58	06:29 18:30	08:06 (WTG04) 08:56 (WTG04)	06:40 20:01	06:05 20:30	05:53 20:51	19:33 (WTG03) 56 20:29 (WTG03)
19	07:39 17:23	07:10 18:00	06:27 18:31	08:06 (WTG04) 08:54 (WTG04)	06:39 20:02	06:04 20:31	05:53 20:51	19:33 (WTG03) 56 20:29 (WTG03)
20	07:38 17:24	07:09 18:01	06:26 18:32	08:07 (WTG04) 08:53 (WTG04)	06:38 20:03	06:03 20:32	05:53 20:51	19:33 (WTG03) 56 20:29 (WTG03)
21	07:38 17:26	07:08 18:02	06:24 18:33	08:24 (WTG04) 08:51 (WTG04)	06:24 20:04	06:02 20:33	05:53 20:52	19:33 (WTG03) 56 20:29 (WTG03)
22	07:37 17:27	07:06 18:03	06:23 18:34	08:21 (WTG04) 08:50 (WTG04)	06:23 20:05	06:02 20:34	05:53 20:52	19:33 (WTG03) 56 20:29 (WTG03)
23	07:37 17:28	07:05 18:04	06:21 18:35	08:19 (WTG04) 08:47 (WTG04)	06:21 20:06	06:01 20:34	05:54 20:52	19:34 (WTG03) 56 20:30 (WTG03)
24	07:36 17:29	07:04 18:05	06:19 18:36	08:18 (WTG04) 08:44 (WTG04)	06:20 20:07	06:00 20:35	05:54 20:52	19:34 (WTG03) 56 20:30 (WTG03)
25	07:36 17:30	07:02 18:06	06:18 18:37	08:16 (WTG04) 08:41 (WTG04)	06:31 20:08	05:59 20:36	05:54 20:52	19:34 (WTG03) 55 20:29 (WTG03)
26	07:35 17:31	07:01 18:08	06:16 18:38	08:15 (WTG04) 08:38 (WTG04)	06:29 20:09	05:59 20:37	05:54 20:52	19:35 (WTG03) 55 20:30 (WTG03)
27	07:34 17:33	07:00 18:09	06:15 18:39	08:13 (WTG04) 08:33 (WTG04)	06:28 20:10	05:58 20:38	05:55 20:52	19:35 (WTG03) 55 20:30 (WTG03)
28	07:33 17:34	06:58 18:10	06:13 18:40	08:12 (WTG04) 09:03 (WTG04)	06:27 20:11	05:58 20:39	05:55 20:52	19:35 (WTG03) 55 20:30 (WTG03)
29	07:33 17:35	06:57 18:11	06:11 19:41	08:11 (WTG04) 09:03 (WTG04)	07:11 20:12	05:57 20:39	05:56 20:52	19:36 (WTG03) 54 20:30 (WTG03)
30	07:32 17:36		07:10 19:42		06:24 20:13	05:57 20:40	05:56 20:52	19:36 (WTG03) 54 20:30 (WTG03)
31	07:31 17:37		07:08 19:43			05:56 20:41	19:33 (WTG03) 20:19 (WTG03)	
Potential sun hours	301	309	370		397	445	448	
Total, worst case		426	1313			572	1602	
Sun reduction		0,47	0,49			0,59	0,66	
Oper. time red.		0,78	0,78			0,78	0,78	
Wind dir. red.		0,74	0,74			0,73	0,73	
Total reduction		0,27	0,28			0,33	0,38	
Total, real		116	372			191	602	

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

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

**Brunco e Niada**

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04/11/2020 15:45 / 8

Licensed user:

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Calculated:

04/11/2020 13:48/2.8.579

### SHADOW - Calendar

Calculation: Ombre Recettori Rev2Shadow receptor: RE04 - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (47)

#### Assumptions for shadow calculations

Reference year for calendar

2020

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	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
134	282	483	550	523	510	295	242	134	107	215	403	778	1.342	591	242	6.831

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

	July	August	September	October	November	December			
1	05:56	19:37 (WTG03)	06:19	06:48	07:16	08:44 (WTG04)	06:48	07:21	
	20:52	53 20:30 (WTG03)	20:34	19:53	19:05	57 09:41 (WTG04)	17:20	16:57	
2	05:57	19:37 (WTG03)	06:20	06:49	07:17	08:43 (WTG04)	06:49	07:22	
	20:52	53 20:30 (WTG03)	20:33	19:52	19:03	58 09:41 (WTG04)	17:19	16:57	
3	05:57	19:37 (WTG03)	06:21	06:50	07:18	08:43 (WTG04)	06:50	07:23	
	20:52	53 20:30 (WTG03)	20:32	19:50	19:02	58 09:41 (WTG04)	17:18	16:57	
4	05:58	19:37 (WTG03)	06:22	06:51	07:19	08:42 (WTG04)	06:51	07:24	
	20:52	52 20:29 (WTG03)	20:31	19:49	19:00	59 09:41 (WTG04)	17:17	16:57	
5	05:58	19:38 (WTG03)	06:23	06:52	07:20	08:42 (WTG04)	06:52	07:25	
	20:52	52 20:30 (WTG03)	20:30	19:47	18:58	59 09:41 (WTG04)	17:16	16:57	
6	05:59	19:38 (WTG03)	06:24	06:53	07:21	08:42 (WTG04)	06:54	07:26	
	20:51	51 20:29 (WTG03)	20:29	19:45	18:57	59 09:41 (WTG04)	17:15	16:57	
7	06:00	19:39 (WTG03)	06:25	06:53	07:22	08:42 (WTG04)	06:55	07:27	
	20:51	50 20:29 (WTG03)	20:28	19:44	18:55	58 09:40 (WTG04)	17:13	16:56	
8	06:00	19:39 (WTG03)	06:26	06:54	07:23	08:42 (WTG04)	06:56	07:28	
	20:51	49 20:28 (WTG03)	20:27	19:42	18:54	58 09:40 (WTG04)	17:12	16:56	
9	06:01	19:39 (WTG03)	06:26	06:55	07:24	08:42 (WTG04)	06:57	07:29	
	20:51	49 20:28 (WTG03)	20:26	19:41	18:52	57 09:39 (WTG04)	17:11	16:56	
10	06:01	19:40 (WTG03)	06:27	06:56	07:25	08:42 (WTG04)	06:58	07:30	
	20:50	48 20:28 (WTG03)	20:24	19:39	18:51	57 09:39 (WTG04)	17:10	16:56	
11	06:02	19:40 (WTG03)	06:28	06:57	07:26	08:42 (WTG04)	06:59	07:30	
	20:50	47 20:27 (WTG03)	20:23	19:37	18:49	56 09:38 (WTG04)	17:10	16:57	
12	06:03	19:41 (WTG03)	06:29	06:58	07:27	08:43 (WTG04)	07:00	07:31	
	20:49	46 20:27 (WTG03)	20:22	19:36	18:47	54 09:37 (WTG04)	17:09	16:57	
13	06:03	19:42 (WTG03)	06:30	06:59	07:28	08:43 (WTG04)	07:02	07:32	
	20:49	45 20:27 (WTG03)	20:21	19:34	18:46	54 09:37 (WTG04)	17:08	16:57	
14	06:04	19:42 (WTG03)	06:31	07:00	07:29	08:44 (WTG04)	07:03	07:33	
	20:48	44 20:26 (WTG03)	20:19	19:33	18:44	53 09:37 (WTG04)	17:07	16:57	
15	06:05	19:43 (WTG03)	06:32	07:01	07:30	08:45 (WTG04)	07:04	07:34	
	20:48	43 20:26 (WTG03)	20:18	19:31	18:43	50 09:35 (WTG04)	17:06	16:57	
16	06:06	19:44 (WTG03)	06:33	07:02	09:11 (WTG04)	07:31	08:46 (WTG04)	07:05	07:34
	20:47	42 20:26 (WTG03)	20:17	19:29	9 09:20 (WTG04)	18:42	48 09:34 (WTG04)	17:05	16:58
17	06:06	19:44 (WTG03)	06:34	07:03	09:05 (WTG04)	07:32	08:47 (WTG04)	07:06	07:35
	20:47	40 20:24 (WTG03)	20:15	19:28	20 09:25 (WTG04)	18:40	46 09:33 (WTG04)	17:05	16:58
18	06:07	19:45 (WTG03)	06:35	07:04	09:02 (WTG04)	07:33	08:48 (WTG04)	07:07	07:36
	20:46	39 20:24 (WTG03)	20:14	19:26	26 09:28 (WTG04)	18:39	43 09:31 (WTG04)	17:04	16:58
19	06:08	19:46 (WTG03)	06:36	07:05	08:59 (WTG04)	07:34	08:49 (WTG04)	07:08	07:36
	20:45	38 20:24 (WTG03)	20:13	19:24	32 09:31 (WTG04)	18:37	40 09:29 (WTG04)	17:03	16:59
20	06:09	19:47 (WTG03)	06:37	07:06	08:57 (WTG04)	07:35	08:50 (WTG04)	07:09	07:37
	20:45	36 20:23 (WTG03)	20:11	19:23	35 09:32 (WTG04)	18:36	38 09:28 (WTG04)	17:02	16:59
21	06:10	19:48 (WTG03)	06:38	07:06	08:55 (WTG04)	07:36	08:52 (WTG04)	07:11	07:37
	20:44	35 20:23 (WTG03)	20:10	19:21	39 09:34 (WTG04)	18:34	33 09:25 (WTG04)	17:02	16:59
22	06:10	19:48 (WTG03)	06:39	07:07	08:54 (WTG04)	07:37	08:54 (WTG04)	07:12	07:38
	20:43	33 20:21 (WTG03)	20:08	19:19	41 09:35 (WTG04)	18:33	29 09:23 (WTG04)	17:01	17:00
23	06:11	19:50 (WTG03)	06:40	07:08	08:52 (WTG04)	07:38	08:58 (WTG04)	07:13	07:38
	20:43	31 20:21 (WTG03)	20:07	19:18	45 09:37 (WTG04)	18:32	22 09:20 (WTG04)	17:01	17:00
24	06:12	19:51 (WTG03)	06:41	07:09	08:51 (WTG04)	07:39	09:03 (WTG04)	07:14	07:39
	20:42	29 20:20 (WTG03)	20:05	19:16	47 09:38 (WTG04)	18:30	12 09:15 (WTG04)	17:00	17:01
25	06:13	19:53 (WTG03)	06:41	07:10	08:50 (WTG04)	06:40	07:15	07:39	17:01
	20:41	27 20:20 (WTG03)	20:04	19:14	49 09:39 (WTG04)	17:29	17:00	17:02	17:02
26	06:14	19:55 (WTG03)	06:42	07:11	08:48 (WTG04)	06:41	07:16	07:40	17:02
	20:40	24 20:19 (WTG03)	20:02	19:13	50 09:38 (WTG04)	17:28	16:59	17:02	17:02
27	06:15	19:56 (WTG03)	06:43	07:12	08:47 (WTG04)	06:42	07:17	07:40	17:02
	20:39	22 20:18 (WTG03)	20:01	19:11	52 09:39 (WTG04)	17:26	16:59	17:03	17:03
28	06:16	20:00 (WTG03)	06:44	07:13	08:46 (WTG04)	06:44	07:18	07:40	17:03
	20:38	16 20:16 (WTG03)	19:59	19:10	54 09:40 (WTG04)	17:25	16:58	17:03	17:03
29	06:16	20:06 (WTG03)	06:45	07:14	08:45 (WTG04)	06:45	07:19	07:41	17:03
	20:37	4 20:10 (WTG03)	19:58	19:08	55 09:40 (WTG04)	17:24	16:58	17:04	17:04
30	06:17	19:56 (WTG03)	06:46	07:15	08:44 (WTG04)	06:46	07:20	07:41	17:04
	20:36	19:56 (WTG03)	19:06	56 09:40 (WTG04)	17:23	16:58	17:05	17:05	17:05
31	06:18	19:56 (WTG03)	06:47	07:16	08:44 (WTG04)	06:47	07:21	07:41	17:05
	20:35	19:55 (WTG03)	19:06	56 09:40 (WTG04)	17:23	16:58	17:05	17:05	17:05
Potential sun hours	455	425	374	347	301	292			
Total, worst case	1151		610	1158					
Sun reduction	0,74		0,65	0,54					
Oper. time red.	0,78		0,78	0,78					
Wind dir. red.	0,73		0,74	0,74					
Total reduction	0,42		0,37	0,31					
Total, real	482		227	362					

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:

**Brunco e Niada**

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04/11/2020 15:45 / 10

Licensed user:

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Calculated:  
04/11/2020 13:48/2.8.579

**SHADOW - Calendar**

**Calculation: Ombre Recettori Rev2Shadow receptor: RE05 - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (48)**

**Assumptions for shadow calculations**

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

Reference year for calendar 2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	05:56 20:52	06:49 (WTG09) 07:19 (WTG09)	06:19 20:34	06:48 19:53	18:29 (WTG14) 19:05	07:16 19:05
2	05:57 20:52	06:48 (WTG09) 07:19 (WTG09)	06:20 20:33	06:49 19:52	18:29 (WTG14) 19:03	07:17 19:03
3	05:57 20:52	06:49 (WTG09) 07:20 (WTG09)	06:21 20:32	06:50 19:50	18:28 (WTG14) 19:02	07:18 19:02
4	05:58 20:52	06:48 (WTG09) 07:20 (WTG09)	06:22 20:31	06:51 19:49	18:28 (WTG14) 19:00	07:19 19:00
5	05:58 20:52	06:48 (WTG09) 07:21 (WTG09)	06:23 20:30	06:52 19:47	18:28 (WTG14) 18:58	07:20 17:16
6	05:59 20:51	06:48 (WTG09) 07:20 (WTG09)	06:24 20:29	06:53 19:45	18:26 (WTG14) 18:57	07:21 17:15
7	06:00 20:51	06:48 (WTG09) 07:21 (WTG09)	06:25 20:28	06:54 19:44	18:26 (WTG14) 18:55	07:22 17:14
8	06:00 20:51	06:48 (WTG09) 07:21 (WTG09)	06:26 20:27	06:54 19:42	18:26 (WTG14) 18:54	07:23 17:12
9	06:01 20:51	06:48 (WTG09) 07:22 (WTG09)	06:27 20:26	06:55 19:41	18:27 (WTG14) 18:52	07:24 17:11
10	06:01 20:50	06:48 (WTG09) 07:23 (WTG09)	06:27 20:24	06:56 19:39	18:27 (WTG14) 18:51	07:25 17:11
11	06:02 20:50	06:48 (WTG09) 07:23 (WTG09)	06:28 20:23	06:57 19:37	18:27 (WTG14) 18:49	07:26 17:10
12	06:03 20:49	06:48 (WTG09) 07:23 (WTG09)	06:29 20:22	06:58 19:36	18:28 (WTG14) 18:48	07:27 17:09
13	06:04 20:49	06:48 (WTG09) 07:24 (WTG09)	06:30 20:21	06:59 19:34	18:28 (WTG14) 18:46	07:28 17:08
14	06:04 20:48	06:47 (WTG09) 07:24 (WTG09)	06:31 20:19	07:00 19:33	18:29 (WTG14) 18:45	07:29 17:07
15	06:05 20:48	06:47 (WTG09) 07:24 (WTG09)	06:32 20:18	07:01 19:31	18:29 (WTG14) 18:43	07:30 17:06
16	06:06 20:47	06:48 (WTG09) 07:25 (WTG09)	06:33 20:17	07:02 19:29	18:30 (WTG14) 18:42	07:31 17:05
17	06:06 20:47	06:48 (WTG09) 07:25 (WTG09)	06:34 20:15	07:03 19:28	18:31 (WTG14) 18:40	07:32 17:05
18	06:07 20:46	06:47 (WTG09) 07:25 (WTG09)	06:35 20:14	07:04 19:26	18:31 (WTG14) 18:39	07:33 17:04
19	06:08 20:45	06:47 (WTG09) 07:25 (WTG09)	06:36 20:13	07:05 19:24	18:32 (WTG14) 18:37	07:34 17:03
20	06:09 20:45	06:48 (WTG09) 07:26 (WTG09)	06:37 20:11	07:06 19:23	18:33 (WTG14) 18:36	07:35 17:02
21	06:10 20:44	06:48 (WTG09) 07:26 (WTG09)	06:38 20:10	07:06 19:21	18:34 (WTG14) 18:34	07:36 17:02
22	06:10 20:43	06:47 (WTG09) 07:25 (WTG09)	06:39 20:08	07:07 19:19	18:35 (WTG14) 18:33	07:37 17:01
23	06:11 20:43	06:47 (WTG09) 07:26 (WTG09)	06:40 20:07	07:08 19:18	18:36 (WTG14) 18:32	07:38 17:01
24	06:12 20:42	06:48 (WTG09) 07:26 (WTG09)	06:41 20:05	07:09 19:16	18:37 (WTG14) 18:30	07:39 17:00
25	06:13 20:41	06:48 (WTG09) 07:26 (WTG09)	06:41 20:04	07:10 19:15	18:38 (WTG14) 18:29	07:40 17:00
26	06:14 20:40	06:48 (WTG09) 07:26 (WTG09)	06:42 20:02	07:11 19:13	18:39 (WTG14) 18:28	07:41 16:59
27	06:15 20:39	06:48 (WTG09) 07:25 (WTG09)	06:43 20:01	07:12 19:11	18:40 (WTG14) 18:27	07:42 16:59
28	06:16 20:38	06:48 (WTG09) 07:25 (WTG09)	06:44 19:59	07:13 19:10	18:41 (WTG14) 18:26	07:43 16:58
29	06:16 20:37	06:49 (WTG09) 07:25 (WTG09)	06:45 19:58	07:14 19:08	18:42 (WTG14) 18:25	07:44 16:58
30	06:17 20:36	06:49 (WTG09) 07:24 (WTG09)	06:46 19:56	07:15 19:06	18:43 (WTG14) 18:24	07:45 16:58
31	06:18 20:35	06:50 (WTG09) 07:24 (WTG09)	06:47 19:55	07:16 19:21	18:44 (WTG14) 18:23	07:46 16:58
Potential sun hours	455	425	374	347	301	292
Total, worst case	1099	810	1564	3323	3280	2795
Sun reduction	0,74	0,73	0,65	0,54	0,50	0,45
Oper. time red.	0,78	0,78	0,78	0,78	0,78	0,78
Wind dir. red.	0,77	0,78	0,77	0,69	0,68	0,68
Total reduction	0,44	0,44	0,38	0,29	0,27	0,24
Total, real	483	360	602	970	878	671

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:

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Calculated:

04/11/2020 13:48/2.8.579

### SHADOW - Calendar

Calculation: Ombre Recettori Rev2Shadow receptor: RE06 - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (49)

#### Assumptions for shadow calculations

Reference year for calendar 2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	07:41 17:06	07:30 17:38	06:55 18:12	07:07 19:44	06:23 20:14	07:16 (WTG05) 05:56 18:19 (WTG13) 20:42
2	07:41 17:07	07:29 17:40	06:54 18:13	07:05 19:45	06:22 20:15	69 07:16 (WTG05) 05:55 18:19 (WTG13) 20:42
3	07:41 17:08	07:28 17:41	06:52 18:14	07:03 19:46	06:20 20:16	77 07:16 (WTG05) 05:55 18:19 (WTG13) 20:42
4	07:42 17:08	07:27 17:42	06:51 18:15	07:02 19:47	06:19 20:17	81 07:16 (WTG05) 05:54 18:19 (WTG13) 20:43
5	07:42 17:09	07:26 17:43	06:49 18:16	07:00 19:48	06:18 20:18	85 19:28 (WTG13) 20:44 07:17 (WTG05) 05:54
6	07:42 17:10	07:25 17:44	06:48 18:17	06:59 19:49	06:17 20:19	88 19:31 (WTG13) 20:44 07:18 (WTG05) 05:54
7	07:42 17:11	07:24 17:46	06:46 18:18	06:57 19:50	06:16 20:20	89 19:32 (WTG13) 20:45 07:19 (WTG05) 05:54
8	07:42 17:12	07:23 17:47	06:45 18:19	06:56 19:51	06:15 20:21	91 19:34 (WTG13) 20:46 07:20 (WTG05) 05:53
9	07:42 17:13	07:22 17:48	06:43 18:20	06:54 19:52	06:13 20:22	92 19:36 (WTG13) 20:46 07:21 (WTG05) 05:53
10	07:41 17:14	07:21 17:49	06:42 18:22	06:52 19:53	06:12 20:23	93 19:37 (WTG13) 20:47 07:22 (WTG05) 05:53
11	07:41 17:15	07:20 17:50	06:40 18:23	06:51 19:54	06:11 20:23	100 19:52 (WTG14) 20:47 07:23 (WTG05) 05:53
12	07:41 17:16	07:19 17:51	06:38 18:24	06:49 19:55	06:10 20:24	108 19:56 (WTG14) 20:48 07:25 (WTG05) 05:53
13	07:41 17:17	07:18 17:53	06:37 18:25	06:48 19:56	06:09 20:25	109 19:58 (WTG14) 20:48 07:28 (WTG05) 05:53
14	07:41 17:18	07:17 17:54	06:35 18:26	06:46 19:57	06:08 20:26	106 20:00 (WTG14) 20:49 18:25 (WTG13) 05:53
15	07:40 17:19	07:15 17:55	06:34 18:27	06:45 19:58	06:07 20:27	97 20:02 (WTG14) 20:49 18:24 (WTG13) 05:53
16	07:40 17:20	07:14 17:56	06:32 18:28	06:43 19:59	06:07 20:28	99 20:03 (WTG14) 20:50 18:24 (WTG13) 05:53
17	07:40 17:21	07:13 17:57	06:31 18:29	06:42 20:00	06:06 20:29	100 20:04 (WTG14) 20:50 18:24 (WTG13) 05:53
18	07:39 17:22	07:12 17:58	06:29 18:30	06:41 20:01	06:05 20:30	101 20:05 (WTG14) 20:50 18:23 (WTG13) 05:53
19	07:39 17:23	07:11 18:00	06:27 18:31	06:39 20:02	06:04 20:31	103 20:06 (WTG14) 20:51 18:22 (WTG13) 05:53
20	07:38 17:25	07:09 18:01	06:26 18:32	06:38 20:03	06:03 20:32	104 20:06 (WTG14) 20:51 18:21 (WTG13) 05:53
21	07:38 17:26	07:08 18:02	06:24 18:33	06:36 20:04	06:02 20:33	106 20:07 (WTG14) 20:51 18:22 (WTG13) 05:53
22	07:37 17:27	07:06 18:03	06:23 18:34	06:35 20:05	06:02 20:34	107 20:08 (WTG14) 20:52 18:21 (WTG13) 05:53
23	07:37 17:28	07:05 18:04	06:21 18:35	06:33 20:06	06:01 20:34	109 20:09 (WTG14) 20:52 18:20 (WTG13) 05:54
24	07:36 17:29	07:04 18:05	06:19 18:36	06:32 20:07	06:00 20:35	106 20:10 (WTG14) 20:52 18:21 (WTG13) 05:54
25	07:35 17:30	07:02 18:06	06:18 18:37	06:31 20:08	05:59 20:36	109 20:10 (WTG14) 20:52 18:20 (WTG13) 05:54
26	07:35 17:31	07:01 18:08	06:16 18:38	06:29 20:09	05:59 20:37	110 20:10 (WTG14) 20:52 18:20 (WTG13) 05:54
27	07:34 17:33	07:00 18:09	06:15 18:39	06:28 20:10	05:58 20:38	111 20:11 (WTG14) 20:52 18:20 (WTG13) 05:55
28	07:33 17:34	06:58 18:10	06:13 18:40	06:27 20:11	05:58 20:39	111 20:11 (WTG14) 20:52 18:19 (WTG13) 05:55
29	07:33 17:35	06:57 18:11	07:11 19:41	06:25 20:12	05:57 20:39	111 20:10 (WTG14) 20:52 18:19 (WTG13) 05:56
30	07:32 17:36	07:10 19:42	06:24 20:13	06:24 20:13	05:57 20:40	112 20:11 (WTG14) 20:52 18:20 (WTG13) 05:56
31	07:31 17:37	07:08 19:43	07:08 19:43	07:08 19:43	05:56 20:41	112 20:12 (WTG14) 20:52 18:19 (WTG13) 05:56
Potential sun hours	301	309	370	397	444	448
Total, worst case				700	3109	3428
Sun reduction				0,53	0,59	0,66
Oper. time red.				0,78	0,78	0,78
Wind dir. red.				0,79	0,76	0,75
Total reduction				0,32	0,35	0,39
Total, real				227	1080	1327

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:

**Brunco e Niada**

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Calculated:  
04/11/2020 13:48/2.8.579

**SHADOW - Calendar**

**Calculation:** Ombre Recettori Rev2Shadow receptor: RE06 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (49)

**Assumptions for shadow calculations**

Reference year for calendar

2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	05:56	18:24 (WTG13)	06:19	07:35 (WTG05)	06:48	07:16
	20:52	115 20:19 (WTG14)	20:34	109 20:08 (WTG14)	19:53	19:05
2	05:57	18:24 (WTG13)	06:20	07:33 (WTG05)	06:49	07:17
	20:52	114 20:18 (WTG14)	20:33	107 20:06 (WTG14)	19:52	19:03
3	05:57	18:25 (WTG13)	06:21	07:31 (WTG05)	06:50	07:18
	20:52	114 20:19 (WTG14)	20:32	93 19:47 (WTG13)	19:50	19:02
4	05:58	18:25 (WTG13)	06:22	07:30 (WTG05)	06:51	07:19
	20:52	114 20:19 (WTG14)	20:31	93 19:46 (WTG13)	19:49	19:00
5	05:58	18:25 (WTG13)	06:23	07:29 (WTG05)	06:52	07:20
	20:52	114 20:19 (WTG14)	20:30	92 19:45 (WTG13)	19:47	18:58
6	05:59	18:25 (WTG13)	06:24	07:28 (WTG05)	06:53	07:21
	20:51	114 20:19 (WTG14)	20:29	91 19:43 (WTG13)	19:45	18:57
7	06:00	18:26 (WTG13)	06:25	07:27 (WTG05)	06:54	07:22
	20:51	114 20:20 (WTG14)	20:28	89 19:41 (WTG13)	19:44	18:55
8	06:00	18:26 (WTG13)	06:26	07:26 (WTG05)	06:54	07:23
	20:51	113 20:19 (WTG14)	20:27	88 19:40 (WTG13)	19:42	18:54
9	06:01	18:26 (WTG13)	06:27	07:26 (WTG05)	06:55	07:24
	20:51	114 20:20 (WTG14)	20:26	84 19:37 (WTG13)	19:41	18:52
10	06:01	18:27 (WTG13)	06:27	07:25 (WTG05)	06:56	07:25
	20:50	113 20:20 (WTG14)	20:24	80 19:35 (WTG13)	19:39	18:51
11	06:02	18:27 (WTG13)	06:28	07:25 (WTG05)	06:57	07:26
	20:50	113 20:20 (WTG14)	20:23	75 19:32 (WTG13)	19:37	18:49
12	06:03	18:27 (WTG13)	06:29	07:23 (WTG05)	06:58	07:27
	20:49	113 20:20 (WTG14)	20:22	68 19:27 (WTG13)	19:36	18:48
13	06:04	18:28 (WTG13)	06:30	07:23 (WTG05)	06:59	07:28
	20:49	112 20:20 (WTG14)	20:21	57 19:21 (WTG13)	19:34	18:46
14	06:04	18:27 (WTG13)	06:31	07:22 (WTG05)	07:00	07:29
	20:48	113 20:20 (WTG14)	20:19	42 08:04 (WTG05)	19:33	18:45
15	06:05	18:28 (WTG13)	06:32	07:22 (WTG05)	07:01	07:30
	20:48	112 20:20 (WTG14)	20:18	42 08:04 (WTG05)	19:31	18:43
16	06:06	18:29 (WTG13)	06:33	07:22 (WTG05)	07:02	07:31
	20:47	111 20:20 (WTG14)	20:17	42 08:04 (WTG05)	19:29	18:42
17	06:06	18:29 (WTG13)	06:34	07:22 (WTG05)	07:03	07:32
	20:47	111 20:20 (WTG14)	20:15	42 08:04 (WTG05)	19:28	18:40
18	06:07	18:29 (WTG13)	06:35	07:22 (WTG05)	07:04	07:33
	20:46	110 20:19 (WTG14)	20:14	42 08:04 (WTG05)	19:26	18:39
19	06:08	18:30 (WTG13)	06:36	07:22 (WTG05)	07:05	07:34
	20:45	109 20:19 (WTG14)	20:13	41 08:03 (WTG05)	19:24	18:37
20	06:09	18:30 (WTG13)	06:37	07:21 (WTG05)	07:06	07:35
	20:45	109 20:19 (WTG14)	20:11	41 08:02 (WTG05)	19:23	18:36
21	06:10	18:31 (WTG13)	06:38	07:21 (WTG05)	07:06	07:36
	20:44	108 20:19 (WTG14)	20:10	41 08:02 (WTG05)	19:21	18:34
22	06:10	18:31 (WTG13)	06:39	07:22 (WTG05)	07:07	07:37
	20:43	107 20:18 (WTG14)	20:08	39 08:01 (WTG05)	19:19	18:33
23	06:11	18:31 (WTG13)	06:40	07:22 (WTG05)	07:08	07:38
	20:43	107 20:18 (WTG14)	20:07	39 08:01 (WTG05)	19:18	18:32
24	06:12	18:32 (WTG13)	06:41	07:23 (WTG05)	07:09	07:39
	20:42	105 20:17 (WTG14)	20:05	37 08:00 (WTG05)	19:16	18:30
25	06:13	18:33 (WTG13)	06:41	07:23 (WTG05)	07:10	07:40
	20:41	104 20:17 (WTG14)	20:04	36 07:59 (WTG05)	19:15	17:29
26	06:14	18:34 (WTG13)	06:42	07:24 (WTG05)	07:11	07:41
	20:40	102 20:16 (WTG14)	20:02	34 07:58 (WTG05)	19:13	17:28
27	06:15	18:34 (WTG13)	06:43	07:25 (WTG05)	07:12	07:42
	20:39	101 20:15 (WTG14)	20:01	31 07:56 (WTG05)	19:11	17:26
28	06:16	18:34 (WTG13)	06:44	07:26 (WTG05)	07:13	07:43
	20:38	100 20:14 (WTG14)	19:59	29 07:55 (WTG05)	19:10	17:25
29	06:16	18:35 (WTG13)	06:45	07:27 (WTG05)	07:14	07:44
	20:37	98 20:13 (WTG14)	19:58	25 07:52 (WTG05)	19:08	17:24
30	06:17	07:41 (WTG05)	06:46	07:29 (WTG05)	07:15	07:45
	20:36	103 20:12 (WTG14)	19:56	20 07:49 (WTG05)	19:06	17:23
31	06:18	07:37 (WTG05)	06:47	07:32 (WTG05)	07:16	07:46
	20:35	108 20:10 (WTG14)	19:55	14 07:46 (WTG05)	19:04	17:21
Potential sun hours	455	425		374	347	301
Total, worst case	3395		1763			292
Sun reduction	0,74		0,73			
Oper. time red.	0,78		0,78			
Wind dir. red.	0,75		0,77			
Total reduction	0,43		0,44			
Total, real	1466		779			

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:

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Calculated:

04/11/2020 13:48/2.8.579

**SHADOW - Calendar**

**Calculation: Ombre Recettori Rev2Shadow receptor: RE07 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (50)**

**Assumptions for shadow calculations**

Reference year for calendar

2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	
1	07:41	07:30	06:55	07:07	06:23	07:20 (WTG05)	05:56
	17:06	17:38	18:12	19:44	20:14	105 19:32 (WTG13)	20:42
2	07:41	07:29	06:54	07:05	06:22	07:21 (WTG05)	05:55
	17:07	17:40	18:13	19:45	20:15	106 19:33 (WTG13)	20:42
3	07:41	07:28	06:52	07:03	06:20	07:20 (WTG05)	05:55
	17:08	17:41	18:14	19:46	20:16	107 19:33 (WTG13)	20:43
4	07:42	07:27	06:51	07:02	06:19	07:21 (WTG05)	05:54
	17:08	17:42	18:15	19:47	20:17	107 19:34 (WTG13)	20:44
5	07:42	07:26	06:49	07:00	06:18	07:22 (WTG05)	05:54
	17:09	17:43	18:16	19:48	20:18	107 19:35 (WTG13)	20:44
6	07:42	07:25	06:48	06:59	06:17	07:23 (WTG05)	05:54
	17:10	17:44	18:17	19:49	20:19	118 19:50 (WTG14)	20:45
7	07:42	07:24	06:46	06:57	06:16	07:25 (WTG05)	05:54
	17:11	17:46	18:18	19:50	20:20	121 19:53 (WTG14)	20:46
8	07:42	07:23	06:45	06:56	06:15	07:26 (WTG05)	05:53
	17:12	17:47	18:19	19:51	20:21	122 19:56 (WTG14)	20:46
9	07:42	07:22	06:43	06:54	06:13	07:28 (WTG05)	05:53
	17:13	17:48	18:20	19:52	5 07:41 (WTG05)	20:22	120 19:57 (WTG14)
10	07:41	07:21	06:42	06:52	06:12	07:30 (WTG05)	05:53
	17:14	17:49	18:22	19:53	16 07:52 (WTG05)	20:23	119 19:59 (WTG14)
11	07:41	07:20	06:40	06:51	06:11	07:32 (WTG05)	05:53
	17:15	17:50	18:23	19:54	22 07:54 (WTG05)	20:23	112 20:00 (WTG14)
12	07:41	07:19	06:38	06:49	06:10	07:29 (WTG05)	05:53
	17:16	17:51	18:24	19:55	27 07:56 (WTG05)	20:24	107 20:01 (WTG14)
13	07:41	07:18	06:37	06:48	06:09	07:28 (WTG05)	05:53
	17:17	17:53	18:25	19:56	30 07:58 (WTG05)	20:25	108 20:02 (WTG14)
14	07:41	07:17	06:35	06:46	06:08	07:27 (WTG05)	05:53
	17:18	17:54	18:26	19:57	32 07:59 (WTG05)	20:26	109 20:02 (WTG14)
15	07:40	07:15	06:34	06:45	06:07	07:25 (WTG05)	05:53
	17:19	17:55	18:27	19:58	35 08:00 (WTG05)	20:27	110 20:03 (WTG14)
16	07:40	07:14	06:32	06:43	06:07	07:24 (WTG05)	05:53
	17:20	17:56	18:28	19:59	37 08:01 (WTG05)	20:28	111 20:03 (WTG14)
17	07:40	07:13	06:31	06:42	06:06	07:22 (WTG05)	05:53
	17:21	17:57	18:29	20:00	39 08:01 (WTG05)	20:29	112 20:05 (WTG14)
18	07:39	07:12	06:29	06:41	06:05	07:22 (WTG05)	05:53
	17:22	17:58	18:30	20:01	39 08:01 (WTG05)	20:30	113 20:05 (WTG14)
19	07:39	07:10	06:27	06:39	06:04	07:20 (WTG05)	05:53
	17:23	18:00	18:31	20:02	41 08:01 (WTG05)	20:31	113 20:05 (WTG14)
20	07:38	07:09	06:26	06:38	06:03	07:20 (WTG05)	05:53
	17:25	18:01	18:32	20:03	42 08:02 (WTG05)	20:32	114 20:05 (WTG14)
21	07:38	07:08	06:24	06:36	06:02	07:20 (WTG05)	05:53
	17:26	18:02	18:33	20:04	42 08:02 (WTG05)	20:33	114 20:06 (WTG14)
22	07:37	07:06	06:23	06:35	06:02	07:19 (WTG05)	05:53
	17:27	18:03	18:34	20:05	62 19:09 (WTG13)	20:34	114 20:06 (WTG14)
23	07:37	07:05	06:21	06:33	06:01	07:19 (WTG05)	05:54
	17:28	18:04	18:35	20:06	73 19:15 (WTG13)	20:34	115 20:06 (WTG14)
24	07:36	07:04	06:19	06:32	06:00	07:18 (WTG05)	05:54
	17:29	18:05	18:36	20:07	81 19:17 (WTG13)	20:35	115 20:07 (WTG14)
25	07:35	07:02	06:18	06:31	05:59	07:18 (WTG05)	05:54
	17:30	18:06	18:37	20:08	88 19:21 (WTG13)	20:36	116 20:07 (WTG14)
26	07:35	07:01	06:16	06:29	05:59	07:19 (WTG05)	05:54
	17:31	18:08	18:38	20:09	91 19:23 (WTG13)	20:37	116 20:08 (WTG14)
27	07:34	07:00	06:15	06:28	05:58	07:19 (WTG05)	05:55
	17:33	18:09	18:39	20:10	95 19:26 (WTG13)	20:38	115 20:07 (WTG14)
28	07:33	06:58	06:13	06:27	05:58	07:18 (WTG05)	05:55
	17:34	18:10	18:40	20:11	99 19:27 (WTG13)	20:39	116 20:07 (WTG14)
29	07:33	06:57	06:11	06:25	05:57	07:19 (WTG05)	05:56
	17:35	18:11	19:41	20:12	101 19:28 (WTG13)	20:39	116 20:08 (WTG14)
30	07:32		06:10	06:24	05:57	07:19 (WTG05)	05:56
	17:36		19:42	20:13	103 19:30 (WTG13)	20:40	116 20:08 (WTG14)
31	07:31		06:08		05:56		18:12 (WTG13)
	17:37		19:43		20:41	116 20:08 (WTG14)	
Potential sun hours	301	309	370	397	444		448
Total, worst case				1200	3510		3446
Sun reduction				0,53	0,59		0,66
Oper. time red.				0,78	0,78		0,78
Wind dir. red.				0,78	0,76		0,76
Total reduction				0,32	0,35		0,39
Total, real				386	1228		1348

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

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

**Brunco e Niada**

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Calculated:

04/11/2020 13:48/2.8.579

### SHADOW - Calendar

Calculation: Ombre Recettori Rev2Shadow receptor: RE07 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (50)

#### Assumptions for shadow calculations

Reference year for calendar

2020

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	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
134	282	483	550	523	510	295	242	134	107	215	403	778	1.342	591	242	6.831

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

	July	August	September	October	November	December
1	05:56	18:19 (WTG13)	06:19	18:25 (WTG13)	06:48	07:21
	20:52	115 20:14 (WTG14)	20:34	106 20:11 (WTG14)	19:53	22 07:53 (WTG05)   19:05
2	05:57	18:18 (WTG13)	06:20	07:42 (WTG05)	06:49	07:34 (WTG05)   07:17
	20:52	115 20:13 (WTG14)	20:33	116 20:10 (WTG14)	19:52	16 07:50 (WTG05)   19:03
3	05:57	18:19 (WTG13)	06:21	07:39 (WTG05)	06:50	07:39 (WTG05)   07:18
	20:52	115 20:14 (WTG14)	20:32	120 20:08 (WTG14)	19:50	5 07:44 (WTG05)   19:02
4	05:58	18:19 (WTG13)	06:22	07:37 (WTG05)	06:51	07:19
	20:52	115 20:14 (WTG14)	20:31	121 20:06 (WTG14)	19:49	19:00
5	05:58	18:19 (WTG13)	06:23	07:35 (WTG05)	06:52	07:20
	20:52	116 20:15 (WTG14)	20:30	122 20:04 (WTG14)	19:47	18:58
6	05:59	18:19 (WTG13)	06:24	07:34 (WTG05)	06:53	07:21
	20:51	115 20:14 (WTG14)	20:29	122 20:02 (WTG14)	19:45	18:57
7	06:00	18:19 (WTG13)	06:25	07:33 (WTG05)	06:54	07:22
	20:51	116 20:15 (WTG14)	20:28	113 19:57 (WTG14)	19:44	18:55
8	06:00	18:19 (WTG13)	06:26	07:31 (WTG05)	06:54	07:23
	20:51	116 20:15 (WTG14)	20:27	108 19:45 (WTG13)	19:42	18:54
9	06:01	18:20 (WTG13)	06:26	07:31 (WTG05)	06:55	07:24
	20:51	115 20:15 (WTG14)	20:26	107 19:44 (WTG13)	19:41	18:52
10	06:01	18:20 (WTG13)	06:27	07:30 (WTG05)	06:56	07:25
	20:50	116 20:16 (WTG14)	20:24	107 19:43 (WTG13)	19:39	18:51
11	06:02	18:20 (WTG13)	06:28	07:29 (WTG05)	06:57	07:26
	20:50	116 20:16 (WTG14)	20:23	106 19:41 (WTG13)	19:37	18:49
12	06:03	18:20 (WTG13)	06:29	07:27 (WTG05)	06:58	07:27
	20:49	116 20:16 (WTG14)	20:22	105 19:39 (WTG13)	19:36	18:48
13	06:04	18:20 (WTG13)	06:30	07:27 (WTG05)	06:59	07:28
	20:49	117 20:17 (WTG14)	20:21	102 19:37 (WTG13)	19:34	18:46
14	06:04	18:20 (WTG13)	06:31	07:26 (WTG05)	07:00	07:29
	20:48	116 20:16 (WTG14)	20:19	101 19:36 (WTG13)	19:33	18:45
15	06:05	18:20 (WTG13)	06:32	07:26 (WTG05)	07:01	07:30
	20:48	116 20:16 (WTG14)	20:18	98 19:34 (WTG13)	19:31	18:43
16	06:06	18:21 (WTG13)	06:33	07:26 (WTG05)	07:02	07:31
	20:47	116 20:17 (WTG14)	20:17	94 19:32 (WTG13)	19:29	18:42
17	06:06	18:21 (WTG13)	06:34	07:25 (WTG05)	07:03	07:32
	20:47	116 20:17 (WTG14)	20:15	90 19:29 (WTG13)	19:28	18:40
18	06:07	18:21 (WTG13)	06:35	07:25 (WTG05)	07:04	07:33
	20:46	115 20:16 (WTG14)	20:14	85 19:27 (WTG13)	19:26	18:39
19	06:08	18:21 (WTG13)	06:36	07:25 (WTG05)	07:05	07:34
	20:45	115 20:16 (WTG14)	20:13	79 19:24 (WTG13)	19:24	18:37
20	06:09	18:21 (WTG13)	06:37	07:24 (WTG05)	07:06	07:35
	20:45	116 20:17 (WTG14)	20:11	72 19:19 (WTG13)	19:23	18:36
21	06:10	18:22 (WTG13)	06:38	07:24 (WTG05)	07:06	07:36
	20:44	115 20:17 (WTG14)	20:10	60 19:13 (WTG13)	19:21	18:34
22	06:10	18:21 (WTG13)	06:39	07:24 (WTG05)	07:07	07:37
	20:43	115 20:16 (WTG14)	20:08	42 08:06 (WTG05)	19:19	18:33
23	06:11	18:22 (WTG13)	06:40	07:24 (WTG05)	07:08	07:38
	20:43	114 20:16 (WTG14)	20:07	41 08:05 (WTG05)	19:18	18:32
24	06:12	18:22 (WTG13)	06:41	07:24 (WTG05)	07:09	07:39
	20:42	114 20:16 (WTG14)	20:05	41 08:05 (WTG05)	19:16	18:30
25	06:13	18:23 (WTG13)	06:41	07:25 (WTG05)	07:10	06:40
	20:41	113 20:16 (WTG14)	20:04	39 08:04 (WTG05)	19:15	17:29
26	06:14	18:23 (WTG13)	06:42	07:25 (WTG05)	07:11	06:41
	20:40	112 20:15 (WTG14)	20:02	38 08:03 (WTG05)	19:13	17:28
27	06:15	18:22 (WTG13)	06:43	07:26 (WTG05)	07:12	06:42
	20:39	112 20:14 (WTG14)	20:01	36 08:02 (WTG05)	19:11	17:26
28	06:16	18:23 (WTG13)	06:44	07:27 (WTG05)	07:13	06:44
	20:38	111 20:14 (WTG14)	19:59	34 08:01 (WTG05)	19:10	17:25
29	06:16	18:23 (WTG13)	06:45	07:27 (WTG05)	07:14	06:45
	20:37	110 20:13 (WTG14)	19:58	32 07:59 (WTG05)	19:08	17:24
30	06:17	18:24 (WTG13)	06:46	07:28 (WTG05)	07:15	06:46
	20:36	109 20:13 (WTG14)	19:56	29 07:57 (WTG05)	19:06	17:23
31	06:18	18:24 (WTG13)	06:47	07:29 (WTG05)	07:16	06:47
	20:35	108 20:12 (WTG14)	19:55	27 07:56 (WTG05)	19:05	17:21
Potential sun hours	455	425	374	347	301	292
Total, worst case	3546	2493	43			
Sun reduction	0,74	0,73	0,65			
Oper. time red.	0,78	0,78	0,78			
Wind dir. red.	0,76	0,77	0,79			
Total reduction	0,44	0,44	0,40			
Total, real	1546	1099	17			

