

PROGETTO DI REALIZZAZIONE DI UN PARCO EOLICO

Località "Valle Castagna, Valle Cornuta, Mezzana del Cantone"
Comune di Montemilone (PZ)



Vincenzo Rossi

A.8 RELAZIONE SPECIALISTICA STUDIO SUGLI EFFETTI DI SHADOW – FLICKERING

Cliente/Customer			Commessa/Job		Emesso da	
<u>MILONIA S.R.L.</u>			98102		PER	
04	05/04/2017	REVISIONE	Scafidi	Scafidi	Ing. A. Sammartano	
03	16/10/2014	REVISIONE	Ing. S. Casareale	Ing. S. Casareale	Ing. A. Sammartano	
02	04/12/2013	REVISIONE	Ing. S. Casareale	Ing. S. Casareale	Ing. A. Sammartano	
01	30/11/2012	REVISIONE	Ing. S. Casareale	Ing. S. Casareale	Ing. A. Sammartano	
00	07/01/2010	EMISSIONE	Ing. E. Tremamunno	Ing. V. Mastrangelo	Ing. V. Mastrangelo	
Rev	Data	Descrizione	Preparato	Verificato	Approvato	
			Autorizzazione Emissione			

SHADOW - Main Result

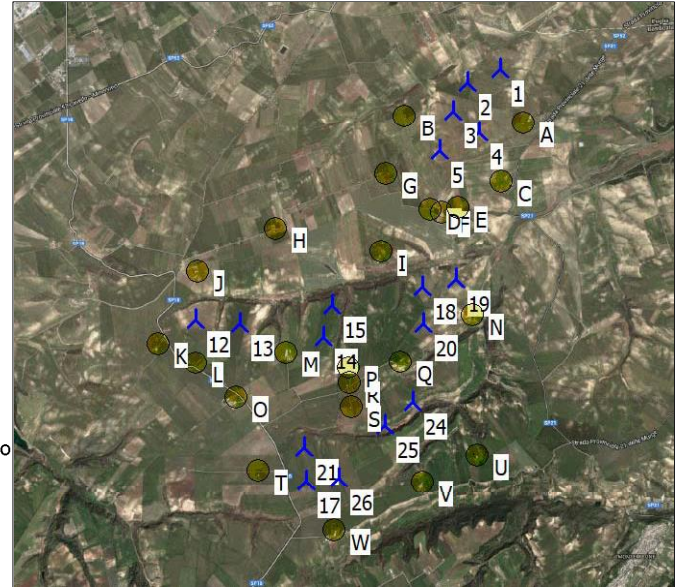
Assumptions for shadow calculations

Maximum distance for influence
 Calculate only when more than 20 % of sun is covered by the blade
 Please look in WTG table

Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 1 minutes
 The calculated times are "worst case" given by the following assumptions:
 The sun is shining all the day, from sunrise to sunset
 The rotor plane is always perpendicular to the line from the WTG to the sun
 The WTG is always operating

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
 Height contours used: Height Contours: CONTOURLINE_ONLINEDATA_3.wpo
 Obstacles used in calculation
 Eye height: 1,5 m
 Grid resolution: 10,0 m
 Topographic shadow included in calculation

