

Project:

Mikonkeidas layout

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FCG Suunnittelu ja tekniikka Oy

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Calculated:

6.11.2013 11:49/2.8.579

SHADOW - Main Result

Calculation: Mikonkeidas N117-2400 x 19 x HH141

Assumptions for shadow calculations

Maximum distance for influence

Calculate only when more than 20 % of sun is covered by the blade

Please look in WTG table

Minimum sun height over horizon for influence

3 °

Day step for calculation

1 days

Time step for calculation

1 minutes

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,16	2,61	3,94	5,80	8,65	8,98	8,14	6,70	4,15	2,67	1,18	0,89

Operational hours are calculated from WTGs in calculation and wind distribution:

MERRA_basic_E22.002_N62.000

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
668	589	523	506	590	727	895	1 214	880	702	723	633	8 652

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

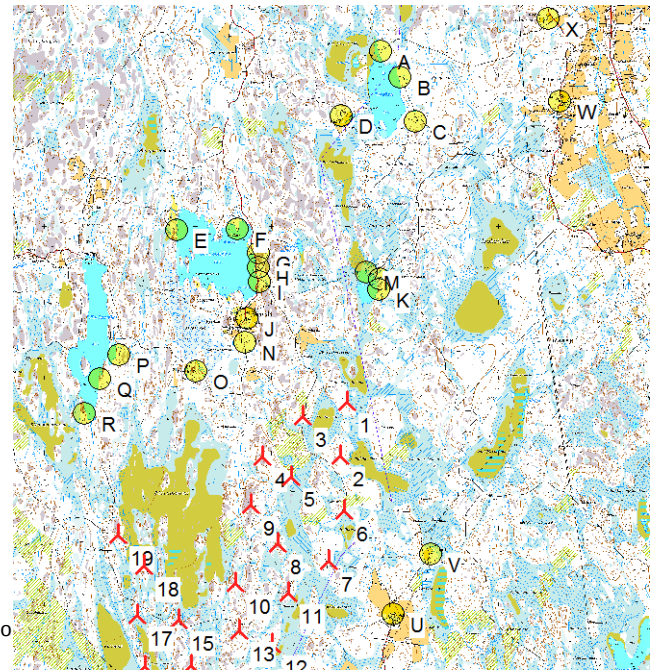
A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:

Height contours used: Height Contours: Mikonkeidas_height contour lines.wpo

Obstacles used in calculation

Eye height: 1,5 m

Grid resolution: 10,0 m



▲ New WTG

Scale 1:100 000

● Shadow receptor

WTGs

Finish TM ETRS-TM35FIN-ETRS89

	East	North	Z	Row data/Description
--	------	-------	---	----------------------

			[m]						[kW]	[m]	[m]	[m]	[RPM]
1	220 000	6 893 680	68,4	NORDEX N117 2400 117,0 !O! hub:...	No	NORDEX	N117-2 400	2 400	117,0	141,0	1 486	11,8	
2	219 904	6 892 973	70,0	NORDEX N117 2400 117,0 !O! hub:...	No	NORDEX	N117-2 400	2 400	117,0	141,0	1 486	11,8	
3	219 414	6 893 491	67,5	NORDEX N117 2400 117,0 !O! hub:...	No	NORDEX	N117-2 400	2 400	117,0	141,0	1 486	11,8	
4	218 874	6 892 956	65,0	NORDEX N117 2400 117,0 !O! hub:...	No	NORDEX	N117-2 400	2 400	117,0	141,0	1 486	11,8	
5	219 260	6 892 686	65,0	NORDEX N117 2400 117,0 !O! hub:...	No	NORDEX	N117-2 400	2 400	117,0	141,0	1 486	11,8	
6	219 958	6 892 234	72,5	NORDEX N117 2400 117,0 !O! hub:...	No	NORDEX	N117-2 400	2 400	117,0	141,0	1 486	11,8	
7	219 754	6 891 573	71,4	NORDEX N117 2400 117,0 !O! hub:...	No	NORDEX	N117-2 400	2 400	117,0	141,0	1 486	11,8	
8	219 088	6 891 805	67,5	NORDEX N117 2400 117,0 !O! hub:...	No	NORDEX	N117-2 400	2 400	117,0	141,0	1 486	11,8	
9	218 724	6 892 313	72,5	NORDEX N117 2400 117,0 !O! hub:...	No	NORDEX	N117-2 400	2 400	117,0	141,0	1 486	11,8	
10	218 517	6 891 280	65,0	NORDEX N117 2400 117,0 !O! hub:...	No	NORDEX	N117-2 400	2 400	117,0	141,0	1 486	11,8	
11	219 221	6 891 156	70,0	NORDEX N117 2400 117,0 !O! hub:...	No	NORDEX	N117-2 400	2 400	117,0	141,0	1 486	11,8	
12	219 005	6 890 480	72,5	NORDEX N117 2400 117,0 !O! hub:...	No	NORDEX	N117-2 400	2 400	117,0	141,0	1 486	11,8	
13	218 579	6 890 660	68,0	NORDEX N117 2400 117,0 !O! hub:...	No	NORDEX	N117-2 400	2 400	117,0	141,0	1 486	11,8	
14	217 937	6 890 195	62,5	NORDEX N117 2400 117,0 !O! hub:...	No	NORDEX	N117-2 400	2 400	117,0	141,0	1 486	11,8	
15	217 767	6 890 795	60,0	NORDEX N117 2400 117,0 !O! hub:...	No	NORDEX	N117-2 400	2 400	117,0	141,0	1 486	11,8	
16	217 329	6 890 184	55,0	NORDEX N117 2400 117,0 !O! hub:...	No	NORDEX	N117-2 400	2 400	117,0	141,0	1 486	11,8	
17	217 229	6 890 854	55,0	NORDEX N117 2400 117,0 !O! hub:...	No	NORDEX	N117-2 400	2 400	117,0	141,0	1 486	11,8	
18	217 321	6 891 514	57,5	NORDEX N117 2400 117,0 !O! hub:...	No	NORDEX	N117-2 400	2 400	117,0	141,0	1 486	11,8	
19	216 966	6 891 910	55,9	NORDEX N117 2400 117,0 !O! hub:...	No	NORDEX	N117-2 400	2 400	117,0	141,0	1 486	11,8	