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:

**Bruncu e Niada**

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Calculated:  
04/11/2020 13:48/2.8.579

**SHADOW - Calendar**

**Calculation:** Ombre Recettori Rev2Shadow receptor: RE08 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (51)

**Assumptions for shadow calculations**

Reference year for calendar

2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	07:41   17:06	07:30   17:38	06:55   18:12	07:06   19:44	06:23   20:14	19:43 (WTG10)   05:55   20:42
2	07:41   17:07	07:29   17:40	06:54   18:13	07:05   19:45	06:21   20:15	11   19:54 (WTG10)   05:55   20:42
3	07:41   17:07	07:28   17:41	06:52   18:14	07:03   19:46	06:20   20:16	13   19:40 (WTG10)   05:55   20:43
4	07:42   17:08	07:27   17:42	06:51   18:15	07:02   19:47	06:19   20:17	15   19:40 (WTG10)   05:54   20:44
5	07:42   17:09	07:26   17:43	06:49   18:16	07:00   19:48	06:18   20:18	16   19:56 (WTG10)   05:54   20:44
6	07:42   17:10	07:25   17:44	06:48   18:17	06:59   19:49	06:17   20:19	18   19:39 (WTG10)   05:54   20:45
7	07:42   17:11	07:24   17:45	06:46   18:18	06:57   19:50	06:16   20:20	19   19:58 (WTG10)   05:53   20:45
8	07:42   17:12	07:23   17:47	06:45   18:19	06:55   19:51	06:14   20:21	20   19:59 (WTG10)   05:53   20:46
9	07:41   17:13	07:22   17:48	06:43   18:20	06:54   19:52	06:13   20:21	21   20:00 (WTG10)   05:53   20:47
10	07:41   17:14	07:21   17:49	06:41   18:21	06:52   19:53	06:12   20:22	22   19:38 (WTG10)   05:53   20:47
11	07:41   17:15	07:20   17:50	06:40   18:22	06:51   19:54	06:11   20:23	24   20:02 (WTG10)   05:53   20:48
12	07:41   17:16	07:19   17:51	06:38   18:23	06:49   19:55	06:10   20:24	25   19:38 (WTG10)   05:53   20:48
13	07:41   17:17	07:18   17:53	06:37   18:25	06:48   19:56	06:09   20:25	26   19:39 (WTG10)   05:52   20:49
14	07:41   17:18	07:17   17:54	06:35   18:26	06:46   19:57	06:08   20:26	27   20:05 (WTG10)   05:52   20:49
15	07:40   17:19	07:15   17:55	06:34   18:27	06:45   19:58	06:07   20:27	28   19:39 (WTG10)   05:52   20:50
16	07:40   17:20	07:14   17:56	06:32   18:28	06:43   19:59	06:06   20:28	27   20:06 (WTG10)   05:52   20:50
17	07:40   17:21	07:13   17:57	06:30   18:29	06:42   20:00	06:05   20:29	28   19:39 (WTG10)   05:52   20:50
18	07:39   17:22	07:12   17:58	06:29   18:30	06:40   20:01	06:05   20:30	28   20:07 (WTG10)   05:53   20:51
19	07:39   17:23	07:10   17:59	06:27   18:31	06:39   20:02	06:04   20:31	28   19:41 (WTG10)   05:53   20:51
20	07:38   17:24	07:09   18:01	06:26   18:32	06:37   20:03	06:03   20:32	29   20:10 (WTG10)   05:53   20:51
21	07:38   17:25	07:08   18:02	06:24   18:33	06:36   20:04	06:02   20:33	29   19:41 (WTG10)   05:53   20:51
22	07:37   17:27	07:06   18:03	06:22   18:34	06:35   20:05	06:01   20:34	27   19:42 (WTG10)   05:53   20:51
23	07:37   17:28	07:05   18:04	06:21   18:35	06:33   20:06	06:01   20:34	26   19:43 (WTG10)   05:53   20:52
24	07:36   17:29	07:04   18:05	06:19   18:36	06:32   20:07	06:00   20:35	24   20:09 (WTG10)   05:54   20:52
25	07:35   17:30	07:02   18:06	06:18   18:37	06:31   20:08	05:59   20:36	23   19:45 (WTG10)   05:54   20:52
26	07:35   17:31	07:01   18:07	06:16   18:38	06:29   20:09	05:59   20:37	21   20:08 (WTG10)   05:54   20:52
27	07:34   17:32	06:59   18:08	06:14   18:39	06:28   20:10	05:58   20:38	19   20:07 (WTG10)   05:55   20:52
28	07:33   17:34	06:58   18:10	06:13   18:40	06:27   20:11	05:57   20:39	16   19:49 (WTG10)   05:55   20:52
29	07:33   17:35	06:57   18:11	07:11   19:21	06:25   20:12	3   19:50 (WTG10)   05:57   13   20:03 (WTG10)   05:55   20:52	
30	07:32   17:36		07:10   19:41	06:24   20:13	6   19:45 (WTG10)   05:56   10   20:02 (WTG10)   05:56   20:52	
31	07:31   17:37		07:08   19:42	06:23   20:14	8   19:44 (WTG10)   05:56   2   19:56 (WTG10)   05:56   20:52	
Potential sun hours	301	309	370	397	445	448
Total, worst case		11	22	17	629	
Sun reduction		0,47	0,49	0,53	0,59	
Oper. time red.		0,78	0,78	0,78	0,78	
Wind dir. red.		0,78	0,79	0,75	0,75	
Total reduction		0,29	0,30	0,31	0,35	
Total, real		3	7	5	217	

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:

**Brunco e Niada**

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04/11/2020 15:45 / 16

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Calculated:  
04/11/2020 13:48/2.8.579

**SHADOW - Calendar**

**Calculation:** Ombre Recettori Rev2Shadow receptor: RE08 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (51)

**Assumptions for shadow calculations**

Reference year for calendar

2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	05:56 20:52	06:19 20:34	19:49 (WTG10) 20:14 (WTG10)	06:48 19:53	07:16 19:05	06:48 17:20
2	05:57 20:52	06:20 20:33	19:48 (WTG10) 20:12 (WTG10)	06:49 19:52	07:17 19:03	06:49 17:19
3	05:57 20:52	06:21 20:32	19:48 (WTG10) 20:11 (WTG10)	06:50 19:50	07:18 19:01	06:50 17:18
4	05:58 20:52	06:22 20:31	19:48 (WTG10) 20:10 (WTG10)	06:51 19:48	07:19 19:00	06:51 17:17
5	05:58 20:52	06:23 20:30	19:48 (WTG10) 20:09 (WTG10)	06:52 19:47	07:20 18:58	06:52 17:15
6	05:59 20:51	06:24 20:29	19:49 (WTG10) 20:08 (WTG10)	06:52 19:45	07:21 18:57	06:54 17:14
7	05:59 20:51	06:24 20:28	19:49 (WTG10) 20:07 (WTG10)	06:53 19:44	07:22 18:55	06:55 17:13
8	06:00 20:51	06:25 20:27	19:49 (WTG10) 20:06 (WTG10)	06:54 19:42	07:23 18:54	06:56 17:12
9	06:01 20:50	06:26 20:25	19:50 (WTG10) 20:05 (WTG10)	06:55 19:41	07:24 18:52	06:57 17:11
10	06:01 20:50	06:27 20:24	19:49 (WTG10) 20:03 (WTG10)	06:56 19:39	07:25 18:50	06:58 17:10
11	06:02 20:50	06:28 20:23	19:50 (WTG10) 20:02 (WTG10)	06:57 19:37	07:26 18:49	06:59 17:09
12	06:03 20:49	06:29 20:22	19:51 (WTG10) 20:01 (WTG10)	06:58 19:36	07:27 18:47	07:00 17:09
13	06:03 20:49	06:30 20:20	19:52 (WTG10) 20:00 (WTG10)	06:59 19:34	07:28 18:46	07:01 17:08
14	06:04 20:48	06:31 20:19	19:53 (WTG10) 19:59 (WTG10)	07:00 19:32	07:29 18:44	07:03 17:07
15	06:05 20:48	06:32 20:18	19:55 (WTG10) 19:58 (WTG10)	07:01 19:31	19:07 (WTG12) 19:10 (WTG12)	07:04 18:23 (WTG04)
16	06:06 20:47	06:33 20:17	19:59 (WTG10) 19:57 (WTG10)	07:02 19:29	19:05 (WTG12) 19:03 (WTG12)	07:05 18:22 (WTG04)
17	06:06 20:47	06:34 20:15	19:59 (WTG10) 19:57 (WTG10)	07:03 19:27	19:09 (WTG12) 19:07 (WTG12)	07:06 18:21 (WTG04)
18	06:07 20:46	06:35 20:14	19:56 (WTG10) 19:55 (WTG10)	07:04 19:26	19:02 (WTG12) 19:06 (WTG12)	07:07 18:16 (WTG04)
19	06:08 20:45	06:36 20:12	19:55 (WTG10) 19:54 (WTG10)	07:04 19:24	19:01 (WTG12) 19:04 (WTG12)	07:08 18:15 (WTG04)
20	06:09 20:45	06:37 20:11	19:55 (WTG10) 19:53 (WTG10)	07:05 19:23	19:01 (WTG12) 19:03 (WTG12)	07:09 18:14 (WTG04)
21	06:09 20:44	06:38 20:10	19:53 (WTG10) 19:52 (WTG10)	07:06 19:21	19:01 (WTG12) 19:03 (WTG12)	07:10 18:15 (WTG04)
22	06:10 20:43	06:39 20:08	19:53 (WTG10) 19:51 (WTG10)	07:07 19:19	19:01 (WTG12) 19:03 (WTG12)	07:11 18:14 (WTG04)
23	06:11 20:43	06:39 20:07	19:52 (WTG10) 19:50 (WTG10)	07:08 19:18	19:01 (WTG12) 19:03 (WTG12)	07:12 18:13 (WTG04)
24	06:12 20:42	06:40 20:05	19:52 (WTG10) 19:51 (WTG10)	07:09 19:16	19:01 (WTG12) 19:03 (WTG12)	07:13 18:12 (WTG04)
25	06:13 20:41	06:41 20:04	19:51 (WTG10) 19:50 (WTG10)	07:10 19:14	19:01 (WTG12) 19:03 (WTG12)	07:14 18:11 (WTG04)
26	06:14 20:40	06:42 20:02	19:50 (WTG10) 19:49 (WTG10)	07:11 19:13	19:01 (WTG12) 19:03 (WTG12)	07:15 18:10 (WTG04)
27	06:15 20:39	06:43 20:01	19:50 (WTG10) 19:49 (WTG10)	07:12 19:11	19:01 (WTG12) 19:03 (WTG12)	07:16 18:09 (WTG04)
28	06:15 20:38	06:44 20:17	19:50 (WTG10) 19:49 (WTG10)	07:13 19:09	19:01 (WTG12) 19:03 (WTG12)	07:17 18:08 (WTG04)
29	06:16 20:37	06:45 20:16	19:50 (WTG10) 19:49 (WTG10)	07:14 19:08	19:01 (WTG12) 19:03 (WTG12)	07:18 18:07 (WTG04)
30	06:17 20:36	06:46 20:15	19:49 (WTG10) 19:48 (WTG10)	07:15 19:06	19:01 (WTG12) 19:03 (WTG12)	07:19 18:06 (WTG04)
31	06:18 20:35	06:47 20:15	19:49 (WTG10) 19:48 (WTG10)	07:16 19:06	19:01 (WTG12) 19:03 (WTG12)	07:20 18:05 (WTG04)
Potential sun hours	455	425	374	347	301	292
Total, worst case	414	237	20	13		
Sun reduction	0,74	0,73	0,65	0,54		
Oper. time red.	0,78	0,78	0,78	0,78		
Wind dir. red.	0,75	0,75	0,79	0,78		
Total reduction	0,43	0,43	0,40	0,33		
Total, real	179	102	8	4		

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:

**Bruncu e Niada**

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04/11/2020 15:45 / 17

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Calculated:

04/11/2020 13:48/2.8.579

### SHADOW - Calendar

Calculation: Ombre Recettori Rev2Shadow receptor: RE09 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (52)

#### Assumptions for shadow calculations

Reference year for calendar

2020

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	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
134	282	483	550	523	510	295	242	134	107	215	403	778	1.342	591	242	6.831

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

	January	February	March	April	May	June		
1	07:41 17:06	07:30 17:38	06:55 18:12	07:06 19:44	06:23 20:14	19:49 (WTG10) 19:54 (WTG10)	05:55 20:42	19:52 (WTG10) 20:09 (WTG10)
2	07:41 17:07	07:29 17:40	06:54 18:13	07:05 19:45	06:21 20:15	19:46 (WTG10) 19:54 (WTG10)	05:55 20:42	19:53 (WTG10) 20:08 (WTG10)
3	07:41 17:07	07:28 17:41	06:52 18:14	07:03 19:46	06:20 20:16	19:45 (WTG10) 19:55 (WTG10)	05:55 20:43	19:54 (WTG10) 20:07 (WTG10)
4	07:42 17:08	07:27 17:42	06:51 18:15	07:02 19:47	06:19 20:17	19:44 (WTG10) 19:56 (WTG10)	05:54 20:44	19:56 (WTG10) 20:06 (WTG10)
5	07:42 17:09	07:26 17:43	06:49 18:16	07:00 19:48	06:18 20:18	19:44 (WTG10) 19:57 (WTG10)	05:54 20:44	19:58 (WTG10) 20:03 (WTG10)
6	07:42 17:10	07:25 17:44	06:48 18:17	06:59 19:49	06:17 20:19	19:43 (WTG10) 19:58 (WTG10)	05:54 20:45	
7	07:42 17:11	07:24 17:45	06:46 18:18	06:57 19:50	06:16 20:20	19:43 (WTG10) 19:59 (WTG10)	05:53 20:45	
8	07:42 17:12	07:23 17:47	06:45 18:19	06:55 19:51	06:14 20:20	19:42 (WTG10) 20:00 (WTG10)	05:53 20:46	
9	07:41 17:13	07:22 17:48	06:43 18:20	06:54 19:52	06:13 20:21	19:42 (WTG10) 20:01 (WTG10)	05:53 20:47	
10	07:41 17:14	07:21 17:49	06:41 18:21	06:52 19:53	06:12 20:22	19:41 (WTG10) 20:02 (WTG10)	05:53 20:47	
11	07:41 17:15	07:20 17:50	06:40 18:22	06:51 19:54	06:11 20:23	19:41 (WTG10) 20:03 (WTG10)	05:53 20:48	
12	07:41 17:16	07:19 17:51	06:38 18:23	06:49 19:55	06:10 20:24	19:41 (WTG10) 20:03 (WTG10)	05:53 20:48	
13	07:41 17:17	07:18 17:53	06:37 18:25	06:48 19:56	06:09 20:25	19:41 (WTG10) 20:04 (WTG10)	05:52 20:49	
14	07:41 17:18	07:17 17:54	06:35 18:26	06:46 19:57	06:08 20:26	19:41 (WTG10) 20:05 (WTG10)	05:52 20:49	
15	07:40 17:19	07:15 17:55	06:34 18:27	06:45 19:58	06:07 20:27	19:41 (WTG10) 20:06 (WTG10)	05:52 20:50	
16	07:40 17:20	07:14 17:56	06:32 18:28	06:43 19:59	06:06 20:28	19:41 (WTG10) 20:07 (WTG10)	05:52 20:50	
17	07:40 17:21	07:13 17:57	06:30 18:29	06:42 20:00	06:05 20:29	19:41 (WTG10) 20:07 (WTG10)	05:52 20:50	
18	07:39 17:22	07:12 17:58	06:29 18:30	06:40 20:01	06:05 20:30	19:42 (WTG10) 20:09 (WTG10)	05:53 20:51	
19	07:39 17:23	07:10 17:59	06:27 18:31	06:39 20:02	06:04 20:31	19:42 (WTG10) 20:10 (WTG10)	05:53 20:51	
20	07:38 17:24	07:09 18:01	06:26 18:32	06:37 20:03	06:03 20:32	19:42 (WTG10) 20:10 (WTG10)	05:53 20:51	
21	07:38 17:25	07:08 18:02	06:24 18:33	06:36 20:04	06:02 20:33	19:42 (WTG10) 20:11 (WTG10)	05:53 20:51	
22	07:37 17:27	07:06 18:03	06:22 18:34	06:35 20:05	06:01 20:34	19:44 (WTG10) 20:12 (WTG10)	05:53 20:52	
23	07:37 17:28	07:05 18:04	06:21 18:35	06:33 20:06	06:01 20:34	19:44 (WTG10) 20:13 (WTG10)	05:53 20:52	
24	07:36 17:29	07:04 18:05	17:44 (WTG04) 06:19	18:15 (WTG12) 06:32	06:00 20:35	19:45 (WTG10) 20:14 (WTG10)	05:54 20:52	
25	07:35 17:30	07:02 18:06	17:45 (WTG04) 06:18	18:17 (WTG12) 06:31	05:59 20:36	19:45 (WTG10) 20:13 (WTG10)	05:54 20:52	
26	07:35 17:31	07:01 18:07	17:47 (WTG04) 06:16	18:18 (WTG12) 06:29	05:59 20:37	19:46 (WTG10) 20:12 (WTG10)	05:54 20:52	
27	07:34 17:32	06:59 18:08	17:49 (WTG04) 06:14	18:19 (WTG12) 06:28	05:58 20:38	19:47 (WTG10) 20:12 (WTG10)	05:55 20:52	
28	07:33 17:33	06:58 18:10	17:49 (WTG04) 06:13	18:17 (WTG12) 06:27	05:57 20:39	19:47 (WTG10) 20:11 (WTG10)	05:55 20:52	
29	07:33 17:35	06:57 18:11	17:51 (WTG04) 07:11	18:21 (WTG12) 06:25	05:57 20:39	19:49 (WTG10) 20:11 (WTG10)	05:55 20:52	
30	07:32 17:36		07:10 19:42	19:22 (WTG12) 20:12	05:56 20:40	19:51 (WTG10) 20:10 (WTG10)	05:56 20:52	
31	07:31 17:37		07:08 19:43	19:23 (WTG12) 20:13	05:56 20:41	19:52 (WTG10) 20:10 (WTG10)	05:56 20:52	
Potential sun hours	301	309	370	397	445		448	
Total, worst case		11	23	2	669		60	
Sun reduction		0,47	0,49	0,53	0,59		0,66	
Oper. time red.		0,78	0,78	0,78	0,78		0,78	
Wind dir. red.		0,78	0,79	0,75	0,75		0,75	
Total reduction		0,29	0,30	0,31	0,34		0,39	
Total, real		3	7	1	230		23	

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:

**Brunco e Niada**

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04/11/2020 15:45 / 18

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Calculated:  
04/11/2020 13:48/2.8.579

**SHADOW - Calendar**

**Calculation:** Ombre Recettori Rev2Shadow receptor: RE09 - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (52)

**Assumptions for shadow calculations**

Reference year for calendar

2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	05:56 20:52	06:19 20:34	19:52 (WTG10) 20:14 (WTG10)	06:48 19:53	07:16 19:05	06:48 17:20
2	05:57 20:52	06:20 20:33	19:51 (WTG10) 20:12 (WTG10)	06:49 19:52	07:17 19:03	06:49 17:19
3	05:57 20:52	06:21 20:32	19:51 (WTG10) 20:11 (WTG10)	06:50 19:50	07:18 19:01	06:50 17:18
4	05:58 20:52	06:22 20:31	19:51 (WTG10) 20:10 (WTG10)	06:51 19:48	07:19 19:00	06:51 17:17
5	05:58 20:52	06:23 20:30	19:52 (WTG10) 20:09 (WTG10)	06:52 19:47	07:20 18:58	06:52 17:15
6	05:59 20:51	06:24 20:29	19:52 (WTG10) 20:08 (WTG10)	06:52 19:45	07:21 18:57	06:54 17:14
7	05:59 20:51	06:24 20:28	19:53 (WTG10) 20:07 (WTG10)	06:53 19:44	07:22 18:55	06:55 17:13
8	06:00 20:51	20:03 (WTG10) 20:11 (WTG10)	19:54 (WTG10) 20:06 (WTG10)	06:54 19:42	07:23 18:54	06:56 17:12
9	06:01 20:50	20:02 (WTG10) 20:13 (WTG10)	19:54 (WTG10) 20:05 (WTG10)	06:55 19:41	07:24 18:52	06:57 17:11
10	06:01 20:50	20:01 (WTG10) 20:15 (WTG10)	19:54 (WTG10) 20:03 (WTG10)	06:56 19:39	07:25 18:50	06:58 17:10
11	06:02 20:50	20:00 (WTG10) 20:16 (WTG10)	19:56 (WTG10) 20:02 (WTG10)	06:57 19:37	07:26 18:49	06:59 17:09
12	06:03 20:49	19:59 (WTG10) 20:17 (WTG10)	19:57 (WTG10) 20:01 (WTG10)	06:58 19:36	07:27 18:47	07:00 17:09
13	06:03 20:49	19:59 (WTG10) 20:19 (WTG10)	19:59 (WTG10) 20:00 (WTG10)	06:59 19:34	19:14 (WTG12) 19:15 (WTG12)	07:28 18:46
14	06:04 20:48	19:57 (WTG10) 20:19 (WTG10)	07:00 19:32	19:08 (WTG12) 19:12 (WTG12)	07:29 18:44	18:22 (WTG04) 18:23 (WTG04)
15	06:05 20:48	19:57 (WTG10) 20:20 (WTG10)	07:01 19:31	19:06 (WTG12) 19:10 (WTG12)	07:30 18:43	18:20 (WTG04) 18:23 (WTG04)
16	06:06 20:47	19:56 (WTG10) 20:21 (WTG10)	07:02 19:29	19:05 (WTG12) 19:09 (WTG12)	07:31 18:41	18:19 (WTG04) 18:21 (WTG04)
17	06:06 20:47	19:55 (WTG10) 20:21 (WTG10)	07:03 19:27	19:04 (WTG12) 19:07 (WTG12)	07:32 18:40	18:17 (WTG04) 18:20 (WTG04)
18	06:07 20:46	19:55 (WTG10) 20:22 (WTG10)	07:04 19:26	19:03 (WTG12) 19:06 (WTG12)	07:33 18:39	18:16 (WTG04) 18:16 (WTG04)
19	06:08 20:45	19:55 (WTG10) 20:23 (WTG10)	07:04 19:24	19:02 (WTG12) 19:04 (WTG12)	07:34 18:37	18:16 (WTG04) 18:17 (WTG04)
20	06:09 20:45	19:54 (WTG10) 20:23 (WTG10)	07:05 19:23	19:02 (WTG12) 19:03 (WTG12)	07:35 18:36	17:09 17:02
21	06:09 20:44	19:53 (WTG10) 20:22 (WTG10)	07:06 19:21	07:36 18:34	07:36 18:34	17:09 17:02
22	06:10 20:43	19:53 (WTG10) 20:21 (WTG10)	07:07 19:19	07:37 18:33	07:37 18:33	17:12 17:01
23	06:11 20:43	19:53 (WTG10) 20:21 (WTG10)	07:08 19:18	07:38 18:32	07:38 18:32	17:13 17:01
24	06:12 20:42	19:53 (WTG10) 20:20 (WTG10)	07:09 19:16	07:39 18:30	07:39 18:30	17:14 17:00
25	06:13 20:41	19:53 (WTG10) 20:20 (WTG10)	07:10 19:14	07:40 17:29	07:40 17:29	17:15 17:01
26	06:14 20:40	19:51 (WTG10) 20:18 (WTG10)	07:11 19:13	06:41 17:28	06:41 17:28	17:16 16:59
27	06:15 20:39	19:51 (WTG10) 20:18 (WTG10)	07:12 19:11	06:42 17:26	06:42 17:26	17:17 16:59
28	06:15 20:38	19:51 (WTG10) 20:17 (WTG10)	07:13 19:09	06:43 17:25	06:43 17:25	17:18 16:58
29	06:16 20:37	19:51 (WTG10) 20:16 (WTG10)	07:14 19:08	06:45 17:24	06:45 17:24	17:19 16:58
30	06:17 20:36	19:51 (WTG10) 20:15 (WTG10)	07:15 19:06	06:46 17:22	06:46 17:22	17:20 16:58
31	06:18 20:35	19:52 (WTG10) 20:15 (WTG10)	06:47 19:55	06:47 17:21	06:47 17:21	17:05 17:06
Potential sun hours	455	425	374	347	301	292
Total, worst case	558	173	24	14		
Sun reduction	0,74	0,73	0,65	0,54		
Oper. time red.	0,78	0,78	0,78	0,78		
Wind dir. red.	0,75	0,75	0,79	0,78		
Total reduction	0,43	0,43	0,40	0,33		
Total, real	240	74	10	5		

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:

**Bruncu e Niada**

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04/11/2020 15:45 / 19

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Calculated:  
04/11/2020 13:48/2.8.579

**SHADOW - Calendar**

**Calculation: Ombre Recettori Rev2Shadow receptor: RE10 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (53)**

**Assumptions for shadow calculations**

Reference year for calendar

2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	07:41 17:06	07:30 17:38	06:55 18:12	07:06 19:44	06:23 20:14	19:40 (WTG10) 20:42
2	07:41 17:07	07:29 17:40	06:54 18:13	07:05 19:45	06:21 20:15	19:38 (WTG10) 20:42
3	07:41 17:07	07:28 17:41	06:52 18:14	07:03 19:46	06:20 20:16	19:38 (WTG10) 20:43
4	07:42 17:08	07:27 17:42	06:51 18:15	07:02 19:47	06:19 20:17	19:37 (WTG10) 20:44
5	07:42 17:09	07:26 17:43	06:49 18:16	07:00 19:48	06:18 20:18	19:37 (WTG10) 20:44
6	07:42 17:10	07:25 17:44	06:48 18:17	06:59 19:49	06:17 20:19	19:37 (WTG10) 20:45
7	07:42 17:11	07:24 17:45	06:46 18:18	06:57 19:50	06:16 20:20	19:37 (WTG10) 20:45
8	07:42 17:12	07:23 17:47	06:45 18:19	06:55 19:51	06:14 20:20	19:37 (WTG10) 20:46
9	07:41 17:13	07:22 17:48	06:43 18:20	06:54 19:52	06:13 20:21	19:37 (WTG10) 20:47
10	07:41 17:14	07:21 17:49	06:41 18:21	06:52 19:53	06:12 20:22	19:37 (WTG10) 20:47
11	07:41 17:15	07:20 17:50	06:40 18:22	06:51 19:54	06:11 20:23	19:37 (WTG10) 20:48
12	07:41 17:16	07:19 17:51	06:38 18:23	06:49 19:55	06:10 20:24	19:37 (WTG10) 20:48
13	07:41 17:17	07:18 17:53	06:37 18:25	06:48 19:56	06:09 20:25	19:37 (WTG10) 20:49
14	07:41 17:18	07:17 17:54	06:35 18:26	06:46 19:57	06:08 20:26	19:38 (WTG10) 20:49
15	07:40 17:19	07:15 17:55	06:34 18:27	06:45 19:58	06:07 20:27	19:38 (WTG10) 20:50
16	07:40 17:20	07:14 17:56	06:32 18:28	06:43 19:59	06:06 20:28	19:38 (WTG10) 20:50
17	07:40 17:21	07:13 17:57	06:30 18:29	06:42 20:00	06:05 20:29	19:39 (WTG10) 20:50
18	07:39 17:22	07:12 17:58	06:29 18:30	06:40 20:01	06:05 20:30	19:40 (WTG10) 20:51
19	07:39 17:23	07:10 17:59	06:27 18:31	06:39 20:02	06:04 20:31	19:41 (WTG10) 20:51
20	07:38 17:24	07:09 18:01	06:26 18:32	06:37 20:03	06:03 20:32	19:41 (WTG10) 20:51
21	07:38 17:25	07:08 18:02	06:24 18:33	06:36 20:04	06:02 20:33	19:42 (WTG10) 20:51
22	07:37 17:27	07:06 18:03	06:22 18:34	06:35 20:05	06:01 20:34	19:44 (WTG10) 20:52
23	07:37 17:28	07:05 18:04	06:21 18:35	06:33 20:06	06:01 20:34	19:45 (WTG10) 20:52
24	07:36 17:29	07:04 18:05	06:19 18:36	06:32 20:07	06:00 20:35	19:47 (WTG10) 20:52
25	07:35 17:30	07:02 18:06	06:18 18:37	06:31 20:08	05:59 20:36	19:48 (WTG10) 20:52
26	07:35 17:31	07:01 18:07	06:16 18:38	06:29 20:09	19:46 (WTG10) 20:37	19:51 (WTG10) 20:52
27	07:34 17:32	06:59 18:08	06:14 18:39	06:28 20:10	19:44 (WTG10) 20:38	19:51 (WTG10) 20:52
28	07:33 17:34	06:58 18:10	06:13 18:40	06:27 20:11	19:42 (WTG10) 20:39	19:51 (WTG10) 20:52
29	07:33 17:35	06:57 18:11	07:11 19:41	06:25 20:12	19:41 (WTG10) 20:39	19:51 (WTG10) 20:52
30	07:32 17:36		07:10 19:42	06:24 20:13	19:51 (WTG10) 20:40	19:51 (WTG10) 20:56
31	07:31 17:37		07:08 19:43		19:52 (WTG10) 20:41	19:51 (WTG10) 20:56
Potential sun hours	301	309	370	397	445	448
Total, worst case		10	21	38	570	
Sun reduction		0,47	0,49	0,53	0,59	
Oper. time red.		0,78	0,78	0,78	0,78	
Wind dir. red.		0,78	0,79	0,75	0,75	
Total reduction		0,29	0,30	0,31	0,35	
Total, real		3	6	12	198	

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:

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Calculated:  
04/11/2020 13:48/2.8.579

**SHADOW - Calendar**

**Calculation:** Ombre Recettori Rev2Shadow receptor: RE10 - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (53)

**Assumptions for shadow calculations**

Reference year for calendar

2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	05:56 20:52	06:19 20:34	19:48 (WTG10) 20:14 (WTG10)	06:48 19:53	07:16 19:05	06:48 17:20
2	05:57 20:52	06:20 20:33	19:47 (WTG10) 20:12 (WTG10)	06:49 19:52	07:17 19:03	06:49 17:19
3	05:57 20:52	06:21 20:32	19:46 (WTG10) 20:11 (WTG10)	06:50 19:50	07:18 19:01	06:50 17:18
4	05:58 20:52	06:22 20:31	19:46 (WTG10) 20:10 (WTG10)	06:51 19:48	07:19 19:00	06:51 17:17
5	05:58 20:52	06:23 20:30	19:46 (WTG10) 20:09 (WTG10)	06:52 19:47	07:20 18:58	06:52 17:15
6	05:59 20:51	06:24 20:29	19:46 (WTG10) 20:08 (WTG10)	06:52 19:45	07:21 18:57	06:54 17:14
7	05:59 20:51	06:24 20:28	19:47 (WTG10) 20:07 (WTG10)	06:53 19:44	07:22 18:55	06:55 17:13
8	06:00 20:51	06:25 20:27	19:47 (WTG10) 20:06 (WTG10)	06:54 19:42	07:23 18:54	06:56 17:12
9	06:01 20:50	06:26 20:25	19:47 (WTG10) 20:05 (WTG10)	06:55 19:41	07:24 18:52	06:57 17:11
10	06:01 20:50	06:27 20:24	19:46 (WTG10) 20:03 (WTG10)	06:56 19:39	07:25 18:50	06:58 17:10
11	06:02 20:50	06:28 20:23	19:47 (WTG10) 20:02 (WTG10)	06:57 19:37	07:26 18:49	06:59 17:09
12	06:03 20:49	06:29 20:22	19:48 (WTG10) 20:01 (WTG10)	06:58 19:36	07:27 18:47	07:00 17:09
13	06:03 20:49	06:30 20:20	19:48 (WTG10) 20:00 (WTG10)	06:59 19:34	07:28 18:46	07:01 17:08
14	06:04 20:48	06:31 20:19	19:49 (WTG10) 19:59 (WTG10)	07:00 19:32	07:29 18:44	07:03 17:07
15	06:05 20:48	06:32 20:18	19:50 (WTG10) 19:58 (WTG10)	07:01 19:31	19:09 (WTG12) 19:10 (WTG12)	07:30 18:43
16	06:06 20:47	06:33 20:17	19:52 (WTG10) 19:56 (WTG10)	07:02 19:29	19:05 (WTG12) 19:09 (WTG12)	07:31 18:41
17	06:06 20:47	20:02 (WTG10) 20:05 (WTG10)	06:34 20:15	07:03 19:27	19:03 (WTG12) 19:07 (WTG12)	18:43 18:40
18	06:07 20:46	3 20:05 (WTG10) 20:09 (WTG10)	20:15 20:14	2 19:55 (WTG10) 07:04 19:26	4 19:07 (WTG12) 19:02 (WTG12) 19:06 (WTG12)	3 18:20 (WTG04) 18:16 (WTG04) 18:18 (WTG04)
19	06:08 20:45	10 20:09 (WTG10) 19:57 (WTG10)	06:36 20:12	4 19:26 07:04 19:24	2 18:18 (WTG04) 19:01 (WTG12) 19:04 (WTG12)	2 17:04 07:07 18:37
20	06:09 20:45	14 20:11 (WTG10) 19:56 (WTG10)	20:12 06:37	3 19:24 07:05 19:23	2 18:17 (WTG04) 19:00 (WTG12) 19:03 (WTG12)	17:03 07:37 18:36
21	06:09 20:44	17 20:13 (WTG10) 19:54 (WTG10)	20:11 06:38	3 19:23 07:06 19:21	2 18:15 (WTG04) 19:00 (WTG12) 19:01 (WTG12)	17:02 07:37 18:34
22	06:10 20:43	20 20:14 (WTG10) 19:53 (WTG10)	20:10 06:39	2 19:21 07:07 19:19	2 18:59 (WTG12) 19:00 (WTG12)	07:38 17:01
23	06:11 20:43	22 20:15 (WTG10) 19:52 (WTG10)	20:08 06:39	2 19:19 07:08 19:18	18:33 07:38 18:32	17:00 07:38 17:01
24	06:12 20:42	24 20:16 (WTG10) 19:52 (WTG10)	20:07 06:40	19:18 07:09 19:16	18:32 07:39 18:30	17:00 07:39 17:01
25	06:13 20:41	25 20:17 (WTG10) 19:51 (WTG10)	20:05 06:41	19:16 07:10 19:14	18:30 06:40 17:29	17:01 07:39 16:59
26	06:14 20:40	27 20:18 (WTG10) 19:50 (WTG10)	20:04 06:42	19:14 07:11 19:13	17:29 06:41 17:28	17:01 07:40 17:02
27	06:15 20:39	28 20:18 (WTG10) 19:49 (WTG10)	20:02 06:43	19:13 07:12 19:11	17:28 06:42 17:26	17:02 07:40 17:03
28	06:15 20:38	29 20:18 (WTG10) 19:49 (WTG10)	20:01 06:44	19:11 07:13 19:09	17:26 06:43 17:25	17:03 07:40 17:03
29	06:16 20:37	28 20:17 (WTG10) 19:48 (WTG10)	19:59 06:45	19:09 07:14 19:08	17:25 06:45 17:24	17:03 07:40 17:04
30	06:17 20:36	28 20:16 (WTG10) 19:48 (WTG10)	19:58 06:46	19:08 07:15 19:06	17:24 06:46 17:22	17:04 07:41 17:05
31	06:18 20:35	27 20:15 (WTG10) 19:48 (WTG10)	19:56 06:47	19:06 07:16 19:06	17:22 06:47 17:21	17:05 07:41 17:06
Potential sun hours	455	425	374	347	301	292
Total, worst case	329	283	24	11		
Sun reduction	0,74	0,73	0,65	0,54		
Oper. time red.	0,78	0,78	0,78	0,78		
Wind dir. red.	0,75	0,75	0,79	0,78		
Total reduction	0,43	0,43	0,40	0,33		
Total, real	143	122	10	4		

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:

**Brunco e Niada**

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Calculated:  
04/11/2020 13:48/2.8.579

**SHADOW - Calendar**

**Calculation: Ombre Recettori Rev2Shadow receptor: RE11 - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (54)**

**Assumptions for shadow calculations**

Reference year for calendar 2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	07:41	07:30	17:05 (WTG04)	06:55	07:06	06:23
	17:06	17:38	12 17:17 (WTG04)	18:12	19:44	19:07 (WTG10)
2	07:41	07:29	17:06 (WTG04)	06:54	07:05	06:21
	17:07	17:40	12 17:18 (WTG04)	18:13	19:45	19:07 (WTG10)
3	07:41	07:28	17:08 (WTG04)	06:52	07:03	06:20
	17:07	17:41	12 17:20 (WTG04)	18:14	19:46	19:07 (WTG10)
4	07:42	07:27	17:10 (WTG04)	06:51	07:02	06:19
	17:08	17:42	11 17:21 (WTG04)	18:15	19:47	19:07 (WTG10)
5	07:42	07:26	17:13 (WTG04)	06:49	17:57 (WTG12)	07:00
	17:09	17:43	7 17:20 (WTG04)	18:16	2 17:58 (WTG12)	19:48
6	07:42	07:25	17:15 (WTG04)	06:48	18:00 (WTG12)	19:48
	17:10	17:44	18:17	2 17:58 (WTG12)	19:49	19:48 (WTG10)
7	07:42	07:24	17:17 (WTG04)	06:46	17:55 (WTG12)	06:57
	17:11	17:45	18:18	5 18:00 (WTG12)	19:50	19:48 (WTG10)
8	07:42	07:23	17:19 (WTG04)	06:45	17:54 (WTG12)	06:55
	17:12	17:47	18:19	7 18:01 (WTG12)	19:51	19:48 (WTG10)
9	07:42	07:22	17:21 (WTG04)	06:43	17:53 (WTG12)	06:54
	17:13	17:48	18:20	8 18:01 (WTG12)	19:52	19:48 (WTG10)
10	07:41	07:21	17:23 (WTG04)	06:42	17:53 (WTG12)	06:52
	17:14	17:49	18:21	10 18:03 (WTG12)	19:53	19:48 (WTG10)
11	07:41	07:20	17:25 (WTG04)	06:40	17:52 (WTG12)	06:51
	17:15	17:50	18:22	11 18:03 (WTG12)	19:54	19:48 (WTG10)
12	07:41	07:19	17:27 (WTG04)	06:38	17:53 (WTG12)	06:49
	17:16	17:51	18:24	12 18:05 (WTG12)	19:55	19:48 (WTG10)
13	07:41	07:18	17:29 (WTG04)	06:37	17:52 (WTG12)	06:48
	17:17	17:53	18:25	14 18:06 (WTG12)	19:56	19:48 (WTG10)
14	07:41	07:17	17:31 (WTG04)	06:35	17:52 (WTG12)	06:46
	17:18	17:54	18:26	14 18:06 (WTG12)	19:57	19:48 (WTG10)
15	07:40	07:15	17:33 (WTG04)	06:34	17:54 (WTG12)	06:45
	17:19	17:55	18:27	14 18:08 (WTG12)	19:58	19:48 (WTG10)
16	07:40	07:14	17:35 (WTG04)	06:32	17:54 (WTG12)	06:43
	17:20	17:56	18:28	15 18:09 (WTG12)	19:59	19:48 (WTG10)
17	07:40	07:13	17:37 (WTG04)	06:30	17:57 (WTG12)	06:42
	17:21	17:57	18:29	13 18:10 (WTG12)	20:00	19:48 (WTG10)
18	07:39	16:59 (WTG04)	07:12	06:29	17:59 (WTG12)	06:40
	17:22	2 17:00 (WTG04)	17:58	18:30	8 18:07 (WTG12)	20:01
19	07:39	17:00 (WTG04)	07:10	06:27	06:39	06:05
	17:23	2 17:02 (WTG04)	17:59	18:31	20:02	20:31
20	07:38	17:00 (WTG04)	07:09	06:26	06:37	06:03
	17:24	2 17:02 (WTG04)	18:01	18:32	20:03	11 19:41 (WTG10)
21	07:38	17:00 (WTG04)	07:08	06:24	06:36	06:02
	17:25	4 17:04 (WTG04)	18:02	18:33	20:04	19 19:24 (WTG10)
22	07:37	17:00 (WTG04)	07:06	06:23	06:35	06:01
	17:27	5 17:05 (WTG04)	18:03	18:34	20:05	24 19:45 (WTG10)
23	07:37	17:00 (WTG04)	07:05	06:21	06:33	06:00
	17:28	6 17:06 (WTG04)	18:04	18:35	20:06	27 19:46 (WTG10)
24	07:36	17:01 (WTG04)	07:04	06:19	06:32	06:00
	17:29	7 17:08 (WTG04)	18:05	18:36	20:07	30 19:46 (WTG10)
25	07:35	17:01 (WTG04)	07:02	06:18	06:31	05:59
	17:30	8 17:09 (WTG04)	18:06	18:37	20:08	33 19:47 (WTG10)
26	07:35	17:01 (WTG04)	07:01	06:16	06:29	05:59
	17:31	9 17:10 (WTG04)	18:07	18:38	20:09	36 19:49 (WTG10)
27	07:34	17:01 (WTG04)	06:59	06:14	06:28	05:58
	17:32	10 17:11 (WTG04)	18:09	18:39	20:10	38 19:49 (WTG10)
28	07:33	17:02 (WTG04)	06:58	06:13	06:27	05:57
	17:34	11 17:13 (WTG04)	18:10	18:40	20:11	40 19:50 (WTG10)
29	07:33	17:03 (WTG04)	06:57	07:11	06:25	05:57
	17:35	11 17:14 (WTG04)	18:11	19:41	20:12	42 19:51 (WTG10)
30	07:32	17:03 (WTG04)		07:10	06:24	05:56
	17:36	12 17:15 (WTG04)		19:42	20:13	44 19:52 (WTG10)
31	07:31	17:04 (WTG04)		07:08		05:56
	17:37	12 17:16 (WTG04)		19:43		20:41
Potential sun hours	301	309	370	397	445	448
Total, worst case	101	54	135	344	1855	1575
Sun reduction	0,45	0,47	0,49	0,53	0,59	0,66
Oper. time red.	0,78	0,78	0,78	0,78	0,78	0,78
Wind dir. red.	0,74	0,74	0,79	0,76	0,76	0,76
Total reduction	0,26	0,27	0,30	0,31	0,35	0,39
Total, real	26	15	41	108	646	617

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:

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Calculated:  
04/11/2020 13:48/2.8.579

**SHADOW - Calendar**

Calculation: Ombre Recettori Rev2Shadow receptor: RE11 - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (54)