All coordinates are in
 UTM (north)-WGS84 Zone: 33



Scale 1:100.000
 New WTG
 Shadow receptor

WTGs

No.	Easting	Northing	Z	Row data/Description	WTG type			Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
					Valid	Manufact.	Type-generator				Calculation distance [m]	RPM [RPM]
1	579.674	4.549.025	256,6	Siemens SWT-3.5-142 3520 14...	Yes	Siemens	SWT-3.5-142-3.520	3.520	142,0	129,0	1.699	10,6
2	579.242	4.548.849	251,6	Siemens SWT-3.5-142 3530 14...	Yes	Siemens	SWT-3.5-142-3.530	3.530	142,0	129,0	1.699	10,6
3	579.053	4.548.466	268,5	Siemens SWT-3.5-142 3530 14...	Yes	Siemens	SWT-3.5-142-3.530	3.530	142,0	129,0	1.699	10,6
4	579.396	4.548.193	285,0	Siemens SWT-3.5-142 3530 14...	Yes	Siemens	SWT-3.5-142-3.530	3.530	142,0	129,0	1.699	10,6
5	578.878	4.547.943	280,0	Siemens SWT-3.5-142 3530 14...	Yes	Siemens	SWT-3.5-142-3.530	3.530	142,0	129,0	1.699	10,6
12	575.668	4.545.671	315,0	Siemens SWT-3.5-142 3530 14...	Yes	Siemens	SWT-3.5-142-3.530	3.530	142,0	129,0	1.699	10,6
13	576.260	4.545.630	315,0	Siemens SWT-3.5-142 3530 14...	Yes	Siemens	SWT-3.5-142-3.530	3.530	142,0	129,0	1.699	10,6
14	577.364	4.545.468	315,9	Siemens SWT-3.5-142 3530 14...	Yes	Siemens	SWT-3.5-142-3.530	3.530	142,0	129,0	1.699	10,6
15	577.480	4.545.882	298,6	Siemens SWT-3.5-142 3530 14...	Yes	Siemens	SWT-3.5-142-3.530	3.530	142,0	129,0	1.699	10,6
17	577.151	4.543.556	344,3	Siemens SWT-3.5-142 3530 14...	Yes	Siemens	SWT-3.5-142-3.530	3.530	142,0	129,0	1.699	10,6
18	578.676	4.546.140	290,6	Siemens SWT-3.5-142 3530 14...	Yes	Siemens	SWT-3.5-142-3.530	3.530	142,0	129,0	1.699	10,6
19	579.111	4.546.245	288,3	Siemens SWT-3.5-142 3530 14...	Yes	Siemens	SWT-3.5-142-3.530	3.530	142,0	129,0	1.699	10,6
20	578.688	4.545.650	311,3	Siemens SWT-3.5-142 3530 14...	Yes	Siemens	SWT-3.5-142-3.530	3.530	142,0	129,0	1.699	10,6
21	577.121	4.544.001	337,5	Siemens SWT-3.5-142 3530 14...	Yes	Siemens	SWT-3.5-142-3.530	3.530	142,0	129,0	1.699	10,6
24	578.558	4.544.618	307,1	Siemens SWT-3.5-142 3530 14...	Yes	Siemens	SWT-3.5-142-3.530	3.530	142,0	129,0	1.699	10,6
25	578.189	4.544.302	307,0	Siemens SWT-3.5-142 3530 14...	Yes	Siemens	SWT-3.5-142-3.530	3.530	142,0	129,0	1.699	10,6
26	577.588	4.543.598	340,0	Siemens SWT-3.5-142 3530 14...	Yes	Siemens	SWT-3.5-142-3.530	3.530	142,0	129,0	1.699	10,6

Shadow receptor-Input

No.	Easting	Northing	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
	[m]	[m]	[m]	[m]	[m]	[m]	[°]	[°]	
A	579.983	4.548.326	274,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
B	578.401	4.548.394	263,4	1,0	1,0	1,0	0,0	90,0	"Green house mode"
C	579.696	4.547.544	269,3	1,0	1,0	1,0	0,0	90,0	"Green house mode"
D	578.764	4.547.161	300,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
E	579.130	4.547.200	283,9	1,0	1,0	1,0	0,0	90,0	"Green house mode"
F	578.908	4.547.130	299,6	1,0	1,0	1,0	0,0	90,0	"Green house mode"
G	578.166	4.547.627	285,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
H	576.718	4.546.895	306,2	1,0	1,0	1,0	0,0	90,0	"Green house mode"
I	578.116	4.546.595	304,5	1,0	1,0	1,0	0,0	90,0	"Green house mode"
J	575.690	4.546.307	315,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
K	575.182	4.545.358	320,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
L	575.675	4.545.101	322,8	1,0	1,0	1,0	0,0	90,0	"Green house mode"

To be continued on next page...