Shadow receptor-Input

Finish TM ETRS-TM35FIN-ETRS89

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
A	Lomarakenus (Tönijärvi)	220 446	6 898 321	65,0	1,0	1,0	1,0	0,0	0,0	"Green house mode"
B	Lomarakenus (Tönijärvi)	220 690	6 897 979	65,0	1,0	1,0	1,0	0,0	0,0	"Green house mode"
C	Lomarakenus (Tönijärvi)	220 900	6 897 388	70,8	1,0	1,0	1,0	0,0	0,0	"Green house mode"
D	Asuinrakenus (Rantamäki)	219 926	6 897 462	67,7	1,0	1,0	1,0	0,0	0,0	"Green house mode"

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SHADOW - Main Result

Calculation: Mikonkeidas N117-2400 x 19 x HH141

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No.	Name	Finish TM ETRS-TM35FIN-ETRS89							Degrees from south cw	Slope of window	Direction mode
		East	North	Z	Width	Height	Height a.g.l.				
				[m]	[m]	[m]	[m]	[°]		[°]	
E	Lomarakenus (Stora Sandjärv)	217 748	6 895 956	52,5	1,0	1,0	1,0	0,0	0,0	0,0	"Green house mode"
F	Lomarakenus (Stora Sandjärv)	218 545	6 895 971	52,5	1,0	1,0	1,0	0,0	0,0	0,0	"Green house mode"
G	Lomarakenus (Stora Sandjärv)	218 823	6 895 653	60,0	1,0	1,0	1,0	0,0	0,0	0,0	"Green house mode"
H	Lomarakenus (Stora Sandjärv)	218 823	6 895 463	53,4	1,0	1,0	1,0	0,0	0,0	0,0	"Green house mode"
I	Lomarakenus (Stora Sandjärv)	218 839	6 895 272	53,2	1,0	1,0	1,0	0,0	0,0	0,0	"Green house mode"
J	Asuinrakennus (Sandvik)	218 669	6 894 786	53,0	1,0	1,0	1,0	0,0	0,0	0,0	"Green house mode"
K	Lomarakenus (Kaakkolampi)	220 413	6 895 172	67,5	1,0	1,0	1,0	0,0	0,0	0,0	"Green house mode"
L	Lomarakenus (Kaakkolampi)	220 427	6 895 305	67,9	1,0	1,0	1,0	0,0	0,0	0,0	"Green house mode"
M	Lomarakenus (Kaakkolampi)	220 247	6 895 399	67,5	1,0	1,0	1,0	0,0	0,0	0,0	"Green house mode"
N	Asuinrakennus (Gransten)	218 645	6 894 467	55,0	1,0	1,0	1,0	0,0	0,0	0,0	"Green house mode"
O	Asuinrakennus (Bergvik)	217 999	6 894 084	55,4	1,0	1,0	1,0	0,0	0,0	0,0	"Green house mode"
P	Lomarakenus (Lilla Sandjärv)	216 990	6 894 302	47,6	1,0	1,0	1,0	0,0	0,0	0,0	"Green house mode"
Q	Lomarakenus (Lilla Sandjärv)	216 733	6 893 988	45,0	1,0	1,0	1,0	0,0	0,0	0,0	"Green house mode"
R	Lomarakenus (Lilla Sandjärv)	216 523	6 893 533	47,6	1,0	1,0	1,0	0,0	0,0	0,0	"Green house mode"
S	Asuinrakennus (Kallioniemi)	218 262	6 889 164	60,9	1,0	1,0	1,0	0,0	0,0	0,0	"Green house mode"
T	Asuinrakennus (Kivistö)	218 938	6 889 327	70,0	1,0	1,0	1,0	0,0	0,0	0,0	"Green house mode"
U	Asuinrakennus (Peltomaa)	220 606	6 890 869	67,5	1,0	1,0	1,0	0,0	0,0	0,0	"Green house mode"
V	Asuinrakennus (Vaarainkorpi)	221 108	6 891 661	65,0	1,0	1,0	1,0	0,0	0,0	0,0	"Green house mode"
W	Asuinrakennus (Korpela)	222 806	6 897 657	68,7	1,0	1,0	1,0	0,0	0,0	0,0	"Green house mode"
X	Asuinrakennus (Korkiaharju)	222 646	6 898 747	71,8	1,0	1,0	1,0	0,0	0,0	0,0	"Green house mode"