**Assumptions for shadow calculations**

Reference year for calendar

2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	05:56 20:52	19:15 (WTG10) 06:19 20:08 (WTG10) 20:34	19:12 (WTG10) 06:48 20:14 (WTG10) 19:53	07:16 19:05	18:31 (WTG12) 06:48 18:44 (WTG12) 17:20	07:21 16:57
2	05:57 20:52	19:15 (WTG10) 06:20 20:08 (WTG10) 20:33	19:12 (WTG10) 06:49 20:12 (WTG10) 19:52	07:17 19:03	18:31 (WTG12) 06:49 18:43 (WTG12) 17:19	07:22 16:57
3	05:57 20:52	19:15 (WTG10) 06:21 20:09 (WTG10) 20:32	19:12 (WTG10) 06:50 20:11 (WTG10) 19:50	07:18 19:01	18:30 (WTG12) 06:50 18:41 (WTG12) 17:18	07:23 16:57
4	05:58 20:52	19:15 (WTG10) 06:22 20:09 (WTG10) 20:31	19:12 (WTG10) 06:51 20:10 (WTG10) 19:49	07:19 19:00	18:30 (WTG12) 06:51 18:39 (WTG12) 17:17	07:24 16:57
5	05:58 20:52	19:15 (WTG10) 06:23 20:10 (WTG10) 20:30	19:12 (WTG10) 06:52 20:09 (WTG10) 19:47	07:20 18:58	18:30 (WTG12) 06:52 18:38 (WTG12) 17:16	07:25 16:57
6	05:59 20:51	19:15 (WTG10) 06:24 20:09 (WTG10) 20:29	19:13 (WTG10) 06:52 20:08 (WTG10) 19:45	07:21 18:57	18:30 (WTG12) 06:54 18:36 (WTG12) 17:14	07:26 16:56
7	05:59 20:51	19:15 (WTG10) 06:25 20:10 (WTG10) 20:28	19:13 (WTG10) 06:53 20:07 (WTG10) 19:44	07:22 18:55	18:31 (WTG12) 06:55 18:35 (WTG12) 17:13	16:42 (WTG04) 07:27 16:51 (WTG04) 16:56
8	06:00 20:51	19:14 (WTG10) 06:25 20:10 (WTG10) 20:27	19:14 (WTG10) 06:54 20:06 (WTG10) 19:42	07:23 18:54	18:31 (WTG12) 06:56 18:33 (WTG12) 17:12	16:40 (WTG04) 07:28 16:52 (WTG04) 16:56
9	06:01 20:50	19:15 (WTG10) 06:26 20:11 (WTG10) 20:25	19:14 (WTG10) 06:55 20:05 (WTG10) 19:41	07:24 18:52	06:57 17:11	16:38 (WTG04) 07:29 16:50 (WTG04) 16:56
10	06:01 20:50	19:15 (WTG10) 06:27 20:12 (WTG10) 20:24	19:15 (WTG10) 06:56 20:04 (WTG10) 19:39	07:25 18:50	06:58 17:10	16:37 (WTG04) 07:30 16:49 (WTG04) 16:56
11	06:02 20:50	19:14 (WTG10) 06:28 20:11 (WTG10) 20:23	19:14 (WTG10) 06:57 20:02 (WTG10) 19:37	07:26 18:49	06:59 17:09	16:36 (WTG04) 07:30 16:48 (WTG04) 16:56
12	06:03 20:49	19:14 (WTG10) 06:29 20:12 (WTG10) 20:22	19:15 (WTG10) 06:58 20:01 (WTG10) 19:36	07:27 18:47	07:00 17:09	16:36 (WTG04) 07:31 16:48 (WTG04) 16:57
13	06:03 20:49	19:14 (WTG10) 06:30 20:13 (WTG10) 20:20	19:16 (WTG10) 06:59 20:00 (WTG10) 19:34	07:28 18:46	07:01 17:08	16:35 (WTG04) 07:32 16:47 (WTG04) 16:57
14	06:04 20:48	19:13 (WTG10) 06:31 20:12 (WTG10) 20:19	19:17 (WTG10) 07:00 19:59 (WTG10) 19:32	07:29 18:44	07:03 17:07	16:35 (WTG04) 07:33 16:46 (WTG04) 16:57
15	06:05 20:48	19:14 (WTG10) 06:32 20:13 (WTG10) 20:18	19:18 (WTG10) 07:01 19:58 (WTG10) 19:31	07:30 18:43	07:04 17:06	16:34 (WTG04) 07:33 16:45 (WTG04) 16:57
16	06:06 20:47	19:14 (WTG10) 06:33 20:14 (WTG10) 20:17	19:19 (WTG10) 07:02 19:56 (WTG10) 19:29	07:31 18:41	07:05 17:05	16:34 (WTG04) 07:34 16:44 (WTG04) 16:57
17	06:06 20:47	19:13 (WTG10) 06:34 20:13 (WTG10) 20:15	19:20 (WTG10) 07:03 19:55 (WTG10) 19:28	07:32 18:40	07:06 17:04	16:35 (WTG04) 07:35 16:44 (WTG04) 16:58
18	06:07 20:46	19:13 (WTG10) 06:35 20:14 (WTG10) 20:14	19:21 (WTG10) 07:04 19:54 (WTG10) 19:26	07:33 18:39	07:07 17:04	16:35 (WTG04) 07:35 16:43 (WTG04) 16:58
19	06:08 20:45	19:13 (WTG10) 06:36 20:14 (WTG10) 20:12	19:22 (WTG10) 07:04 19:52 (WTG10) 19:24	07:34 18:37	07:08 17:03	16:35 (WTG04) 07:36 16:42 (WTG04) 16:59
20	06:09 20:45	19:13 (WTG10) 06:37 20:15 (WTG10) 20:11	19:24 (WTG10) 07:05 19:51 (WTG10) 19:23	07:35 18:36	07:09 17:02	16:35 (WTG04) 07:37 16:41 (WTG04) 16:59
21	06:09 20:44	19:12 (WTG10) 06:38 20:14 (WTG10) 20:10	19:26 (WTG10) 07:06 19:49 (WTG10) 19:21	07:36 18:34	07:11 17:02	16:35 (WTG04) 07:37 16:40 (WTG04) 16:59
22	06:10 20:43	19:12 (WTG10) 06:39 20:15 (WTG10) 20:08	19:30 (WTG10) 07:07 19:48 (WTG10) 19:19	07:37 18:33	07:12 17:01	16:36 (WTG04) 07:38 16:40 (WTG04) 17:00
23	06:11 20:43	19:12 (WTG10) 06:39 20:18 (WTG11) 20:07	19:35 (WTG10) 07:08 19:44 (WTG10) 19:18	07:38 18:32	07:13 17:01	16:37 (WTG04) 07:38 16:39 (WTG04) 17:00
24	06:12 20:42	19:12 (WTG10) 06:40 20:20 (WTG11) 20:05	07:09 19:16	07:39 18:30	07:14 17:00	16:37 (WTG04) 07:39 16:39 (WTG04) 17:01
25	06:13 20:41	19:13 (WTG10) 06:41 20:20 (WTG11) 20:04	07:10 19:14	18:44 (WTG12) 06:40 18:47 (WTG12) 17:29	07:15 17:00	16:37 (WTG04) 07:39 16:38 (WTG04) 17:01
26	06:14 20:40	19:13 (WTG10) 06:42 20:19 (WTG11) 20:02	07:11 19:13	18:39 (WTG12) 06:41 18:51 (WTG12) 17:28	07:16 16:59	07:40 17:02
27	06:15 20:39	19:12 (WTG10) 06:43 20:18 (WTG11) 20:01	07:12 19:11	18:36 (WTG12) 06:42 18:51 (WTG12) 17:26	07:17 16:59	07:40 17:03
28	06:15 20:38	19:12 (WTG10) 06:44 20:17 (WTG11) 19:59	07:13 19:10	18:35 (WTG12) 06:44 18:49 (WTG12) 17:25	07:18 16:58	07:40 17:03
29	06:16 20:37	19:12 (WTG10) 06:45 20:16 (WTG11) 19:58	07:14 19:08	18:33 (WTG12) 06:45 18:47 (WTG12) 17:24	07:19 16:58	07:41 17:04
30	06:17 20:36	19:12 (WTG10) 06:46 20:15 (WTG10) 19:56	07:15 19:06	18:32 (WTG12) 06:46 18:46 (WTG12) 17:22	07:20 16:58	07:41 17:05
31	06:18 20:35	19:12 (WTG10) 06:47 20:15 (WTG10) 19:55	06:47 17:21	06:47 17:21	06:47 17:21	07:41 17:06
Potential sun hours	455	425	374	347	301	292
Total, worst case	1856	989	72	65	158	
Sun reduction	0,74	0,73	0,65	0,54	0,50	
Oper. time red.	0,78	0,78	0,78	0,78	0,78	
Wind dir. red.	0,76	0,76	0,79	0,79	0,74	
Total reduction	0,44	0,43	0,40	0,33	0,29	
Total, real	810	427	29	22	46	

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:

**Brunco e Niada**

Printed/Page

04/11/2020 15:45 / 23

Licensed user:

**Ing. Bruno Manca**  
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IT-09028 Sestu  
+390702358125  
Bruno Manca / ingbrunomanca@gmail.com

Calculated:

04/11/2020 13:48/2.8.579

### SHADOW - Calendar

Calculation: Ombre Recettori Rev2Shadow receptor: RE12 - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (55)

#### Assumptions for shadow calculations

Reference year for calendar 2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:41 17:06	07:30 17:38	06:55 18:12	07:07 19:44	06:23 20:14	05:55 20:42	05:56 20:52	06:19 20:34	06:48 19:53	07:16 19:05	06:48 17:20	07:21 16:57
2	07:41 17:07	07:29 17:40	06:54 18:13	07:05 19:45	06:21 20:15	05:55 20:42	05:57 20:52	06:20 20:33	06:49 19:52	07:17 19:03	06:49 17:19	07:22 16:57
3	07:42 17:07	07:28 17:41	06:52 18:14	07:03 19:46	06:20 20:16	05:55 20:43	05:57 20:52	06:21 20:32	06:50 19:50	07:18 19:01	06:50 17:18	07:23 16:57
4	07:42 17:08	07:27 17:42	06:51 18:15	07:02 19:47	06:19 20:17	05:54 20:44	05:58 20:52	06:22 20:31	06:51 19:49	07:19 19:00	06:51 17:17	07:24 16:57
5	07:42 17:09	07:26 17:43	06:49 18:16	07:00 19:48	06:18 20:18	05:54 20:44	05:58 20:52	06:23 20:30	06:52 19:47	07:20 18:58	06:52 17:16	07:25 16:57
6	07:42 17:10	07:25 17:44	06:48 18:17	06:59 19:49	06:17 20:19	05:54 20:45	05:59 20:51	06:24 20:29	06:52 19:45	07:21 18:57	06:54 17:14	07:26 16:56
7	07:42 17:11	07:24 17:45	06:46 18:18	06:57 19:50	06:16 20:20	05:53 20:46	05:59 20:51	06:25 20:28	06:53 19:44	07:22 18:55	06:55 17:13	07:27 16:56
8	07:42 17:12	07:23 17:47	06:45 18:19	06:55 19:51	06:14 20:21	05:53 20:46	06:00 20:51	06:25 20:27	06:54 19:42	07:23 18:54	06:56 17:12	07:28 16:56
9	07:42 17:13	07:22 17:48	06:43 18:20	06:54 19:52	06:13 20:22	05:53 20:47	06:01 20:51	06:26 20:26	06:55 19:41	07:24 18:52	06:57 17:11	07:29 16:56
10	07:41 17:14	07:21 17:49	06:42 18:21	06:52 19:53	06:12 20:23	05:53 20:47	06:01 20:50	06:27 20:24	06:56 19:39	07:25 18:50	06:58 17:10	07:30 16:56
11	07:41 17:15	07:20 17:50	06:40 18:22	06:51 19:54	06:11 20:23	05:53 20:48	06:02 20:50	06:28 20:23	06:57 19:37	07:26 18:49	06:59 17:09	07:30 16:56
12	07:41 17:16	07:19 17:51	06:38 18:24	06:49 19:55	06:10 20:24	05:53 20:48	06:03 20:49	06:29 20:22	06:58 19:36	07:27 18:47	07:00 17:09	07:31 16:57
13	07:41 17:17	07:18 17:53	06:37 18:25	06:48 19:56	06:09 20:25	05:52 20:49	06:03 20:49	06:30 20:21	06:59 19:34	07:28 18:46	07:02 17:08	07:32 16:57
14	07:41 17:18	07:17 17:54	06:35 18:26	06:46 19:57	06:08 20:26	05:52 20:49	06:04 20:48	06:31 20:19	07:00 19:32	07:29 18:44	07:03 17:07	07:33 16:57
15	07:40 17:19	07:15 17:55	06:34 18:27	06:45 19:58	06:07 20:27	05:52 20:50	06:05 20:48	06:32 20:18	07:01 19:31	07:30 18:43	07:04 17:06	07:34 16:57
16	07:40 17:20	07:14 17:56	06:32 18:28	06:43 19:59	06:06 20:28	05:52 20:50	06:06 20:47	06:33 20:17	07:02 19:29	07:31 18:41	07:05 17:05	07:34 16:57
17	07:40 17:21	07:13 17:57	06:31 18:29	06:42 20:00	06:05 20:29	05:52 20:50	06:06 20:47	06:34 20:15	07:03 19:28	07:32 18:40	07:06 17:04	07:35 16:58
18	07:39 17:22	07:12 17:58	06:29 18:30	06:40 20:01	06:05 20:30	05:53 20:51	06:07 20:46	06:35 20:14	07:04 19:26	07:33 18:39	07:07 17:04	07:36 16:58
19	07:39 17:23	07:10 18:00	06:27 18:31	06:39 20:02	06:04 20:31	05:53 20:51	06:08 20:45	06:36 20:13	07:05 19:24	07:34 18:37	07:08 17:03	07:36 16:58
20	07:38 17:24	07:09 18:01	06:26 18:32	06:38 20:03	06:03 20:32	05:53 20:51	06:09 20:45	06:37 20:11	07:05 19:23	07:35 18:36	07:09 17:02	07:37 16:59
21	07:38 17:25	07:08 18:02	06:24 18:33	06:36 20:04	06:02 20:33	05:53 20:52	06:09 20:44	06:38 20:10	07:06 19:21	07:36 18:34	07:11 17:02	07:37 16:59
22	07:37 17:27	07:06 18:03	06:23 18:34	06:35 20:05	06:01 20:34	05:53 20:52	06:10 20:43	06:39 20:08	07:07 19:19	07:37 18:33	07:12 17:01	07:38 17:00
23	07:37 17:28	07:05 18:04	06:21 18:35	06:33 20:06	06:01 20:34	05:53 20:52	06:11 20:43	06:39 20:07	07:08 19:18	07:38 18:32	07:13 17:01	07:38 17:00
24	07:36 17:29	07:04 18:05	06:19 18:36	06:32 20:07	06:00 20:35	05:54 20:52	06:12 20:42	06:40 20:05	07:09 19:16	07:39 18:30	07:14 17:00	07:39 17:01
25	07:36 17:30	07:02 18:06	06:18 18:37	06:31 20:08	06:31 20:36	05:59 20:52	06:13 20:41	06:41 20:04	07:10 19:14	07:40 17:29	07:15 17:00	07:39 17:01
26	07:35 17:31	07:01 18:07	06:16 18:38	06:29 20:09	06:29 20:37	05:59 20:52	06:14 20:40	06:42 20:02	07:11 19:13	07:41 17:28	07:16 16:59	07:40 17:02
27	07:34 17:32	07:00 18:09	06:15 18:39	06:28 20:10	06:28 20:38	05:58 20:52	06:15 20:39	06:43 20:01	07:12 19:11	07:42 17:26	07:17 16:59	07:40 17:03
28	07:33 17:34	06:58 18:10	06:13 18:40	06:27 20:11	06:27 20:39	05:55 20:52	06:15 20:38	06:44 19:59	07:13 19:10	07:43 17:25	07:18 16:58	07:40 17:03
29	07:33 17:35	06:57 18:11	07:11 19:41	06:25 20:12	06:25 20:39	05:55 20:52	06:16 20:37	06:45 19:58	07:14 19:08	07:44 17:24	07:19 16:58	07:41 17:04
30	07:32 17:36	07:00 18:12	07:10 19:42	06:24 20:13	06:24 20:40	05:56 20:52	06:17 20:36	06:46 19:56	07:15 19:06	07:45 17:22	07:20 16:58	07:41 17:05
31	07:31 17:37	07:00 18:13	07:08 19:43	06:24 20:14	06:24 20:41	05:56 20:53	06:18 20:35	06:47 19:55	07:16 17:21	07:46 17:23	07:21 16:59	07:41 17:06
Potential sun hours	301	309	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:  
**Brunco e Niada**

Printed/Page  
04/11/2020 15:45 / 24

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+390702358125  
Bruno Manca / ingbrunomanca@gmail.com  
Calculated:  
04/11/2020 13:48/2.8.579

### SHADOW - Calendar

Calculation: Ombre Recettori Rev2Shadow receptor: RE13 - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (56)

#### Assumptions for shadow calculations

Reference year for calendar 2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:41 17:06	08:10 (WTG02) 08:36 (WTG02)	07:30 17:38	06:55 18:12	07:07 19:44	06:23 20:14	05:56 20:42	05:56 20:52	06:19 20:35	06:48 19:53	06:48 19:05	07:21 17:20
2	07:41 17:07	08:10 (WTG02) 08:36 (WTG02)	07:29 17:40	06:54 18:13	07:05 19:45	06:22 20:15	05:55 20:42	05:57 20:52	06:20 20:34	06:49 19:52	06:49 19:03	07:17 17:19
3	07:42 17:08	08:11 (WTG02) 08:36 (WTG02)	07:28 17:41	06:52 18:14	07:03 19:46	06:20 20:16	05:55 20:43	05:57 20:52	06:21 20:32	06:50 19:50	06:50 19:02	06:50 17:18
4	07:42 17:08	08:11 (WTG02) 08:36 (WTG02)	07:28 17:42	06:51 18:15	07:02 19:47	06:19 20:17	05:54 20:44	05:58 20:52	06:22 20:31	06:51 19:49	06:51 19:00	06:51 17:17
5	07:42 17:09	08:12 (WTG02) 08:37 (WTG02)	07:27 17:43	06:49 18:16	07:00 19:48	06:18 20:18	05:54 20:44	05:58 20:52	06:23 20:30	06:52 19:47	06:52 19:00	06:53 17:16
6	07:42 17:10	08:13 (WTG02) 08:37 (WTG02)	07:26 17:44	06:48 18:17	06:59 19:49	06:17 20:19	05:54 20:45	05:59 20:52	06:24 20:29	06:53 19:46	06:54 18:58	06:54 17:16
7	07:42 17:11	08:14 (WTG02) 08:37 (WTG02)	07:25 17:46	06:46 18:18	06:57 19:50	06:16 20:20	05:54 20:46	06:00 20:51	06:25 20:28	06:54 19:44	06:54 18:55	06:55 17:14
8	07:42 17:12	08:15 (WTG02) 08:37 (WTG02)	07:24 17:47	06:45 18:19	06:56 19:51	06:15 20:21	05:53 20:46	06:00 20:51	06:26 20:27	06:54 19:42	06:54 18:54	06:56 17:12
9	07:42 17:13	08:16 (WTG02) 08:37 (WTG02)	07:22 17:48	06:43 18:21	06:54 19:52	06:13 20:22	05:53 20:47	06:01 20:51	06:26 20:26	06:55 19:41	06:55 18:52	06:57 17:11
10	07:42 17:14	08:16 (WTG02) 08:36 (WTG02)	07:21 17:49	06:42 18:22	06:53 19:53	06:12 20:23	05:53 20:47	06:01 20:50	06:27 20:24	06:56 19:39	06:56 18:51	06:58 17:11
11	07:41 17:15	08:17 (WTG02) 08:36 (WTG02)	07:20 17:50	06:40 18:23	06:51 19:54	06:11 20:24	05:53 20:48	06:02 20:50	06:28 20:23	06:57 19:37	06:59 18:49	06:59 17:10
12	07:41 17:16	08:19 (WTG02) 08:36 (WTG02)	07:19 17:52	06:39 18:24	06:49 19:55	06:10 20:25	05:53 20:48	06:03 20:49	06:29 20:22	06:58 19:36	07:27 17:09	07:01 16:57
13	07:41 17:17	08:20 (WTG02) 08:36 (WTG02)	07:18 17:53	06:37 18:25	06:48 19:56	06:09 20:26	05:53 20:49	06:03 20:49	06:30 20:21	06:59 19:34	07:28 17:08	07:02 16:57
14	07:41 17:18	08:21 (WTG02) 08:34 (WTG02)	07:17 17:54	06:35 18:26	06:46 19:57	06:08 20:26	05:53 20:49	06:04 20:49	06:31 20:19	07:00 19:33	07:29 18:45	07:03 17:07
15	07:40 17:19	08:24 (WTG02) 08:33 (WTG02)	07:16 17:55	06:34 18:27	06:45 19:58	06:07 20:27	05:53 20:50	06:05 20:48	06:32 20:18	07:01 19:31	07:30 18:43	07:04 17:06
16	07:40 17:20	08:24 (WTG02) 08:33 (WTG02)	07:16 17:56	06:34 18:28	06:45 19:59	06:07 20:28	05:53 20:50	06:05 20:47	06:32 20:17	07:01 19:29	07:30 18:42	07:04 17:05
17	07:40 17:21	08:24 (WTG02) 08:33 (WTG02)	07:16 17:57	06:34 18:29	06:45 20:00	06:07 20:29	05:53 20:50	06:05 20:47	06:32 20:15	07:01 19:28	07:30 18:40	07:04 17:05
18	07:39 17:22	08:24 (WTG02) 08:33 (WTG02)	07:16 17:58	06:34 18:30	06:45 20:01	06:07 20:30	05:53 20:51	06:05 20:46	06:32 20:14	07:01 19:26	07:30 18:39	07:04 17:04
19	07:39 17:23	08:24 (WTG02) 08:33 (WTG02)	07:16 17:59	06:34 18:31	06:45 20:02	06:07 20:31	05:53 20:51	06:05 20:46	06:32 20:13	07:01 19:24	07:30 18:37	07:04 17:03
20	07:39 17:24	08:24 (WTG02) 08:33 (WTG02)	07:16 18:00	06:34 18:32	06:45 20:03	06:07 20:32	05:53 20:51	06:05 20:45	06:32 20:11	07:01 19:23	07:30 18:36	07:04 17:02
21	07:39 17:25	08:24 (WTG02) 08:33 (WTG02)	07:16 18:01	06:34 18:33	06:45 20:04	06:07 20:33	05:53 20:52	06:05 20:44	06:32 20:10	07:01 19:21	07:30 18:34	07:04 17:02
22	07:39 17:26	08:24 (WTG02) 08:33 (WTG02)	07:16 18:02	06:34 18:34	06:45 20:05	06:07 20:34	05:53 20:52	06:05 20:43	06:32 20:08	07:01 19:19	07:30 18:33	07:04 17:01
23	07:39 17:27	08:24 (WTG02) 08:33 (WTG02)	07:16 18:03	06:34 18:35	06:45 20:06	06:07 20:35	05:53 20:52	06:05 20:43	06:32 20:07	07:01 19:18	07:30 18:32	07:04 17:01
24	07:39 17:28	08:24 (WTG02) 08:33 (WTG02)	07:16 18:04	06:34 18:36	06:45 20:07	06:07 20:36	05:53 20:52	06:05 20:42	06:32 20:05	07:01 19:16	07:30 18:30	07:04 17:00
25	07:39 17:29	08:24 (WTG02) 08:33 (WTG02)	07:16 18:05	06:34 18:37	06:45 20:08	06:07 20:37	05:53 20:52	06:05 20:41	06:32 20:04	07:01 19:15	07:30 18:29	07:04 17:00
26	07:39 17:30	08:24 (WTG02) 08:33 (WTG02)	07:16 18:06	06:34 18:38	06:45 20:09	06:07 20:38	05:53 20:52	06:05 20:40	06:32 20:03	07:01 19:13	07:30 18:28	07:04 17:00
27	07:39 17:31	08:24 (WTG02) 08:33 (WTG02)	07:16 18:07	06:34 18:39	06:45 20:10	06:07 20:39	05:53 20:52	06:05 20:39	06:32 20:01	07:01 19:12	07:30 18:27	07:04 17:00
28	07:39 17:32	08:24 (WTG02) 08:33 (WTG02)	07:16 18:08	06:34 18:40	06:45 20:11	06:07 20:40	05:53 20:52	06:05 20:38	06:32 20:00	07:01 19:10	07:30 18:26	07:04 17:00
29	07:39 17:33	08:24 (WTG02) 08:33 (WTG02)	07:16 18:09	06:34 18:41	06:45 20:12	06:07 20:41	05:53 20:52	06:05 20:38	06:32 20:00	07:01 19:08	07:30 18:25	07:04 17:00
30	07:39 17:34	08:24 (WTG02) 08:33 (WTG02)	07:16 18:10	06:34 18:42	06:45 20:13	06:07 20:42	05:53 20:52	06:05 20:38	06:32 20:00	07:01 19:07	07:30 18:24	07:04 17:00
31	07:39 17:35	08:24 (WTG02) 08:33 (WTG02)	07:16 18:11	06:34 18:43	06:45 20:14	06:07 20:43	05:53 20:52	06:05 20:38	06:32 20:00	07:01 19:06	07:30 18:23	07:04 17:00
Potential sun hours	301	311	309	370	397	445	448	455	425	374	347	301
Total, worst case												
Sun reduction		0.45										0.50
Oper. time red.		0.78										0.78
Wind dir. red.		0.67										0.67
Total reduction		0.24										0.27
Total, real		74										10
												292
												783
												0.45
												0.78
												0.67
												0.24
												186

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:

**Brunco e Niada**

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Calculated:

04/11/2020 13:48/2.8.579

### SHADOW - Calendar

Calculation: Ombre Recettori Rev2Shadow receptor: RE14 - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (57)

#### Assumptions for shadow calculations

Reference year for calendar

2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:41 17:06	08:09 (WTG02) 17:38	07:30 18:12	06:55 19:44	07:07 20:14	06:23 20:42	05:56 20:52	05:56 20:35	06:19 19:53	06:48 19:05	07:16 17:20	06:48 16:57	07:59 (WTG02) 08:19 (WTG02)
2	07:41 17:07	08:09 (WTG02) 17:40	07:29 18:13	06:54 19:45	07:05 20:15	06:22 20:42	05:55 20:52	05:57 20:34	06:20 19:52	06:49 19:03	07:17 17:19	06:49 16:57	07:59 (WTG02) 08:20 (WTG02)
3	07:42 17:08	08:10 (WTG02) 17:41	07:28 18:14	06:52 19:46	07:03 20:16	06:20 20:43	05:55 20:52	05:57 20:32	06:21 19:50	06:50 19:02	06:50 17:18	06:50 16:57	07:59 (WTG02) 08:21 (WTG02)
4	07:42 17:08	08:10 (WTG02) 17:42	07:28 18:15	06:51 19:47	07:02 20:17	06:19 20:44	05:54 20:52	05:58 20:31	06:22 19:49	06:51 19:00	07:19 17:17	06:51 16:57	07:59 (WTG02) 08:21 (WTG02)
5	07:42 17:09	08:11 (WTG02) 17:43	07:27 18:16	06:49 19:48	07:00 20:18	06:18 20:44	05:54 20:52	05:58 20:30	06:23 19:47	06:52 18:58	07:20 17:16	06:53 16:57	07:59 (WTG02) 08:22 (WTG02)
6	07:42 17:10	08:12 (WTG02) 17:44	07:26 18:17	06:48 19:49	06:59 20:19	06:17 20:45	05:54 20:52	05:59 20:29	06:24 19:46	06:53 18:57	07:21 17:15	06:54 16:57	07:59 (WTG02) 08:23 (WTG02)
7	07:42 17:11	08:12 (WTG02) 17:45	07:25 18:18	06:46 19:50	06:57 20:20	06:16 20:46	05:54 20:51	06:00 20:28	06:25 19:44	06:54 18:55	07:22 17:14	06:55 16:56	07:59 (WTG02) 08:24 (WTG02)
8	07:42 17:12	08:14 (WTG02) 17:46	07:24 18:19	06:45 19:51	06:56 20:21	06:15 20:46	05:53 20:51	06:00 20:27	06:26 19:42	06:54 18:54	07:23 17:12	06:56 16:56	07:59 (WTG02) 08:25 (WTG02)
9	07:42 17:13	08:15 (WTG02) 17:47	07:22 18:20	06:43 19:52	06:54 20:22	06:13 20:47	05:53 20:51	06:01 20:26	06:26 19:41	06:55 18:52	07:24 17:11	06:57 16:56	07:59 (WTG02) 08:25 (WTG02)
10	07:42 17:14	08:15 (WTG02) 17:48	07:21 18:21	06:42 19:52	06:53 20:22	06:12 20:47	05:53 20:51	06:01 20:26	06:27 19:41	06:56 18:52	07:25 17:11	06:58 16:57	07:59 (WTG02) 08:25 (WTG02)
11	07:41 17:15	08:16 (WTG02) 17:49	07:20 18:22	06:40 19:53	06:51 20:23	06:11 20:47	05:53 20:50	06:02 20:24	06:28 19:39	06:57 18:51	07:26 17:11	06:59 16:57	07:59 (WTG02) 08:25 (WTG02)
12	07:41 17:16	08:17 (WTG02) 17:50	07:19 18:23	06:39 19:54	06:49 20:24	06:10 20:48	05:53 20:50	06:03 20:23	06:29 19:37	06:58 18:49	07:27 17:10	07:01 16:57	08:00 (WTG02) 08:26 (WTG02)
13	07:41 17:17	08:17 (WTG02) 17:51	07:18 18:24	06:38 19:55	06:49 20:25	06:09 20:48	05:53 20:49	06:03 20:22	06:30 19:36	06:59 18:48	07:28 17:09	07:02 16:57	08:00 (WTG02) 08:27 (WTG02)
14	07:41 17:18	08:19 (WTG02) 17:52	07:18 18:25	06:37 19:56	06:48 20:26	06:08 20:49	05:53 20:49	06:04 20:21	07:00 19:34	07:29 18:46	07:29 17:08	07:03 16:57	08:00 (WTG02) 08:28 (WTG02)
15	07:40 17:19	08:21 (WTG02) 17:53	07:16 18:26	06:34 19:57	06:45 20:26	06:07 20:49	05:53 20:49	06:05 20:19	07:01 19:33	07:30 18:45	07:04 17:07	07:04 16:57	08:01 (WTG02) 08:28 (WTG02)
16	07:40 17:20	08:23 (WTG02) 17:54	07:14 18:27	06:32 19:58	06:43 20:27	06:06 20:50	05:53 20:48	06:06 20:18	07:02 19:31	07:31 18:43	07:05 17:06	07:05 16:57	08:01 (WTG02) 08:29 (WTG02)
17	07:40 17:21	08:23 (WTG02) 17:55	07:14 18:28	06:32 19:59	06:43 20:28	06:06 20:50	05:53 20:47	06:06 20:17	07:02 19:29	07:31 18:42	07:05 17:05	07:05 16:58	08:01 (WTG02) 08:29 (WTG02)
18	07:39 17:22	08:28 (WTG02) 17:56	07:13 18:29	06:31 20:00	06:42 20:29	06:06 20:50	05:53 20:47	06:06 20:15	07:03 19:28	07:32 18:40	07:06 17:05	07:06 16:58	08:01 (WTG02) 08:29 (WTG02)
19	07:39 17:23	08:30 (WTG02) 17:57	07:12 18:30	06:29 20:01	06:41 20:30	06:05 20:51	05:53 20:46	06:07 20:14	07:04 19:26	07:33 18:39	07:07 17:04	07:07 16:58	08:02 (WTG02) 08:30 (WTG02)
20	07:39 17:24	08:30 (WTG02) 17:58	07:11 18:31	06:27 20:02	06:39 20:31	06:04 20:51	05:53 20:46	06:08 20:13	07:05 19:24	07:34 18:37	07:08 17:03	07:08 16:59	08:03 (WTG02) 08:31 (WTG02)
21	07:38 17:25	08:31 (WTG02) 17:59	07:10 18:32	06:26 20:03	06:38 20:32	06:03 20:51	05:53 20:45	06:09 20:11	07:06 19:23	07:35 18:36	07:10 17:02	07:10 16:59	08:04 (WTG02) 08:32 (WTG02)
22	07:37 17:26	08:32 (WTG02) 18:00	07:09 18:33	06:25 20:04	06:37 20:33	06:02 20:52	05:53 20:44	06:10 20:10	07:07 19:21	07:36 18:34	07:11 17:02	07:11 16:59	08:04 (WTG02) 08:33 (WTG02)
23	07:37 17:27	08:33 (WTG02) 18:01	07:07 18:34	06:23 20:05	06:35 20:34	06:02 20:52	05:53 20:43	06:10 20:08	07:07 19:19	07:37 18:33	07:12 17:01	07:12 16:58	08:04 (WTG02) 08:34 (WTG02)
24	07:36 17:28	08:34 (WTG02) 18:02	07:05 18:35	06:21 20:06	06:33 20:35	06:01 20:52	05:54 20:43	06:11 20:07	07:08 19:18	07:38 18:32	07:13 17:01	07:13 16:58	08:05 (WTG02) 08:35 (WTG02)
25	07:36 17:29	08:35 (WTG02) 18:03	07:04 18:36	06:19 20:07	06:32 20:36	06:00 20:52	05:54 20:42	06:12 20:05	07:09 19:16	07:39 18:30	07:14 17:00	07:14 16:59	08:05 (WTG02) 08:36 (WTG02)
26	07:35 17:30	08:36 (WTG02) 18:04	07:02 18:37	06:18 20:08	06:31 20:37	05:59 20:52	05:54 20:41	06:13 20:04	07:10 19:15	07:40 18:29	07:15 17:00	07:15 16:59	08:05 (WTG02) 08:37 (WTG02)
27	07:35 17:31	08:37 (WTG02) 18:05	07:01 18:38	06:16 20:09	06:29 20:38	05:59 20:52	05:54 20:40	06:14 20:03	07:11 19:13	07:41 18:28	07:16 17:00	07:16 16:59	08:06 (WTG02) 08:38 (WTG02)
28	07:34 17:32	08:38 (WTG02) 18:06	07:00 18:39	06:15 20:10	06:28 20:39	05:58 20:52	05:55 20:39	06:15 20:01	07:12 19:11	07:42 18:27	07:17 17:00	07:17 16:59	08:06 (WTG02) 08:39 (WTG02)
29	07:34 17:33	08:39 (WTG02) 18:07	06:58 18:40	06:13 20:11	06:27 20:39	05:58 20:52	05:55 20:38	06:16 20:00	07:13 19:10	07:43 18:26	07:18 17:00	07:18 16:58	08:07 (WTG02) 08:40 (WTG02)
30	07:33 17:34	08:40 (WTG02) 18:08	06:57 18:41	06:12 20:12	06:26 20:39	05:57 20:52	05:56 20:38	06:16 19:58	07:14 19:08	07:44 18:25	07:19 17:00	07:19 16:58	08:07 (WTG02) 08:41 (WTG02)
31	07:32 17:35	08:41 (WTG02) 18:09	06:56 18:42	06:11 20:13	06:25 20:40	05:56 20:52	05:56 20:37	06:17 19:56	07:15 19:06	07:45 18:24	07:20 17:00	07:20 16:58	08:08 (WTG02) 08:42 (WTG02)
Potential sun hours	301	309	370	397	445	448	455	425	374	347	301	292	
Total, worst case		349									55		817
Sun reduction		0.45									0.50		0.45
Oper. time red.		0.78									0.78		0.78
Wind dir. red.		0.67									0.67		0.67
Total reduction		0.24									0.27		0.24
Total, real		83									15		194

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		



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Calculated:  
04/11/2020 13:48/2.8.579

**SHADOW - Calendar**

Calculation: Ombre Recettori Rev2Shadow receptor: RE15 - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (58)

**Assumptions for shadow calculations**

Reference year for calendar 2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:41 17:06	08:06 (WTG02) 08:33 (WTG02)	07:30 17:38	06:55 18:12	07:07 19:44	06:23 20:14	05:56 20:42	05:56 20:52	06:19 20:35	06:48 19:53	06:48 19:05	07:21 17:20
2	07:41 17:07	08:06 (WTG02) 08:34 (WTG02)	07:29 17:40	06:54 18:13	07:05 19:45	06:22 20:15	05:55 20:42	05:57 20:52	06:20 20:34	06:49 19:52	06:49 19:03	07:17 17:19
3	07:42 17:08	08:06 (WTG02) 08:34 (WTG02)	07:28 17:41	06:52 18:14	07:03 19:46	06:20 20:16	05:55 20:43	05:57 20:52	06:21 20:32	06:50 19:50	06:50 19:02	07:18 17:18
4	07:42 17:08	08:06 (WTG02) 08:34 (WTG02)	07:28 17:42	06:51 18:15	07:02 19:47	06:19 20:17	05:54 20:44	05:58 20:52	06:22 20:31	06:51 19:49	06:51 19:00	07:19 17:17
5	07:42 17:09	08:06 (WTG02) 08:35 (WTG02)	07:27 17:43	06:49 18:16	07:00 19:48	06:18 20:18	05:54 20:44	05:58 20:52	06:23 20:30	06:52 19:47	06:52 19:00	07:20 17:16
6	07:42 17:10	08:07 (WTG02) 08:35 (WTG02)	07:26 17:44	06:48 18:17	06:59 19:49	06:17 20:19	05:54 20:45	05:59 20:52	06:24 20:29	06:53 19:46	06:54 18:58	07:21 17:15
7	07:42 17:11	08:07 (WTG02) 08:35 (WTG02)	07:25 17:46	06:46 18:18	06:57 19:50	06:16 20:20	05:54 20:46	06:00 20:51	06:25 20:28	06:54 19:44	06:54 18:55	07:22 17:14
8	07:42 17:12	08:08 (WTG02) 08:36 (WTG02)	07:24 17:47	06:45 18:19	06:56 19:51	06:15 20:21	05:53 20:46	06:00 20:51	06:26 20:27	06:54 19:42	06:54 18:54	07:23 17:12
9	07:42 17:13	08:09 (WTG02) 08:36 (WTG02)	07:22 17:48	06:43 18:21	06:54 19:52	06:13 20:22	05:53 20:47	06:01 20:51	06:26 20:26	06:55 19:41	06:55 18:52	07:24 17:11
10	07:42 17:14	08:09 (WTG02) 08:35 (WTG02)	07:21 17:49	06:42 18:22	06:53 19:53	06:12 20:23	05:53 20:47	06:01 20:50	06:27 20:24	06:56 19:39	06:56 18:51	07:25 17:11
11	07:41 17:15	08:09 (WTG02) 08:36 (WTG02)	07:20 17:50	06:40 18:23	06:51 19:54	06:11 20:24	05:53 20:48	06:02 20:50	06:28 20:23	06:57 19:37	06:59 18:49	07:26 17:10
12	07:41 17:16	08:10 (WTG02) 08:36 (WTG02)	07:19 17:52	06:39 18:24	06:49 19:55	06:10 20:25	05:53 20:48	06:03 20:49	06:29 20:22	06:58 19:36	07:27 17:09	07:01 16:57
13	07:41 17:17	08:12 (WTG02) 08:36 (WTG02)	07:18 17:53	06:37 18:25	06:48 19:56	06:09 20:26	05:53 20:49	06:03 20:49	06:30 20:21	06:59 19:34	07:28 18:46	07:02 17:08
14	07:41 17:18	08:12 (WTG02) 08:36 (WTG02)	07:17 17:54	06:35 18:26	06:46 19:57	06:08 20:26	05:53 20:49	06:04 20:49	06:31 20:19	07:00 19:33	07:29 18:45	07:03 17:07
15	07:40 17:19	08:13 (WTG02) 08:36 (WTG02)	07:16 17:55	06:34 18:27	06:45 19:58	06:07 20:27	05:53 20:50	06:05 20:48	06:32 20:18	07:01 19:31	07:30 18:43	07:04 17:06
16	07:40 17:20	08:13 (WTG02) 08:35 (WTG02)	07:14 17:56	06:32 18:28	06:43 19:59	06:06 20:28	05:53 20:50	06:06 20:47	06:33 20:17	07:02 19:29	07:31 18:42	07:05 17:05
17	07:40 17:21	08:15 (WTG02) 08:35 (WTG02)	07:13 17:57	06:31 18:29	06:42 20:00	06:06 20:29	05:53 20:50	06:06 20:47	06:34 20:15	07:03 19:28	07:32 18:40	07:06 17:05
18	07:39 17:22	08:16 (WTG02) 08:34 (WTG02)	07:12 18:00	06:29 18:30	06:41 20:01	06:05 20:30	05:53 20:51	06:07 20:46	06:35 20:14	07:04 19:26	07:33 18:39	07:07 17:04
19	07:39 17:23	08:18 (WTG02) 08:33 (WTG02)	07:11 18:01	06:27 18:31	06:39 20:02	06:04 20:31	05:53 20:51	06:08 20:46	06:36 20:13	07:05 19:24	07:34 18:37	07:08 17:03
20	07:38 17:24	08:19 (WTG02) 08:31 (WTG02)	07:09 18:01	06:26 18:32	06:38 20:03	06:03 20:32	05:53 20:51	06:09 20:45	06:37 20:11	07:06 19:23	07:35 18:36	07:10 17:02
21	07:38 17:26	08:23 (WTG02) 08:30 (WTG02)	07:08 18:02	06:24 18:33	06:36 20:04	06:02 20:33	05:53 20:52	06:10 20:44	06:38 20:10	07:07 19:21	07:36 18:34	07:11 17:02
22	07:37 17:27	08:30 (WTG02) 18:03	07:07 18:34	06:23 18:34	06:35 20:05	06:02 20:34	05:53 20:52	06:10 20:43	06:39 20:08	07:07 19:19	07:12 18:33	07:12 17:01
23	07:37 17:28	07:05 18:04	06:21 18:35	06:33 20:06	06:01 20:35	05:54 20:52	06:11 20:43	06:40 20:07	07:08 19:18	07:38 18:32	07:13 17:01	07:38 17:00
24	07:36 17:29	07:04 18:05	06:19 18:36	06:32 20:07	06:00 20:35	05:54 20:52	06:12 20:42	06:41 20:05	07:09 19:16	07:39 18:30	07:14 17:00	07:39 17:01
25	07:36 17:30	07:02 18:06	06:18 18:37	06:31 20:08	05:59 20:36	05:54 20:52	06:13 20:41	06:41 20:04	07:10 19:15	07:39 18:33	07:15 17:00	07:39 17:02
26	07:35 17:31	07:01 18:08	06:16 18:38	06:29 20:09	05:59 20:37	05:54 20:52	06:14 20:40	06:42 20:03	07:11 19:13	07:16 18:59	07:35 18:32	07:40 17:02
27	07:34 17:33	07:00 18:09	06:15 18:39	06:28 20:10	05:58 20:38	05:55 20:52	06:15 20:39	06:43 20:01	07:12 19:11	07:17 18:59	07:34 18:31	07:40 17:03
28	07:34 17:34	06:58 18:10	06:13 18:40	06:27 20:11	05:58 20:39	05:55 20:52	06:16 20:38	06:44 20:00	07:13 19:10	07:18 18:58	07:34 18:32	07:40 17:04
29	07:33 17:35	06:57 18:11	06:11 18:41	06:25 20:12	05:57 20:39	05:56 20:52	06:16 20:38	06:45 19:58	07:14 19:08	07:19 18:58	07:35 18:31	07:41 17:04
30	07:32 17:36	07:10 19:42	06:24 20:13	06:57 20:57	05:57 20:40	05:56 20:52	06:17 20:37	06:46 19:56	07:15 19:06	07:20 18:58	07:33 18:31	07:41 17:05
31	07:31 17:37	07:08 19:43	06:24 20:13	06:57 20:57	05:57 20:41	05:56 20:52	06:18 20:36	06:47 19:55	07:16 19:21	07:21 18:58	07:34 18:32	07:41 17:06
Potential sun hours	301	309	370	397	445	448	455	425	374	347	301	292
Total, worst case		495									164	827
Sun reduction		0.45									0.50	0.45
Oper. time red.		0.78									0.78	0.78
Wind dir. red.		0.68									0.68	0.68
Total reduction		0.24									0.27	0.24
Total, real		118									44	198

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:

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04/11/2020 15:45 / 27

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Calculated:
04/11/2020 13:48/2.8.579

SHADOW - Calendar

Calculation: Ombre Recettori Rev2Shadow receptor: RE16 - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (59)

Assumptions for shadow calculations

Reference year for calendar 2020

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

Table with 12 columns (Jan-Dec) and 1 row of sunshine probability values: 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

Table with 17 columns (N to Sum) and 1 row of operational time values: 134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831

Main shadow calculation table with columns for months (January-December) and rows for each day of the month, including sun rise/set times and reduction factors.

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

Matrix defining table layout: Day in month, Sun rise/set times, Minutes with flicker, First/Last time with flicker (WTG causing flicker).

Project:

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Calculated:
04/11/2020 13:48/2.8.579

SHADOW - Calendar

Calculation: Ombre Recettori Rev2Shadow receptor: RE17 - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (60)

Assumptions for shadow calculations

Reference year for calendar 2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to June) and rows for time slots (07:41 to 17:37). Includes summary rows for Potential sun hours, Total, worst case, Sun reduction, Oper. time red., Wind dir. red., Total reduction, and Total, real.