SHADOW - Main Result

...continued from previous page

No.	Easting	Northing	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
			[m]	[m]	[m]	[m]	[°]	[°]	
M	576.878	4.545.260	325,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
N	579.337	4.545.771	261,1	1,0	1,0	1,0	0,0	90,0	"Green house mode"
O	576.211	4.544.652	330,8	1,0	1,0	1,0	0,0	90,0	"Green house mode"
P	577.704	4.545.057	323,7	1,0	1,0	1,0	0,0	90,0	"Green house mode"
Q	578.388	4.545.140	316,5	1,0	1,0	1,0	0,0	90,0	"Green house mode"
R	577.709	4.544.861	325,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
S	577.749	4.544.547	329,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
T	576.522	4.543.694	340,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
U	579.422	4.543.929	327,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
V	578.691	4.543.567	327,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
W	577.533	4.542.914	345,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"

Calculation Results

Shadow receptor

Shadow, worst case

No.	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
A	0:00	0	0:00
B	162:17	276	0:53
C	24:00	52	0:34
D	0:00	0	0:00
E	0:00	0	0:00
F	0:00	0	0:00
G	57:16	80	0:49
H	0:00	0	0:00
I	79:40	131	0:49
J	0:00	0	0:00
K	18:36	48	0:31
L	0:00	0	0:00
M	105:47	150	1:10
N	37:56	62	0:48
O	35:30	78	0:32
P	41:38	135	0:36
Q	26:41	66	0:32
R	37:52	119	0:38
S	165:09	205	1:19
T	87:59	121	1:12
U	13:08	45	0:25
V	26:02	83	0:30
W	0:00	0	0:00

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

No.	Name	Worst case [h/year]
1	Siemens SWT-3.5-142 3520 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (688)	22:44
2	Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (689)	22:54
3	Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (690)	47:46
4	Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (691)	44:36
5	Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (692)	147:36
12	Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (693)	16:46
13	Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (694)	38:51
14	Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (695)	102:35
15	Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (696)	0:00
17	Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (697)	48:40
18	Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (698)	62:54
19	Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (699)	16:46
20	Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (700)	41:47
21	Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (701)	127:21
24	Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (702)	77:10
25	Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (703)	119:04
26	Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (704)	30:40

Project:

Montemilone

Licensed user:

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Calculated:

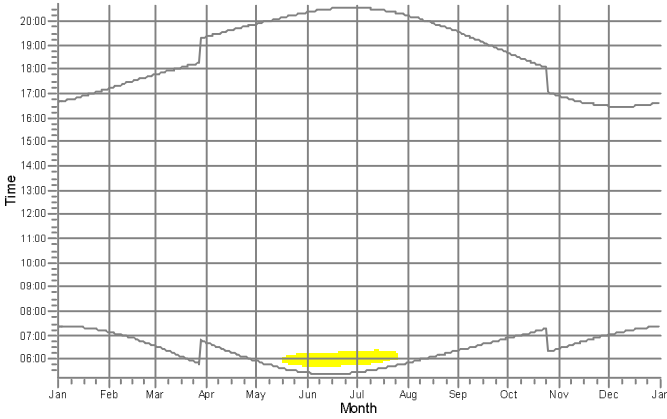
23/05/2017 15:23/3.1.579

SHADOW - Main Result

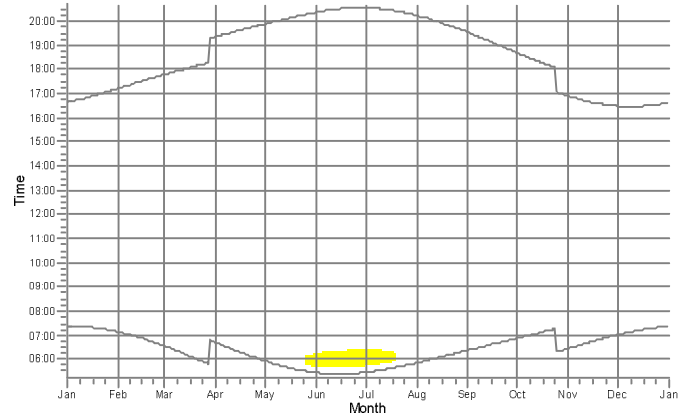
Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