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values	
		Shadow hours per year	[h/year]
A	Lomarakenus (Tönijärvi)	0:00	
B	Lomarakenus (Tönijärvi)	0:00	
C	Lomarakenus (Tönijärvi)	0:00	
D	Asuinrakennus (Rantamäki)	0:00	
E	Lomarakenus (Stora Sandjärv)	0:00	
F	Lomarakenus (Stora Sandjärv)	0:00	
G	Lomarakenus (Stora Sandjärv)	0:00	
H	Lomarakenus (Stora Sandjärv)	0:00	
I	Lomarakenus (Stora Sandjärv)	0:00	
J	Asuinrakennus (Sandvik)	0:00	
K	Lomarakenus (Kaakkolampi)	0:00	
L	Lomarakenus (Kaakkolampi)	0:00	
M	Lomarakenus (Kaakkolampi)	0:00	
N	Asuinrakennus (Gransten)	1:32	
O	Asuinrakennus (Bergvik)	1:10	
P	Lomarakenus (Lilla Sandjärv)	0:00	
Q	Lomarakenus (Lilla Sandjärv)	0:00	
R	Lomarakenus (Lilla Sandjärv)	0:00	
S	Asuinrakennus (Kallioniemi)	4:13	
T	Asuinrakennus (Kivistö)	6:02	
U	Asuinrakennus (Peltomaa)	9:12	
V	Asuinrakennus (Vaarainkorpi)	3:58	
W	Asuinrakennus (Korpela)	0:00	
X	Asuinrakennus (Korkiaharju)	0:00	

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

No.	Name	Worst case	Expected
		[h/year]	[h/year]
1	NORDEX N117 2400 117.0 !O! hub: 141,0 m (TOT: 199,5 m) (344)	0:00	0:00
2	NORDEX N117 2400 117.0 !O! hub: 141,0 m (TOT: 199,5 m) (345)	0:00	0:00
3	NORDEX N117 2400 117.0 !O! hub: 141,0 m (TOT: 199,5 m) (346)	9:24	1:32

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SHADOW - Main Result

Calculation: Mikonkeidas N117-2400 x 19 x HH141

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
4	NORDEX N117 2400 117.0 !O! hub: 141,0 m (TOT: 199,5 m) (347)	7:32	1:10
5	NORDEX N117 2400 117.0 !O! hub: 141,0 m (TOT: 199,5 m) (348)	0:00	0:00
6	NORDEX N117 2400 117.0 !O! hub: 141,0 m (TOT: 199,5 m) (349)	10:19	2:42
7	NORDEX N117 2400 117.0 !O! hub: 141,0 m (TOT: 199,5 m) (350)	34:01	9:00
8	NORDEX N117 2400 117.0 !O! hub: 141,0 m (TOT: 199,5 m) (351)	0:00	0:00
9	NORDEX N117 2400 117.0 !O! hub: 141,0 m (TOT: 199,5 m) (352)	0:00	0:00
10	NORDEX N117 2400 117.0 !O! hub: 141,0 m (TOT: 199,5 m) (353)	0:00	0:00
11	NORDEX N117 2400 117.0 !O! hub: 141,0 m (TOT: 199,5 m) (354)	6:33	1:28
12	NORDEX N117 2400 117.0 !O! hub: 141,0 m (TOT: 199,5 m) (355)	0:00	0:00
13	NORDEX N117 2400 117.0 !O! hub: 141,0 m (TOT: 199,5 m) (356)	0:00	0:00
14	NORDEX N117 2400 117.0 !O! hub: 141,0 m (TOT: 199,5 m) (357)	21:23	6:02
15	NORDEX N117 2400 117.0 !O! hub: 141,0 m (TOT: 199,5 m) (358)	0:00	0:00
16	NORDEX N117 2400 117.0 !O! hub: 141,0 m (TOT: 199,5 m) (359)	15:09	4:13
17	NORDEX N117 2400 117.0 !O! hub: 141,0 m (TOT: 199,5 m) (360)	0:00	0:00
18	NORDEX N117 2400 117.0 !O! hub: 141,0 m (TOT: 199,5 m) (361)	0:00	0:00
19	NORDEX N117 2400 117.0 !O! hub: 141,0 m (TOT: 199,5 m) (362)	0:00	0:00

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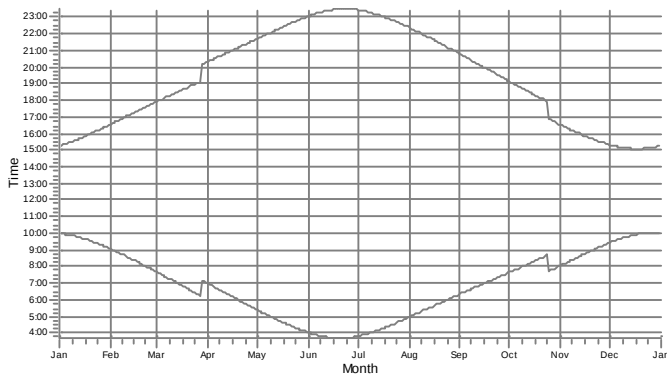
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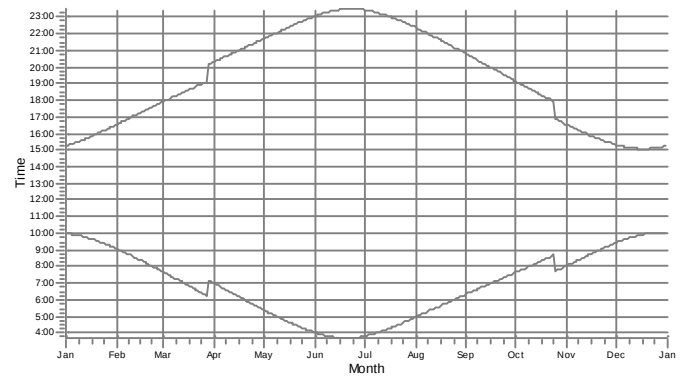
SHADOW - Calendar, graphical