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

Matrix with 4 columns: 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:

**Brunco e Niada**

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 Calculated:  
 04/11/2020 13:48/2.8.579

### SHADOW - Calendar

**Calculation:** Ombre Recettori Rev2Shadow receptor: RE17 - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (60)

#### Assumptions for shadow calculations

Reference year for calendar 2020

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	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
134	282	483	550	523	510	295	242	134	107	215	403	778	1.342	591	242	6.831

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

	July	August	September	October	November	December		
1	05:56	15:08 (WTG08)   06:19	08:14 (WTG09)   06:48	08:06 (WTG09)   07:16	06:48	07:21   08:57 (WTG05)		
	20:52   186	18:14 (WTG08)   20:34	17:03 (WTG08)   19:53	19:29 (WTG07)   19:05	17:20	16:57   90   16:30 (WTG13)		
2	05:57	15:09 (WTG08)   06:20	08:14 (WTG09)   06:49	08:06 (WTG09)   07:17	06:49	07:22   08:57 (WTG05)		
	20:52   184	18:13 (WTG08)   20:33	09:16 (WTG09)   19:52	19:27 (WTG07)   19:03	17:19	16:57   90   16:30 (WTG13)		
3	05:57	15:10 (WTG08)   06:21	08:12 (WTG09)   06:50	08:07 (WTG09)   07:18	06:50	07:23   08:57 (WTG05)		
	20:52   183	18:13 (WTG08)   20:32	09:16 (WTG09)   19:50	19:28 (WTG07)   19:02	17:18	16:57   90   16:30 (WTG13)		
4	05:58	15:10 (WTG08)   06:22	08:12 (WTG09)   06:51	08:08 (WTG09)   07:19	18:04 (WTG14)   06:51	07:24   08:57 (WTG05)		
	20:52   182	18:12 (WTG08)   20:31	09:17 (WTG09)   19:49	19:25 (WTG07)   19:00	13   18:17 (WTG14)   17:17	16:57   90   16:30 (WTG13)		
5	05:58	15:12 (WTG08)   06:23	08:11 (WTG09)   06:52	08:09 (WTG09)   07:20	18:01 (WTG14)   06:52	16:02 (WTG13)   07:25	08:58 (WTG05)	
	20:52   180	18:12 (WTG08)   20:30	09:18 (WTG09)   19:47	19:23 (WTG07)   18:58	18   18:19 (WTG14)   17:16	5   16:07 (WTG13)   16:57	90   16:31 (WTG13)	
6	05:59	15:12 (WTG08)   06:24	08:11 (WTG09)   06:53	08:09 (WTG09)   07:21	17:59 (WTG14)   06:54	15:57 (WTG13)   07:26	08:58 (WTG05)	
	20:51   179	18:11 (WTG08)   20:29	09:19 (WTG09)   19:45	19:20 (WTG07)   18:57	21   18:20 (WTG14)   17:15	15   16:12 (WTG13)   16:57	90   16:31 (WTG13)	
7	06:00	15:14 (WTG08)   06:25	08:10 (WTG09)   06:53	08:10 (WTG09)   07:22	17:58 (WTG14)   06:55	15:54 (WTG13)   07:27	08:58 (WTG05)	
	20:51   177	18:11 (WTG08)   20:28	09:21 (WTG09)   19:44	19:17 (WTG07)   18:55	23   18:21 (WTG14)   17:13	20   16:14 (WTG13)   16:56	90   16:31 (WTG13)	
8	06:00	15:15 (WTG08)   06:26	08:10 (WTG09)   06:54	08:11 (WTG09)   07:23	17:56 (WTG14)   06:56	15:53 (WTG13)   07:28	08:58 (WTG05)	
	20:51   174	18:09 (WTG08)   20:27	09:24 (WTG09)   19:42	19:14 (WTG07)   18:54	26   18:22 (WTG14)   17:12	24   16:17 (WTG13)   16:56	89   16:30 (WTG13)	
9	06:01	15:16 (WTG08)   06:26	08:09 (WTG09)   06:55	08:12 (WTG09)   07:24	17:55 (WTG14)   06:57	15:51 (WTG13)   07:29	08:58 (WTG05)	
	20:51   173	18:09 (WTG08)   20:26	09:26 (WTG09)   19:41	19:08 (WTG07)   18:52	27   18:22 (WTG14)   17:11	27   16:18 (WTG13)   16:56	89   16:31 (WTG13)	
10	06:01	15:18 (WTG08)   06:27	08:09 (WTG09)   06:56	08:13 (WTG09)   07:25	17:54 (WTG14)   06:58	15:50 (WTG13)   07:30	08:59 (WTG05)	
	20:50   170	18:08 (WTG08)   20:24	09:28 (WTG09)   19:39	19:06 (WTG07)   18:51	28   18:22 (WTG14)   17:10	29   16:19 (WTG13)   16:56	89   16:31 (WTG13)	
11	06:02	08:38 (WTG09)   06:28	08:08 (WTG09)   06:57	08:15 (WTG09)   07:26	17:54 (WTG14)   06:59	15:49 (WTG13)   07:30	08:59 (WTG05)	
	20:50   176	18:07 (WTG08)   20:23	09:29 (WTG09)   19:37	19:04 (WTG07)   18:49	28   18:22 (WTG14)   17:10	31   16:20 (WTG13)   16:57	89   16:31 (WTG13)	
12	06:03	08:35 (WTG09)   06:29	08:07 (WTG09)   06:58	08:17 (WTG09)   07:27	17:53 (WTG14)   07:00	15:49 (WTG13)   07:31	09:00 (WTG05)	
	20:49   180	18:06 (WTG08)   20:22	09:30 (WTG09)   19:36	19:01 (WTG07)   18:47	29   18:22 (WTG14)   17:09	33   16:22 (WTG13)   16:57	88   16:32 (WTG13)	
13	06:03	08:33 (WTG09)   06:30	08:07 (WTG09)   06:59	08:19 (WTG09)   07:28	17:53 (WTG14)   07:02	15:48 (WTG13)   07:32	09:00 (WTG05)	
	20:49   181	18:05 (WTG08)   20:21	09:31 (WTG09)   19:34	19:02 (WTG07)   18:46	29   18:22 (WTG14)   17:08	35   16:23 (WTG13)   16:57	88   16:32 (WTG13)	
14	06:04	08:31 (WTG09)   06:31	08:07 (WTG09)   07:00	08:22 (WTG09)   07:29	17:54 (WTG14)   07:03	15:48 (WTG13)   07:33	09:00 (WTG05)	
	20:48   182	18:03 (WTG08)   20:19	09:32 (WTG09)   19:32	19:03 (WTG07)   18:44	29   18:23 (WTG14)   17:07	51   16:23 (WTG13)   16:57	88   16:32 (WTG13)	
15	06:05	08:30 (WTG09)   06:32	08:07 (WTG09)   07:01	08:25 (WTG09)   07:30	17:54 (WTG14)   07:04	15:48 (WTG13)   07:33	09:01 (WTG05)	
	20:48   182	18:02 (WTG08)   20:18	09:33 (WTG09)   19:31	19:04 (WTG07)   18:43	28   18:22 (WTG14)   17:06	58   16:24 (WTG13)   16:57	87   16:32 (WTG13)	
16	06:06	08:29 (WTG09)   06:33	08:06 (WTG09)   07:02	08:32 (WTG09)   07:31	17:54 (WTG14)   07:05	15:48 (WTG13)   07:34	09:02 (WTG05)	
	20:47   182	18:01 (WTG08)   20:17	09:33 (WTG09)   19:29	10   08:42 (WTG09)   18:42	27   18:21 (WTG14)   17:05	63   16:24 (WTG13)   16:58	87   16:33 (WTG13)	
17	06:06	08:28 (WTG09)   06:34	08:06 (WTG09)   07:03	08:34 (WTG09)   07:32	17:54 (WTG14)   07:06	15:48 (WTG13)   07:35	09:02 (WTG05)	
	20:47   182	18:00 (WTG08)   20:15	09:34 (WTG09)   19:28	18:40   26   18:20 (WTG14)   17:05	67   16:25 (WTG13)   16:58	87   16:33 (WTG13)		
18	06:07	08:26 (WTG09)   06:35	08:06 (WTG09)   07:04	08:35 (WTG09)   07:33	17:55 (WTG14)   07:07	15:48 (WTG13)   07:35	09:02 (WTG05)	
	20:46   179	17:57 (WTG08)   20:14	09:34 (WTG09)   19:26	18:39   23   18:18 (WTG14)   17:04	72   16:26 (WTG13)   16:58	86   16:33 (WTG13)		
19	06:08	08:25 (WTG09)   06:36	08:06 (WTG09)   07:05	08:36 (WTG09)   07:34	17:56 (WTG14)   07:08	15:48 (WTG13)   07:36	09:02 (WTG05)	
	20:45   179	17:56 (WTG08)   20:12	09:35 (WTG09)   19:24	18:37   21   18:17 (WTG14)   17:03	74   16:26 (WTG13)   16:59	86   16:33 (WTG13)		
20	06:09	08:24 (WTG09)   06:37	08:05 (WTG09)   07:05	08:37 (WTG09)   07:35	17:57 (WTG14)   07:09	15:48 (WTG13)   07:37	09:03 (WTG05)	
	20:45   176	17:54 (WTG08)   20:11	09:34 (WTG09)   19:23	18:36   18   18:15 (WTG14)   17:02	77   16:26 (WTG13)   16:59	86   16:34 (WTG13)		
21	06:10	08:23 (WTG09)   06:38	08:05 (WTG09)   07:06	08:38 (WTG09)   07:36	17:58 (WTG14)   07:11	15:48 (WTG13)   07:37	09:04 (WTG05)	
	20:44   174	17:52 (WTG08)   20:10	09:34 (WTG09)   19:21	18:34   14   18:13 (WTG14)   17:02	80   16:27 (WTG13)   16:59	86   16:35 (WTG13)		
22	06:10	08:22 (WTG09)   06:39	08:05 (WTG09)   07:07	08:39 (WTG09)   07:37	18:02 (WTG14)   07:12	15:48 (WTG13)   07:38	09:04 (WTG05)	
	20:43   170	17:49 (WTG08)   20:08	09:34 (WTG09)   19:19	18:33   8   18:10 (WTG14)   17:01	82   16:28 (WTG13)   17:00	86   16:35 (WTG13)		
23	06:11	08:21 (WTG09)   06:40	08:05 (WTG09)   07:08	08:40 (WTG09)   07:38	18:03 (WTG14)   07:13	15:48 (WTG13)   07:38	09:04 (WTG05)	
	20:43   168	17:47 (WTG08)   20:07	09:34 (WTG09)   19:18	18:32   07:13	83   16:28 (WTG13)   17:00	86   16:35 (WTG13)		
24	06:12	08:20 (WTG09)   06:41	08:05 (WTG09)   07:09	08:41 (WTG09)   07:39	18:04 (WTG14)   07:14	15:48 (WTG13)   07:39	09:05 (WTG05)	
	20:42   164	17:44 (WTG08)   20:05	09:34 (WTG09)   19:16	18:30   07:14	85   16:28 (WTG13)   17:01	86   16:36 (WTG13)		
25	06:13	08:20 (WTG09)   06:41	08:05 (WTG09)   07:10	08:42 (WTG09)   07:40	18:05 (WTG14)   07:15	15:48 (WTG13)   07:39	09:05 (WTG05)	
	20:41   159	17:42 (WTG08)   20:04	09:34 (WTG09)   19:14	18:29   07:15	86   16:28 (WTG13)   17:02	86   16:36 (WTG13)		
26	06:14	08:19 (WTG09)   06:42	08:05 (WTG09)   07:11	08:43 (WTG09)   07:41	18:06 (WTG14)   07:16	15:48 (WTG13)   07:40	09:06 (WTG05)	
	20:40   155	17:39 (WTG08)   20:02	09:33 (WTG09)   19:13	18:28   07:16	87   16:28 (WTG13)   17:02	87   16:38 (WTG13)		
27	06:15	08:17 (WTG09)   06:43	08:05 (WTG09)   07:12	08:44 (WTG09)   07:42	18:07 (WTG14)   07:17	15:48 (WTG13)   07:40	09:06 (WTG05)	
	20:39   148	17:34 (WTG08)   20:01	09:33 (WTG09)   19:11	18:27   07:17	87   16:28 (WTG13)   17:03	88   16:38 (WTG13)		
28	06:16	08:17 (WTG09)   06:44	08:05 (WTG09)   07:13	08:45 (WTG09)   07:43	18:08 (WTG14)   07:18	15:48 (WTG13)   07:40	09:07 (WTG05)	
	20:38   142	17:30 (WTG08)   19:59	09:33 (WTG09)   19:10	18:26   07:18	88   16:28 (WTG13)   17:04	87   16:38 (WTG13)		
29	06:16	08:16 (WTG09)   06:45	08:05 (WTG09)   07:14	08:46 (WTG09)   07:44	18:09 (WTG14)   07:19	15:48 (WTG13)   07:41	09:07 (WTG05)	
	20:37   135	17:26 (WTG08)   19:58	09:33 (WTG09)   19:08	18:25   07:19	89   16:30 (WTG13)   17:04	88   16:39 (WTG13)		
30	06:17	08:15 (WTG09)   06:46	08:05 (WTG09)   07:15	08:47 (WTG09)   07:45	18:10 (WTG14)   07:20	15:48 (WTG13)   07:41	09:07 (WTG05)	
	20:36   124	17:20 (WTG08)   19:56	09:33 (WTG09)   19:06	18:24   07:20	89   16:30 (WTG13)   17:05	88   16:39 (WTG13)		
31	06:18	08:15 (WTG09)   06:47	08:05 (WTG09)   07:16	08:48 (WTG09)   07:46	18:11 (WTG14)   07:21	15:48 (WTG13)   07:41	09:09 (WTG05)	
	20:35   111	17:13 (WTG08)   19:55	09:33 (WTG09)   19:05	18:23   07:21	90   16:30 (WTG13)   17:06	88   16:41 (WTG13)		
Potential sun hours	455	425	374	347	301	292		
Total, worst case	5237	3264	1094	436	1538	2725		
Sun reduction	0,74	0,73	0,65	0,54	0,50	0,45		
Oper. time red.	0,78	0,78	0,78	0,78	0,78	0,78		
Wind dir. red.	0,74	0,79	0,79	0,78	0,66	0,65		
Total reduction	0,42	0,45	0,40	0,33	0,26	0,23		
Total, real	2205	1456	433	143	399	618		

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

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



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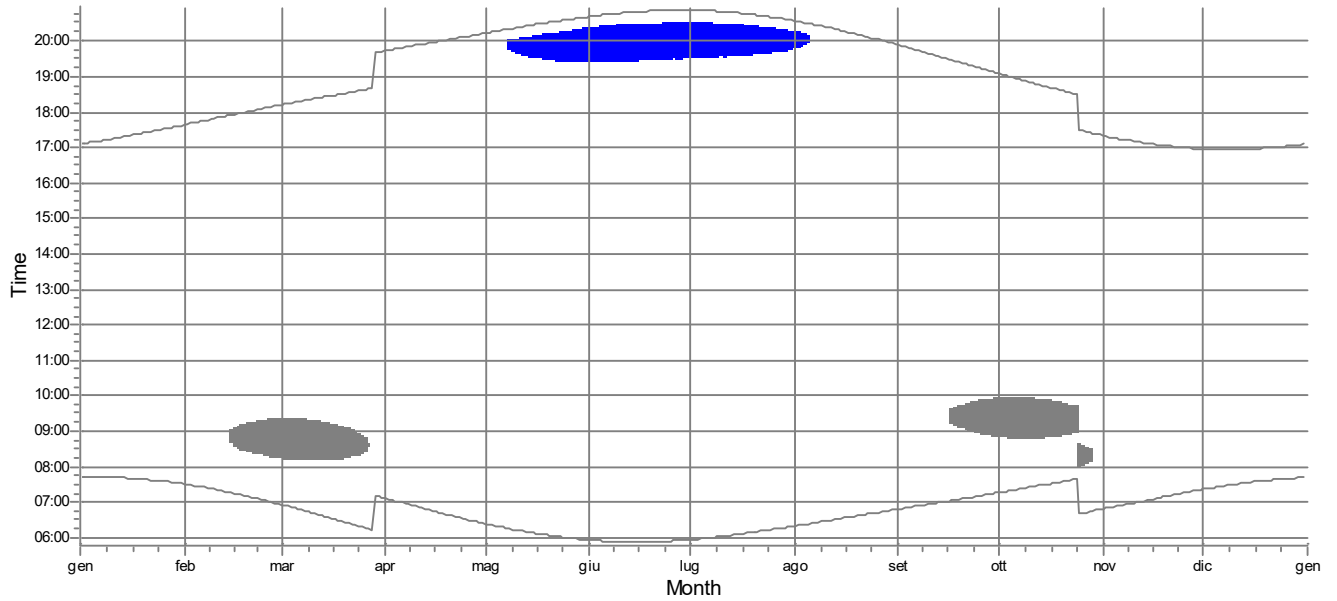
Calculated:

04/11/2020 13:48/2.8.579

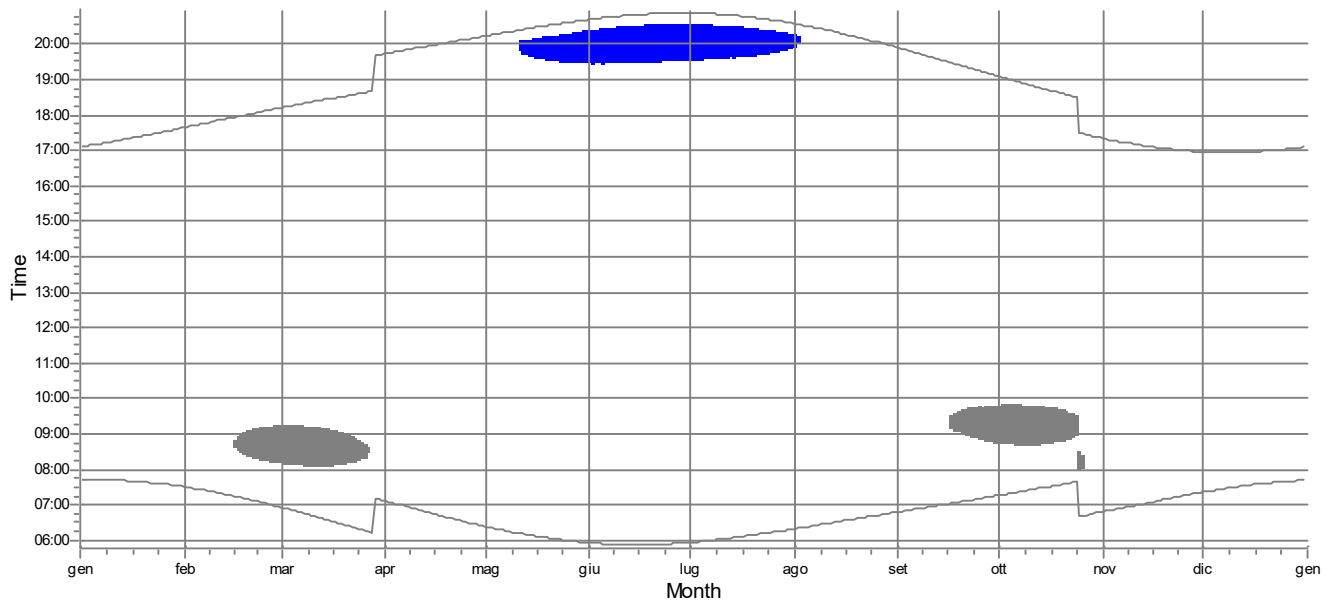
**SHADOW - Calendar, graphical**

Calculation: Ombre Recettori Rev2

RE01: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (44)



RE02: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (45)



WTGs



WTG03: WTG03



WTG04: WTG04

Project:

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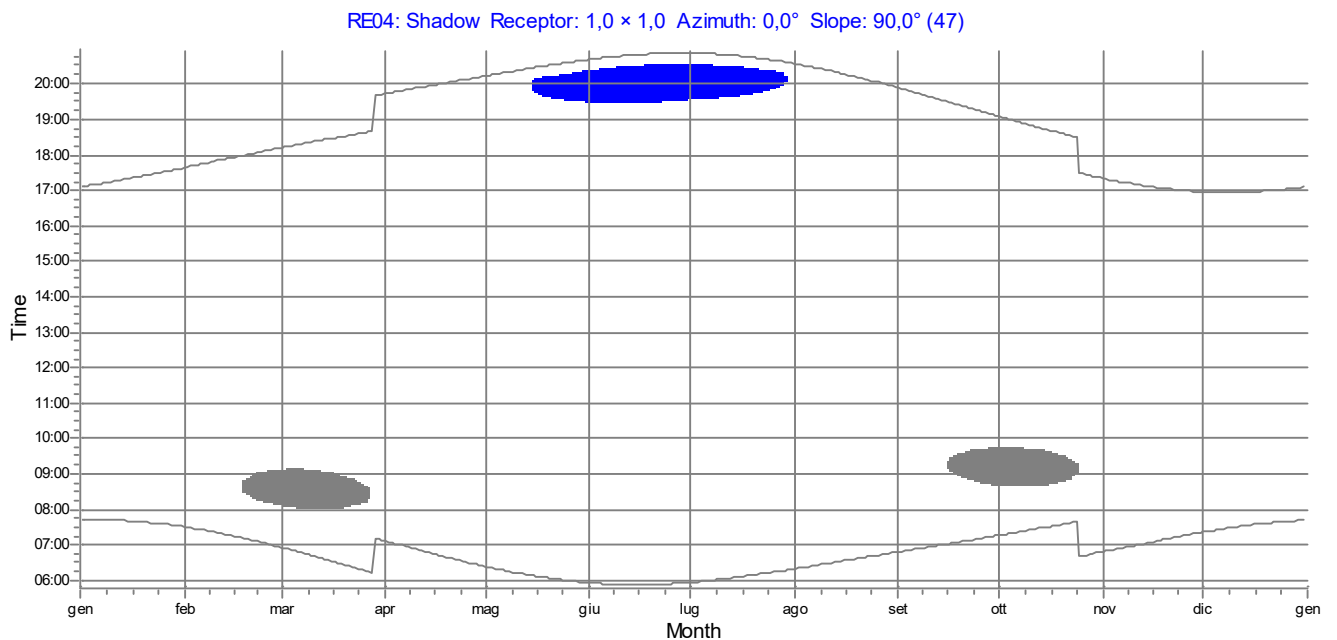
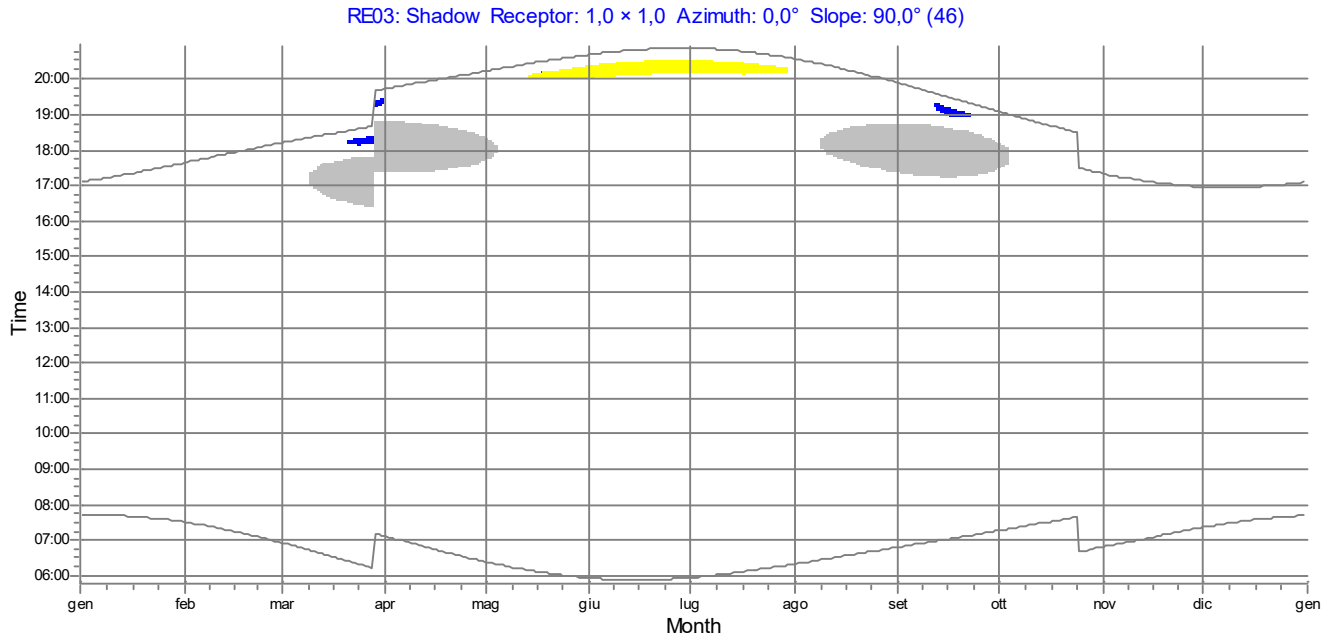
Bruno Manca / ingbrunomanca@gmail.com

Calculated:

04/11/2020 13:48/2.8.579

## SHADOW - Calendar, graphical

Calculation: Ombre Recettori Rev2



WTGs



Project:

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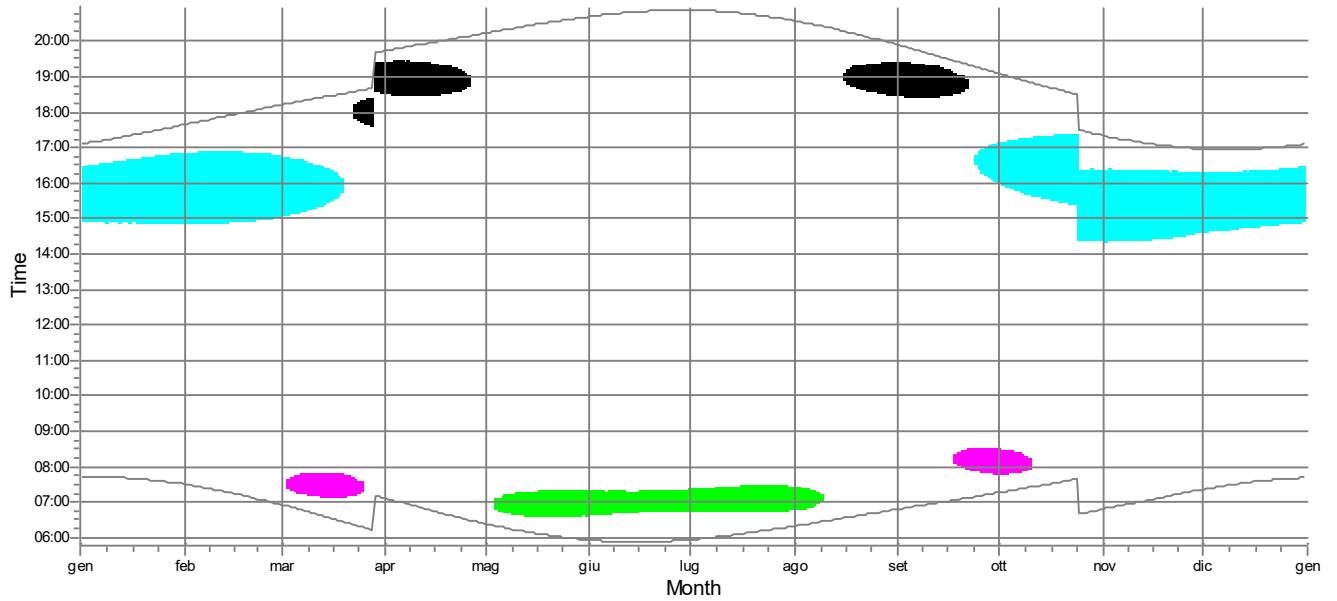
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04/11/2020 13:48/2.8.579

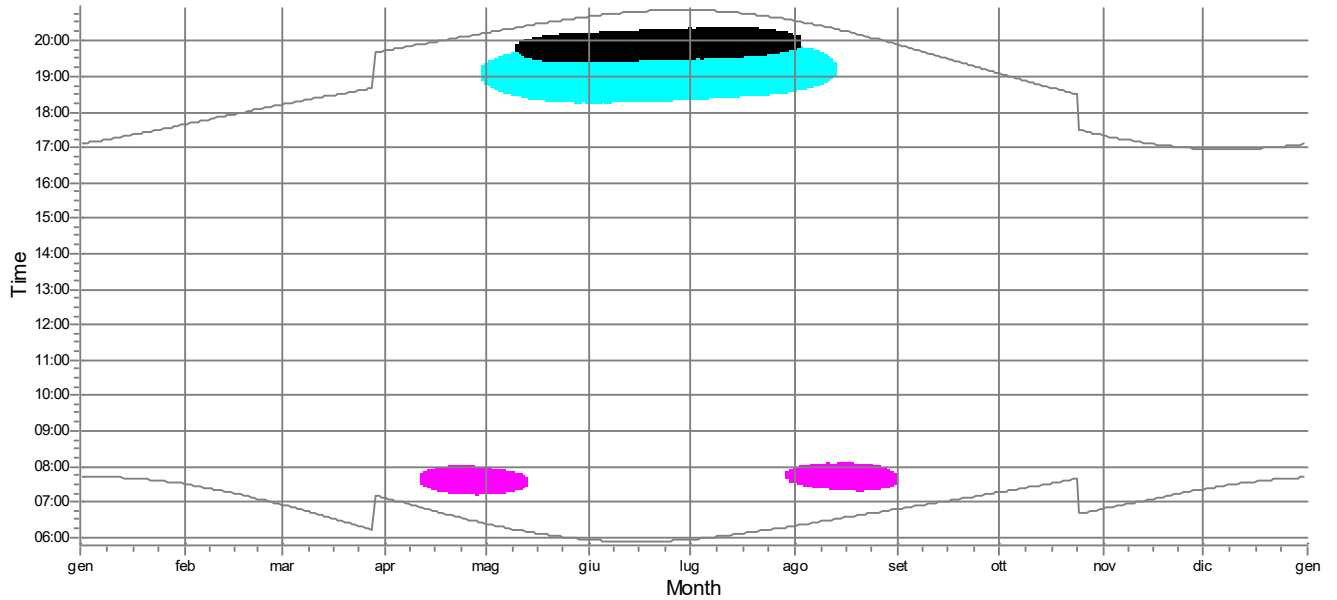
## SHADOW - Calendar, graphical

Calculation: Ombre Recettori Rev2

RE05: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (48)



RE06: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (49)



WTGs



Project:

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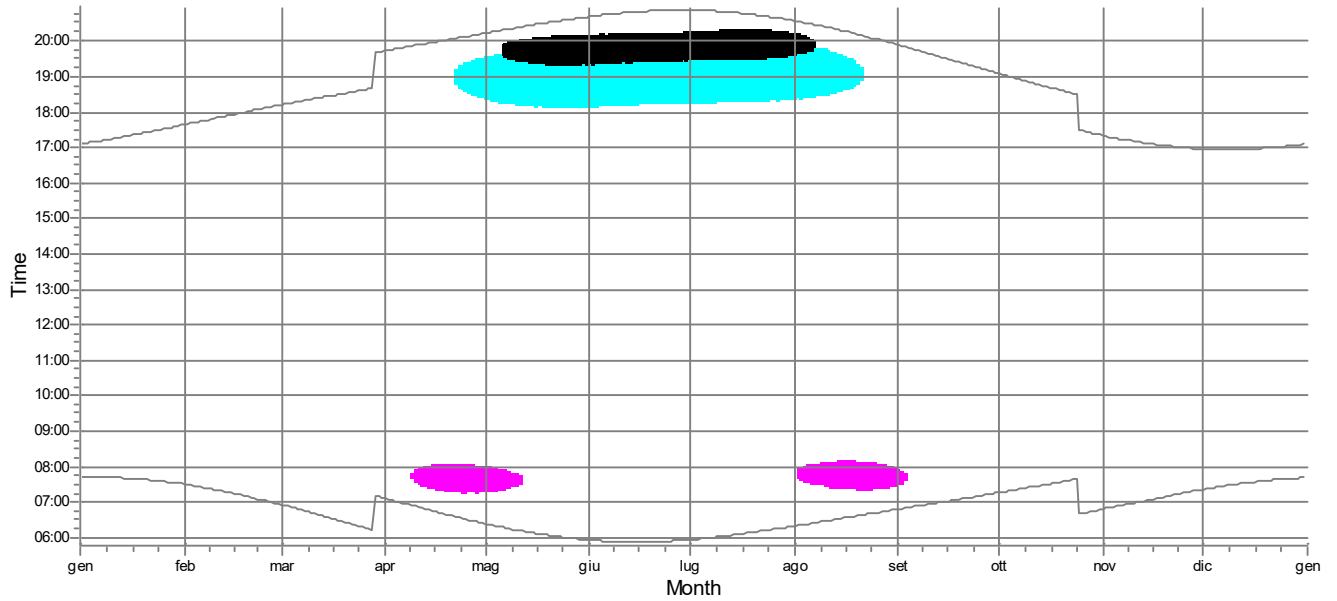
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04/11/2020 13:48/2.8.579

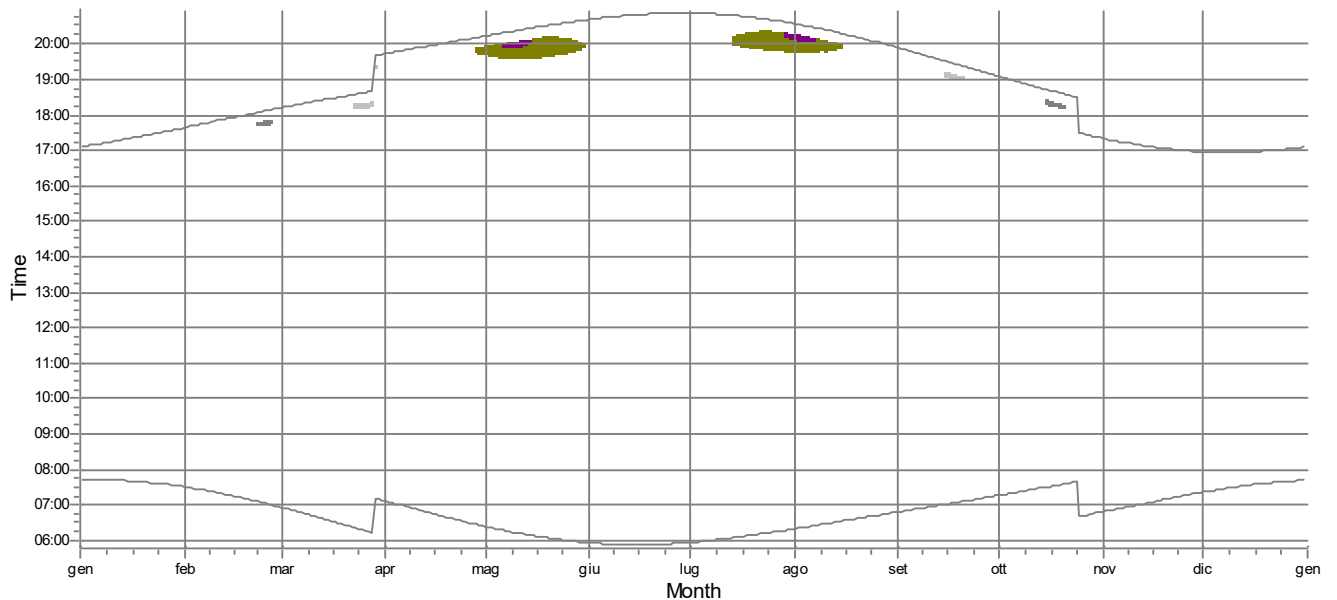
**SHADOW - Calendar, graphical**

Calculation: Ombre Recettori Rev2

RE07: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (50)



RE08: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (51)



WTGs

- |   |              |   |              |   |              |   |              |
|---|--------------|---|--------------|---|--------------|---|--------------|
|  | WTG04: WTG04 |  | WTG10: WTG10 |  | WTG12: WTG12 |  | WTG14: WTG14 |
|  | WTG05: WTG05 |  | WTG11: WTG11 |  | WTG13: WTG13 |   |              |



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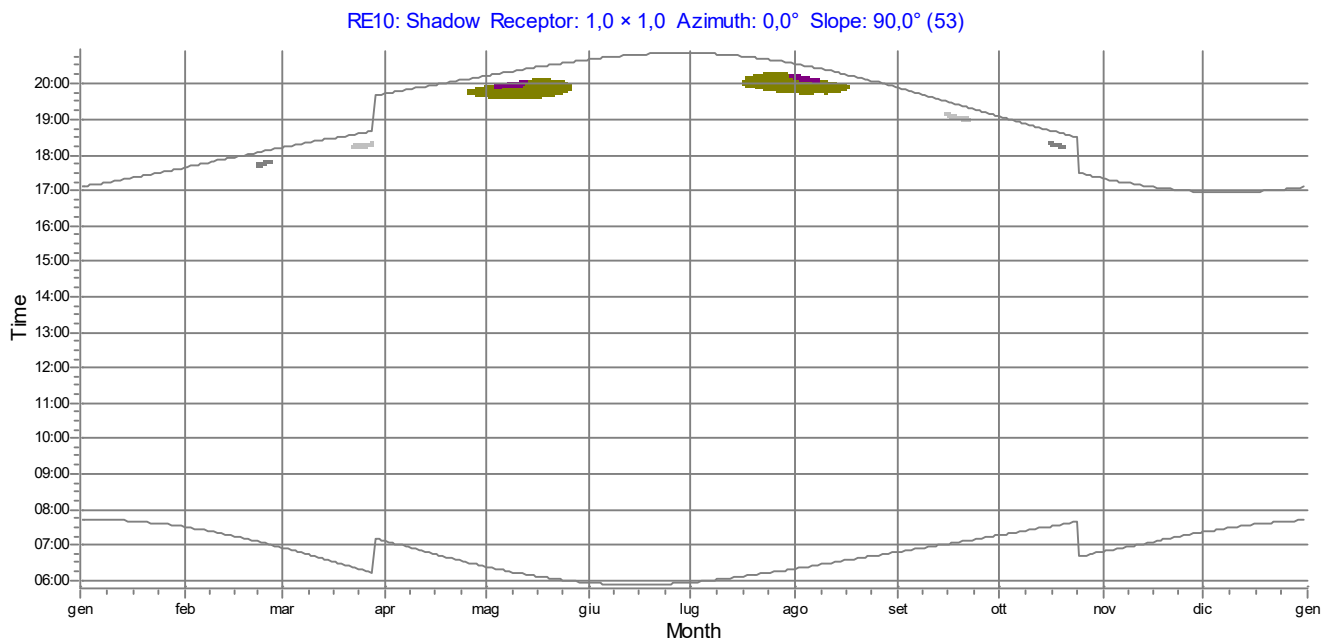
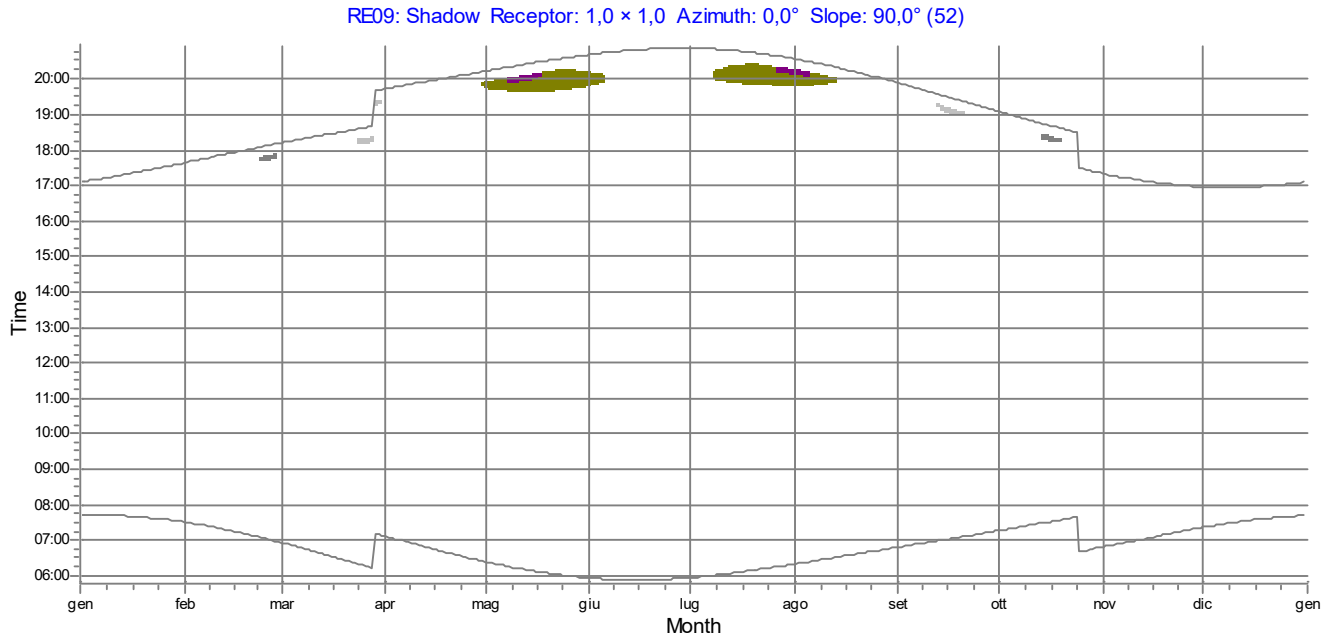
Bruno Manca / ingbrunomanca@gmail.com

Calculated:

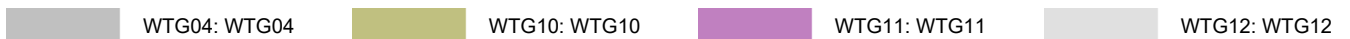
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## SHADOW - Calendar, graphical

Calculation: Ombre Recettori Rev2



WTGs



Project:

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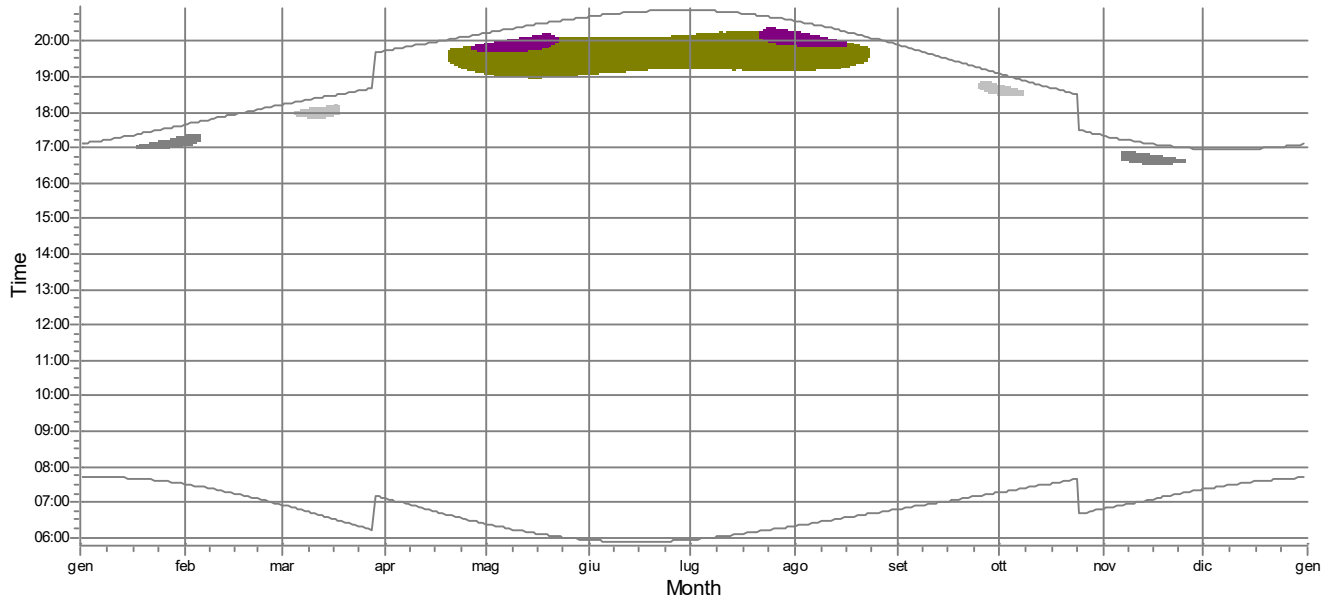
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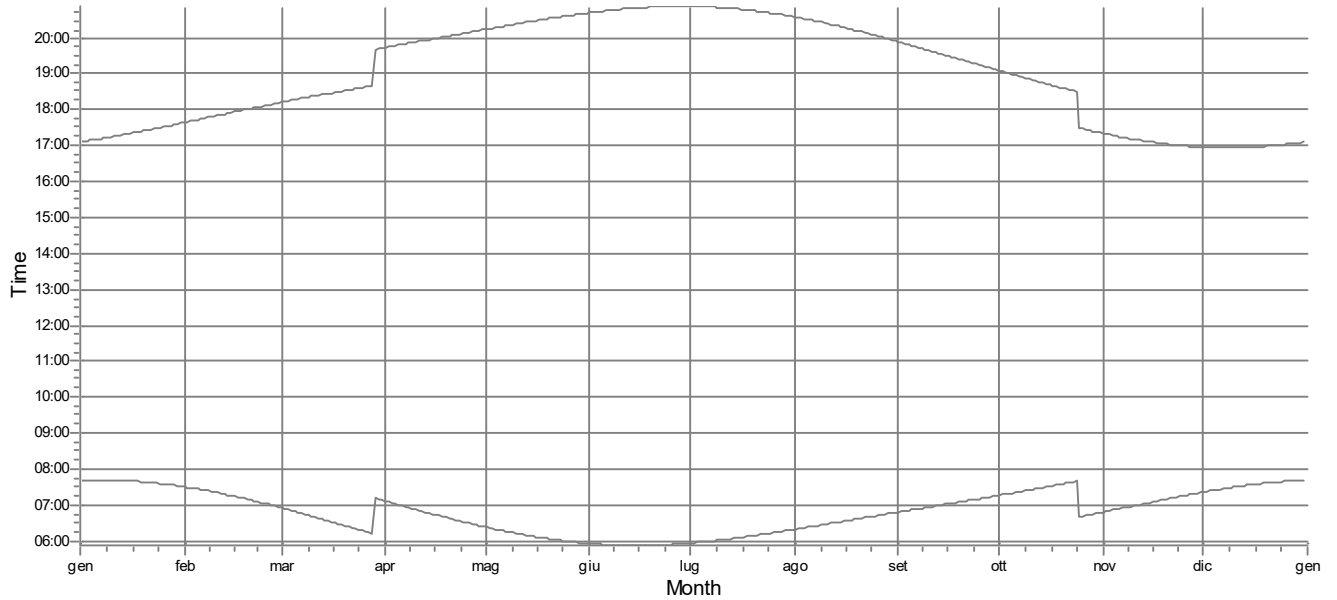
**SHADOW - Calendar, graphical**

Calculation: Ombre Recettori Rev2

RE11: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (54)



RE12: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (55)



WTGs

- WTG04: WTG04
- WTG10: WTG10
- WTG11: WTG11
- WTG12: WTG12

Project:

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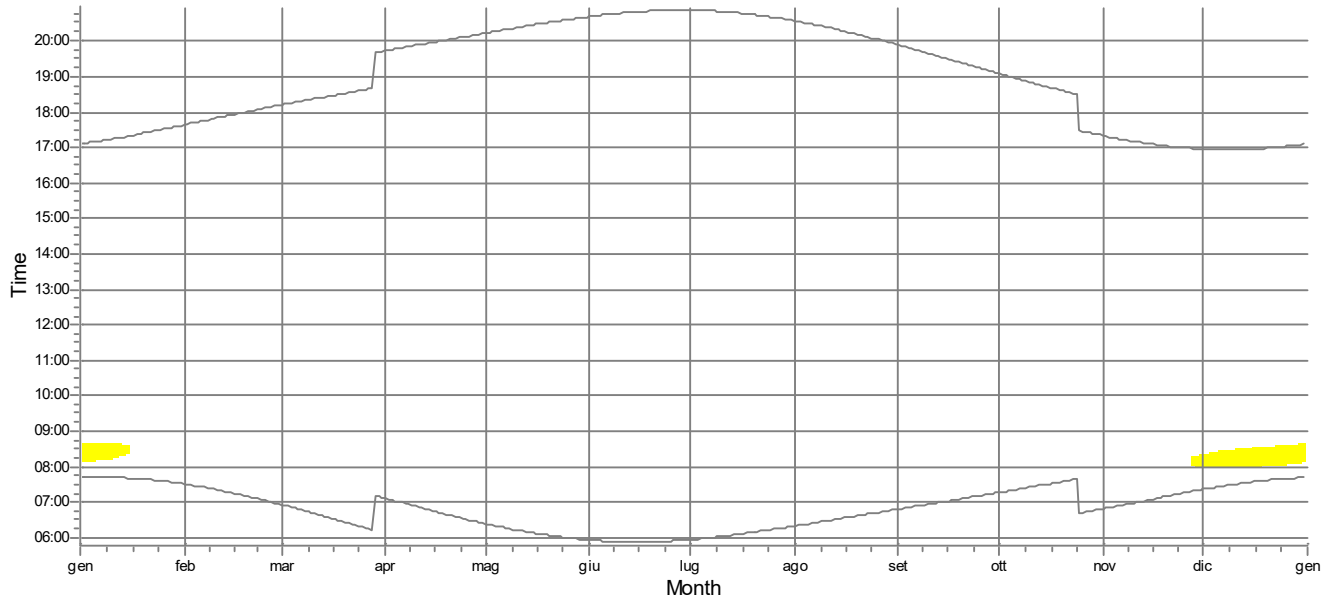
Calculated:

04/11/2020 13:48/2.8.579

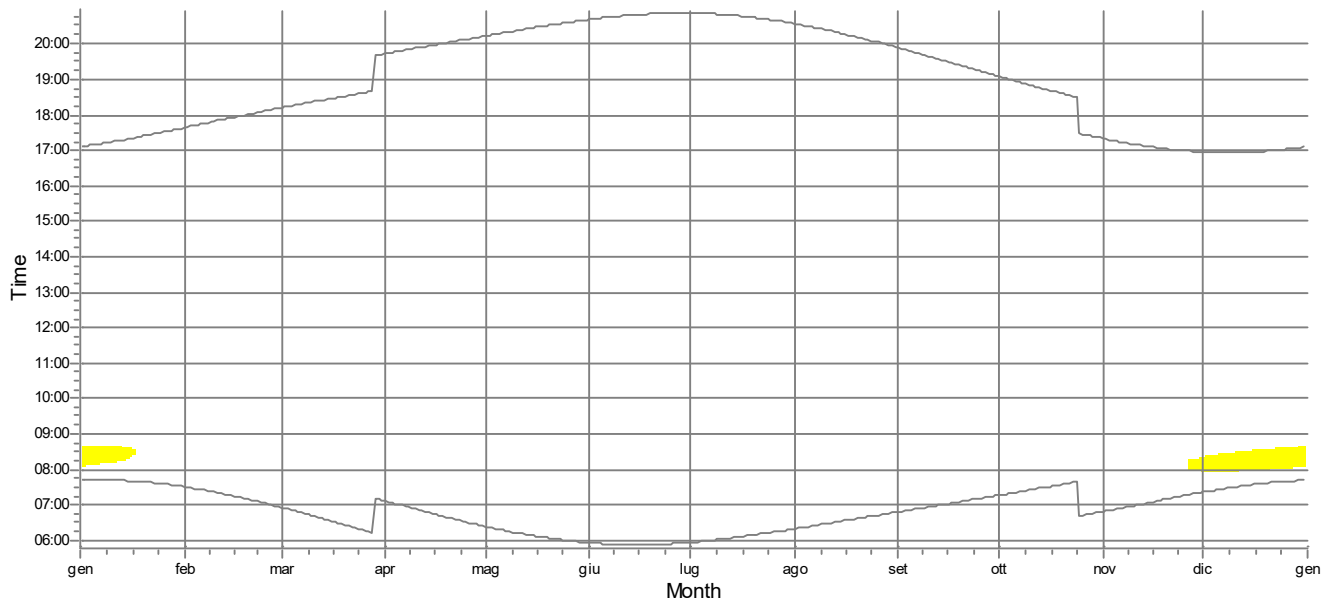
**SHADOW - Calendar, graphical**

Calculation: Ombre Recettori Rev2

RE13: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (56)



RE14: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (57)



WTGs

WTG02: WTG02

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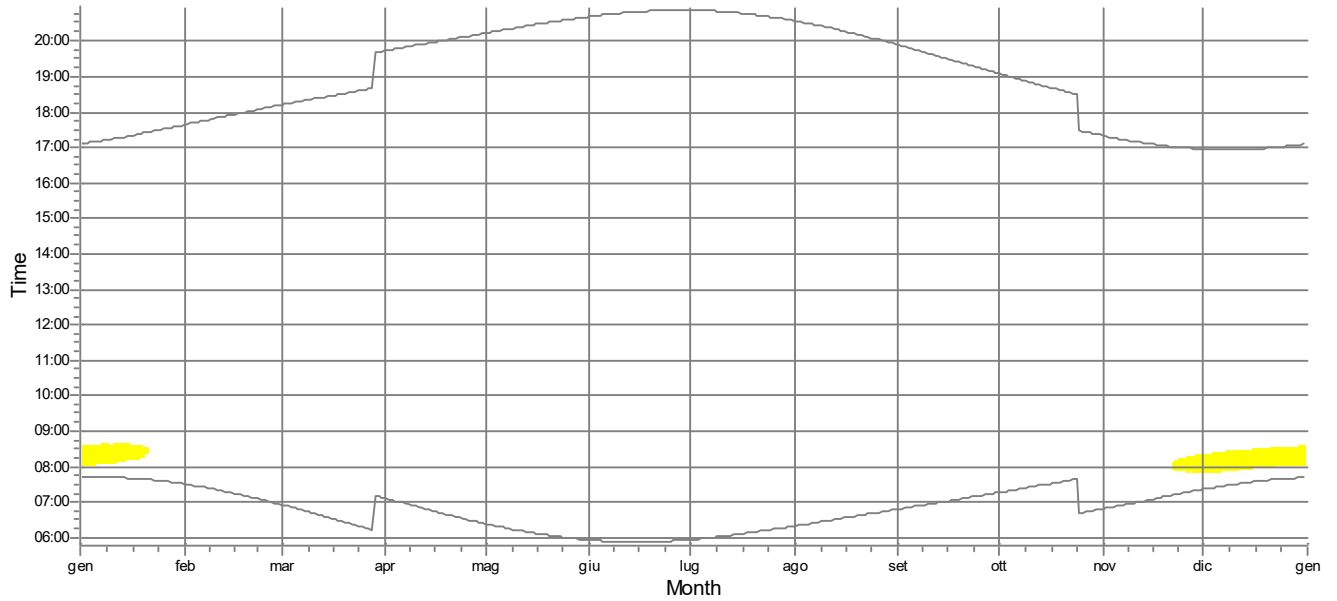
Calculated:

04/11/2020 13:48/2.8.579

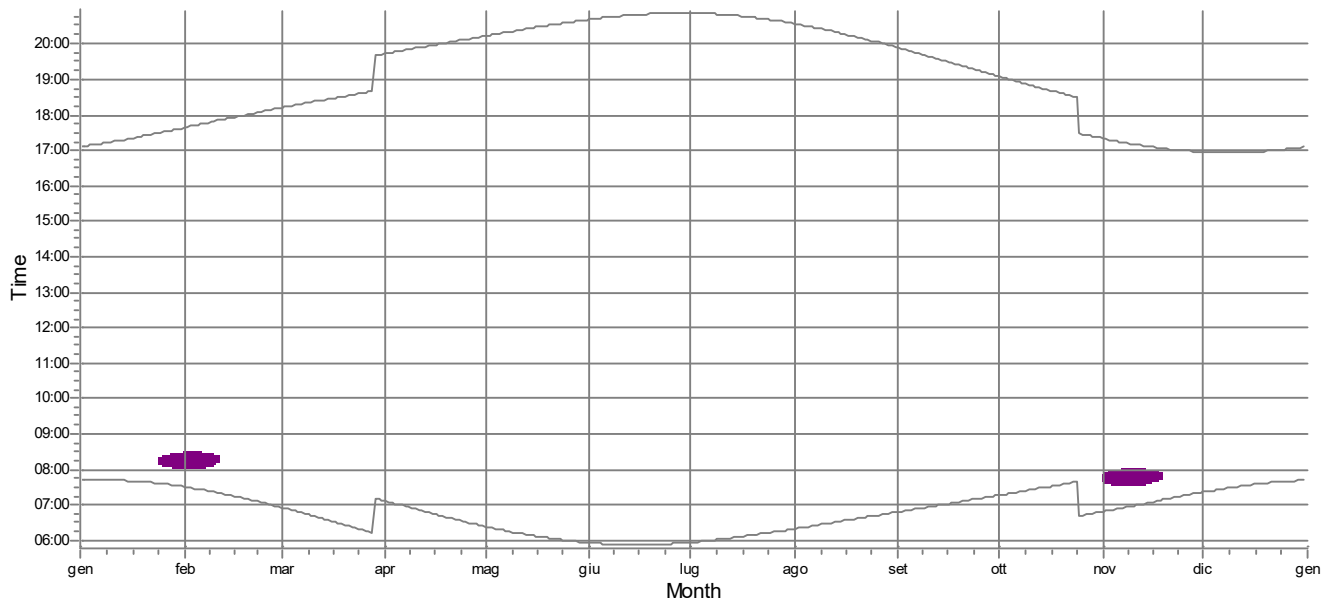
**SHADOW - Calendar, graphical**

Calculation: Ombre Recettori Rev2

RE15: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (58)



RE16: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (59)



WTGs



WTG02: WTG02



WTG11: WTG11



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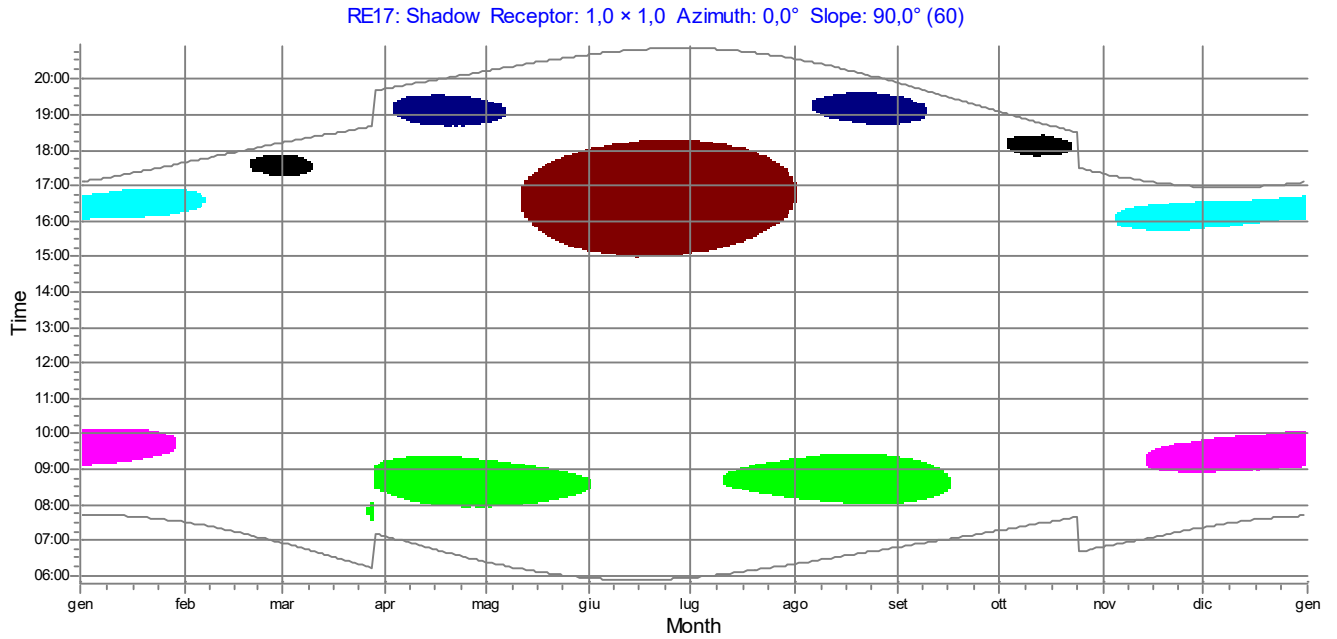
Bruno Manca / ingbrunomanca@gmail.com

Calculated:

04/11/2020 13:48/2.8.579

## SHADOW - Calendar, graphical

Calculation: Ombre Recettori Rev2

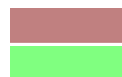


WTGs



WTG05: WTG05

WTG07: WTG07



WTG08: WTG08

WTG09: WTG09



WTG13: WTG13

WTG14: WTG14

Project:

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Calculated:  
04/11/2020 13:48/2.8.579

**SHADOW - Calendar per WTG**

Calculation: Ombre Recettori Rev2WTG: WTG01 - WTG01

**Assumptions for shadow calculations**

Reference year for calendar 2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:41 17:06	07:30 17:38	06:55 18:12	07:07 19:44	06:23 20:14	05:56 20:42	05:56 20:52	06:19 20:35	06:48 19:53	07:16 19:05	06:48 17:20	07:21 16:57
2	07:41 17:07	07:29 17:40	06:54 18:13	07:05 19:45	06:22 20:15	05:55 20:42	05:57 20:52	06:20 20:34	06:49 19:52	07:17 19:03	06:49 17:19	07:22 16:57
3	07:42 17:08	07:28 17:41	06:52 18:14	07:03 19:46	06:20 20:16	05:55 20:43	05:57 20:52	06:21 20:32	06:50 19:50	07:18 19:02	06:50 17:18	07:23 16:57
4	07:42 17:08	07:28 17:42	06:51 18:15	07:02 19:47	06:19 20:17	05:54 20:44	05:58 20:52	06:22 20:31	06:51 19:49	07:19 19:00	06:51 17:17	07:24 16:57
5	07:42 17:09	07:27 17:43	06:49 18:16	07:00 19:48	06:18 20:18	05:54 20:44	05:58 20:52	06:23 20:30	06:52 19:47	07:20 18:58	06:53 17:16	07:25 16:57
6	07:42 17:10	07:26 17:44	06:48 18:17	06:59 19:49	06:17 20:19	05:54 20:45	05:59 20:51	06:24 20:29	06:53 19:45	07:21 18:57	06:54 17:15	07:26 16:57
7	07:42 17:11	07:25 17:46	06:46 18:18	06:57 19:50	06:16 20:20	05:54 20:46	06:00 20:51	06:25 20:28	06:54 19:44	07:22 18:55	06:55 17:13	07:27 16:56
8	07:42 17:12	07:23 17:47	06:45 18:19	06:56 19:51	06:15 20:21	05:53 20:46	06:00 20:51	06:26 20:27	06:54 19:42	07:23 18:54	06:56 17:12	07:28 16:56
9	07:42 17:13	07:22 17:48	06:43 18:20	06:54 19:52	06:13 20:22	05:53 20:47	06:01 20:51	06:26 20:26	06:55 19:41	07:24 18:52	06:57 17:11	07:29 16:56
10	07:42 17:14	07:21 17:49	06:42 18:22	06:52 19:53	06:12 20:23	05:53 20:47	06:01 20:50	06:27 20:24	06:56 19:39	07:25 18:51	06:58 17:11	07:30 16:56
11	07:41 17:15	07:20 17:50	06:40 18:23	06:51 19:54	06:11 20:24	05:53 20:48	06:02 20:50	06:28 20:23	06:57 19:37	07:26 18:49	06:59 17:10	07:30 16:57
12	07:41 17:16	07:19 17:51	06:39 18:24	06:49 19:55	06:10 20:25	05:53 20:48	06:03 20:49	06:29 20:22	06:58 19:36	07:27 18:48	07:00 17:09	07:31 16:57
13	07:41 17:17	07:18 17:53	06:37 18:25	06:48 19:56	06:09 20:25	05:53 20:49	06:03 20:49	06:30 20:21	06:59 19:34	07:28 18:46	07:02 17:08	07:32 16:57
14	07:41 17:18	07:17 17:54	06:35 18:26	06:46 19:57	06:08 20:26	05:53 20:49	06:04 20:48	06:31 20:19	07:00 19:33	07:29 18:45	07:03 17:07	07:33 16:57
15	07:40 17:19	07:16 17:55	06:34 18:27	06:45 19:58	06:07 20:05-20:06/1	05:53 20:50	06:05 20:48	06:32 20:18	07:01 19:31	07:30 18:43	07:04 17:06	07:34 16:57
16	07:40 17:20	07:14 17:56	06:32 18:28	06:43 19:59	06:06 20:06-20:07/1	05:53 20:50	06:06 20:47	06:33 20:17	07:02 19:29	07:31 18:42	07:05 17:05	07:34 16:58
17	07:40 17:21	07:13 17:57	06:31 18:29	06:42 20:00	06:06 20:07-20:08/1	05:53 20:50	06:06 20:47	06:34 20:15	07:03 19:28	07:32 18:40	07:06 17:05	07:35 16:58
18	07:39 17:22	07:12 17:58	06:29 18:30	06:40 20:01	06:05 20:08-20:09/1	05:53 20:51	06:07 20:46	06:35 20:14	07:04 19:26	07:33 18:39	07:07 17:04	07:36 16:58
19	07:39 17:23	07:10 18:00	06:27 18:31	06:39 20:02	06:04 20:09-20:10/1	05:53 20:51	06:08 20:46	06:36 20:13	07:05 19:24	07:34 18:37	07:08 17:03	07:36 16:59
20	07:38 17:24	07:09 18:01	06:26 18:32	06:38 20:03	06:03 20:09-20:10/1	05:53 20:51	06:09 20:45	06:37 20:11	07:06 19:23	07:35 18:36	07:10 17:02	07:37 16:59
21	07:38 17:26	07:08 18:02	06:24 18:33	06:36 20:04	06:02 20:33	05:53 20:52	06:10 20:44	06:38 20:10	07:06 19:21	07:36 18:34	07:11 17:02	07:37 16:59
22	07:37 17:27	07:07 18:03	06:23 18:34	06:35 20:05	06:02 20:34	05:53 20:52	06:10 20:43	06:39 20:08	07:07 19:19	07:37 18:33	07:12 17:01	07:38 17:00
23	07:37 17:28	07:05 18:04	06:21 18:35	06:33 20:06	06:01 20:35	05:54 20:52	06:11 20:43	06:40 20:07	07:08 19:18	07:38 18:32	07:13 17:01	07:38 17:00
24	07:36 17:29	07:04 18:05	06:19 18:36	06:32 20:07	06:00 20:35	05:54 20:52	06:12 20:42	06:41 20:05	07:09 19:16	07:39 18:30	07:14 17:00	07:39 17:01
25	07:36 17:30	07:02 18:06	06:18 18:37	06:31 20:08	05:59 20:36	05:54 20:52	06:13 20:19-20:20/1	06:41 20:04	07:10 19:15	06:40 17:29	07:15 17:00	07:39 17:02
26	07:35 17:31	07:01 18:08	06:16 18:38	06:29 20:09	05:59 20:37	05:54 20:52	06:14 20:18-20:19/1	06:42 20:02	07:11 19:13	06:41 17:28	07:16 16:59	07:40 17:02
27	07:34 17:33	07:00 18:09	06:15 18:39	06:28 20:10	05:58 20:38	05:55 20:52	06:15 20:17-20:18/1	06:43 20:01	07:12 19:11	06:43 17:26	07:17 16:59	07:40 17:03
28	07:33 17:34	06:58 18:10	06:13 18:40	06:27 20:11	05:58 20:39	05:55 20:52	06:16 20:16-20:17/1	06:44 19:59	07:13 19:10	06:44 17:25	07:18 16:58	07:40 17:04
29	07:33 17:35	06:57 18:11	07:11 19:41	06:25 20:12	05:57 20:39	05:56 20:52	06:16 20:37	06:45 19:58	07:14 19:08	06:45 17:24	07:19 16:58	07:41 17:04
30	07:32 17:36		07:10 19:42	06:24 20:13	05:57 20:40	05:56 20:52	06:17 20:37	06:46 19:56	07:15 19:06	06:46 17:23	07:20 16:58	07:41 17:05
31	07:31 17:37		07:08 19:43		05:56 20:41		06:18 20:36	06:47 19:55		06:47 17:21		07:41 17:06
Potential sun hours	301	309	370	397	445	448	455	425	374	347	301	292
Sum of minutes with flicker	0	0	0	0	6	0	4	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:

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Calculated:

04/11/2020 13:48/2.8.579

## SHADOW - Calendar per WTG

Calculation: Ombre Recettori Rev2WTG: WTG02 - WTG02

### Assumptions for shadow calculations

Reference year for calendar

2020

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	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
134	282	483	550	523	510	295	242	134	107	215	403	778	1.342	591	242	6.831

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

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

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

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

Project:

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Calculated:  
04/11/2020 13:48/2.8.579

**SHADOW - Calendar per WTG**

Calculation: Ombre Recettori Rev2WTG: WTG03 - WTG03

**Assumptions for shadow calculations**

Reference year for calendar

2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December		
1	07:41 17:06	07:30 17:38	06:55 18:12	07:07 19:44	06:23 20:14	05:56 20:42	19:29-20:20/51 20:52	05:56 20:52	19:35-20:30/55 20:35	06:19 19:50-20:14/24	06:48 19:53	07:16 19:05	06:48 17:20	07:21 16:57
2	07:41 17:07	07:29 17:40	06:54 18:13	07:05 19:45	06:22 20:15	05:55 20:42	19:29-20:20/51 20:52	05:57 20:52	19:34-20:30/56 20:33	06:20 19:52-20:13/21	06:49 19:52	07:17 19:03	06:49 17:19	07:22 16:57
3	07:42 17:08	07:28 17:41	06:52 18:14	07:03 19:46	06:20 20:16	05:55 20:43	19:29-20:21/52 20:52	05:57 20:52	19:35-20:30/55 20:32	06:21 19:53-20:11/18	06:50 19:50	07:18 19:02	06:50 17:18	07:23 16:57
4	07:42 17:08	07:27 17:42	06:51 18:15	07:02 19:47	06:19 20:17	05:54 20:44	19:29-20:22/53 20:44	05:58 20:52	19:35-20:29/54 20:31	06:22 19:56-20:10/14	06:51 19:49	07:19 19:00	06:51 17:17	07:24 16:57
5	07:42 17:09	07:27 17:43	06:49 18:16	07:00 19:48	06:18 20:18	05:54 20:44	19:29-20:22/53 20:44	05:58 20:52	19:36-20:30/54 20:30	06:23 20:01-20:08/7	06:52 19:47	07:20 18:58	06:53 17:16	07:25 16:57
6	07:42 17:10	07:26 17:44	06:48 18:17	06:59 19:49	06:17 20:19	05:54 20:45	19:29-20:23/54 20:45	05:59 20:51	19:35-20:29/54 20:29	06:24 19:45	06:53 19:45	07:21 18:57	06:54 17:15	07:26 16:57
7	07:42 17:11	07:25 17:46	06:46 18:18	06:57 19:50	06:16 20:20	05:54 20:46	19:29-20:23/54 20:46	06:00 20:51	19:36-20:29/53 20:28	06:25 19:44	06:54 18:55	07:22 18:55	06:55 17:14	07:27 16:56
8	07:42 17:12	07:23 17:47	06:45 18:19	06:56 19:51	06:15 20:21	05:53 20:46	19:30-20:24/54 20:46	06:00 20:51	19:35-20:28/53 20:27	06:26 19:42	06:54 19:42	07:23 18:54	06:56 17:12	07:28 16:56
9	07:42 17:13	07:22 17:48	06:43 18:20	06:54 19:52	06:13 20:22	05:53 20:47	19:30-20:25/55 20:47	06:01 20:51	19:36-20:28/52 20:26	06:26 19:41	06:55 19:41	07:24 18:52	06:57 17:11	07:29 16:56
10	07:42 17:14	07:21 17:49	06:42 18:22	06:52 19:53	06:12 20:23	05:53 20:47	19:30-20:25/55 20:47	06:01 20:50	19:37-20:28/51 20:24	06:27 19:39	06:56 19:39	07:25 18:51	06:58 17:11	07:30 16:57
11	07:41 17:15	07:20 17:50	06:40 18:23	06:51 19:54	06:11 20:24	05:53 20:48	19:30-20:25/55 20:48	06:02 20:50	19:36-20:27/51 20:23	06:28 19:37	06:57 19:37	07:26 18:49	06:59 17:10	07:30 16:57
12	07:41 17:16	07:19 17:51	06:39 18:24	06:49 19:55	06:10 20:24	05:53 20:48	19:30-20:25/55 20:48	06:03 20:49	19:37-20:27/50 20:22	06:29 19:36	06:58 19:09-19:16/1	07:27 18:48	07:00 17:09	07:31 16:57
13	07:41 17:17	07:18 17:53	06:37 18:25	06:48 19:56	06:09 20:25	05:53 20:49	19:30-20:26/56 20:49	06:03 20:49	19:37-20:27/50 20:21	06:30 19:34	06:59 19:06-19:12/6	07:28 18:46	07:02 17:08	07:32 16:57
14	07:41 17:18	07:17 17:54	06:35 18:26	06:46 19:57	06:08 20:26	05:53 20:49	19:36-20:05/29 20:49	05:53 20:48	19:30-20:26/56 20:19	06:04 19:33	07:00 19:04-19:10/6	07:29 18:45	07:03 17:07	07:33 16:57
15	07:40 17:19	07:15 17:55	06:34 18:27	06:45 19:58	06:07 20:27	05:53 20:50	19:35-20:05/30 20:50	06:05 20:48	19:38-20:26/48 20:18	06:32 19:31	07:01 19:04-19:10/6	07:30 18:43	07:04 17:06	07:34 16:57
16	07:40 17:20	07:14 17:56	06:32 18:28	06:43 19:59	06:06 20:28	05:53 20:50	19:34-20:07/33 20:50	06:06 20:47	19:38-20:26/48 20:17	06:33 19:29	07:02 19:02-19:09/7	07:31 18:42	07:05 17:05	07:34 16:58
17	07:40 17:21	07:13 17:57	06:31 18:29	06:42 20:00	06:06 20:29	05:53 20:50	19:34-20:08/34 20:50	06:06 20:47	19:38-20:24/46 20:15	06:34 19:28	07:03 19:01-19:07/6	07:32 18:40	07:06 17:05	07:35 16:58
18	07:39 17:22	07:12 17:58	06:29 18:30	06:41 20:01	06:05 20:30	05:53 20:51	19:33-20:09/36 20:51	06:07 20:46	19:39-20:24/45 20:14	06:35 19:26	07:04 19:00-19:06/6	07:33 18:39	07:07 17:04	07:36 16:58
19	07:39 17:23	07:10 18:00	06:27 18:31	06:39 20:02	06:04 20:31	05:53 20:51	19:32-20:10/38 20:51	06:08 20:46	19:39-20:24/45 20:13	06:36 19:24	07:05 18:59-19:04/5	07:34 18:37	07:08 17:03	07:36 16:59
20	07:38 17:24	07:09 18:01	06:26 18:32	06:38 20:03	06:03 20:32	05:53 20:51	19:31-20:10/39 20:51	06:09 20:45	19:40-20:23/43 20:11	06:37 19:23	07:06 18:59-19:03/4	07:35 18:36	07:10 17:02	07:37 16:59
21	07:38 17:26	07:08 18:02	06:24 18:33	06:36 20:04	06:02 20:33	05:53 20:52	19:31-20:12/41 20:52	06:10 20:44	19:41-20:23/42 20:10	06:38 19:21	07:06 18:58-19:01/3	07:36 18:34	07:11 17:02	07:37 16:59
22	07:37 17:27	07:07 18:03	06:23 18:34	06:35 20:05	06:02 20:34	05:53 20:52	19:30-20:12/42 20:52	06:10 20:43	19:40-20:21/41 20:08	06:39 19:19	07:07 18:58-19:00/2	07:37 18:33	07:12 17:01	07:38 17:00
23	07:37 17:28	07:05 18:04	06:21 18:35	06:33 20:06	06:01 20:35	05:54 20:52	19:30-20:13/43 20:52	06:11 20:43	19:41-20:21/40 20:07	06:40 19:18	07:08 19:18	07:38 18:32	07:13 17:01	07:38 17:00
24	07:36 17:29	07:04 18:05	06:19 18:36	06:32 20:07	06:00 20:35	05:54 20:52	19:30-20:14/44 20:52	06:12 20:42	19:42-20:20/38 20:05	06:41 19:16	07:09 19:16	07:39 18:30	07:14 17:00	07:39 17:01
25	07:36 17:30	07:02 18:06	06:18 18:37	06:31 20:08	05:59 20:36	05:54 20:52	19:29-20:14/45 20:52	06:13 20:41	19:43-20:20/37 20:04	06:41 19:15	07:10 19:15	07:40 17:29	07:15 17:00	07:39 17:02
26	07:35 17:31	07:01 18:08	06:16 18:38	06:29 20:09	05:59 20:37	05:54 20:52	19:29-20:15/46 20:52	06:14 20:40	19:44-20:19/35 20:02	06:42 19:13	07:11 19:13	07:41 17:28	07:16 16:59	07:40 17:02
27	07:34 17:33	07:00 18:09	06:15 18:39	06:28 20:10	05:58 20:38	05:55 20:52	19:29-20:16/47 20:52	06:15 20:39	19:44-20:18/34 20:01	06:43 19:11	07:12 19:11	07:42 17:26	07:17 16:59	07:40 17:03
28	07:33 17:34	06:58 18:10	06:13 18:40	06:27 20:11	05:58 20:39	05:55 20:52	19:29-20:16/47 20:52	06:16 20:38	19:45-20:17/32 19:59	06:44 19:10	07:13 19:10	07:43 17:25	07:18 16:58	07:40 17:04
29	07:33 17:35	06:57 18:11	06:11 19:22/7	06:25 20:12	05:57 20:39	05:56 20:52	19:29-20:18/49 20:52	06:16 20:37	19:46-20:12/26 20:16/5	06:45 19:58	07:14 19:08	07:44 17:24	07:19 16:58	07:41 17:04
30	07:32 17:36	07:00 18:12	06:15 19:23/5	06:24 20:13	05:57 20:40	05:56 20:52	19:29-20:19/50 20:52	06:17 20:37	19:47-20:15/28 19:56	06:46 19:06	07:15 19:06	07:45 17:23	07:20 16:58	07:41 17:05
31	07:31 17:37	07:00 18:13	06:15 19:24/3	06:24 20:13	05:57 20:41	05:56 20:52	19:29-20:19/50 20:52	06:18 20:36	19:48-20:15/27 19:55	06:47 19:06	07:16 19:06	07:46 17:21	07:21 16:58	07:41 17:06
Potential sun hours	301	309	370	397	445	448	445	425	374	347	301	292	0	0
Sum of minutes with flicker	0	0	50	0	864	1661	1397	84	52	0	0	292	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:

**Brunco e Niada**

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Licensed user:

**Ing. Bruno Manca**  
Via Vittorio Veneto 231  
IT-09028 Sestu  
+390702358125  
Bruno Manca / ingbrunomanca@gmail.com  
Calculated:  
04/11/2020 13:48/2.8.579

### SHADOW - Calendar per WTG

Calculation: Ombre Recettori Rev2WTG: WTG05 - WTG05

#### Assumptions for shadow calculations

Reference year for calendar 2020

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	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
134	282	483	550	523	510	295	242	134	107	215	403	778	1.342	591	242	6.831

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

	January	February	March	April	May	June
1	07:41 09:09-10:02/53 17:06	07:30 17:38	06:55 18:12	07:07 19:44	06:23 07:16-07:58/42	05:56 20:14
2	07:41 09:09-10:03/54 17:07	07:29 17:40	06:54 18:13	07:05 19:45	06:22 07:16-07:57/41	05:55 20:15
3	07:41 09:10-10:03/53 17:08	07:28 17:41	06:52 07:27-07:36/9 18:14	07:03 19:46	06:20 07:16-07:55/39	05:55 20:16
4	07:42 09:10-10:03/53 17:08	07:27 17:42	06:51 07:23-07:40/17 18:15	07:02 19:47	06:19 07:16-07:54/38	05:54 20:17
5	07:42 09:11-10:04/53 17:09	07:26 17:43	06:49 07:21-07:42/21 18:16	07:00 19:48	06:18 07:17-07:53/36	05:54 20:18
6	07:42 09:11-10:04/53 17:10	07:25 17:44	06:48 07:18-07:43/25 18:17	06:59 19:49	06:17 07:18-07:52/34	05:54 20:19
7	07:42 09:12-10:04/52 17:11	07:24 17:46	06:46 07:17-07:45/28 18:18	06:57 19:50	06:16 07:19-07:51/32	05:54 20:20
8	07:42 09:13-10:05/52 17:12	07:23 17:47	06:45 07:15-07:46/31 18:19	06:56 19:51	06:15 07:20-07:49/29	05:53 20:21
9	07:42 09:12-10:04/52 17:13	07:22 17:48	06:43 07:14-07:46/32 18:20	06:54 07:41-07:46/5 19:52	06:13 07:21-07:48/27	05:53 20:22
10	07:41 09:13-10:04/51 17:14	07:21 17:49	06:42 07:13-07:47/34 18:21	06:52 07:36-07:52/16 19:53	06:12 07:22-07:46/24	05:53 20:22
11	07:41 09:14-10:05/51 17:15	07:20 17:50	06:40 07:12-07:47/35 18:23	06:51 07:32-07:54/22 19:54	06:11 07:23-07:42/19	05:53 20:23
12	07:41 09:15-10:05/50 17:16	07:19 17:51	06:38 07:12-07:47/35 18:24	06:49 07:29-07:56/27 19:55	06:10 07:25-07:43/18	05:53 20:24
13	07:41 09:15-10:04/49 17:17	07:18 17:53	06:37 07:11-07:47/36 18:25	06:48 07:28-07:58/30 19:56	06:09 07:28-07:40/12	05:53 20:25
14	07:41 09:16-10:05/49 17:18	07:17 17:54	06:35 07:11-07:47/36 18:26	06:46 07:27-07:59/32 19:57	06:08 20:26	05:53 20:26
15	07:40 09:17-10:05/48 17:19	07:15 17:55	06:34 07:10-07:46/36 18:27	06:45 07:24-08:00/36 19:58	06:07 20:27	05:53 20:50
16	07:40 09:17-10:04/47 17:20	07:14 17:56	06:32 07:10-07:46/36 18:28	06:43 07:23-08:01/38 19:59	06:06 20:28	05:53 20:50
17	07:40 09:18-10:04/46 17:21	07:13 17:57	06:31 07:11-07:46/35 18:29	06:42 07:21-08:01/40 20:00	06:06 20:29	05:53 20:50
18	07:39 09:19-10:04/45 17:22	07:12 17:58	06:29 07:10-07:44/34 18:30	06:40 07:20-08:01/41 20:01	06:05 20:30	05:53 20:51
19	07:39 09:20-10:04/44 17:23	07:10 18:00	06:27 07:11-07:44/33 18:31	06:39 07:19-08:01/42 20:02	06:04 20:31	05:53 20:51
20	07:38 09:21-10:03/42 17:24	07:09 18:01	06:26 07:11-07:42/31 18:32	06:38 07:18-08:02/44 20:03	06:03 20:32	05:53 20:51
21	07:38 09:22-10:03/41 17:26	07:08 18:02	06:24 07:12-07:41/29 18:33	06:36 07:18-08:02/44 20:04	06:02 20:33	05:53 20:51
22	07:37 09:23-10:02/39 17:27	07:06 18:03	06:23 07:13-07:40/27 18:34	06:35 07:16-08:01/45 20:05	06:02 20:34	05:53 20:52
23	07:37 09:24-10:01/37 17:28	07:05 18:04	06:21 07:14-07:37/23 18:35	06:33 07:16-08:01/45 20:06	06:01 20:34	05:54 20:52
24	07:36 09:26-10:00/34 17:29	07:04 18:05	06:19 07:16-07:34/18 18:36	06:32 07:15-08:01/46 20:07	06:00 20:35	05:54 20:52
25	07:35 09:27-09:59/32 17:30	07:02 18:06	06:18 07:19-07:31/12 18:37	06:31 07:15-08:01/46 20:08	05:59 20:36	05:54 20:52
26	07:35 09:28-09:57/29 17:31	07:01 18:07	06:16 18:38	06:29 07:15-08:01/46 20:09	05:59 20:37	05:54 20:52
27	07:34 09:30-09:55/25 17:33	06:59 18:09	06:15 18:39	06:28 07:15-08:00/45 20:10	05:58 20:38	05:55 20:52
28	07:33 09:33-09:54/21 17:34	06:58 18:10	06:13 18:40	06:27 07:14-07:59/45 20:11	05:58 20:39	05:55 20:52
29	07:33 09:37-09:50/13 17:35	06:57 18:11	07:11 19:41	06:25 07:15-07:59/44 20:12	05:57 20:39	05:56 20:52
30	07:32 17:36		07:10 19:42	06:24 07:15-07:58/43 20:13	05:57 20:40	05:56 20:52
31	07:31 17:37		07:08 19:43		05:56 20:41	
Potential sun hours	301	309	370	397	444	448
Sum of minutes with flicker	1268	0	653	822	394	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:

**Bruncu e Niada**

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Licensed user:

**Ing. Bruno Manca**  
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Bruno Manca / ingbrunomanca@gmail.com  
Calculated:  
04/11/2020 13:48/2.8.579

## SHADOW - Calendar per WTG

Calculation: Ombre Recettori Rev2WTG: WTG05 - WTG05

### Assumptions for shadow calculations

Reference year for calendar 2020

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	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
134	282	483	550	523	510	295	242	134	107	215	403	778	1.342	591	242	6.831