SHADOW - Calendar per WTG, graphical

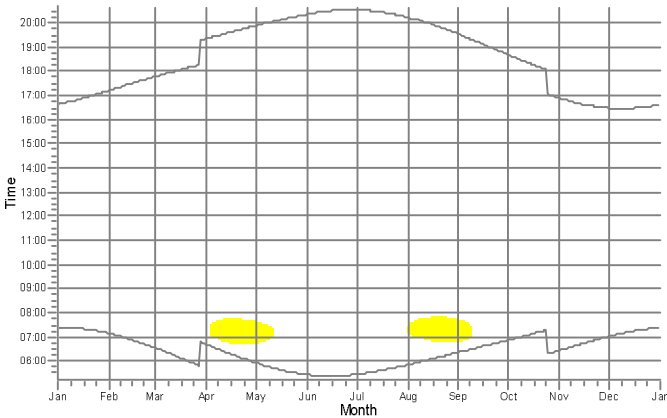
1: Siemens SWT-3.5-142 3520 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (68)



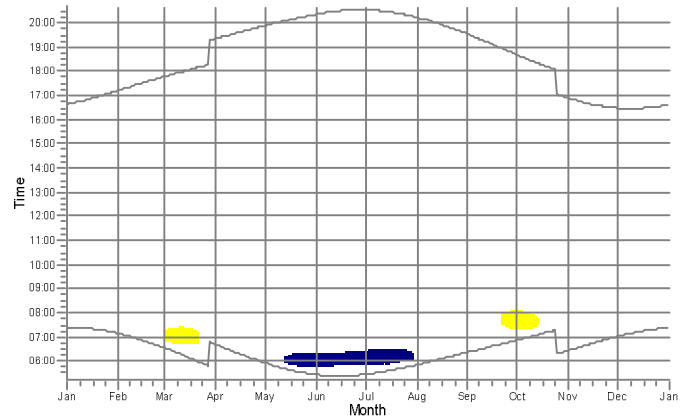
2: Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (689)



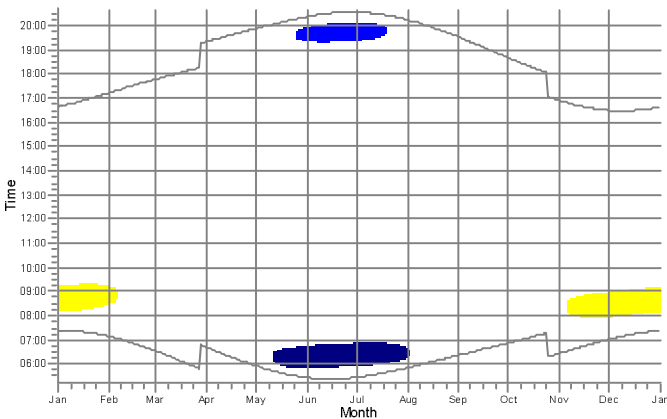
3: Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (69)



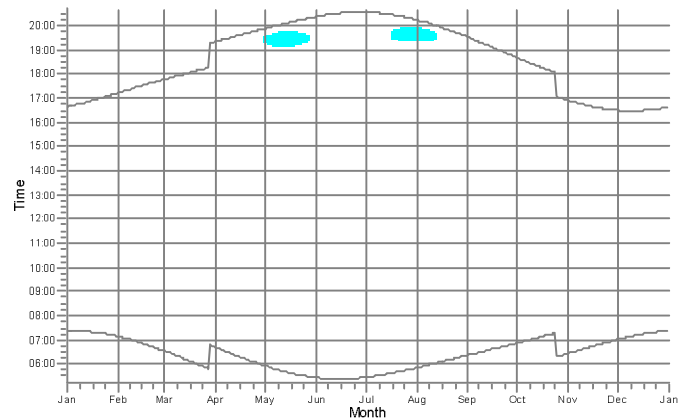
4: Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (691)