Calculation: Mikonkeidas N117-2400 x 19 x HH141

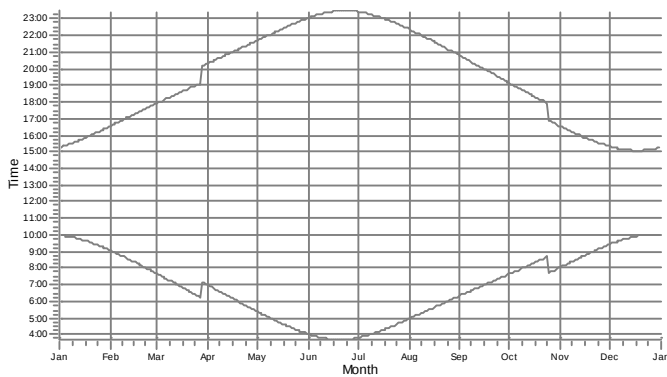
A: Lomarakennus (Tönijärvi)



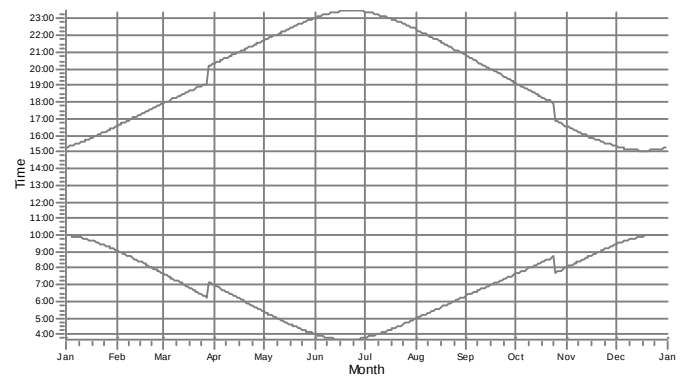
B: Lomarakennus (Tönijärvi)



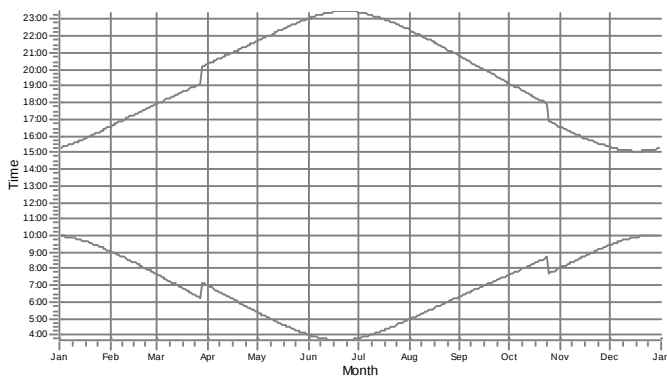
C: Lomarakennus (Tönijärvi)



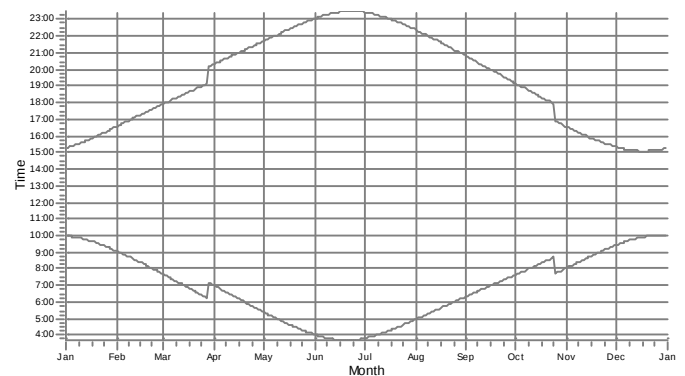
D: Asuinrakennus (Rantamäki)



E: Lomarakennus (Stora Sandjärvi)



F: Lomarakennus (Stora Sandjärvi)