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

	July	August	September	October	November	December
1	05:56 20:52	06:19 07:35-07:54/19 20:34	06:48 07:31-07:53/22 19:53	07:16 07:50-08:26/36 19:05	06:48 17:20	07:21 08:57-09:47/50 16:57
2	05:57 20:52	06:20 07:33-07:55/22 20:33 07:55-07:56/1	06:49 07:34-07:50/16 19:52	07:17 07:50-08:25/35 19:03	06:49 17:19	07:22 08:57-09:48/51 16:57
3	05:57 20:52	06:21 07:31-07:57/26 20:32	06:50 07:39-07:44/5 19:50	07:18 07:50-08:25/35 19:02	06:50 17:18	07:23 08:57-09:48/51 16:57
4	05:58 20:52	06:22 07:30-07:58/28 20:31	06:51 19:49	07:19 07:51-08:24/33 19:00	06:51 17:17	07:24 08:57-09:49/52 16:57
5	05:58 20:52	06:23 07:29-08:00/31 20:30	06:52 19:47	07:20 07:51-08:23/32 18:58	06:52 17:16	07:25 08:58-09:50/52 16:57
6	05:59 20:51	06:24 07:28-08:01/33 20:29	06:53 19:45	07:21 07:52-08:21/29 18:57	06:54 17:15	07:26 08:58-09:50/52 16:57
7	06:00 20:51	06:25 07:27-08:02/35 20:28	06:53 19:44	07:22 07:53-08:20/27 18:55	06:55 17:13	07:27 08:58-09:51/53 16:56
8	06:00 20:51	06:26 07:26-08:03/37 20:27	06:54 19:42	07:23 07:54-08:18/24 18:54	06:56 17:12	07:28 08:58-09:51/53 16:56
9	06:01 20:50	06:26 07:26-08:04/38 20:25	06:55 19:41	07:24 07:56-08:16/20 18:52	06:57 17:11	07:29 08:58-09:51/53 16:56
10	06:01 20:50	06:27 07:25-08:05/40 20:24	06:56 19:39	07:25 07:59-08:12/13 18:51	06:58 17:10	07:30 08:59-09:52/53 16:56
11	06:02 20:50	06:28 07:25-08:06/41 20:23	06:57 19:37	07:26 18:49	06:59 17:10	07:30 08:59-09:53/54 16:57
12	06:03 20:49	06:29 07:23-08:06/43 20:22	06:58 19:36	07:27 18:47	07:00 17:09	07:31 09:00-09:53/53 16:57
13	06:03 20:49	06:30 07:23-08:06/43 20:20	06:59 19:34	07:28 18:46	07:01 17:08	07:32 09:00-09:54/54 16:57
14	06:04 20:48	06:31 07:22-08:07/45 20:19	07:00 19:32	07:29 18:44	07:03 09:08-09:23/15 17:07	07:33 09:00-09:54/54 16:57
15	06:05 20:48	06:32 07:22-08:07/45 20:18	07:01 19:31	07:30 18:43	07:04 09:05-09:26/21 17:06	07:33 09:01-09:55/54 16:57
16	06:06 20:47	06:33 07:22-08:07/45 20:17	07:02 19:29	07:31 18:42	07:05 09:03-09:28/25 17:05	07:34 09:02-09:56/54 16:58
17	06:06 20:47	06:34 07:22-08:07/45 20:15	07:03 19:28	07:32 18:40	07:06 09:02-09:31/29 17:05	07:35 09:01-09:55/54 16:58
18	06:07 20:46	06:35 07:22-08:07/45 20:14	07:04 08:07-08:18/11 19:26	07:33 18:39	07:07 09:01-09:33/32 17:04	07:35 09:02-09:56/54 16:58
19	06:08 20:45	06:36 07:22-08:07/45 20:12	07:05 08:04-08:21/17 19:24	07:34 18:37	07:08 09:00-09:34/34 17:03	07:36 09:02-09:56/54 16:59
20	06:09 20:45	06:37 07:21-08:06/45 20:11	07:05 08:01-08:23/22 19:23	07:35 18:36	07:09 08:59-09:36/37 17:02	07:37 09:03-09:57/54 16:59
21	06:10 20:44	06:38 07:21-08:06/45 20:10	07:06 07:59-08:24/25 19:21	07:36 18:34	07:11 08:58-09:37/39 17:02	07:37 09:04-09:58/54 16:59
22	06:10 20:43	06:39 07:22-08:06/44 20:08	07:07 07:57-08:26/29 19:19	07:37 18:33	07:12 08:58-09:39/41 17:01	07:38 09:04-09:58/54 17:00
23	06:11 20:43	06:40 07:22-08:05/43 20:07	07:08 07:56-08:26/30 19:18	07:38 18:32	07:13 08:58-09:40/42 17:01	07:38 09:04-09:58/54 17:00
24	06:12 20:42	06:40 07:23-08:05/42 20:05	07:09 07:55-08:27/32 19:16	07:39 18:30	07:14 08:57-09:41/44 17:00	07:39 09:05-09:59/54 17:01
25	06:13 20:41	06:41 07:23-08:04/41 20:04	07:10 07:54-08:28/34 19:14	06:40 17:29	07:15 08:57-09:42/45 17:00	07:39 09:05-09:59/54 17:02
26	06:14 20:40	06:42 07:24-08:03/39 20:02	07:11 07:52-08:27/35 19:13	06:41 17:28	07:16 08:56-09:42/46 16:59	07:40 09:06-10:00/54 17:02
27	06:15 20:39	06:43 07:25-08:02/37 20:01	07:12 07:51-08:27/36 19:11	06:42 17:26	07:17 08:56-09:43/47 16:59	07:40 09:06-10:01/55 17:03
28	06:16 20:38	06:44 07:26-08:01/35 19:59	07:13 07:51-08:27/36 19:10	06:44 17:25	07:18 08:56-09:44/48 16:58	07:40 09:07-10:01/54 17:03
29	06:16 20:37	06:45 07:27-07:59/32 19:58	07:14 07:51-08:27/36 19:08	06:45 17:24	07:19 08:57-09:46/49 16:58	07:41 09:07-10:01/54 17:04
30	06:17 07:41-07:48/7 20:36	06:46 07:28-07:57/29 19:56	07:15 07:50-08:26/36 19:06	06:46 17:23	07:20 08:57-09:46/49 16:58	07:41 09:07-10:01/54 17:05
31	06:18 07:37-07:52/15 20:35	06:47 07:29-07:56/27 19:55		06:47 17:21		07:41 09:09-10:02/53 17:06
Potential sun hours	455	425	374	347	301	292
Sum of minutes with flicker	22	1166	422	284	643	1653

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:

**Bruncu e Niada**

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04/11/2020 15:47 / 7

Licensed user:

**Ing. Bruno Manca**  
Via Vittorio Veneto 231  
IT-09028 Sestu  
+390702358125  
Bruno Manca / ingbrunomanca@gmail.com

Calculated:

04/11/2020 13:48/2.8.579

### SHADOW - Calendar per WTG

Calculation: Ombre Recettori Rev2WTG: WTG06 - WTG06

#### Assumptions for shadow calculations

Reference year for calendar 2020

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	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
134	282	483	550	523	510	295	242	134	107	215	403	778	1.342	591	242	6.831

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:41 17:06	07:30 17:38	06:55 18:12	07:07 19:44	06:23 20:14	05:56 20:42	05:56 20:34	06:19 19:53	06:48 19:05	07:16 17:20	06:48 17:20	07:21 16:57
2	07:41 17:07	07:29 17:40	06:54 18:13	07:05 19:45	06:22 20:15	05:55 20:42	05:57 20:33	06:20 19:52	06:49 19:03	07:17 17:19	06:49 17:19	07:22 16:57
3	07:42 17:08	07:28 17:41	06:52 18:14	07:03 19:46	06:20 20:16	05:55 20:43	05:57 20:32	06:21 19:50	06:50 19:02	07:18 17:18	06:50 17:18	07:23 16:57
4	07:42 17:08	07:27 17:42	06:51 18:15	07:02 19:47	06:19 20:17	05:54 20:44	05:58 20:31	06:22 19:49	06:51 19:00	07:19 17:17	06:51 17:17	07:24 16:57
5	07:42 17:09	07:26 17:43	06:49 18:16	07:00 19:48	06:18 20:18	05:54 20:44	05:58 20:30	06:23 19:47	06:52 18:58	07:20 17:16	06:52 17:16	07:25 16:57
6	07:42 17:10	07:25 17:44	06:48 18:17	06:59 19:49	06:17 20:19	05:54 20:45	05:59 20:29	06:24 19:45	06:53 18:57	07:21 17:15	06:54 17:15	07:26 16:57
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18	07:39 17:22	07:12 17:58	06:29 18:30	06:40 20:01	06:05 20:30	05:53 20:51	06:07 20:46	06:35 20:14	07:04 19:26	07:33 18:39	07:07 17:04	07:36 16:58
19	07:39 17:23	07:10 18:00	06:27 18:31	06:39 20:02	06:04 20:31	05:53 20:51	06:08 20:45	06:36 20:13	07:05 19:24	07:34 18:37	07:08 17:03	07:36 16:59
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21	07:38 17:26	07:08 18:02	06:24 18:33	06:36 20:04	06:02 20:33	05:53 20:52	06:10 20:44	06:38 20:10	07:06 19:21	07:36 18:34	07:11 17:02	07:37 16:59
22	07:37 17:27	07:06 18:03	06:23 18:34	06:35 20:05	06:02 20:34	05:53 20:52	06:10 20:43	06:39 20:08	07:07 19:19	07:37 18:33	07:12 17:01	07:38 17:00
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25	07:36 17:30	07:02 18:06	06:18 18:37	06:31 20:08	05:59 20:36	05:54 20:52	06:13 20:41	06:41 20:04	07:10 19:15	07:40 17:29	07:15 17:00	07:39 17:02
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28	07:33 17:34	06:58 18:10	06:13 18:40	06:27 20:11	05:58 20:39	05:55 20:52	06:16 20:38	06:44 19:59	07:13 19:10	07:43 17:25	07:18 16:58	07:40 17:04
29	07:33 17:35	06:57 18:11	07:11 19:41	06:25 20:12	05:57 20:39	05:56 20:52	06:16 20:37	06:45 19:58	07:14 19:08	07:44 17:24	07:19 16:58	07:41 17:04
30	07:32 17:36		07:10 19:42	06:24 20:13	05:57 20:40	05:56 20:52	06:17 20:36	06:46 19:56	07:15 19:06	07:46 17:23	07:20 16:58	07:41 17:05
31	07:31 17:37		07:08 19:43		05:56 20:41		06:18 20:35	06:47 19:55		06:47 17:21		07:41 17:06
Potential sun hours	301	309	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:

**Bruncu e Niada**

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04/11/2020 15:47 / 8

Licensed user:

**Ing. Bruno Manca**  
Via Vittorio Veneto 231  
IT-09028 Sestu  
+390702358125  
Bruno Manca / ingbrunomanca@gmail.com  
Calculated:  
04/11/2020 13:48/2.8.579

### SHADOW - Calendar per WTG

Calculation: Ombre Recettori Rev2WTG: WTG07 - WTG07

#### Assumptions for shadow calculations

Reference year for calendar 2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:41 17:06	07:30 17:38	06:55 18:12	07:07 19:44	06:23 20:14	18:50-19:22/32 20:42	05:56 20:52	06:19 20:34	06:48 19:53	18:48-19:29/41 19:05	07:16 19:05	06:48 17:20	07:21 16:57
2	07:41 17:07	07:29 17:40	06:54 18:13	07:05 19:45	06:22 20:15	18:51-19:19/28 20:42	05:55 20:52	06:20 20:33	06:49 19:52	18:49-19:27/38 19:03	07:17 19:03	06:49 17:19	07:22 16:57
3	07:42 17:08	07:28 17:41	06:52 18:14	07:03 19:46	06:20 20:16	18:52-19:18/26 20:43	05:55 20:52	06:21 20:32	06:50 19:50	18:49-19:26/37 19:02	07:18 19:02	06:50 17:18	07:23 16:57
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17	07:40 17:21	07:13 17:57	06:31 18:29	06:42 20:00	06:06 20:29	18:45-19:31/46 20:29	05:53 20:50	06:34 20:15	07:03 19:28	18:52-19:34/42 19:00	07:32 18:40	07:06 17:05	07:35 16:58
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30	07:32 17:36	06:56 18:12	06:10 19:42	06:24 20:13	05:57 20:40	18:49-19:23/34 20:40	05:56 20:52	06:46 19:56	07:15 19:06	18:47-19:30/43 19:00	07:45 18:23	07:20 16:58	07:41 17:05
31	07:31 17:37	06:55 18:13	06:09 19:43	06:23 20:14	05:56 20:41	18:49-19:23/34 20:41	05:56 20:52	06:47 19:55	07:16 19:07	18:47-19:30/43 19:00	07:46 18:22	07:21 16:58	07:41 17:06
Potential sun hours	301	309	370	397	445	448	455	425	374	255	347	301	292
Sum of minutes with flicker	0	0	0	1062	135	0	0	962	0	255	0	301	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:

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Calculated:  
04/11/2020 13:48/2.8.579

### SHADOW - Calendar per WTG

Calculation: Ombre Recettori Rev2WTG: WTG08 - WTG08

#### Assumptions for shadow calculations

Reference year for calendar

2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:41 17:06	07:30 17:38	06:55 18:12	07:07 19:44	06:23 20:14	05:56 20:42	15:12-17:59/167 20:52	05:56 20:52	15:08-18:14/186 20:34	06:19 20:34	16:33-17:03/30 19:53	06:48 17:20	07:16 16:57
2	07:41 17:07	07:29 17:40	06:54 18:13	07:05 19:45	06:22 20:15	05:55 20:42	15:10-18:00/170 20:52	05:57 20:33	15:09-18:13/184 20:33	06:20 20:33	19:52 20:33	07:17 17:19	06:49 16:57
3	07:41 17:08	07:28 17:41	06:52 18:14	07:03 19:46	06:20 20:16	05:55 20:43	15:10-18:01/171 20:52	05:57 20:32	15:10-18:13/183 20:32	06:21 20:32	19:50 20:29	07:18 17:18	06:50 16:57
4	07:42 17:08	07:27 17:42	06:51 18:15	07:02 19:47	06:19 20:17	05:54 20:44	15:09-18:03/174 20:52	05:58 20:31	15:10-18:12/182 20:31	06:22 20:31	19:49 20:29	07:19 17:17	06:51 16:57
5	07:42 17:09	07:26 17:43	06:49 18:16	07:00 19:48	06:18 20:18	05:54 20:44	15:07-18:03/176 20:52	05:58 20:30	15:12-18:12/180 20:30	06:23 20:30	19:47 20:29	07:20 17:16	06:52 16:57
6	07:42 17:10	07:25 17:44	06:48 18:17	06:59 19:49	06:17 20:19	05:54 20:45	15:07-18:04/177 20:51	05:59 20:29	15:12-18:11/179 20:29	06:24 20:29	19:47 20:29	07:21 17:15	06:54 16:57
7	07:42 17:11	07:24 17:46	06:46 18:18	06:57 19:50	06:16 20:20	05:54 20:46	15:06-18:06/180 20:51	06:00 20:28	15:14-18:11/177 20:28	06:25 20:28	19:45 20:28	07:22 17:13	06:55 16:56
8	07:42 17:12	07:23 17:47	06:45 18:19	06:56 19:51	06:15 20:21	05:53 20:46	15:06-18:07/181 20:51	06:00 20:27	15:15-18:09/174 20:27	06:26 20:27	19:42 20:27	07:23 17:12	06:56 16:56
9	07:42 17:13	07:22 17:48	06:43 18:20	06:54 19:52	06:13 20:22	05:53 20:47	15:05-18:08/183 20:51	06:01 20:26	15:16-18:09/173 20:26	06:26 20:26	19:41 20:26	07:24 17:11	06:57 16:56
10	07:41 17:14	07:21 17:49	06:42 18:22	06:52 19:53	06:12 20:23	05:53 20:47	15:05-18:09/184 20:50	06:01 20:24	15:18-18:08/170 20:24	06:27 20:24	19:39 20:24	07:25 17:11	06:58 16:57
11	07:41 17:15	07:20 17:50	06:40 18:23	06:51 19:54	06:11 20:23	05:53 20:48	15:04-18:09/185 20:50	06:02 20:23	15:19-18:07/168 20:23	06:28 20:23	19:37 20:23	07:26 17:10	06:59 16:57
12	07:41 17:16	07:19 17:51	06:38 18:24	06:49 19:55	06:10 20:24	05:53 20:48	15:03-18:09/186 20:49	06:03 20:22	15:21-18:06/165 20:22	06:29 20:22	19:36 20:22	07:27 17:09	07:00 16:57
13	07:41 17:17	07:18 17:53	06:37 18:25	06:48 19:56	06:09 20:25	05:53 20:49	15:03-18:10/187 20:49	06:03 20:21	15:23-18:05/162 20:21	06:30 20:21	19:34 20:21	07:28 17:08	07:02 16:57
14	07:41 17:18	07:17 17:54	06:35 18:26	06:46 19:57	06:08 20:26	05:53 20:49	15:03-18:11/188 20:48	06:04 20:19	15:24-18:03/159 20:19	06:31 20:19	19:32 20:19	07:29 17:07	07:03 16:57
15	07:40 17:19	07:15 17:55	06:34 18:27	06:45 19:58	06:07 20:27	05:53 20:50	15:02-18:11/189 20:48	06:05 20:18	15:26-18:02/156 20:18	06:32 20:18	19:31 20:18	07:30 17:06	07:04 16:57
16	07:40 17:20	07:14 17:56	06:32 18:28	06:43 19:59	06:06 20:28	05:53 20:50	15:03-18:13/190 20:47	06:06 20:17	15:28-18:01/153 20:17	06:33 20:17	19:29 20:17	07:31 17:05	07:05 16:58
17	07:40 17:21	07:13 17:57	06:31 18:29	06:42 20:00	06:06 20:29	05:53 20:50	15:03-18:13/190 20:47	06:06 20:15	15:30-18:00/150 20:15	06:34 20:15	19:28 20:15	07:32 17:05	07:06 16:58
18	07:39 17:22	07:12 17:58	06:29 18:30	06:40 20:01	06:05 20:30	05:53 20:51	15:03-18:13/190 20:46	06:07 20:14	15:32-17:57/145 20:14	06:35 20:14	19:26 20:14	07:33 17:04	07:07 16:58
19	07:39 17:23	07:10 18:00	06:27 18:31	06:39 20:02	06:04 20:31	05:53 20:51	15:03-18:13/190 20:45	06:08 20:13	15:34-17:56/142 20:13	06:36 20:13	19:24 20:13	07:34 17:03	07:08 16:59
20	07:38 17:24	07:09 18:01	06:26 18:32	06:38 20:03	06:03 20:32	05:53 20:51	15:03-18:14/191 20:45	06:09 20:11	15:37-17:54/137 20:11	06:37 20:11	19:23 20:11	07:35 17:02	07:09 16:59
21	07:38 17:26	07:08 18:02	06:24 18:33	06:36 20:04	06:02 20:33	05:53 20:51	15:03-18:14/191 20:44	06:10 20:10	15:40-17:52/132 20:10	06:38 20:10	19:21 20:10	07:36 17:02	07:11 16:59
22	07:37 17:27	07:06 18:03	06:23 18:34	06:35 20:05	06:02 20:34	05:53 20:52	15:03-18:14/191 20:43	06:10 20:08	15:42-17:49/127 20:08	06:39 20:08	19:19 20:08	07:37 17:01	07:12 17:00
23	07:37 17:28	07:05 18:04	06:21 18:35	06:33 20:06	06:01 20:34	05:54 20:52	15:04-18:14/190 20:43	06:11 20:07	15:45-17:47/122 20:07	06:40 20:07	19:18 20:07	07:38 17:01	07:13 17:00
24	07:36 17:29	07:04 18:05	06:19 18:36	06:32 20:07	06:00 20:35	05:54 20:52	15:04-18:14/190 20:42	06:12 20:05	15:48-17:44/116 20:05	06:41 20:05	19:16 20:05	07:39 17:00	07:14 17:01
25	07:35 17:30	07:02 18:06	06:18 18:37	06:31 20:08	05:59 20:36	05:54 20:52	15:23-17:47/144 20:41	06:13 20:04	15:52-17:42/110 20:04	06:41 20:04	19:14 20:04	07:40 17:00	07:15 17:02
26	07:35 17:31	07:01 18:07	06:16 18:38	06:29 20:09	05:59 20:37	05:54 20:52	15:21-17:49/148 20:40	06:14 20:02	15:55-17:39/104 20:02	06:42 20:02	19:13 20:02	07:41 17:00	07:16 17:02
27	07:34 17:33	07:00 18:09	06:15 18:39	06:28 20:10	05:58 20:38	05:55 20:52	15:20-17:51/151 20:39	06:15 20:01	15:59-17:34/95 20:01	06:43 20:01	19:11 20:01	07:42 17:00	07:17 17:03
28	07:33 17:34	06:58 18:10	06:13 18:40	06:27 20:11	05:58 20:39	05:55 20:52	15:17-17:52/155 20:38	06:16 20:00	16:03-17:30/87 19:59	06:44 19:59	19:10 20:00	07:43 17:00	07:18 17:04
29	07:33 17:35	06:57 18:11	06:11 19:41	06:25 20:12	05:57 20:39	05:56 20:52	15:16-17:54/158 20:37	06:16 20:00	16:08-17:26/78 19:58	06:45 19:58	19:08 20:00	07:44 17:00	07:19 17:04
30	07:32 17:36		06:10 19:42	06:24 20:13	05:57 20:40	05:56 20:52	15:15-17:56/161 20:36	06:17 20:00	16:15-17:20/65 19:56	06:46 19:56	19:06 20:00	07:45 17:00	07:20 17:05
31	07:31 17:37		06:08 19:43	06:23 20:41	05:56 20:41	05:56 20:52	15:13-17:57/164 20:35	06:18 20:00	16:22-17:13/51 19:55	06:47 19:55	19:06 20:00	07:46 17:00	07:21 17:06
Potential sun hours	301	309	370	397	445	448	455	425	374	347	301	292	
Sum of minutes with flicker	0	0	0	0	2386	5543	4412	30	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:

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Calculated:  
04/11/2020 13:48/2.8.579

### SHADOW - Calendar per WTG

Calculation: Ombre Recettori Rev2WTG: WTG09 - WTG09

#### Assumptions for shadow calculations

Reference year for calendar

2020

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	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
134	282	483	550	523	510	295	242	134	107	215	403	778	1.342	591	242	6.831

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

	January	February	March	April	May	June
1	07:41 17:06	07:30 17:38	06:55 18:12	07:07 19:44	08:23-09:11/48 20:14	06:23 20:14
2	07:41 17:07	07:29 17:40	06:54 18:13	07:05 19:45	08:20-09:13/53 20:15	06:22 20:15
3	07:41 17:08	07:28 17:41	06:52 18:14	07:03 19:46	08:18-09:14/56 20:16	06:20 20:16
4	07:42 17:08	07:27 17:42	06:51 18:15	07:02 19:47	08:17-09:15/58 20:17	06:19 20:17
5	07:42 17:09	07:26 17:43	06:49 18:16	07:00 19:48	08:15-09:16/61 20:18	06:18 20:18
6	07:42 17:10	07:25 17:44	06:48 18:17	06:59 19:49	08:14-09:17/63 20:19	06:17 20:19
7	07:42 17:11	07:24 17:46	06:46 18:18	06:57 19:50	08:12-09:17/65 20:20	06:16 20:20
8	07:42 17:12	07:23 17:47	06:45 18:19	06:56 19:51	08:11-09:19/68 20:21	06:15 20:21
9	07:42 17:13	07:22 17:48	06:43 18:20	06:54 19:52	08:09-09:19/70 20:22	06:13 20:22
10	07:41 17:14	07:21 17:49	06:42 18:21	06:52 19:53	08:07-09:19/72 20:22	06:12 20:22
11	07:41 17:15	07:20 17:50	06:40 18:23	06:51 19:54	08:07-09:19/72 20:23	06:11 20:23
12	07:41 17:16	07:19 17:51	06:38 18:24	06:49 19:55	08:05-09:19/74 20:24	06:10 20:24
13	07:41 17:17	07:18 17:53	06:37 18:25	06:48 19:56	08:05-09:20/75 20:25	06:09 20:25
14	07:41 17:18	07:17 17:54	06:35 18:26	06:46 19:57	08:04-09:19/75 20:26	06:08 20:26
15	07:40 17:19	07:15 17:55	06:34 18:27	06:45 19:58	08:03-09:20/77 20:27	06:07 20:27
16	07:40 17:20	07:14 17:56	06:32 18:28	06:43 19:59	08:03-09:20/77 20:28	06:06 20:28
17	07:40 17:21	07:13 17:57	06:31 18:29	06:42 20:00	08:02-09:19/77 20:29	06:06 20:29
18	07:39 17:22	07:12 17:58	06:29 18:30	06:40 20:01	08:02-09:20/78 20:30	06:05 20:30
19	07:39 17:23	07:10 18:00	06:27 18:31	06:39 20:02	08:01-09:19/78 20:31	06:04 20:31
20	07:38 17:24	07:09 18:01	06:26 18:32	06:38 20:03	08:01-09:19/78 20:32	06:03 20:32
21	07:38 17:26	07:08 18:02	06:24 18:33	06:36 20:04	08:01-09:19/78 20:33	06:02 20:33
22	07:37 17:27	07:06 18:03	06:23 18:34	06:35 20:05	08:00-09:18/78 20:34	06:02 20:34
23	07:37 17:28	07:05 18:04	06:21 18:35	06:33 20:06	08:00-09:18/78 20:34	06:01 20:34
24	07:36 17:29	07:04 18:05	06:19 18:36	06:32 20:07	07:59-09:17/78 20:35	06:00 20:35
25	07:35 17:30	07:02 18:06	06:18 18:37	06:31 20:08	07:59-09:16/77 20:36	05:59 20:36
26	07:35 17:31	07:01 18:07	06:16 18:38	06:29 20:09	07:59-09:16/77 20:37	05:59 20:37
27	07:34 17:33	07:00 18:09	06:15 18:39	06:28 20:10	08:00-09:16/76 20:38	05:58 20:38
28	07:33 17:34	06:58 18:10	06:13 18:40	06:27 20:11	07:59-09:15/76 20:39	05:58 20:39
29	07:33 17:35	06:57 18:11	06:11 19:41	06:25 20:12	07:59-09:14/75 20:39	05:57 20:39
30	07:32 17:36		07:10 19:42	06:24 20:13	07:59-09:14/75 20:40	05:57 20:40
31	07:31 17:37		07:08 19:43			05:56 20:41
Potential sun hours	301	309	370	397	445	448
Sum of minutes with flicker	0	0	140	2143	2520	912

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:

**Brunco e Niada**

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Bruno Manca / ingbrunomanca@gmail.com

Calculated:

04/11/2020 13:48/2.8.579

### SHADOW - Calendar per WTG

Calculation: Ombre Recettori Rev2WTG: WTG09 - WTG09

#### Assumptions for shadow calculations

Reference year for calendar 2020

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	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
134	282	483	550	523	510	295	242	134	107	215	403	778	1.342	591	242	6.831

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

	July	August	September	October	November	December
1	05:56 06:49-07:19/30	06:19 06:51-07:23/32	06:48 08:06-09:18/72	07:16 19:05	06:48 17:20	07:21 16:57
	20:52	20:34 08:14-09:16/62	19:53			
2	05:57 06:48-07:19/31	06:20 06:51-07:23/32	06:49 08:06-09:17/71	07:17 19:03	06:49 17:19	07:22 16:57
	20:52	20:33 08:14-09:16/62	19:52			
3	05:57 06:49-07:20/31	06:21 06:51-07:21/30	06:50 08:07-09:17/70	07:18 19:03	06:50 17:19	07:23 16:57
	20:52	20:32 08:12-09:16/64	19:50			
4	05:58 06:48-07:20/32	06:22 06:52-07:20/28	06:51 08:08-09:16/68	07:19 19:00	06:51 17:17	07:24 16:57
	20:52	20:31 08:12-09:17/65	19:49			
5	05:58 06:49-07:21/32	06:23 06:53-07:19/26	06:52 08:09-09:15/66	07:20 18:58	06:52 17:16	07:25 16:57
	20:52	20:30 08:11-09:18/67	19:47			
6	05:59 06:48-07:20/32	06:24 06:55-07:18/23	06:53 08:09-09:12/63	07:21 18:57	06:54 17:15	07:26 16:56
	20:51	20:29 08:11-09:19/68	19:45			
7	06:00 06:48-07:21/33	06:25 06:57-07:16/19	06:53 08:10-09:11/61	07:22 18:55	06:55 17:13	07:27 16:56
	20:51	20:28 08:10-09:19/69	19:44			
8	06:00 06:48-07:21/33	06:26 06:59-07:14/15	06:54 08:11-09:09/58	07:23 18:54	06:56 17:12	07:28 16:56
	20:51	20:27 08:10-09:20/70	19:42			
9	06:01 06:48-07:22/34	06:26 07:03-07:09/6	06:55 08:12-09:08/56	07:24 18:52	06:57 17:11	07:29 16:56
	20:50	20:25 08:09-09:21/72	19:41			
10	06:01 06:48-07:23/35	06:27 08:09-09:21/72	06:56 08:13-09:06/53	07:25 18:51	06:58 17:10	07:30 16:56
	20:50	20:24	19:39			
11	06:02 06:48-07:23/35	06:28 08:08-09:21/73	06:57 08:15-09:04/49	07:26 18:49	06:59 17:10	07:30 16:57
	20:50	20:23	19:37			
12	06:03 06:48-07:23/35	06:29 08:07-09:21/74	06:58 08:17-09:01/44	07:27 18:47	07:00 17:09	07:31 16:57
	20:49	20:22	19:36			
13	06:03 06:48-07:24/36	06:30 08:07-09:22/75	06:59 08:19-08:59/40	07:28 18:46	07:02 17:08	07:32 16:57
	20:49	20:21	19:34			
14	06:04 06:47-07:24/37	06:31 08:07-09:22/75	07:00 08:22-08:55/33	07:29 18:44	07:03 17:07	07:33 16:57
	20:48	20:19	19:32			
15	06:05 06:47-07:24/37	06:32 08:07-09:22/75	07:01 08:25-08:50/25	07:30 18:43	07:04 17:06	07:33 16:57
	20:48	20:18	19:31			
16	06:06 06:48-07:25/37	06:33 08:06-09:23/77	07:02 08:32-08:42/10	07:31 18:41	07:05 17:05	07:34 16:58
	20:47	20:17	19:29			
17	06:06 06:48-07:25/37	06:34 08:06-09:23/77	07:03	07:32 18:40	07:06 17:05	07:35 16:58
	20:47	20:15	19:28			
18	06:07 06:47-07:25/38	06:35 08:06-09:23/77	07:04	07:33 18:39	07:07 17:04	07:35 16:58
	20:46	20:14	19:26			
19	06:08 06:47-07:25/38	06:36 08:06-09:23/77	07:05	07:34 18:37	07:08 17:03	07:36 16:59
	20:45	20:12	19:24			
20	06:09 06:48-07:26/38	06:37 08:05-09:23/78	07:05	07:35 18:35	07:09 17:02	07:37 16:59
	20:45	20:11	19:23			
21	06:10 06:48-07:26/38	06:38 08:05-09:23/78	07:06	07:36 18:34	07:11 17:01	07:37 16:59
	20:44	20:10	19:21			
22	06:10 06:47-07:25/38	06:39 08:05-09:23/78	07:07	07:37 18:33	07:12 17:01	07:38 17:00
	20:43	20:08	19:19			
23	06:11 06:47-07:26/39	06:40 08:05-09:23/78	07:08	07:38 18:32	07:13 17:01	07:38 17:00
	20:43	20:07	19:18			
24	06:12 06:48-07:26/38	06:40 08:05-09:23/78	07:09	07:39 18:31	07:14 17:01	07:39 17:00
	20:42	20:05	19:16			
25	06:13 06:48-07:26/38	06:41 08:05-09:22/77	07:10	07:40 18:30	07:15 17:01	07:39 17:01
	20:41	20:04	19:14			
26	06:14 06:48-07:26/38	06:42 08:05-09:22/77	07:11	07:41 18:29	07:16 17:01	07:40 17:02
	20:40	20:02	19:13			
27	06:15 06:48-07:25/37	06:43 08:05-09:22/77	07:12	07:42 18:28	07:17 17:01	07:40 17:02
	20:39	20:01	19:11			
28	06:16 06:48-07:25/37	06:44 08:05-09:21/76	07:13	07:43 18:26	07:18 17:01	07:40 17:03
	20:38	19:59	19:10			
29	06:16 06:49-07:25/36	06:45 08:05-09:20/75	07:14	07:44 18:25	07:19 17:01	07:41 17:04
	20:37	19:58	19:08			
30	06:17 06:49-07:24/35	06:46 08:05-09:20/75	07:15	07:45 18:24	07:20 17:01	07:41 17:05
	20:36	19:56	19:06			
31	06:18 06:50-07:24/34	06:47 08:05-09:19/74		07:46 18:23	07:21 17:01	07:41 17:06
	20:35	19:55				
Potential sun hours	455	425	374	347	301	292
Sum of minutes with flicker	1924	2483	839	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:

**Brunco e Niada**

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Calculated:

04/11/2020 13:48/2.8.579

**SHADOW - Calendar per WTG**

Calculation: Ombre Recettori Rev2WTG: WTG10 - WTG10

**Assumptions for shadow calculations**

Reference year for calendar

2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December	
1	07:41 17:06	07:30 17:38	06:55 18:12	07:07 19:44	06:23 20:14	19:07-19:54/47 20:42 20:05-20:09/4	05:56 20:52	19:07-20:05/58 20:52	05:56 20:52	19:15-20:08/53 20:34	06:19 19:53	19:12-20:14/62 19:05	06:48 17:20
2	07:41 17:07	07:29 17:40	06:54 18:13	07:05 19:45	06:21 20:15	19:05-19:54/49 20:42 20:05-20:08/3	05:55 20:52	19:06-20:05/59 20:52	05:57 20:52	19:15-20:08/53 20:33	06:20 19:52	19:12-20:12/60 19:03	06:49 17:19
3	07:41 17:07	07:28 17:41	06:52 18:14	07:03 19:46	06:20 20:16	19:05-19:55/50 20:43 20:05-20:07/2	05:55 20:52	19:07-20:05/58 20:52	05:57 20:52	19:15-20:09/54 20:32	06:21 19:50	19:12-20:11/59 19:01	06:50 17:18
4	07:42 17:08	07:27 17:42	06:51 18:15	07:02 19:47	06:19 20:17	19:04-19:56/52 20:44 20:05-20:06/1	05:54 20:52	19:08-20:05/57 20:52	05:58 20:52	19:15-20:09/54 20:31	06:22 19:49	19:12-20:10/58 19:00	06:51 17:17
5	07:42 17:09	07:26 17:43	06:49 18:16	07:00 19:48	06:18 20:18	19:04-19:57/53 20:44	05:54 20:52	19:08-20:03/55 20:52	05:58 20:52	19:15-20:10/55 20:30	06:23 19:47	19:12-20:09/57 18:58	06:52 17:16
6	07:42 17:10	07:25 17:44	06:48 18:17	06:59 19:49	06:17 20:19	19:03-19:58/55 20:45	05:54 20:51	19:08-20:03/55 20:51	05:59 20:51	19:15-20:09/54 20:29	06:24 19:45	19:13-20:08/55 18:57	06:52 17:14
7	07:42 17:11	07:24 17:45	06:46 18:18	06:57 19:50	06:16 20:20	19:03-19:59/56 20:46	05:53 20:51	19:09-20:04/55 20:51	05:59 20:51	19:15-20:10/55 20:28	06:25 19:44	19:13-20:07/54 18:55	06:53 17:13
8	07:42 17:12	07:23 17:47	06:45 18:19	06:55 19:51	06:14 20:21	19:03-20:00/57 20:46	05:53 20:51	19:10-20:04/54 20:51	06:00 20:27	19:14-20:11/57 20:27	06:25 19:42	19:14-20:06/52 18:54	06:54 17:12
9	07:42 17:13	07:22 17:48	06:43 18:20	06:54 19:52	06:13 20:22	19:02-20:01/59 20:47	05:53 20:50	19:10-20:04/54 20:50	06:01 20:25	19:15-20:12/57 20:25	06:26 19:41	19:14-20:05/51 18:52	06:55 17:11
10	07:41 17:14	07:21 17:49	06:42 18:21	06:52 19:53	06:12 20:22	19:02-20:02/60 20:47	05:53 20:50	19:10-20:03/53 20:50	06:01 20:24	19:15-20:13/58 20:24	06:27 19:39	19:15-20:04/49 18:50	06:56 17:10
11	07:41 17:15	07:20 17:50	06:40 18:22	06:51 19:54	06:11 20:23	19:02-20:03/61 20:48	05:53 20:48	19:10-20:03/53 20:48	06:02 20:49	19:14-20:12/58 20:23	06:28 19:37	19:14-20:02/48 18:49	06:57 17:09
12	07:41 17:16	07:19 17:51	06:38 18:24	06:49 19:55	06:10 20:24	19:02-20:04/62 20:48	05:53 20:48	19:11-20:03/52 20:49	06:03 20:49	19:14-20:13/59 20:22	06:29 19:36	19:15-20:01/46 18:47	06:58 17:09
13	07:41 17:17	07:18 17:53	06:37 18:25	06:48 19:56	06:09 20:25	19:02-20:04/62 20:49	05:53 20:49	19:11-20:03/52 20:49	06:03 20:49	19:14-20:14/60 20:21	06:29 19:34	19:16-20:00/44 18:46	06:59 17:08
14	07:41 17:18	07:17 17:54	06:35 18:26	06:46 19:57	06:08 20:26	19:01-20:05/64 20:49	05:52 20:50	19:11-20:03/52 20:49	06:04 20:48	19:13-20:13/60 20:19	06:31 19:32	19:17-19:59/42 18:44	07:00 17:07
15	07:40 17:19	07:15 17:55	06:34 18:27	06:45 19:58	06:07 20:27	19:01-20:06/65 20:50	05:52 20:50	19:12-20:03/51 20:50	06:05 20:48	19:14-20:14/60 20:18	06:32 19:31	19:18-19:58/40 18:43	07:01 17:06
16	07:40 17:20	07:14 17:56	06:32 18:28	06:43 19:59	06:06 20:28	19:01-20:07/66 20:50	05:52 20:50	19:12-20:03/51 20:50	06:06 20:47	19:14-20:15/61 20:17	06:33 19:29	19:19-19:56/37 18:41	07:02 17:05
17	07:40 17:21	07:13 17:57	06:31 18:29	06:42 19:59	06:06 20:29	19:01-20:07/66 20:50	05:53 20:50	19:12-20:03/51 20:50	06:06 20:47	19:13-20:14/61 20:15	06:34 19:28	19:20-19:55/35 18:40	07:03 17:04
18	07:39 17:22	07:12 17:58	06:29 18:30	06:40 20:01	06:05 20:30	19:02-20:08/66 20:51	05:53 20:51	19:13-20:04/51 20:51	06:07 20:46	19:13-20:16/63 20:14	06:35 19:21	19:21-19:54/33 18:39	07:04 17:04
19	07:39 17:23	07:10 18:00	06:27 18:31	06:39 20:02	06:04 20:31	19:02-20:08/66 20:51	05:53 20:51	19:14-20:04/50 20:51	06:08 20:45	19:13-20:16/63 20:12	06:36 19:22	19:22-19:52/30 18:37	07:05 17:03
20	07:38 17:24	07:09 18:01	06:26 18:32	06:38 20:03	19:30-19:41/11	19:02-20:08/66 20:51	05:53 20:51	19:14-20:04/50 20:51	06:09 20:45	19:13-20:17/64 20:11	06:37 19:23	19:24-19:51/27 18:36	07:05 17:02
21	07:38 17:26	07:08 18:02	06:24 18:33	06:36 20:04	19:24-19:43/19	19:02-20:07/65 20:51	05:53 20:51	19:14-20:04/50 20:51	06:10 20:44	19:12-20:16/64 20:10	06:38 19:26	19:26-19:49/23 18:34	07:06 17:01
22	07:37 17:27	07:06 18:03	06:23 18:34	06:35 20:05	19:21-19:45/24	19:03-20:07/64 20:52	05:53 20:52	19:14-20:04/50 20:52	06:10 20:43	19:12-20:17/65 20:08	06:39 19:30	19:30-19:48/18 18:33	07:07 17:01
23	07:37 17:28	07:05 18:04	06:21 18:35	06:33 20:06	19:19-19:46/27	19:03-20:07/64 20:52	05:53 20:52	19:15-20:05/50 20:52	06:11 20:43	19:12-20:18/66 20:07	06:40 19:35	19:35-19:44/9 18:32	07:08 17:01
24	07:36 17:29	07:04 18:05	06:19 18:36	06:32 20:07	19:16-19:46/30	19:04-20:07/63 20:52	05:54 20:52	19:15-20:05/50 20:52	06:12 20:42	19:12-20:18/66 20:05	06:40 20:05	19:16-20:20/4 18:30	07:09 17:00
25	07:35 17:30	07:02 18:06	06:18 18:37	06:31 20:08	19:14-19:47/33	19:04-20:07/63 20:52	05:54 20:52	19:14-20:05/51 20:52	06:13 20:41	19:13-20:19/66 20:04	06:41 20:04	19:17-20:20/3 17:29	07:10 17:00
26	07:35 17:31	07:01 18:07	06:16 18:38	06:29 20:09	19:13-19:49/36	19:03-20:06/63 20:52	05:54 20:52	19:15-20:06/51 20:52	06:14 20:40	19:13-20:18/65 20:02	06:42 19:13	20:17-20:18/1 17:28	07:11 16:59
27	07:34 17:32	06:59 18:09	06:15 18:39	06:28 20:10	19:11-19:49/38	19:04-20:06/62 20:52	05:55 20:52	19:15-20:06/51 20:52	06:15 20:39	19:12-20:18/66 20:01	06:43 19:11	20:18-20:19/2 17:26	07:12 16:59
28	07:33 17:34	06:58 18:10	06:13 18:40	06:27 20:11	19:10-19:50/40	19:04-20:05/61 20:52	05:55 20:52	19:15-20:06/51 20:52	06:15 20:38	19:12-20:17/65 20:04	06:44 19:09	20:16-20:17/1 17:25	07:13 16:58
29	07:33 17:35	06:57 18:11	07:11 19:41	06:25 20:12	19:09-19:51/42	19:05-20:05/60 20:52	05:55 20:52	19:15-20:07/52 20:52	06:16 20:37	19:12-20:16/64 19:58	06:45 19:08	20:16-20:16/4 17:24	07:14 16:58
30	07:32 17:36	07:10 19:42	07:10 20:13	06:24 20:13	19:08-19:52/44	19:05-20:05/60 20:40	05:56 20:52	19:15-20:07/52 20:52	06:17 20:36	19:12-20:15/63 19:56	06:46 19:06	20:15-20:15/63 17:22	07:15 16:58
31	07:31 17:37	07:08 19:43	07:08 19:43	07:08 19:43	19:08-19:52/44	20:05-20:10/5 20:41	05:56 20:41	19:15-20:05/59 20:41	06:18 20:35	19:12-20:15/63 19:55	06:47 19:06	20:15-20:15/63 17:21	07:16 17:06
Potential sun hours	301	309	370	397	445	448	455	425	374	347	301	292	0
Sum of minutes with flicker	0	0	0	344	1933	1589	1948	989	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:

**Bruncu e Niada**

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Calculated:

04/11/2020 13:48/2.8.579

## SHADOW - Calendar per WTG

Calculation: Ombre Recettori Rev2WTG: WTG11 - WTG11

### Assumptions for shadow calculations

Reference year for calendar 2020

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	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
134	282	483	550	523	510	295	242	134	107	215	403	778	1.342	591	242	6.831

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

	January	February	March	April	May	June
1	07:41 17:06	07:30 08:05-08:26/21 17:38	06:55 18:12	07:07 19:44	06:23 19:46-19:54/8 20:14	05:56 20:42
2	07:41 17:07	07:29 08:05-08:26/21 17:40	06:54 18:13	07:05 19:45	06:22 19:44-19:54/10 20:15	05:55 20:42
3	07:41 17:07	07:28 08:05-08:26/21 17:41	06:52 18:14	07:03 19:46	06:20 19:44-19:55/11 20:16	05:55 20:43
4	07:42 17:08	07:27 08:05-08:26/21 17:42	06:51 18:15	07:02 19:47	06:19 19:44-19:56/12 20:17	05:54 20:44
5	07:42 17:09	07:26 08:05-08:26/21 17:43	06:49 18:16	07:00 19:48	06:18 19:44-19:57/13 20:18	05:54 20:44
6	07:42 17:10	07:25 08:06-08:26/20 17:44	06:48 18:17	06:59 19:49	06:17 19:44-19:58/14 20:19	05:54 20:45
7	07:42 17:11	07:24 08:06-08:25/19 17:46	06:46 18:18	06:57 19:50	06:16 19:44-19:59/15 20:20	05:53 20:46
8	07:42 17:12	07:23 08:07-08:25/18 17:47	06:45 18:19	06:56 19:51	06:14 19:45-20:00/15 20:21	05:53 20:46
9	07:42 17:13	07:22 08:09-08:24/15 17:48	06:43 18:20	06:54 19:52	06:13 19:45-20:01/16 20:22	05:53 20:47
10	07:41 17:14	07:21 08:10-08:22/12 17:49	06:42 18:21	06:52 19:53	06:12 19:45-20:02/17 20:23	05:53 20:47
11	07:41 17:15	07:20 08:13-08:20/7 17:50	06:40 18:23	06:51 19:54	06:11 19:45-20:03/18 20:23	05:53 20:48
12	07:41 17:16	07:19 17:51	06:38 18:24	06:49 19:55	06:10 19:46-20:04/18 20:24	05:53 20:48
13	07:41 17:17	07:18 17:53	06:37 18:25	06:48 19:56	06:09 19:46-20:04/18 20:25	05:53 20:49
14	07:41 17:18	07:17 17:54	06:35 18:26	06:46 19:57	06:08 19:47-20:05/18 20:26	05:52 20:49
15	07:40 17:19	07:15 17:55	06:34 18:27	06:45 19:58	06:07 19:48-20:06/18 20:27	05:52 20:50
16	07:40 17:20	07:14 17:56	06:32 18:28	06:43 19:59	06:06 19:48-20:07/19 20:28	05:52 20:50
17	07:40 17:21	07:13 17:57	06:31 18:29	06:42 20:00	06:06 19:49-20:07/18 20:29	05:53 20:50
18	07:39 17:22	07:12 17:58	06:29 18:30	06:40 20:01	06:05 19:51-20:09/18 20:30	05:53 20:51
19	07:39 17:23	07:10 18:00	06:27 18:31	06:39 20:02	06:04 19:52-20:10/18 20:31	05:53 20:51
20	07:38 17:24	07:09 18:01	06:26 18:32	06:38 20:03	06:03 19:54-20:09/15 20:32	05:53 20:51
21	07:38 17:26	07:08 18:02	06:24 18:33	06:36 20:04	06:02 19:56-20:07/11 20:33	05:53 20:52
22	07:37 17:27	07:06 18:03	06:23 18:34	06:35 20:05	06:01 20:01-20:03/2 20:34	05:53 20:52
23	07:37 17:28	07:05 18:04	06:21 18:35	06:33 20:06	06:01 20:34	05:53 20:52
24	07:36 17:29	07:04 18:05	06:19 18:36	06:32 20:07	06:00 20:35	05:54 20:52
25	07:36 08:10-08:18/8 17:30	07:02 18:06	06:18 18:37	06:31 20:08	05:59 20:36	05:54 20:52
26	07:35 08:08-08:20/12 17:31	07:01 18:07	06:16 18:38	06:29 20:09	05:59 20:37	05:54 20:52
27	07:34 08:08-08:22/14 17:32	07:00 18:09	06:15 18:39	06:28 19:48-19:49/1 20:10	05:58 20:38	05:55 20:52
28	07:33 08:07-08:23/16 17:34	06:58 18:10	06:13 18:40	06:27 19:47-19:50/3 20:11	05:58 20:39	05:55 20:52
29	07:33 08:06-08:24/18 17:35	06:57 18:11	07:11 19:41	06:25 19:46-19:51/5 20:12	05:57 20:39	05:55 20:52
30	07:32 08:05-08:25/20 17:36		07:10 19:42	06:24 19:46-19:52/6 20:13	05:56 20:40	05:56 20:52
31	07:31 08:05-08:25/20 17:37		07:08 19:43		05:56 20:41	
Potential sun hours	301	309	370	397	445	448
Sum of minutes with flicker	108	196	0	15	322	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:

**Bruncu e Niada**

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Calculated:

04/11/2020 13:48/2.8.579

## SHADOW - Calendar per WTG

Calculation: Ombre Recettori Rev2WTG: WTG11 - WTG11

### Assumptions for shadow calculations

Reference year for calendar 2020

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	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
134	282	483	550	523	510	295	242	134	107	215	403	778	1.342	591	242	6.831

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

	July	August	September	October	November	December
1	05:56 20:52	06:19 19:56-20:14/18 20:34	06:48 19:53	07:16 19:05	06:48 07:42-07:49/7	07:21 16:57
2	05:57 20:52	06:20 19:55-20:12/17 20:33	06:49 19:52	07:17 19:03	06:49 07:39-07:51/12	07:22 16:57
3	05:57 20:52	06:21 19:55-20:11/16 20:32	06:50 19:50	07:18 19:02	06:50 07:38-07:54/16	07:23 16:57
4	05:58 20:52	06:22 19:54-20:10/16 20:31	06:51 19:49	07:19 19:00	06:51 07:37-07:55/18	07:24 16:57
5	05:58 20:52	06:23 19:54-20:09/15 20:30	06:52 19:47	07:20 18:58	06:52 07:36-07:55/19	07:25 16:57
6	05:59 20:51	06:24 19:54-20:08/14 20:29	06:53 19:45	07:21 18:57	06:54 07:35-07:56/21	07:26 16:56
7	05:59 20:51	06:25 19:54-20:07/13 20:28	06:53 19:44	07:22 18:55	06:55 07:36-07:57/21	07:27 16:56
8	06:00 20:51	06:25 19:54-20:06/12 20:27	06:54 19:42	07:23 18:54	06:56 07:36-07:57/21	07:28 16:56
9	06:01 20:51	06:26 19:54-20:05/11 20:26	06:55 19:41	07:24 18:52	06:57 07:35-07:57/22	07:29 16:56
10	06:01 20:50	06:27 19:54-20:04/10 20:24	06:56 19:39	07:25 18:51	06:58 07:35-07:57/22	07:30 16:56
11	06:02 20:50	06:28 19:53-20:02/9 20:23	06:57 19:37	07:26 18:49	06:59 07:36-07:57/21	07:30 16:57
12	06:03 20:49	06:29 19:53-20:01/8 20:22	06:58 19:36	07:27 18:47	07:00 07:37-07:57/20	07:31 16:57
13	06:03 20:49	06:30 19:54-20:00/6 20:21	06:59 19:34	07:28 18:46	07:02 07:37-07:57/20	07:32 16:57
14	06:04 20:48	06:31 19:54-19:59/5 20:19	07:00 19:32	07:29 18:44	07:03 07:38-07:56/18	07:33 16:57
15	06:05 20:48	06:32 19:55-19:58/3 20:18	07:01 19:31	07:30 18:43	07:04 07:39-07:55/16	07:33 16:57
16	06:06 20:47	06:33 19:55-19:56/1 20:17	07:02 19:29	07:31 18:41	07:05 07:41-07:55/14	07:34 16:58
17	06:06 20:47	06:34 20:15	07:03 19:28	07:32 18:40	07:06 07:42-07:54/12	07:35 16:58
18	06:07 20:46	06:35 20:14	07:04 19:26	07:33 18:39	07:07 07:44-07:52/8	07:36 16:58
19	06:08 20:45	06:36 20:13	07:05 19:24	07:34 18:37	07:08	07:36 16:59
20	06:09 20:45	06:37 20:11	07:05 19:23	07:35 18:36	07:09	07:37 16:59
21	06:10 20:44	06:38 20:10	07:06 19:21	07:36 18:34	07:11	07:37 16:59
22	06:10 20:08-20:15/7 20:43	06:39 20:08	07:07 19:19	07:37 18:33	07:12	07:38 17:00
23	06:11 20:05-20:18/13 20:43	06:40 20:07	07:08 19:18	07:38 18:32	07:13	07:38 17:00
24	06:12 20:04-20:20/16 20:42	06:40 20:05	07:09 19:16	07:39 18:30	07:14	07:39 17:01
25	06:13 20:02-20:20/18 20:41	06:41 20:04	07:10 19:14	06:40 17:29	07:15	07:39 17:02
26	06:14 20:01-20:19/18 20:40	06:42 20:02	07:11 19:13	06:41 17:28	07:16	07:40 17:02
27	06:15 19:59-20:18/19 20:39	06:43 20:01	07:12 19:11	06:42 17:26	07:17	07:40 17:03
28	06:15 19:59-20:17/18 20:38	06:44 19:59	07:13 19:10	06:44 17:25	07:18	07:40 17:03
29	06:16 19:58-20:16/18 20:37	06:45 19:58	07:14 19:08	06:45 17:24	07:19	07:41 17:04
30	06:17 19:57-20:15/18 20:36	06:46 19:56	07:15 19:06	06:46 17:22	07:20	07:41 17:05
31	06:18 19:57-20:15/18 20:35	06:47 19:55	 17:21	06:47 17:21		07:41 17:06
Potential sun hours	455	425	374	347	301	292
Sum of minutes with flicker	163	174	0	0	308	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:

**Brunco e Niada**

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04/11/2020 15:47 / 15

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**Ing. Bruno Manca**  
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Calculated:  
04/11/2020 13:48/2.8.579

### SHADOW - Calendar per WTG

Calculation: Ombre Recettori Rev2WTG: WTG12 - WTG12

#### Assumptions for shadow calculations

Reference year for calendar

2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December		
1	07:41 17:06	07:30 17:38	06:55 18:12	07:07 19:44	06:23 20:14	05:56 20:42	05:56 20:52	06:19 20:34	06:48 19:53	17:25-18:41/76 19:05 18:31-18:44/13	07:16 17:20	17:31-18:08/37 18:31-18:44/13	06:48 17:20	07:21 16:57
2	07:41 17:07	07:29 17:40	06:54 18:13	07:05 19:45	06:22 20:15	05:55 20:42	05:57 20:52	06:20 20:33	06:49 19:52	17:24-18:41/77 19:03 18:31-18:43/12	07:17 17:19	17:34-18:05/31 18:31-18:43/12	06:49 17:19	07:22 16:57
3	07:41 17:08	07:28 17:41	06:52 18:14	07:03 19:46	06:20 20:16	05:55 20:43	05:57 20:52	06:21 20:32	06:50 19:50	17:23-18:41/78 19:02 17:38-18:00/22	07:18 17:18	17:38-18:00/22 18:30-18:41/11	06:50 06:51	07:23 07:24
4	07:42 17:08	07:27 17:42	06:51 18:15	07:02 19:47	06:19 20:17	05:54 20:44	05:58 20:52	06:22 20:31	06:51 19:49	17:22-18:41/79 19:00	07:19 19:00	18:30-18:39/9 19:00	06:51 17:17	07:24 16:57
5	07:42 17:09	07:26 17:43	06:49 18:16	07:00 19:48	06:18 20:18	05:54 20:44	05:58 20:52	06:23 20:30	06:52 19:47	17:22-18:41/79 19:00	07:20 18:58	18:30-18:38/8 18:58	06:52 17:16	07:25 16:57
6	07:42 17:10	07:25 17:44	06:48 18:17	06:59 19:49	06:17 20:19	05:54 20:45	05:59 20:51	06:24 20:29	06:53 19:45	17:20-18:40/80 19:00	07:21 18:57	18:30-18:36/6 18:57	06:54 17:15	07:26 16:56
7	07:42 17:11	07:24 17:46	06:46 18:18	06:57 19:50	06:16 20:20	05:53 20:46	06:00 20:51	06:25 20:28	06:53 19:44	17:20-18:40/80 19:00	07:22 18:55	18:31-18:35/4 18:55	06:55 17:13	07:27 16:56
8	07:42 17:12	07:23 17:47	06:45 18:19	06:56 19:51	06:15 20:21	05:53 20:46	06:00 20:51	06:26 20:27	06:54 19:42	17:19-18:40/81 19:00	07:23 18:54	18:31-18:33/2 18:54	06:56 17:12	07:28 16:56
9	07:42 17:13	07:22 17:48	06:43 18:20	06:54 19:52	06:13 20:22	05:53 20:47	06:01 20:51	06:28 20:26	06:55 19:41	17:19-18:39/80 19:00	07:24 18:52	18:39-18:42/7 18:52	06:57 17:11	07:29 16:56
10	07:41 17:14	07:21 17:49	06:42 18:21	06:52 19:53	06:12 20:23	05:53 20:47	06:01 20:50	06:27 20:24	06:56 19:39	18:01-18:22/21 19:00	07:25 18:51	17:19-18:38/80 18:51	06:58 17:10	07:30 16:56
11	07:41 17:15	07:20 17:50	06:40 18:23	06:51 19:54	06:11 20:23	05:53 20:48	06:02 20:50	06:28 20:23	06:57 19:37	17:56-18:24/28 19:00	07:26 18:49	17:18-18:39/80 18:49	06:59 17:10	07:30 16:57
12	07:41 17:16	07:19 17:51	06:38 18:24	06:49 19:55	06:10 20:24	05:53 20:48	06:03 20:49	06:29 20:22	06:58 19:36	17:54-18:26/32 19:00	07:27 18:47	17:18-18:38/80 18:47	07:00 17:09	07:31 16:57
13	07:41 17:17	07:18 17:53	06:37 18:25	06:48 19:56	06:09 20:25	05:53 20:49	06:03 20:49	06:30 20:21	06:59 19:34	17:51-18:28/37 19:00	07:28 18:46	17:18-18:37/79 19:15/1	07:02 17:08	07:32 16:57
14	07:41 17:18	07:17 17:54	06:35 18:26	06:46 19:57	06:08 20:26	05:53 20:49	06:04 20:48	06:31 20:19	07:01 19:32	17:49-18:30/41 19:00	07:29 18:44	17:17-18:36/79 19:12/4	07:03 17:07	07:33 16:57
15	07:40 17:19	07:15 17:55	06:34 18:27	06:45 19:58	06:07 20:27	05:53 20:50	06:05 20:48	06:32 20:18	07:01 19:31	17:47-18:32/45 19:00	07:30 18:43	17:17-18:35/78 19:10/4	07:04 17:06	07:33 16:57
16	07:40 17:20	07:14 17:56	06:32 18:29	06:43 19:59	06:06 20:28	05:53 20:50	06:06 20:47	06:33 20:17	07:02 19:29	17:46-18:33/47 19:00	07:31 18:42	17:17-18:34/77 19:05/9	07:05 17:05	07:34 16:58
17	07:40 17:21	07:13 17:57	06:31 18:29	06:42 19:59	06:06 20:29	05:53 20:50	06:06 20:47	06:34 20:15	07:03 19:28	17:44-18:35/51 19:00	07:32 18:40	17:17-18:33/76 19:03/7	07:06 17:05	07:35 16:58
18	07:39 17:22	07:12 17:58	06:29 18:30	06:40 20:01	06:05 20:30	05:53 20:51	06:07 20:46	06:35 20:14	07:04 19:26	17:42-18:36/54 19:00	07:33 18:39	17:17-18:32/75 19:02/6	07:07 17:04	07:36 16:58
19	07:39 17:23	07:10 18:00	06:27 18:31	06:39 20:02	06:04 20:31	05:53 20:51	06:08 20:45	06:36 20:13	07:05 19:24	17:41-18:37/56 19:00	07:34 18:37	17:18-18:31/73 19:01/9	07:08 17:03	07:36 16:59
20	07:38 17:24	07:09 18:01	06:26 18:32	06:38 20:03	06:03 20:32	05:53 20:51	06:09 20:45	06:37 20:11	07:05 19:23	17:38-18:37/59 19:00	07:35 18:36	17:18-18:30/72 19:00/3	07:09 17:02	07:37 16:59
21	07:38 17:26	07:08 18:02	06:24 18:33	06:36 20:04	06:02 20:33	05:53 20:52	06:10 20:44	06:38 20:10	07:06 19:21	17:37-18:38/61 19:00	07:36 18:34	17:19-18:29/70 19:00/11	07:11 17:02	07:37 16:59
22	07:37 17:27	07:06 18:03	06:23 18:34	06:35 20:05	06:01 20:34	05:53 20:52	06:10 20:43	06:39 20:08	07:07 19:19	17:36-18:38/62 19:00	07:37 18:33	17:19-18:28/69 18:59/9	07:12 17:01	07:38 16:59
23	07:37 17:28	07:05 18:04	06:21 18:35	06:33 20:06	06:01 20:34	05:54 20:52	06:11 20:43	06:40 20:07	07:08 19:18	17:34-18:39/65 19:00	07:38 18:32	17:20-18:26/66 19:00/7	07:13 17:01	07:38 16:59
24	07:36 17:29	07:04 18:05	06:19 18:36	06:32 20:07	06:00 20:35	05:54 20:52	06:12 20:42	06:40 20:05	07:09 19:16	17:33-18:40/67 19:00	07:39 18:30	17:21-18:25/64 18:23/61	07:14 17:00	07:39 16:59
25	07:36 17:30	07:02 18:06	06:18 18:37	06:31 20:08	05:59 20:36	05:54 20:52	06:13 20:41	06:41 20:04	07:10 19:14	17:32-18:40/68 19:00	07:40 18:29	17:22-18:23/61 18:44/73	07:15 17:00	07:39 16:59
26	07:35 17:31	07:01 18:07	06:16 18:38	06:29 20:09	05:59 20:37	05:54 20:52	06:14 20:40	06:42 20:02	07:11 19:13	17:31-18:41/70 19:00	07:41 18:28	17:22-18:21/59 18:51/12	07:16 16:59	07:40 17:02
27	07:34 17:33	07:00 18:09	06:15 18:39	06:28 20:10	05:58 20:38	05:55 20:52	06:15 20:39	06:43 20:01	07:12 19:11	17:30-18:41/71 19:00	07:42 18:36	17:23-18:19/56 18:51/15	07:17 16:59	07:40 17:03
28	07:33 17:34	06:58 18:10	06:13 18:40	06:27 20:11	05:58 20:39	05:55 20:52	06:16 20:38	06:44 19:59	07:13 19:10	17:28-18:40/72 19:00	07:43 18:25	17:25-18:17/52 18:49/14	07:18 17:25	07:40 17:03
29	07:33 17:35	06:57 18:11	06:11 18:41	06:25 20:12	05:57 20:39	05:56 20:52	06:16 20:37	06:45 19:58	07:14 19:08	17:26-18:41/74 19:00	07:44 18:33	17:26-18:14/48 18:47/14	07:19 17:24	07:41 16:58
30	07:32 17:36	07:02 18:10	06:10 18:42	06:24 20:13	05:57 20:40	05:56 20:52	06:17 20:36	06:46 19:56	07:15 19:06	17:28-18:41/75 19:00	07:45 18:32	17:28-18:12/44 18:46/14	07:20 17:23	07:41 17:05
31	07:31 17:37	07:01 18:13	06:08 18:43	06:23 20:14	05:56 20:41	05:56 20:52	06:18 20:35	06:47 19:55	07:16 19:06	17:25-18:41/76 19:00	07:46 18:31	17:25-18:11/46 18:46/14	07:21 17:21	07:41 17:06
Potential sun hours	301	309	370	397	445	448	455	425	374	347	301	292	0	0
Sum of minutes with flicker	0	0	1506	2014	80	0	0	1243	2249	155	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:

**Brunco e Niada**

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04/11/2020 15:47 / 16

Licensed user:

**Ing. Bruno Manca**  
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Calculated:  
04/11/2020 13:48/2.8.579

**SHADOW - Calendar per WTG**

Calculation: Ombre Recettori Rev2WTG: WTG13 - WTG13

**Assumptions for shadow calculations**

Reference year for calendar 2020

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	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
134	282	483	550	523	510	295	242	134	107	215	403	778	1.342	591	242	6.831

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

	January	February	March	April	May	June
1	07:41 14:56-16:41/105 17:06	07:30 14:54-16:49/115 17:38	06:55 15:06-16:42/96 18:12	07:07 19:44	06:23 18:25-19:32/67 20:14	05:56 18:12-19:49/97 20:42 19:49-19:54/5
2	07:41 14:56-16:41/105 17:07	07:29 14:54-16:48/114 17:40	06:54 15:06-16:41/95 18:13	07:05 19:45	06:22 18:23-19:33/70 20:15	05:55 18:12-19:49/97 20:42 19:49-19:53/4
3	07:41 14:56-16:42/106 17:08	07:28 14:54-16:48/114 17:41	06:52 15:08-16:41/93 18:14	07:03 19:46	06:20 18:21-19:33/72 20:16	05:55 18:12-19:49/97 20:43 19:49-19:54/5
4	07:42 14:56-16:42/106 17:08	07:27 14:54-16:47/113 17:42	06:51 15:09-16:39/90 18:15	07:02 19:47	06:19 18:20-19:34/74 20:17	05:54 18:13-19:50/97 20:44 19:50-19:55/5
5	07:42 14:56-16:43/107 17:09	07:26 14:54-16:45/111 17:43	06:49 15:11-16:38/87 18:16	07:00 19:48	06:18 18:19-19:35/76 20:18	05:54 18:13-19:50/97 20:44 19:50-19:55/5
6	07:42 14:56-16:44/108 17:10	07:25 14:54-16:42/108 17:44	06:48 15:12-16:37/85 18:17	06:59 19:49	06:17 18:18-19:36/78 20:19	05:54 18:13-19:50/97 20:45 19:50-19:55/5
7	07:42 14:56-16:45/109 17:11	07:24 14:54-16:37/103 17:46	06:46 15:14-16:36/82 18:18	06:57 19:50	06:16 18:18-19:37/79 20:20	05:54 18:13-19:50/97 20:46 19:50-19:56/6
8	07:42 14:56-16:45/109 17:12	07:23 14:54-16:49/115 17:47	06:45 15:15-16:34/79 18:19	06:56 19:51	06:15 18:17-19:38/81 20:21	05:53 18:13-19:51/98 20:46 19:51-19:56/5
9	07:42 14:55-16:45/110 17:13	07:22 14:54-16:50/116 17:48	06:43 15:16-16:32/76 18:20	06:54 19:52	06:14 18:16-19:39/83 20:22	05:53 18:14-19:51/97 20:47 19:51-19:56/5
10	07:41 14:56-16:46/110 17:14	07:21 14:55-16:50/115 17:49	06:42 15:18-16:31/73 18:22	06:53 19:53	06:12 18:15-19:40/85 20:23	05:53 18:14-19:51/97 20:47 19:51-19:57/6
11	07:41 14:56-16:47/111 17:15	07:20 14:55-16:50/115 17:50	06:40 15:20-16:29/69 18:23	06:51 19:54	06:11 18:15-19:40/85 20:23	05:53 18:14-19:52/98 20:48 19:52-19:57/5
12	07:41 14:56-16:48/112 17:16	07:19 14:54-16:49/115 17:52	06:39 15:23-16:27/64 18:24	06:49 19:55	06:10 18:14-19:41/87 20:24	05:53 18:14-19:51/97 20:48 19:51-19:57/6
13	07:41 14:55-16:48/113 17:17	07:18 14:55-16:50/115 17:53	06:37 15:24-16:25/61 18:25	06:48 19:56	06:09 18:14-19:41/87 20:25	05:53 18:14-19:51/97 20:49 19:51-19:57/6
14	07:41 14:56-16:49/113 17:18	07:17 14:55-16:50/115 17:54	06:35 15:27-16:23/56 18:26	06:46 19:57	06:08 18:13-19:42/89 20:26	05:53 18:14-19:51/97 20:49 19:51-19:57/6
15	07:40 14:56-16:49/113 17:19	07:15 14:56-16:50/114 17:55	06:34 15:29-16:20/51 18:27	06:45 19:58	06:07 18:13-19:43/90 20:27	05:53 18:14-19:52/98 20:50 19:52-19:58/6
16	07:40 14:55-16:49/114 17:20	07:14 14:56-16:49/113 17:56	06:32 15:32-16:17/45 18:28	06:43 19:59	06:07 18:12-19:43/91 20:28	05:53 18:16-19:53/97 20:50 19:53-19:59/6
17	07:40 14:56-16:50/114 17:21	07:13 14:56-16:49/113 17:57	06:31 15:36-16:14/38 18:29	06:42 20:00	06:06 18:13-19:45/92 20:29	05:53 18:16-19:53/97 20:50 19:53-19:59/6
18	07:39 14:55-16:50/115 17:22	07:12 14:57-16:49/112 17:58	06:29 15:40-16:10/30 18:30	06:41 20:01	06:05 18:12-19:45/93 20:30	05:53 18:16-19:53/97 20:51 19:53-19:59/6
19	07:39 14:55-16:51/116 17:23	07:10 14:57-16:48/111 18:00	06:27 15:46-16:05/19 18:31	06:39 20:02	06:04 18:12-19:45/93 20:31	05:53 18:16-19:53/97 20:51 19:53-19:59/6
20	07:38 14:55-16:51/116 17:25	07:09 14:58-16:48/110 18:01	06:26 18:32	06:38 20:03	06:03 18:11-19:45/94 20:32	05:53 18:16-19:53/97 20:51 19:53-19:59/6
21	07:38 14:55-16:52/117 17:26	07:08 14:59-16:48/109 18:02	06:24 18:33	06:36 20:04	06:02 18:12-19:46/94 20:33	05:53 18:16-19:53/97 20:52 19:53-19:59/6
22	07:37 14:55-16:51/116 17:27	07:06 14:59-16:47/108 18:03	06:23 18:34	06:35 18:49-19:09/20 20:05	06:02 18:12-19:46/94 20:34	05:53 18:17-19:54/97 20:52 19:54-20:00/6
23	07:37 14:54-16:51/117 17:28	07:05 15:00-16:47/107 18:04	06:21 18:35	06:33 18:44-19:15/31 20:06	06:01 18:11-19:46/95 20:34	05:54 18:17-19:54/97 20:52 19:54-20:00/6
24	07:36 14:55-16:52/117 17:29	07:04 15:01-16:47/106 18:05	06:19 18:36	06:32 18:39-19:17/38 20:07	06:00 18:12-19:47/95 20:35	05:54 18:17-19:54/97 20:52 19:54-20:00/6
25	07:36 14:54-16:52/118 17:30	07:02 15:01-16:46/105 18:06	06:18 18:37	06:31 18:36-19:21/45 20:08	05:59 18:11-19:47/96 20:36	05:54 18:17-19:54/97 20:52 19:54-20:00/6
26	07:35 14:54-16:51/117 17:31	07:01 15:02-16:46/104 18:08	06:16 18:38	06:29 18:34-19:23/49 20:09	05:59 18:12-19:48/96 20:37	05:54 18:18-19:55/97 20:52 19:55-20:01/6
27	07:34 14:54-16:51/117 17:33	07:00 15:02-16:45/103 18:09	06:15 18:39	06:28 18:32-19:26/54 20:10	05:58 18:12-19:48/96 20:38	05:55 18:18-19:55/97 20:52 19:55-20:01/6
28	07:33 14:54-16:52/118 17:34	06:58 15:04-16:44/100 18:10	06:13 18:40	06:27 18:29-19:27/58 20:11	05:58 18:11-19:47/96 20:39	05:55 18:17-19:55/98 20:52 19:55-20:00/5
29	07:33 14:54-16:51/117 17:35	06:57 15:04-16:43/99 18:11	07:11 19:41	06:25 18:27-19:28/61 20:12	05:57 18:12-19:48/96 20:39	05:56 18:18-19:55/97 20:52 19:55-20:01/6
30	07:32 14:54-16:51/117 17:36		07:10 19:42	06:24 18:26-19:30/64 20:13	05:57 18:12-19:49/97 20:40	05:56 18:18-19:55/97 20:52 19:55-20:01/6
31	07:31 14:54-16:50/116 17:37		07:08 19:43		05:56 18:12-19:49/97 20:41	
Potential sun hours	301	309	370	397	444	448
Sum of minutes with flicker	3499	3221	1289	420	2758	3083

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:

**Brunco e Niada**

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Calculated:  
04/11/2020 13:48/2.8.579

**SHADOW - Calendar per WTG**

Calculation: Ombre Recettori Rev2WTG: WTG13 - WTG13

**Assumptions for shadow calculations**

Reference year for calendar 2020

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 NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum  
134 282 483 550 523 510 295 242 134 107 215 403 778 1.342 591 242 6.831  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	05:56 18:19-19:56/97 20:52 19:56-20:01/5	06:19 18:25-19:51/86 20:34 19:53	06:48 19:53	07:16 16:02-17:05/63 19:05	06:48 14:24-16:19/115 17:20	07:21 14:38-16:30/112 16:57
2	05:57 18:18-19:55/97 20:52 19:55-20:01/6	06:20 18:26-19:50/84 20:33 19:52	06:49 19:52	07:17 15:59-17:07/68 19:03	06:49 14:23-16:19/116 17:19	07:22 14:39-16:30/111 16:57
3	05:57 18:19-19:56/97 20:52 19:56-20:02/6	06:21 18:25-19:49/84 20:32 19:50	06:50 19:50	07:18 15:57-17:08/71 19:02	06:50 14:24-16:20/116 17:18	07:23 14:40-16:30/110 16:57
4	05:58 18:19-19:56/97 20:52 19:56-20:01/5	06:22 18:26-19:48/82 20:31 19:45	06:51 19:45	07:19 15:55-17:09/74 19:00	06:51 14:24-16:19/115 17:17	07:24 14:40-16:30/110 16:57
5	05:58 18:19-19:56/97 20:52 19:56-20:02/6	06:23 18:27-19:47/80 20:30 19:47	06:52 19:47	07:20 15:52-17:10/78 18:58	06:52 14:24-16:08/104 16:08-16:19/11	07:25 14:41-16:31/110 16:57
6	05:59 18:19-19:56/97 20:51 19:56-20:01/5	06:24 18:27-19:47/80 20:29 19:45	06:53 19:45	07:21 15:50-17:11/81 18:57	06:54 14:24-16:13/109 17:15	07:26 14:42-16:31/109 16:57
7	06:00 18:19-19:57/98 20:51 19:57-20:02/5	06:25 18:28-19:46/78 20:28 19:44	06:54 19:44	07:22 15:48-17:12/84 18:55	06:55 14:24-16:15/111 17:14	07:27 14:43-16:31/108 16:57
8	06:00 18:19-19:56/97 20:51 19:56-20:01/5	06:26 18:29-19:45/76 20:27 19:42	06:54 19:42	07:23 15:46-17:12/86 18:54	06:56 14:24-16:18/114 17:13	07:28 14:43-16:30/107 16:56
9	06:01 18:20-19:57/97 20:51 19:57-20:01/4	06:27 18:30-19:44/74 20:26 19:41	06:55 19:41	07:24 15:44-17:13/89 18:52	06:57 14:25-16:19/114 17:12	07:29 14:44-16:31/107 16:56
10	06:01 18:20-19:57/97 20:50 19:57-20:02/5	06:27 18:31-19:43/72 20:24 19:39	06:56 19:39	07:25 15:43-17:14/91 18:51	06:58 14:25-16:19/114 17:11	07:30 14:45-16:31/106 16:57
11	06:02 18:20-19:56/96 20:50 19:56-20:01/5	06:28 18:32-19:41/69 20:23 19:37	06:57 19:37	07:26 15:41-17:14/93 18:49	06:59 14:25-16:20/115 17:10	07:30 14:46-16:31/105 16:57
12	06:03 18:20-19:57/97 20:49 19:57-20:01/4	06:29 18:33-19:39/66 20:22 19:36	06:58 19:36	07:27 15:39-17:15/96 18:48	07:00 14:26-16:22/116 17:09	07:31 14:47-16:32/105 16:57
13	06:04 18:20-19:57/97 20:49 19:57-20:01/4	06:30 18:34-19:37/63 20:21 19:34	06:59 19:34	07:28 15:38-17:15/97 18:46	07:02 14:26-16:23/117 17:08	07:32 14:48-16:32/104 16:57
14	06:04 18:20-19:56/96 20:48 19:56-20:00/4	06:31 18:36-19:36/60 20:19 19:33	07:00 19:33	07:29 15:37-17:17/100 18:45	07:03 14:26-16:23/117 17:07	07:33 14:47-16:32/105 16:57
15	06:05 18:20-19:57/97 20:48 19:57-20:01/4	06:32 18:37-19:34/57 20:18 19:31	07:01 19:31	07:30 15:36-17:17/101 18:43	07:04 14:26-16:24/118 17:06	07:33 14:48-16:32/104 16:57
16	06:06 18:21-19:57/96 20:47 19:57-20:01/4	06:33 18:39-19:32/53 20:17 19:29	07:02 19:29	07:31 15:35-17:17/102 18:42	07:05 14:27-16:24/117 17:05	07:34 14:49-16:33/104 16:58
17	06:06 18:21-19:57/96 20:47 19:57-20:01/4	06:34 18:41-19:29/48 20:15 19:28	07:03 19:28	07:32 15:33-17:17/104 18:40	07:06 14:28-16:25/117 17:05	07:35 14:49-16:33/104 16:58
18	06:07 18:21-19:56/95 20:46 19:56-20:00/4	06:35 18:44-19:27/43 20:14 19:26	07:04 19:26	07:33 15:32-17:18/106 18:39	07:07 14:28-16:26/118 17:04	07:36 14:50-16:33/103 16:58
19	06:08 18:21-19:56/95 20:45 19:56-19:59/3	06:36 18:47-19:24/37 20:13 19:24	07:05 19:24	07:34 15:31-17:18/107 18:37	07:08 14:29-16:26/117 17:03	07:36 14:50-16:33/103 16:59
20	06:09 18:21-19:57/96 20:45 19:57-19:59/2	06:37 18:49-19:19/30 20:11 19:23	07:06 19:23	07:35 15:30-17:18/108 18:36	07:09 14:29-16:26/117 17:03	07:37 14:51-16:34/103 16:59
21	06:10 18:22-19:57/95 20:44 19:57-19:59/2	06:38 18:55-19:13/18 20:10 19:21	07:06 19:21	07:36 15:29-17:18/109 18:34	07:11 14:30-16:27/117 17:02	07:37 14:52-16:35/103 17:00
22	06:10 18:21-19:56/95 20:43 19:56-19:58/2	06:39 20:08 19:19	07:07 19:19	07:37 15:28-17:18/110 18:33	07:12 14:31-16:28/117 17:01	07:38 14:52-16:35/103 17:00
23	06:11 18:22-19:56/94 20:43 19:56-19:58/2	06:40 20:07 19:18	07:08 19:18	07:38 15:28-17:19/111 18:32	07:13 14:32-16:28/116 17:01	07:38 14:52-16:35/103 17:01
24	06:12 18:22-19:55/93 20:42 19:55-19:57/2	06:41 20:05 19:16	07:09 19:16	07:39 15:27-17:19/112 18:30	07:14 14:32-16:28/116 17:00	07:39 14:53-16:36/103 17:01
25	06:13 18:23-19:55/92 20:41 19:55-19:57/2	06:41 20:04 19:15	07:10 19:15	07:40 14:26-16:19/113 17:29	07:15 14:33-16:28/115 17:00	07:39 14:53-16:36/103 17:02
26	06:14 18:23-19:55/92 20:40 19:55-19:56/1	06:42 20:02 19:13	07:11 19:13	06:41 14:26-16:19/113 17:28	07:16 14:34-16:28/114 16:59	07:40 14:54-16:38/104 17:02
27	06:15 18:22-19:54/92 20:39 19:54-19:55/1	06:43 20:01 19:11	07:12 19:11	06:42 14:25-16:19/114 17:26	07:17 14:34-16:28/114 16:59	07:40 14:54-16:38/104 17:03
28	06:16 18:23-19:54/91 20:38 19:59	06:44 19:59 19:10	07:13 19:10	06:44 14:25-16:19/114 17:25	07:18 14:35-16:28/113 16:58	07:40 14:54-16:38/104 17:04
29	06:16 18:23-19:53/90 20:37 19:58	06:45 19:58 19:08	07:14 19:08	06:45 14:25-16:20/115 17:24	07:19 14:37-16:30/113 16:58	07:41 14:54-16:39/105 17:04
30	06:17 18:24-19:53/89 20:36 19:56	06:46 19:56 19:06	07:15 19:06	06:46 14:25-16:19/114 17:23	07:20 14:37-16:30/113 16:58	07:41 14:55-16:39/104 17:05
31	06:18 18:24-19:52/88 20:35 19:55	06:47 19:55 19:05	07:16 19:05	06:47 14:24-16:19/115 17:21	07:21 14:37-16:30/113 16:58	07:41 14:56-16:41/105 17:06
Potential sun hours	455	425	374	347	301	292
Sum of minutes with flicker	3045	1340	280	3039	3466	3271

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:

**Brunco e Niada**

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Calculated:

04/11/2020 13:48/2.8.579

### SHADOW - Calendar per WTG

Calculation: Ombre Recettori Rev2WTG: WTG14 - WTG14

#### Assumptions for shadow calculations

Reference year for calendar

2020

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	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
134	282	483	550	523	510	295	242	134	107	215	403	778	1.342	591	242	6.831

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

	January	February	March	April	May	June
1	07:41 17:06	07:30 17:39	06:55 17:20-17:50/30 18:12	07:07 18:35-19:23/48 19:44	06:23 20:14	05:56 19:24-20:09/45 20:42 20:09-20:12/3
2	07:41 17:07	07:29 17:40	06:54 17:20-17:49/29 18:13	07:05 18:34-19:23/49 19:45	06:22 20:15	05:55 19:23-20:09/46 20:42 20:09-20:12/3
3	07:42 17:08	07:28 17:41	06:52 17:20-17:49/29 18:14	07:03 18:32-19:23/51 19:46	06:20 20:16	05:55 19:24-20:09/45 20:43 20:09-20:12/3
4	07:42 17:08	07:27 17:42	06:51 17:20-17:48/28 18:15	07:02 18:32-19:24/52 19:47	06:19 20:17	05:54 19:25-20:10/45 20:44 20:10-20:13/3
5	07:42 17:09	07:27 17:43	06:49 17:21-17:47/26 18:16	07:00 18:31-19:24/53 19:48	06:18 20:18	05:54 19:25-20:10/45 20:44 20:10-20:13/3
6	07:42 17:10	07:26 17:44	06:48 17:21-17:46/25 18:17	06:59 18:31-19:24/53 19:49	06:17 19:39-19:50/11 20:19	05:54 19:25-20:09/44 20:45 20:09-20:13/4
7	07:42 17:11	07:25 17:46	06:46 17:23-17:45/22 18:18	06:57 18:31-19:23/52 19:50	06:16 19:36-19:53/17 20:20	05:54 19:25-20:10/45 20:46 20:10-20:13/3
8	07:42 17:12	07:23 17:47	06:45 17:24-17:43/19 18:19	06:56 18:31-19:24/53 19:51	06:15 19:33-19:56/23 20:21	05:53 19:26-20:10/44 20:46 20:10-20:14/4
9	07:42 17:13	07:22 17:48	06:43 17:25-17:40/15 18:21	06:54 18:30-19:23/53 19:52	06:14 19:31-19:57/26 20:22	05:53 19:26-20:10/44 20:47 20:10-20:14/4
10	07:41 17:14	07:21 17:49	06:42 17:29-17:37/8 18:22	06:53 18:31-19:23/52 19:53	06:12 19:30-19:59/29 20:23	05:53 19:26-20:10/44 20:47 20:10-20:14/4
11	07:41 17:15	07:20 17:50	06:40 18:23	06:51 18:30-19:22/52 19:54	06:11 19:29-20:00/31 20:24	05:53 19:27-20:11/44 20:48 20:11-20:15/4
12	07:41 17:16	07:19 17:52	06:39 18:24	06:49 18:30-19:21/51 19:55	06:10 19:28-20:01/33 20:24	05:53 19:26-20:10/44 20:48 20:10-20:14/4
13	07:41 17:17	07:18 17:53	06:37 18:25	06:48 18:30-19:21/51 19:56	06:09 19:27-20:02/35 20:25	05:53 19:26-20:10/44 20:49 20:10-20:14/4
14	07:41 17:18	07:17 17:54	06:35 18:26	06:46 18:31-19:21/50 19:57	06:08 19:26-20:02/36 20:26	05:53 19:27-20:10/43 20:49 20:10-20:14/4
15	07:40 17:19	07:15 17:55	06:34 18:27	06:45 18:31-19:19/48 19:58	06:07 19:25-20:03/38 20:27	05:53 19:27-20:10/43 20:50 20:10-20:14/4
16	07:40 17:20	07:14 17:56	06:32 18:28	06:43 18:32-19:19/47 19:59	06:07 19:24-20:04/40 20:28	05:53 19:28-20:11/43 20:50 20:11-20:16/5
17	07:40 17:21	07:13 17:57	06:31 18:29	06:42 18:32-19:17/45 20:00	06:06 19:25-20:05/40 20:29	05:53 19:28-20:11/43 20:50 20:11-20:16/5
18	07:39 17:22	07:12 17:59	06:29 18:30	06:41 18:33-19:17/44 20:01	06:05 19:24-20:06/42 20:30	05:53 19:29-20:11/42 20:51 20:11-20:16/5
19	07:39 17:23	07:10 18:00	06:27 18:31	06:39 18:33-19:15/42 20:02	06:04 19:23-20:06/43 20:31	05:53 19:29-20:11/42 20:51 20:11-20:16/5
20	07:38 17:25	07:09 18:01	06:26 18:32	06:38 18:34-19:14/40 20:03	06:03 19:23-20:06/43 20:32	05:53 19:29-20:11/42 20:51 20:11-20:16/5
21	07:38 17:26	07:08 17:31-17:42/11 18:02	06:24 18:33	06:36 18:36-19:13/37 20:04	06:02 19:23-20:07/44 20:33	05:53 19:29-20:11/42 20:52 20:11-20:16/5
22	07:37 17:27	07:07 17:27-17:43/16 18:03	06:23 18:34	06:35 18:37-19:11/34 20:05	06:02 19:23-20:07/44 20:34	05:53 19:30-20:12/42 20:52 20:12-20:17/5
23	07:37 17:28	07:05 17:26-17:45/19 18:04	06:21 17:53-18:11/18 18:35	06:33 18:38-19:09/31 20:06	06:01 19:22-20:07/45 20:34	05:54 19:30-20:12/42 20:52 20:12-20:17/5
24	07:36 17:29	07:04 17:25-17:46/21 18:05	06:19 17:48-18:13/25 18:36	06:32 18:40-19:06/26 20:07	06:00 19:23-20:08/45 20:35	05:54 19:30-20:12/42 20:52 20:12-20:17/5
25	07:36 17:30	07:02 17:23-17:47/24 18:06	06:18 17:46-18:16/30 18:37	06:31 18:42-19:04/22 20:08	06:00 19:23-20:08/45 20:36	05:54 19:30-20:12/42 20:52 20:12-20:17/5
26	07:35 17:31	07:01 17:22-17:49/27 18:08	06:16 17:43-18:18/35 18:38	06:29 18:46-19:01/15 20:09	05:59 19:23-20:09/46 20:37	05:55 19:30-20:13/43 20:52 20:13-20:18/5
27	07:34 17:33	07:00 17:21-17:49/28 18:09	06:15 17:42-18:20/38 18:39	06:28 20:10	05:58 19:23-20:08/45 20:38	05:55 19:30-20:13/43 20:52 20:13-20:17/4
28	07:33 17:34	06:58 17:21-17:50/29 18:10	06:13 17:40-18:20/40 18:40	06:27 20:11	05:58 19:22-20:08/46 20:39	05:55 19:30-20:13/43 20:52 20:13-20:17/4
29	07:33 17:35	06:57 17:20-17:49/29 18:11	07:11 18:38-19:21/43 19:41	06:25 20:12	05:57 19:23-20:09/46 20:39	05:56 19:31-20:14/43 20:52 20:14-20:18/4
30	07:32 17:36		07:10 18:37-19:22/45 19:42	06:24 20:13	05:57 19:24-20:09/45 20:40	05:56 19:30-20:14/44 20:52 20:14-20:18/4
31	07:31 17:37		07:08 18:35-19:22/47 19:43		05:56 19:23-20:09/46 20:41	
Potential sun hours	301	309	370	397	444	448
Sum of minutes with flicker	0	204	552	1151	1008	1428

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:

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Calculated:

04/11/2020 13:48/2.8.579

### SHADOW - Calendar per WTG

Calculation: Ombre Recettori Rev2WTG: WTG14 - WTG14

#### Assumptions for shadow calculations

Reference year for calendar 2020

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	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
134	282	483	550	523	510	295	242	134	107	215	403	778	1.342	591	242	6.831