5: Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (69)



12: Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (693)



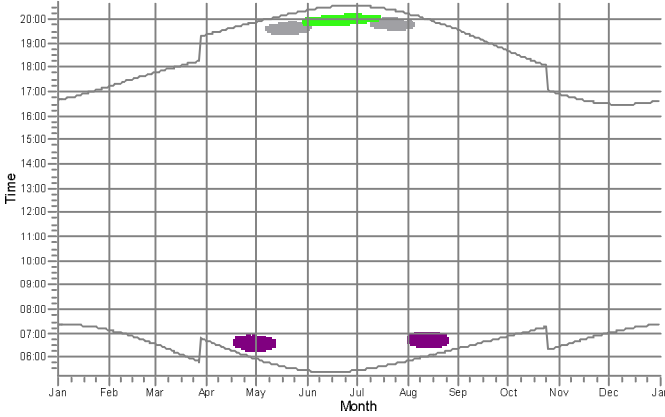
Shadow receptors

B: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (2)
C: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (3)

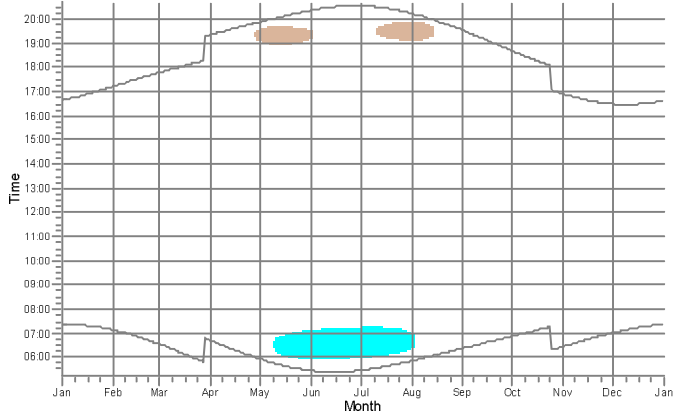
G: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (7)
M: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (13)

SHADOW - Calendar per WTG, graphical

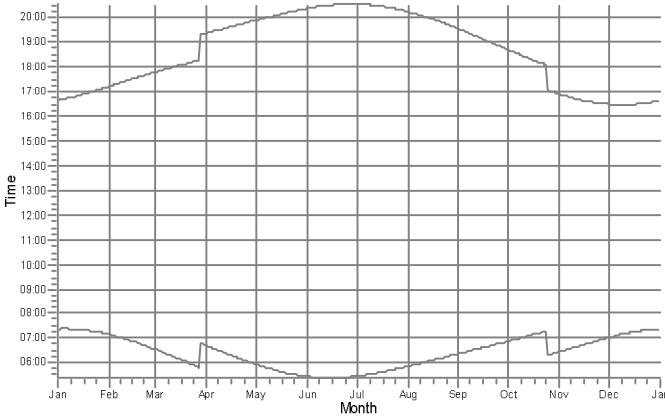
13: Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (6)



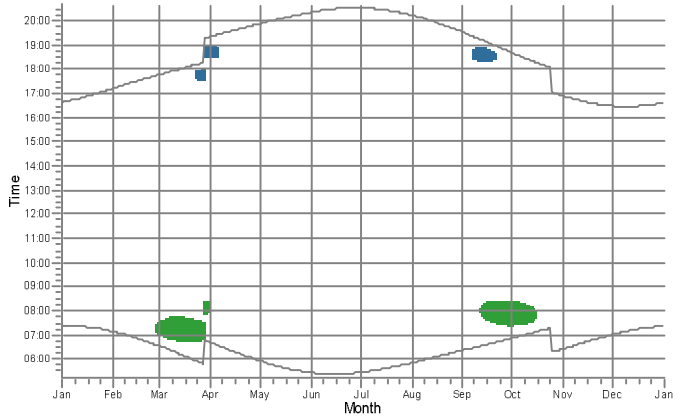
14: Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (695)