WTGs

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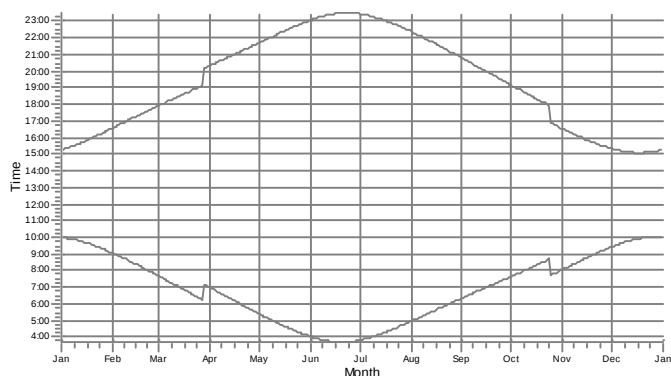
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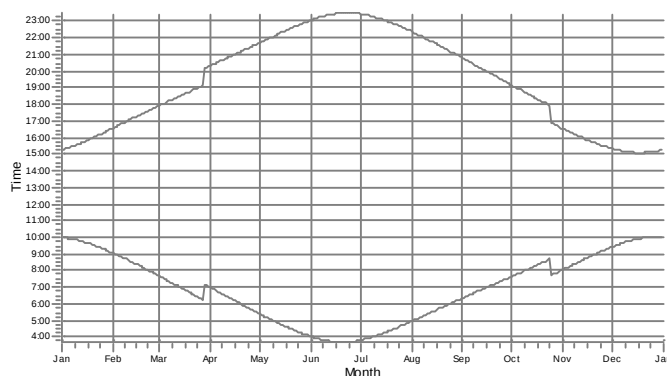
SHADOW - Calendar, graphical

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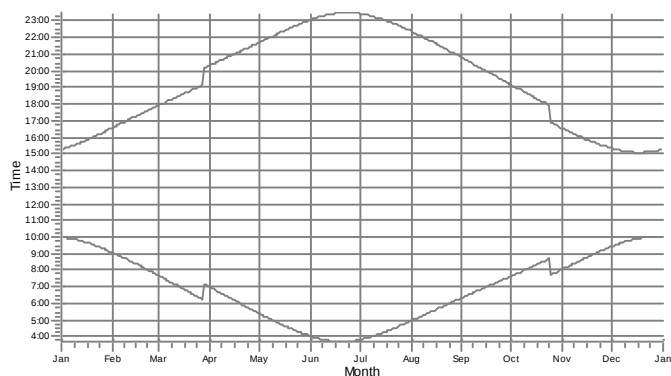
G: Lomarakenus (Stora Sandjärv)



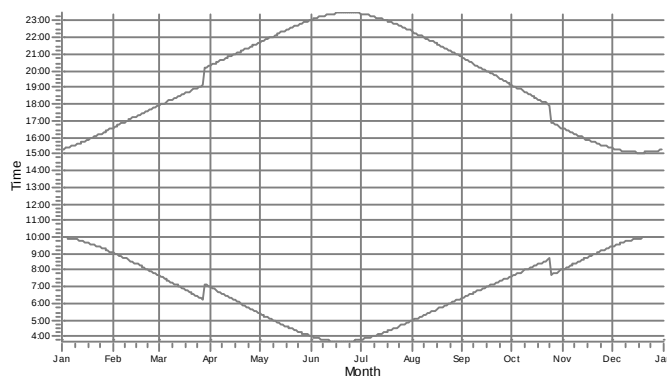
H: Lomarakenus (Stora Sandjärv)



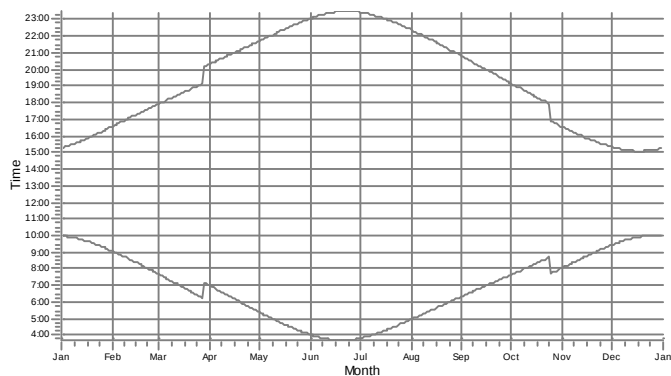
I: Lomarakenus (Stora Sandjärv)



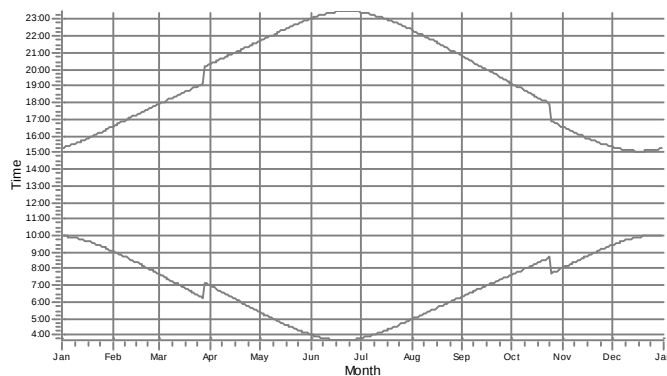
J: Asuinrakennus (Sandvik)



K: Lomarakenus (Kaakkolampi)



L: Lomarakenus (Kaakkolampi)