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

	July	August	September	October	November	December
1	05:56 19:31-20:15/44	06:19 19:39-20:11/32	06:48 18:29-19:21/52	07:16 18:04-18:17/13	06:48 17:19	07:21 16:57
	20:52 20:15-20:19/4	20:35	19:53	19:05	17:20	16:57
2	05:57 19:31-20:14/43	06:20 19:40-20:10/30	06:49 18:29-19:21/52	07:17 19:03	06:49 17:19	07:22 16:57
	20:52 20:14-20:18/4	20:33	19:52	19:03	17:19	16:57
3	05:57 19:31-20:15/44	06:21 19:40-20:08/28	06:50 18:28-19:21/53	07:18 19:02	06:50 17:18	07:23 16:57
	20:52 20:15-20:19/4	20:32	19:50	19:02	17:18	16:57
4	05:58 19:31-20:15/44	06:22 19:42-20:06/24	06:51 18:28-19:21/53	07:19 18:04-18:17/13	06:51 17:17	07:24 16:57
	20:52 20:15-20:19/4	20:31	19:49	19:00	17:17	16:57
5	05:58 19:31-20:16/45	06:23 19:44-20:04/20	06:52 18:28-19:20/52	07:20 18:01-18:19/18	06:53 17:16	07:25 16:57
	20:52 20:16-20:19/3	20:30	19:47	18:58	17:16	16:57
6	05:59 19:31-20:15/44	06:24 19:46-20:02/16	06:53 18:26-19:19/53	07:21 17:59-18:20/21	06:54 17:15	07:26 16:57
	20:51 20:15-20:19/4	20:29	19:45	18:57	17:15	16:57
7	06:00 19:31-20:16/45	06:25 19:51-19:57/6	06:54 18:26-19:19/53	07:22 17:58-18:21/23	06:55 17:14	07:27 16:57
	20:51 20:16-20:20/4	20:28	19:44	18:55	17:14	16:57
8	06:00 19:31-20:16/45	06:26 19:51-19:57/6	06:54 18:26-19:18/52	07:23 17:56-18:22/26	06:56 17:13	07:28 16:57
	20:51 20:16-20:19/3	20:27	19:42	18:54	17:13	16:57
9	06:01 19:31-20:16/45	06:27 19:51-19:57/6	06:55 18:27-19:17/50	07:24 17:55-18:22/27	06:57 17:12	07:29 16:57
	20:51 20:16-20:20/4	20:26	19:41	18:52	17:12	16:57
10	06:02 19:32-20:17/45	06:27 19:51-19:57/6	06:56 18:27-19:17/50	07:25 17:54-18:22/28	06:58 17:11	07:30 16:57
	20:50 20:17-20:20/3	20:24	19:39	18:51	17:11	16:57
11	06:02 19:31-20:17/46	06:28 19:51-19:57/6	06:57 18:27-19:16/49	07:26 17:54-18:22/28	06:59 17:10	07:31 16:57
	20:50 20:17-20:20/3	20:23	19:37	18:49	17:10	16:57
12	06:03 19:32-20:17/45	06:29 19:51-19:57/6	06:58 18:28-19:15/47	07:27 17:53-18:22/29	07:00 17:09	07:31 16:57
	20:49 20:17-20:20/3	20:22	19:36	18:48	17:09	16:57
13	06:04 19:32-20:18/46	06:30 18:51-19:09/18	06:59 18:28-19:14/46	07:28 17:53-18:22/29	07:02 17:08	07:32 16:57
	20:49 20:18-20:20/2	20:21	19:34	18:46	17:08	16:57
14	06:04 19:31-20:17/46	06:31 18:51-19:09/18	07:00 18:29-19:12/43	07:29 17:54-18:23/29	07:03 17:07	07:33 16:57
	20:48 20:17-20:20/3	20:19	19:33	18:45	17:07	16:57
15	06:05 19:32-20:17/45	06:32 18:51-19:09/18	07:01 18:29-19:10/41	07:30 17:54-18:22/28	07:04 17:06	07:34 16:57
	20:48 20:17-20:20/3	20:18	19:31	18:43	17:06	16:57
16	06:06 19:32-20:18/46	06:33 18:57-19:04/7	07:02 18:30-19:08/38	07:31 17:54-18:21/27	07:05 17:05	07:34 16:57
	20:47 20:18-20:20/2	20:17	19:29	18:42	17:05	16:58
17	06:06 19:33-20:18/45	06:34 18:51-19:09/18	07:03 18:31-19:06/35	07:32 17:54-18:20/26	07:06 17:05	07:35 16:57
	20:47 20:18-20:20/2	20:15	19:28	18:40	17:05	16:58
18	06:07 19:32-20:17/45	06:35 18:48-19:12/24	07:04 18:33-19:04/31	07:33 17:55-18:18/23	07:07 17:04	07:36 16:57
	20:46 20:17-20:19/2	20:14	19:26	18:39	17:04	16:58
19	06:08 19:32-20:17/45	06:36 18:46-19:14/28	07:05 18:35-19:01/26	07:34 17:56-18:17/21	07:08 17:03	07:36 16:59
	20:46 20:17-20:19/2	20:13	19:24	18:37	17:03	16:59
20	06:09 19:33-20:18/45	06:37 18:43-19:14/31	07:06 18:38-18:58/20	07:35 17:57-18:15/18	07:09 17:03	07:37 16:59
	20:45 20:18-20:19/1	20:11	19:23	18:36	17:03	16:59
21	06:10 19:33-20:18/45	06:38 18:41-19:16/35	07:06 18:43-18:52/9	07:36 17:59-18:13/14	07:11 17:02	07:37 17:00
	20:44 20:18-20:19/1	20:10	19:21	18:34	17:02	17:00
22	06:10 19:33-20:17/44	06:39 18:39-19:17/38	07:07 18:02-18:10/8	07:37 18:02-18:10/8	07:12 17:01	07:38 17:00
	20:43 20:17-20:18/1	20:08	19:19	18:33	17:01	17:00
23	06:11 19:33-20:17/44	06:40 18:38-19:18/40	07:08 18:38-19:18/40	07:38 18:38-19:18/40	07:13 17:01	07:38 17:01
	20:43 20:17-20:18/1	20:07	19:18	18:32	17:01	17:01
24	06:12 19:34-20:17/43	06:41 18:37-19:19/42	07:09 18:37-19:19/42	07:39 18:37-19:19/42	07:14 17:00	07:39 17:01
	20:42 19:34-20:17/43	20:05	19:16	18:30	17:00	17:01
25	06:13 19:34-20:17/43	06:42 18:36-19:20/44	07:10 18:36-19:20/44	07:40 18:36-19:20/44	07:15 17:00	07:39 17:02
	20:41 19:34-20:17/43	20:04	19:15	17:29	17:00	17:02
26	06:14 19:35-20:16/41	06:42 18:35-19:20/45	07:11 18:35-19:20/45	07:41 18:35-19:20/45	07:16 16:59	07:40 17:02
	20:40 19:35-20:16/41	20:02	19:13	17:28	16:59	17:02
27	06:15 19:34-20:15/41	06:43 18:34-19:21/47	07:12 18:34-19:21/47	07:42 18:34-19:21/47	07:17 16:59	07:40 17:03
	20:39 19:34-20:15/41	20:01	19:11	17:26	16:59	17:03
28	06:16 19:35-20:14/39	06:44 18:33-19:21/48	07:13 18:33-19:21/48	07:43 18:33-19:21/48	07:18 16:58	07:40 17:04
	20:38 19:35-20:14/39	19:59	19:10	17:25	16:58	17:04
29	06:17 19:36-20:13/37	06:45 18:31-19:21/50	07:14 18:31-19:21/50	07:44 18:31-19:21/50	07:19 16:58	07:41 17:04
	20:37 19:36-20:13/37	19:58	19:08	17:24	16:58	17:04
30	06:17 19:37-20:13/36	06:46 18:30-19:21/51	07:15 18:30-19:21/51	07:45 18:30-19:21/51	07:20 16:58	07:41 17:05
	20:36 19:37-20:13/36	19:56	19:06	17:23	16:58	17:05
31	06:18 19:38-20:12/34	06:47 18:30-19:21/51	07:16 18:30-19:21/51	07:46 18:30-19:21/51	07:21 17:00	07:41 17:06
	20:36 19:38-20:12/34	19:55	19:05	17:21	17:00	17:06
Potential sun hours	455	425	374	347	301	292
Sum of minutes with flicker	1408	755	905	436	0	0

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

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

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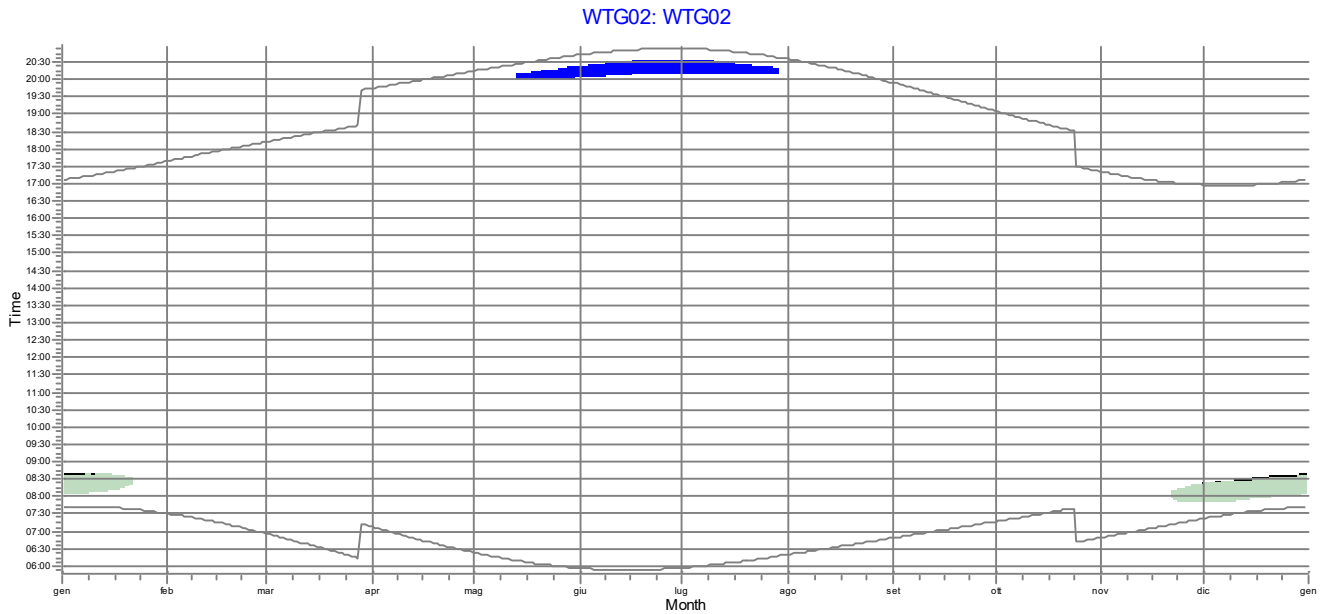
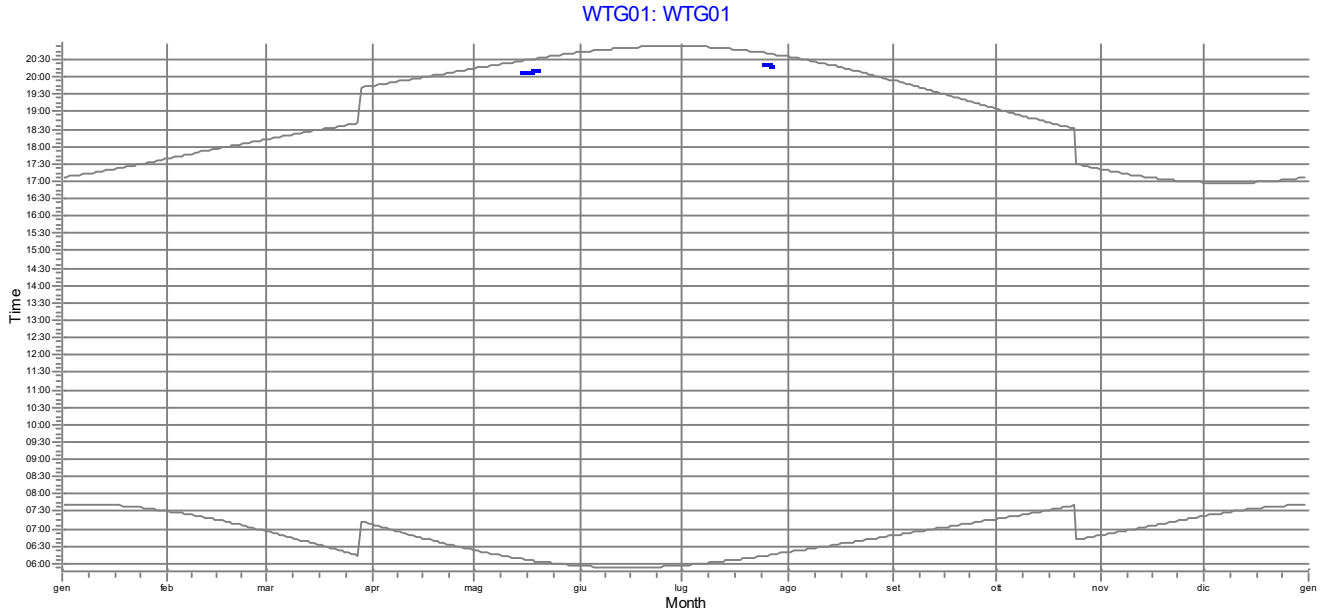
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Calculated:

04/11/2020 13:48/2.8.579

## SHADOW - Calendar per WTG, graphical

Calculation: Ombre Recettori Rev2



Shadow receptors

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #0000FF; margin-right: 5px;"></span> RE03: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (46)</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #00FFFF; margin-right: 5px;"></span> RE13: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (56)</li> </ul> | <ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #808080; margin-right: 5px;"></span> RE14: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (57)</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #90EE90; margin-right: 5px;"></span> RE15: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (58)</li> </ul> |
|--|--|

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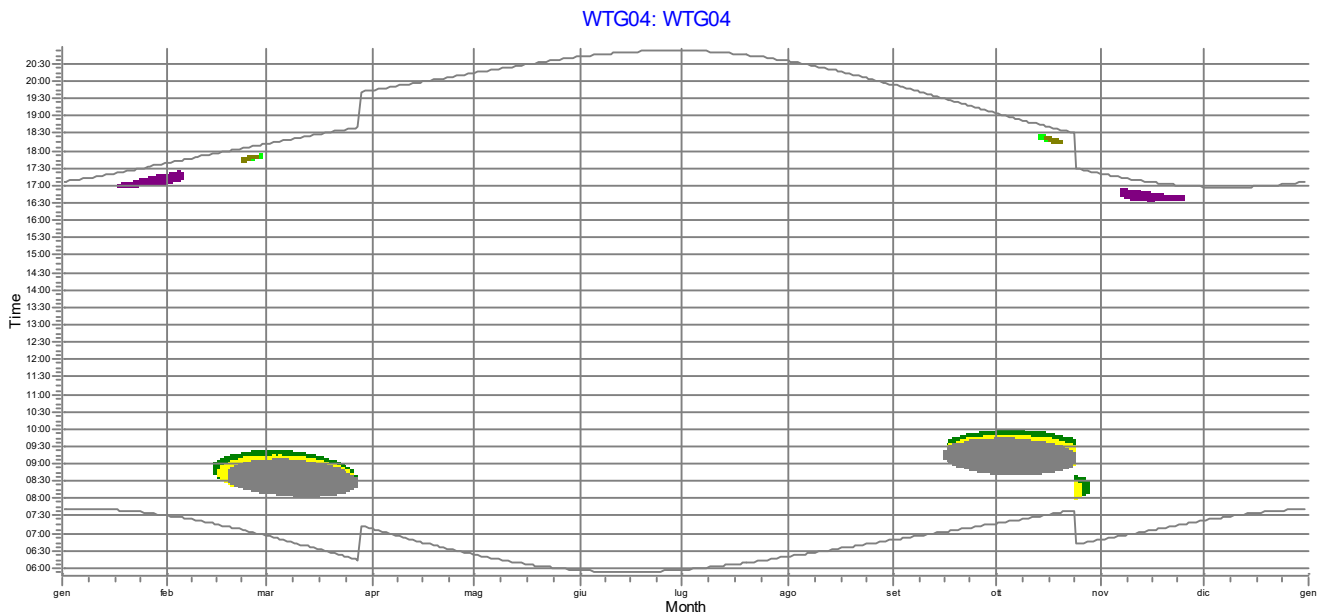
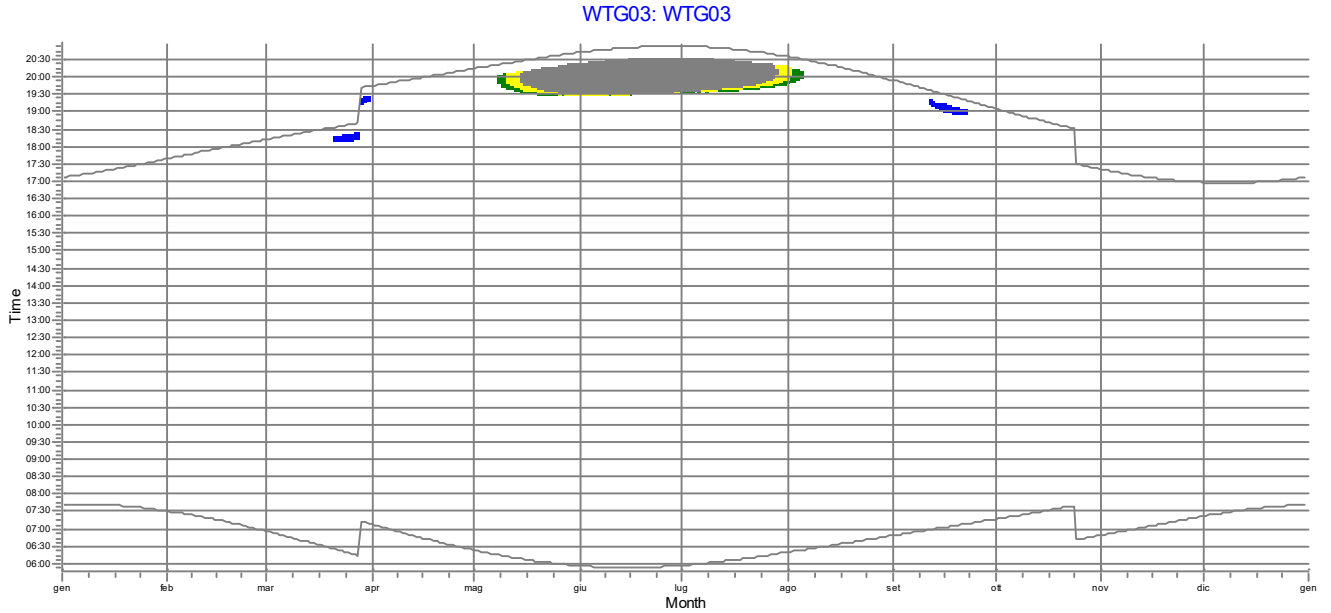
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## SHADOW - Calendar per WTG, graphical

Calculation: Ombre Recettori Rev2



### Shadow receptors

	RE01: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (44)		RE08: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (51)
	RE02: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (45)		RE09: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (52)
	RE03: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (46)		RE10: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (53)
	RE04: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (47)		RE11: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (54)

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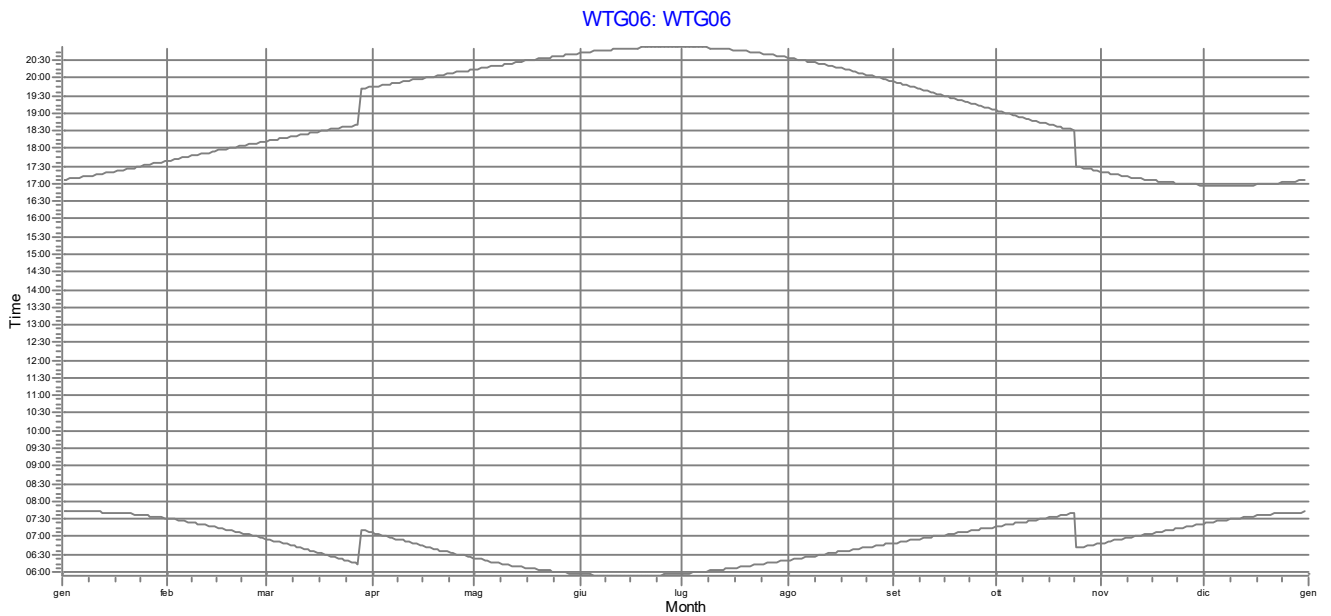
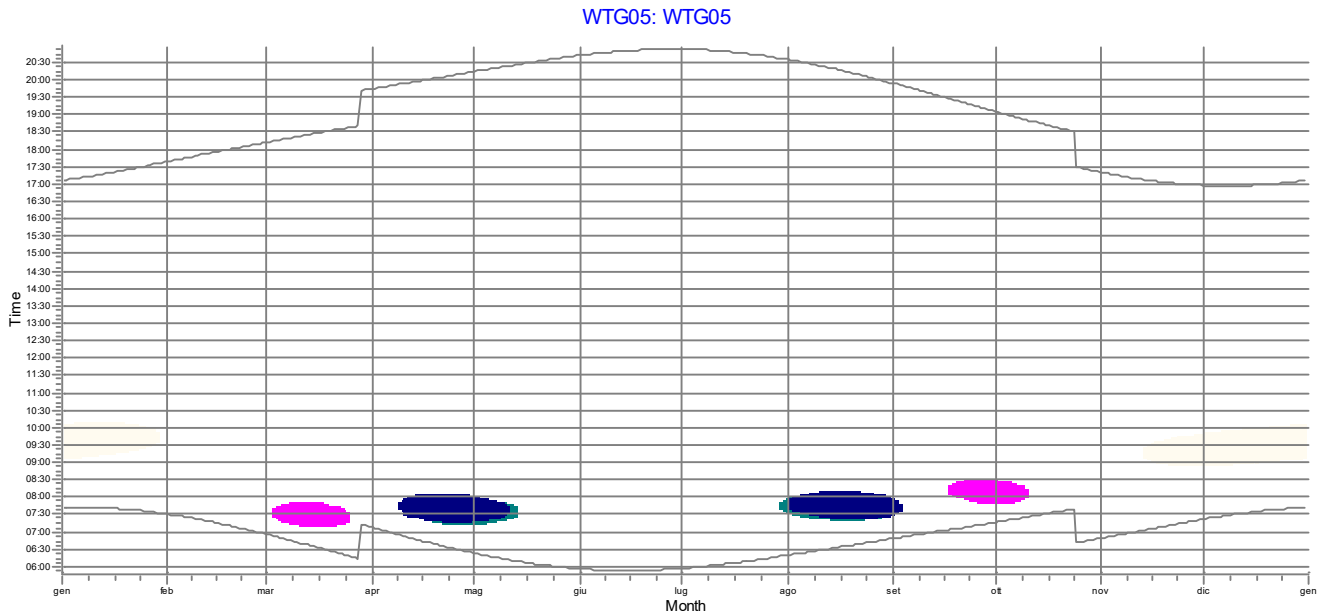
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## SHADOW - Calendar per WTG, graphical

Calculation: Ombre Recettori Rev2



Shadow receptors

RE05: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (48)  
 RE06: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (49)

RE07: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (50)  
 RE17: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (60)



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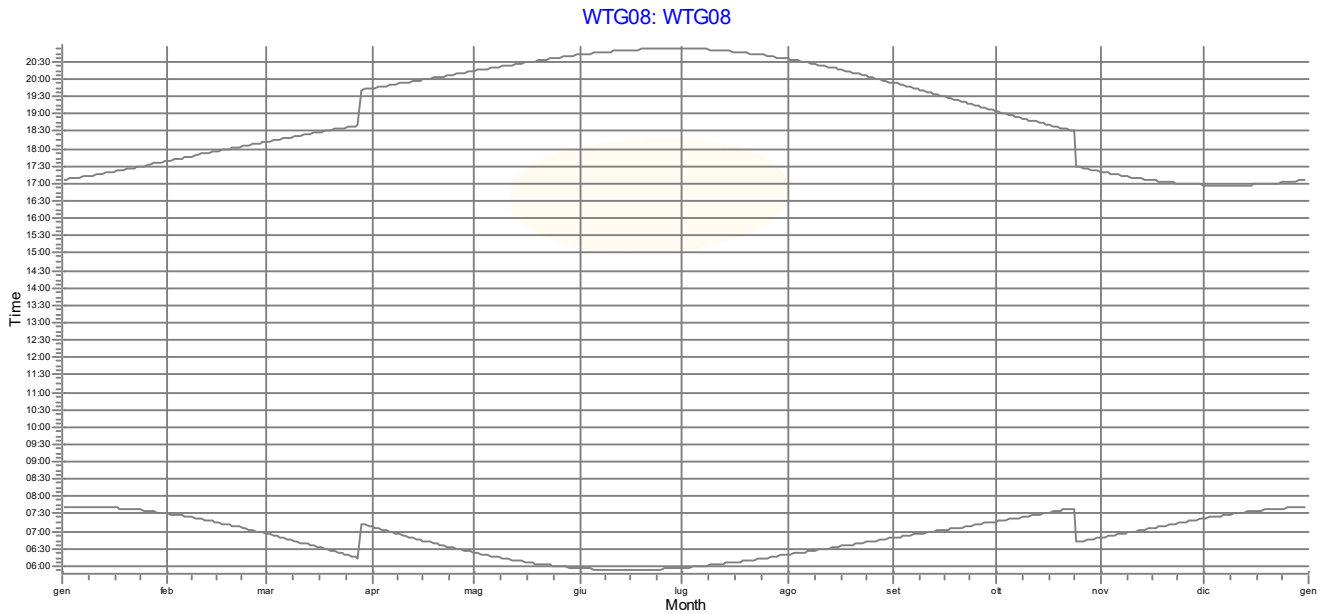
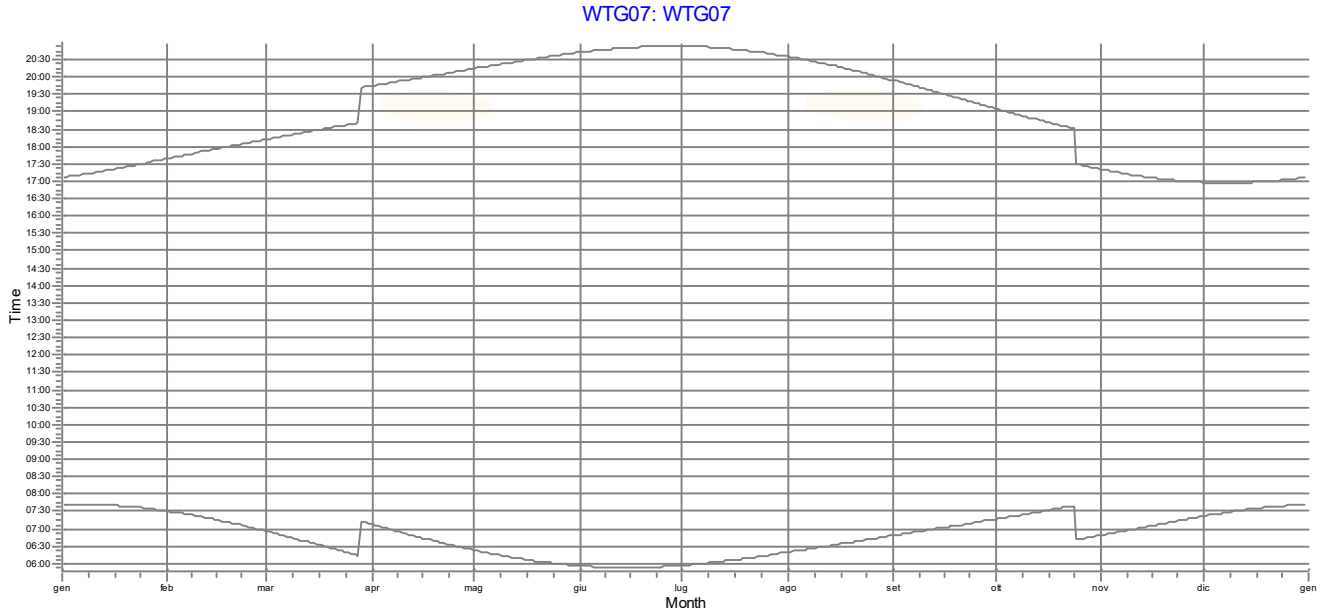
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## SHADOW - Calendar per WTG, graphical

Calculation: Ombre Recettori Rev2



Shadow receptors

RE17: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (60)

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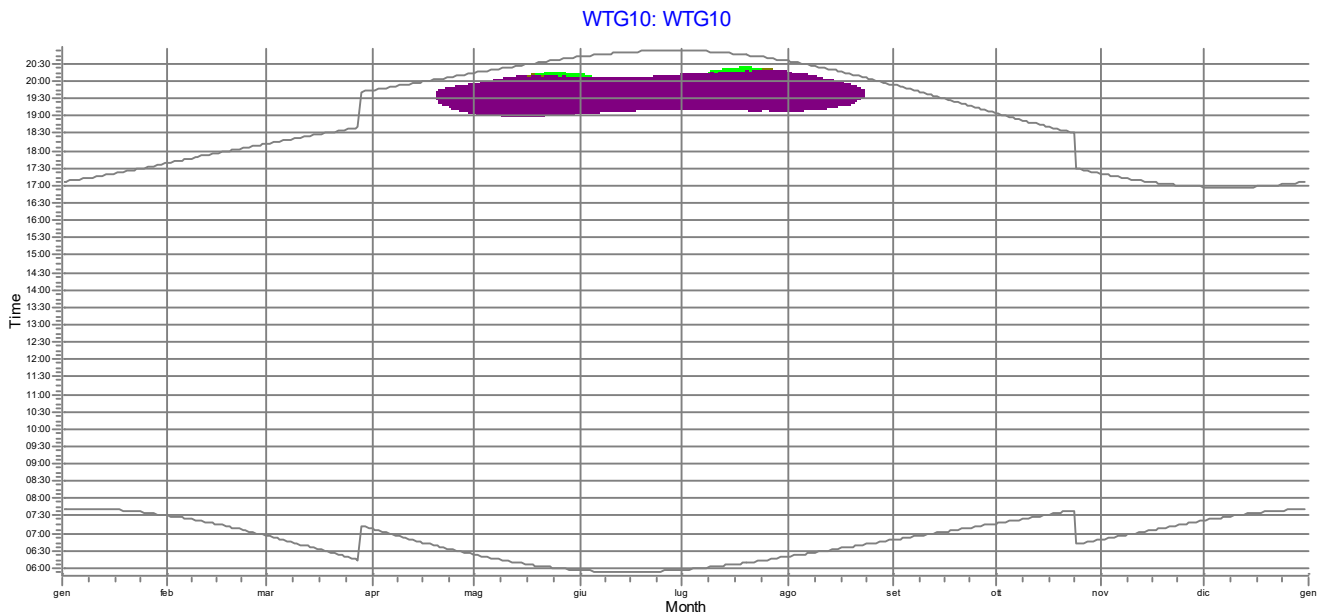
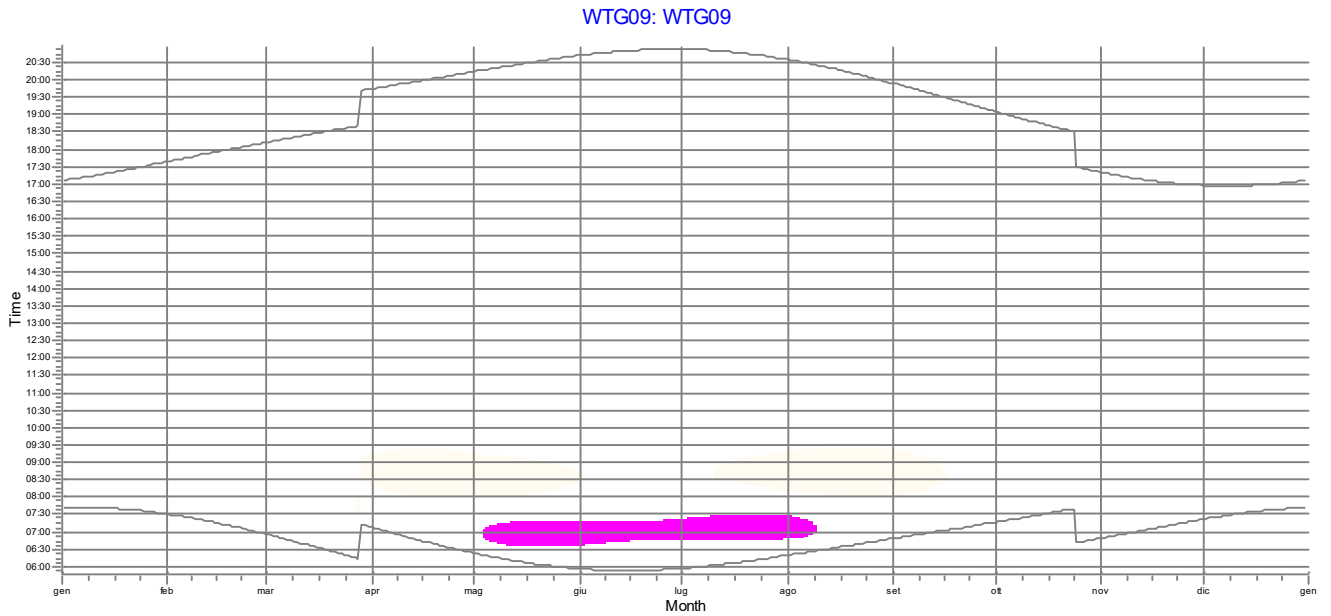
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## SHADOW - Calendar per WTG, graphical

Calculation: Ombre Recettori Rev2



### Shadow receptors

- RE05: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (48)
- RE08: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (51)
- RE09: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (52)

- RE10: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (53)
- RE11: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (54)
- RE17: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (60)

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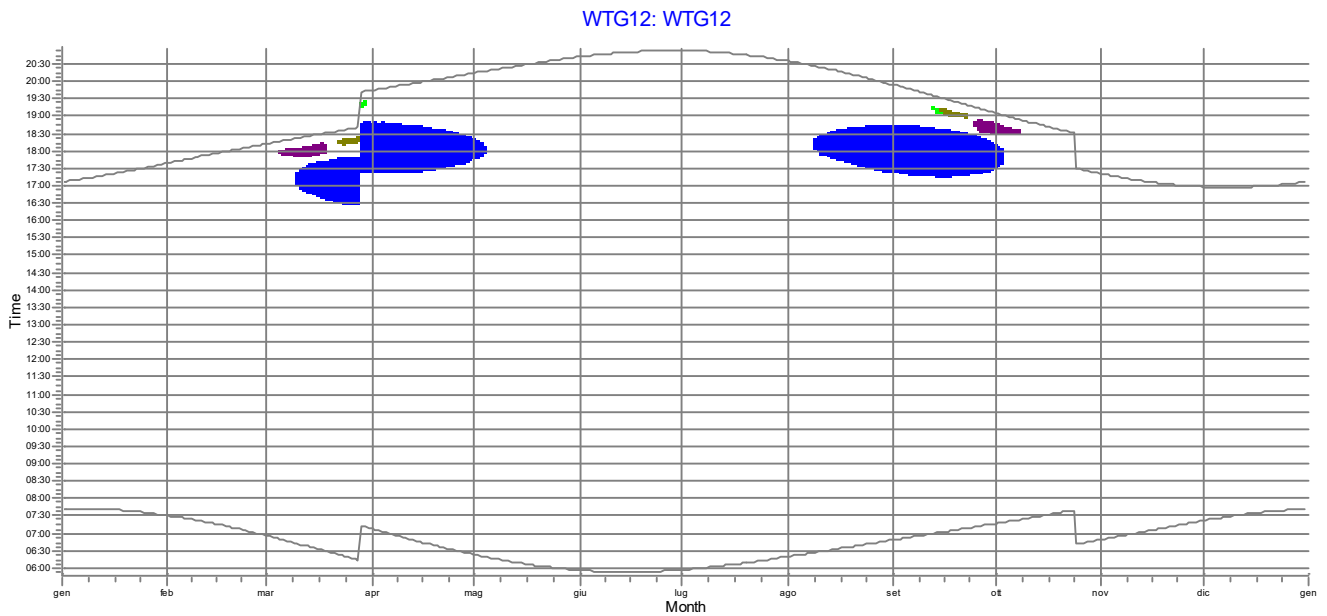
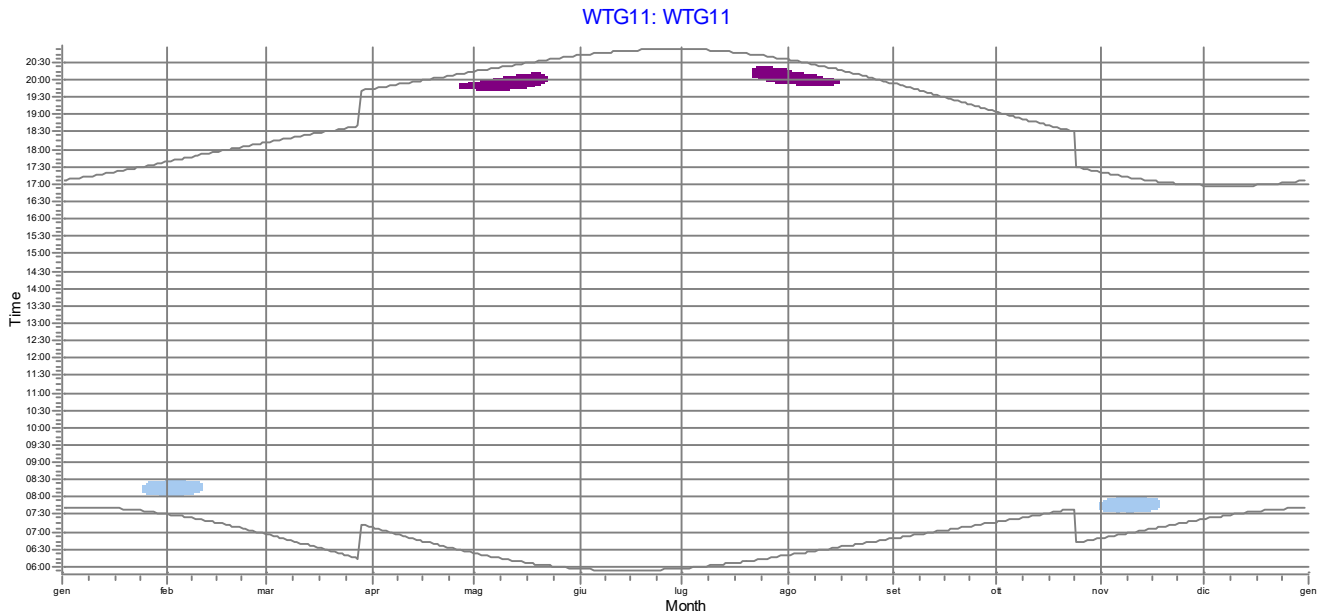
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## SHADOW - Calendar per WTG, graphical

Calculation: Ombre Recettori Rev2



Shadow receptors

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #4169E1; margin-right: 5px;"></span> RE03: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (46)</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #8B4513; margin-right: 5px;"></span> RE08: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (51)</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #00FF00; margin-right: 5px;"></span> RE09: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (52)</li> </ul> | <ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #808000; margin-right: 5px;"></span> RE10: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (53)</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #800080; margin-right: 5px;"></span> RE11: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (54)</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #ADD8E6; margin-right: 5px;"></span> RE16: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (59)</li> </ul> |
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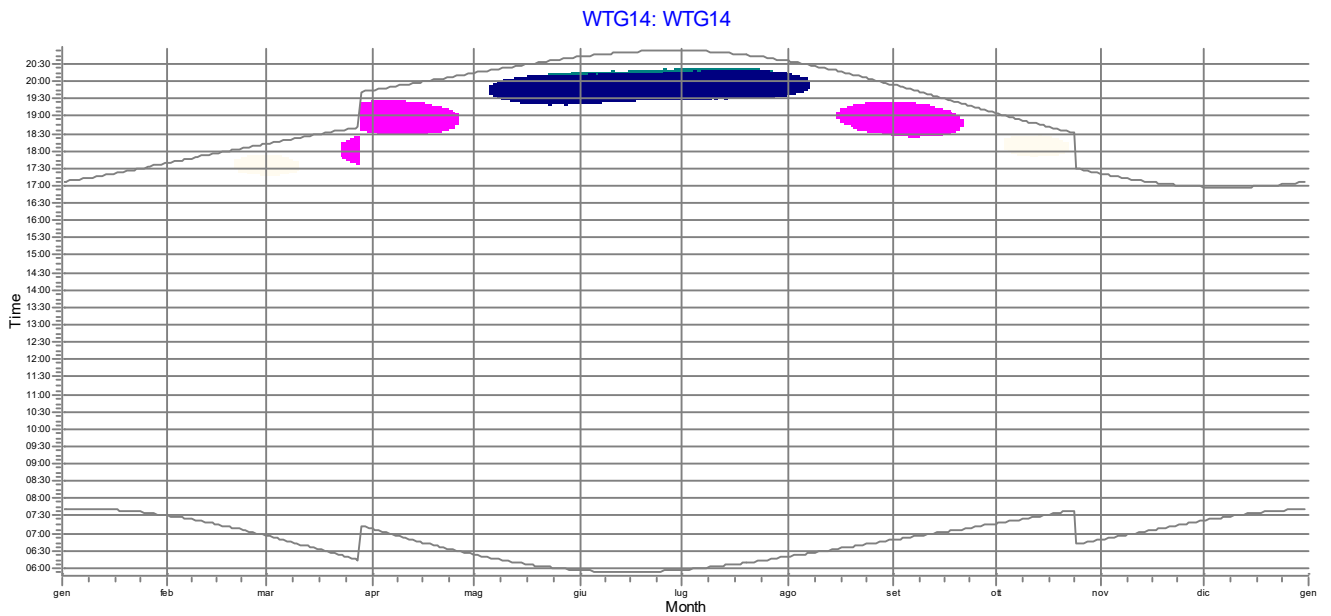
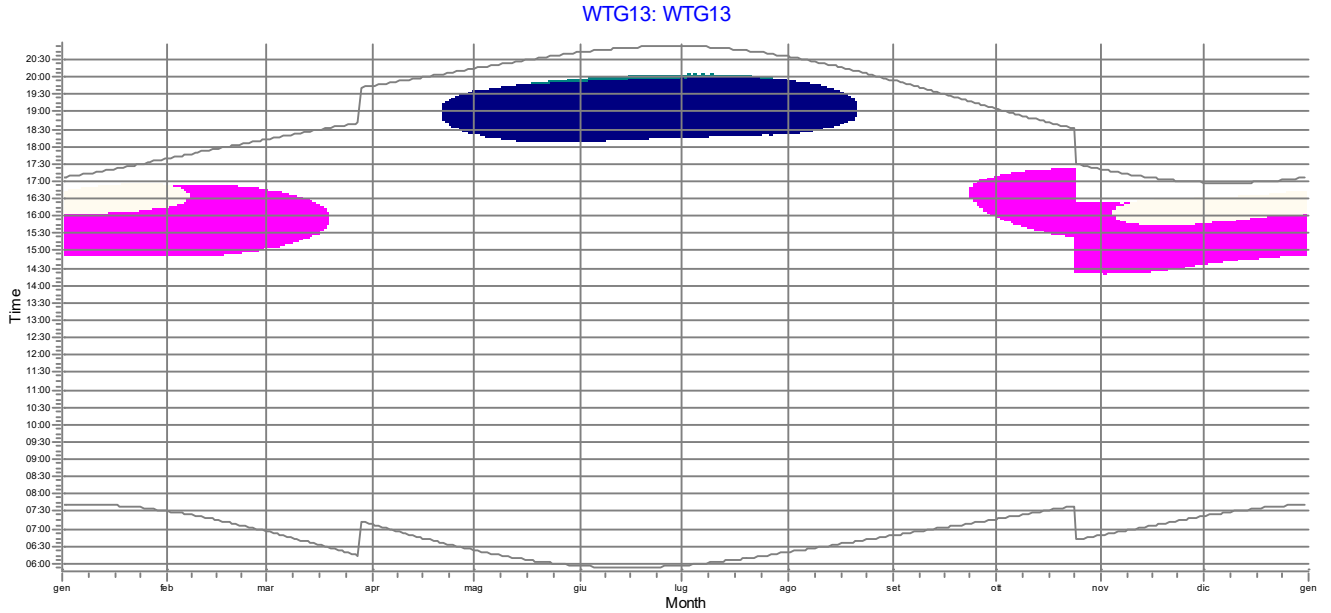
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## SHADOW - Calendar per WTG, graphical

Calculation: Ombre Recettori Rev2



Shadow receptors

- RE05: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (48)
- RE06: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (49)

- RE07: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (50)
- RE17: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (60)