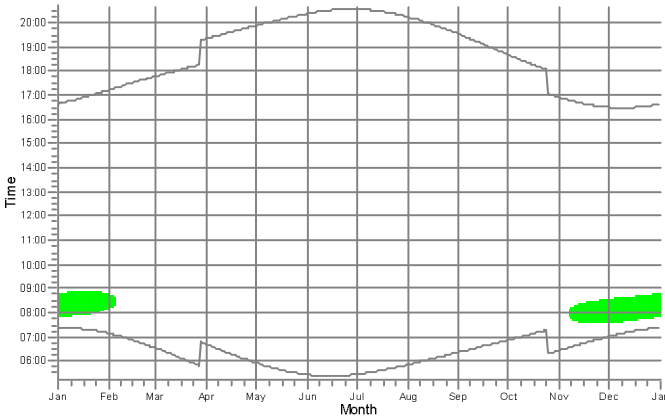
15: Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (6)



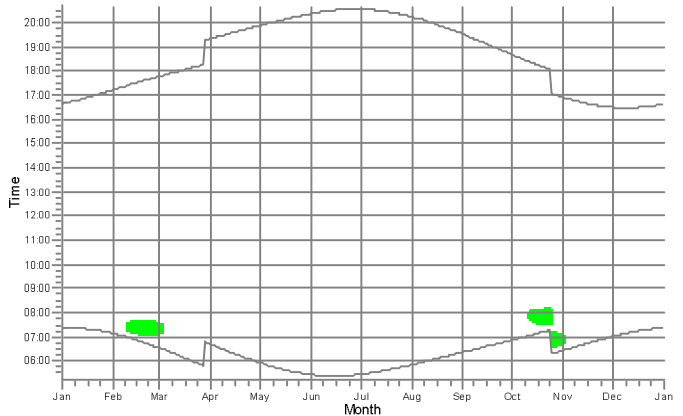
17: Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (697)











18: Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (6)



19: Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (699)

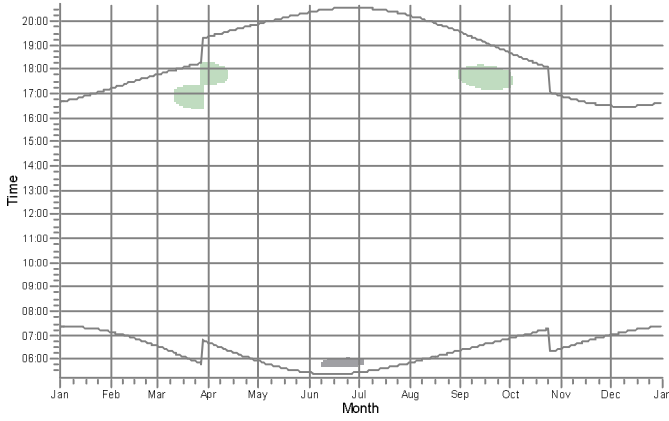


Shadow receptors

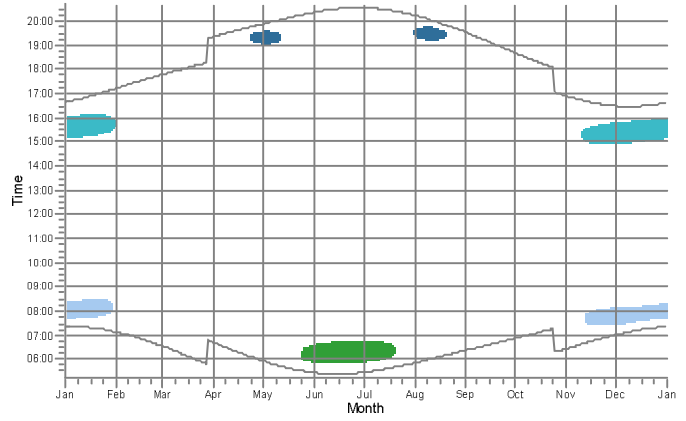
- | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
|  I: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (9) |  P: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (16) |  T: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (20) |
|  K: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (11) |  Q: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (17) |  V: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (22) |
|  M: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (13) |  R: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (18) | |