WTGs

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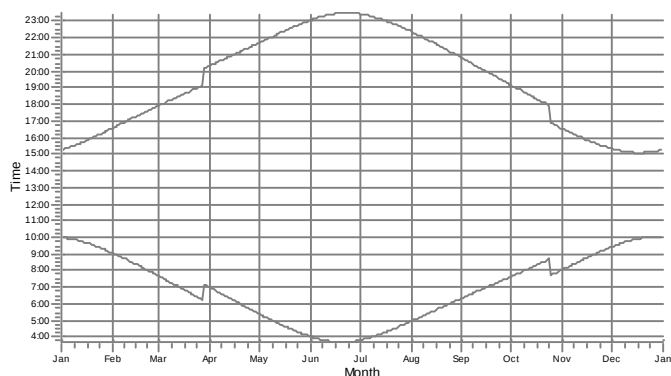
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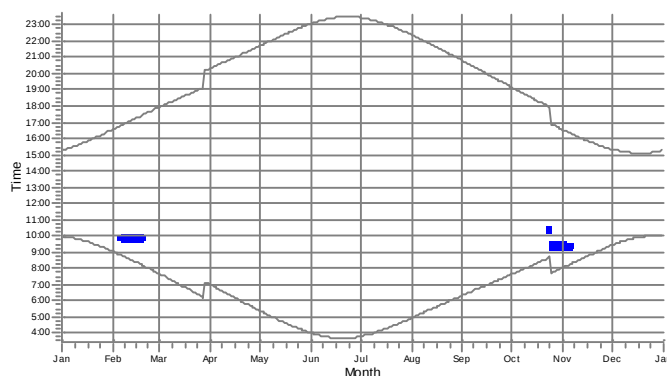
SHADOW - Calendar, graphical

Calculation: Mikonkeidas N117-2400 x 19 x HH141

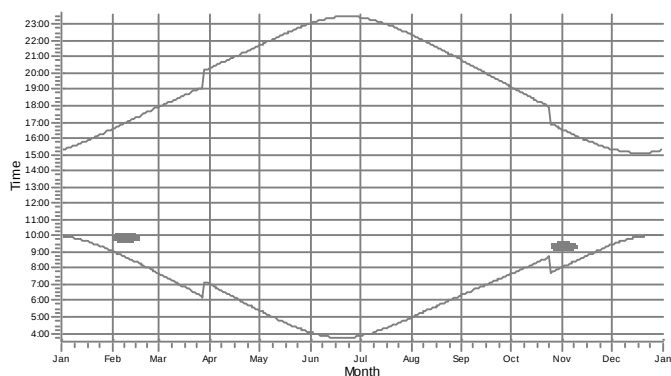
M: Lomarakenus (Kaakkolamm)



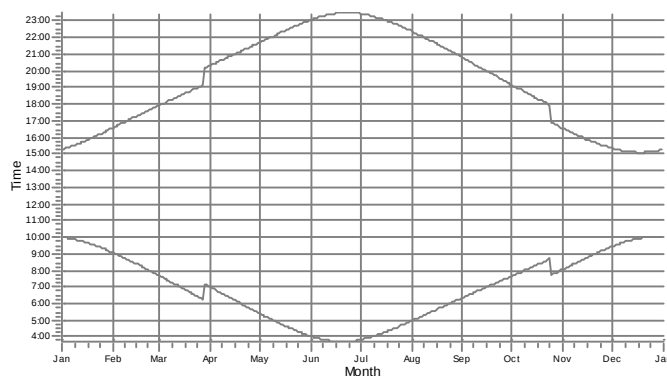
N: Asuinrakenus (Gransten)



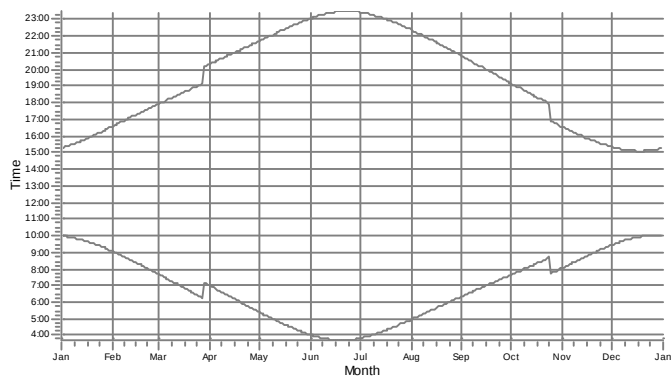
O: Asuinrakenus (Bergvik)



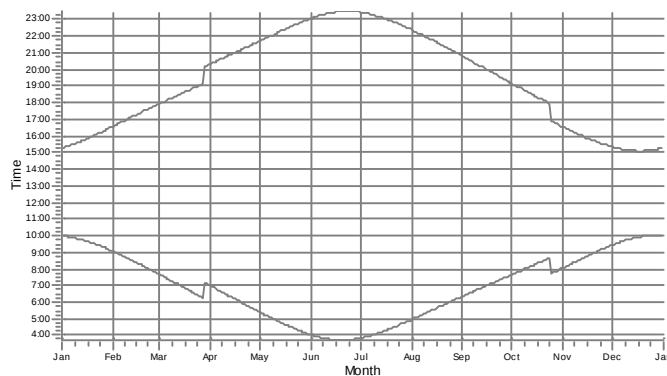
P: Lomarakenus (Lilla Sandjäv)



Q: Lomarakenus (Lilla Sandjäv)



R: Lomarakenus (Lilla Sandjäv)



WTGs

3: NORDEX N117 2400 117.0 !OI! hub: 141,0 m (TOT: 199,5 m) (346)

4: NORDEX N117 2400 117.0 !OI! hub: 141,0 m (TOT: 199,5 m) (347)