SHADOW - Calendar per WTG, graphical

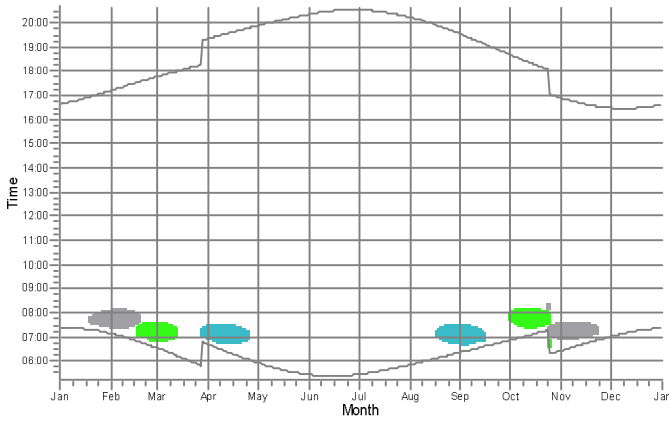
20: Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (7)



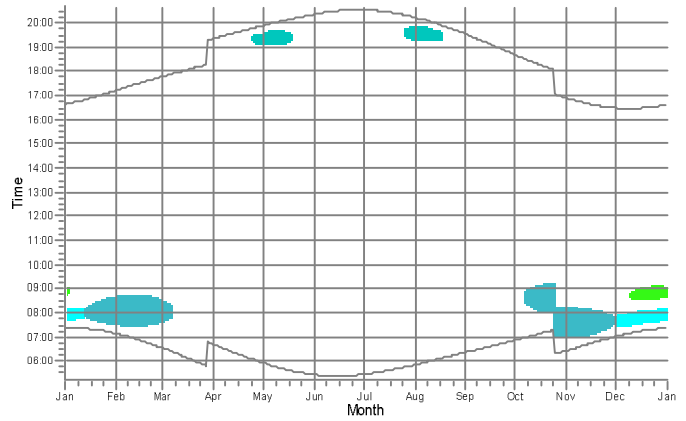
21: Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (701)



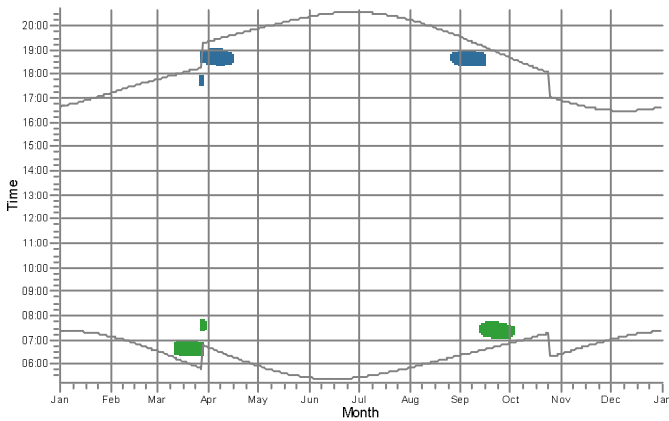
24: Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (7)












25: Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (703)



26: Siemens SWT-3.5-142 3530 142.0 !O! hub: 129,0 m (TOT: 200,0 m) (704)



Shadow receptors

 M: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (13)	 P: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (16)	 T: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (20)
 N: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (14)	 R: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (18)	 U: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (21)
 O: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (15)	 S: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (19)	 V: Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (22)

SHADOW - Map



0 500 1000 1500 2000 m

Map: Merged sat , Print scale 1:40.000, Map center UTM (north)-WGS84 Zone: 33 East: 577.622 North: 4.545.969

New WTG Obstacle Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_ONLINEDATA_3.wpo (3)