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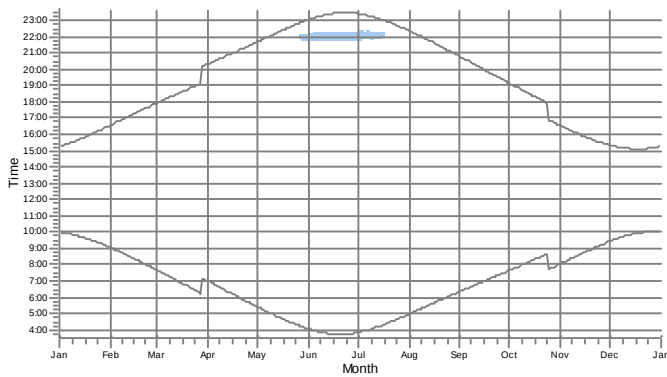
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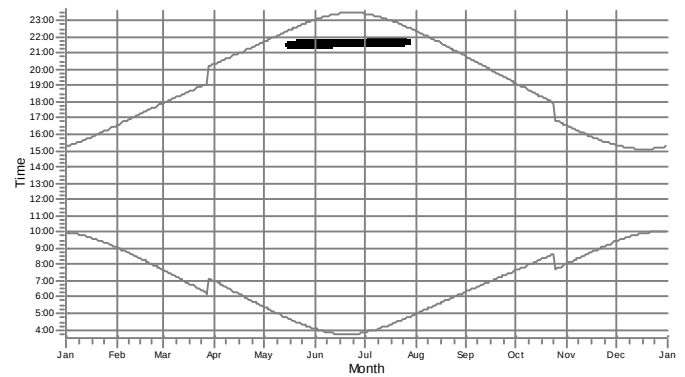
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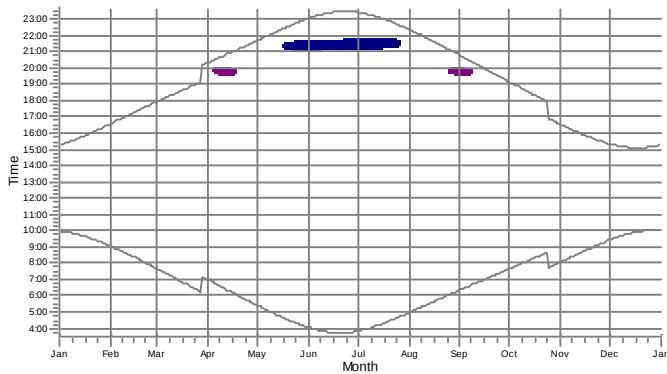
S: Asuinrakennus (Kallioniemi)



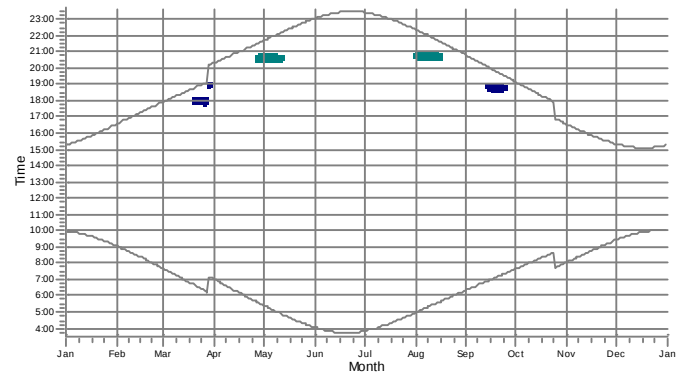
T: Asuinrakennus (Kivistö)



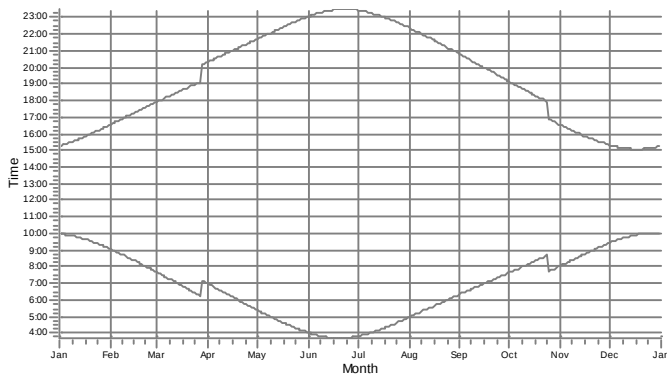
U: Asuinrakennus (Peltomaa)



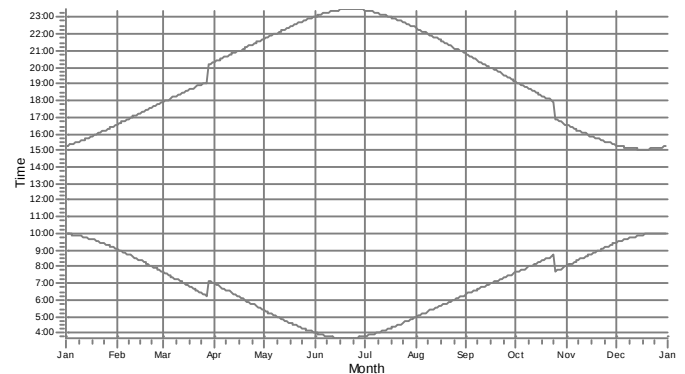
V: Asuinrakennus (Vaarainkorpi)



W: Asuinrakennus (Korpela)



X: Asuinrakennus (Korkiaharju)



WTGs

- 6: NORDEX N117 2400 117.0 !OI! hub: 141,0 m (TOT: 199,5 m) (349)
- 7: NORDEX N117 2400 117.0 !OI! hub: 141,0 m (TOT: 199,5 m) (350)
- 11: NORDEX N117 2400 117.0 !OI! hub: 141,0 m (TOT: 199,5 m) (354)

- 14: NORDEX N117 2400 117.0 !OI! hub: 141,0 m (TOT: 199,5 m) (357)
- 16: NORDEX N117 2400 117.0 !OI! hub: 141,0 m (TOT: 199,5 m) (359)

Project:

Mikonkeidas layout

Printed/Page

11.11.2013 9:34 / 8

Licensed user:

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+358104095666

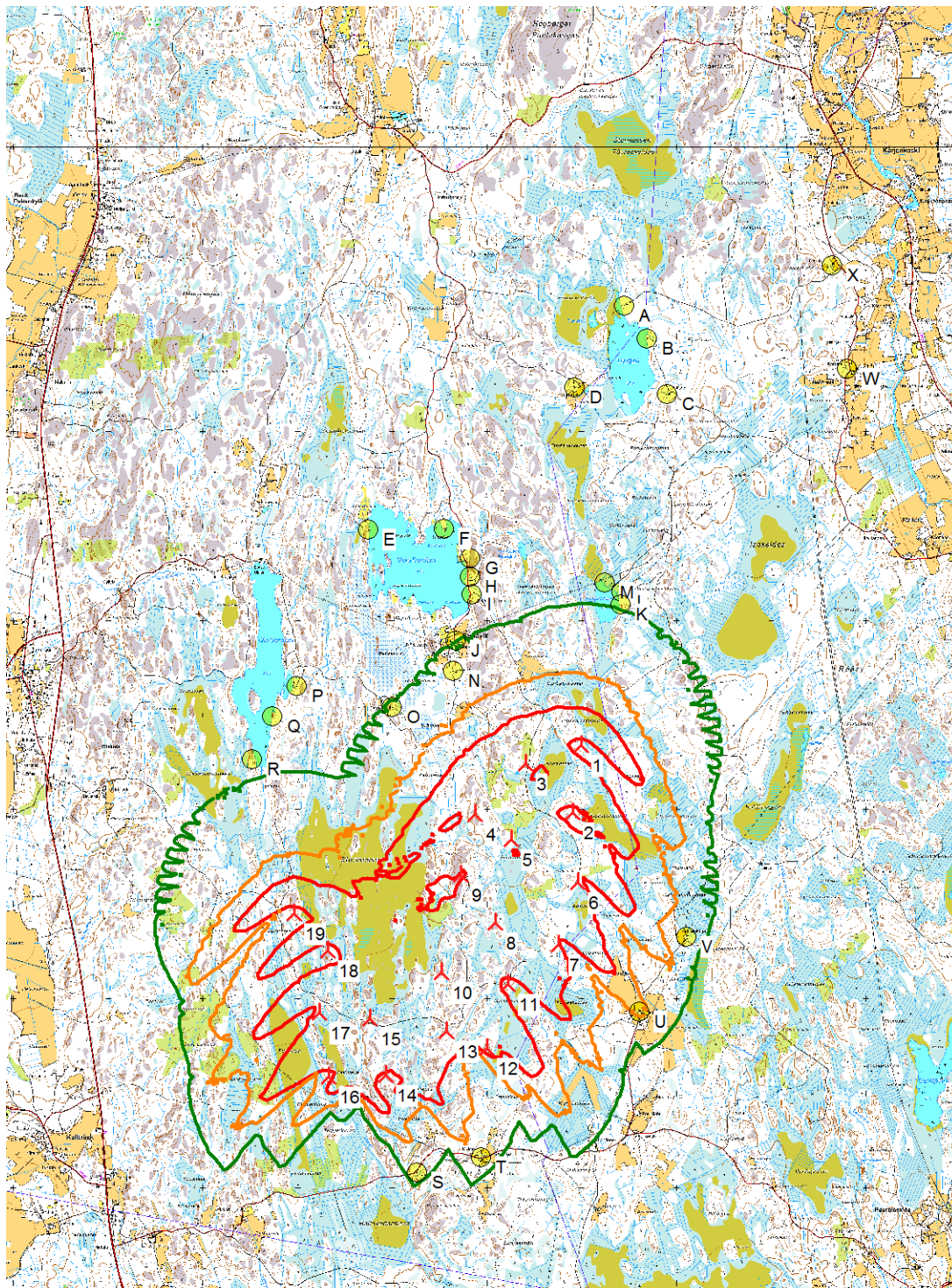
Hans Vadbäck / hans.vadbäck@fcg.fi

Calculated:

6.11.2013 11:49/2.8.579

SHADOW - Map

Calculation: Mikonkeidas N117-2400 x 19 x HH141



Hours per year, real case

 1 h/a
 8 h/a
 20 h/a

0 1 2 3 4 km

Map: Peruskartta_pieni, Print scale 1:70 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 219 538 North: 6 894 146

New WTG

Shadow receptor

Flicker map level: Height Contours: Mikonkeidas_height contour lines.wpo (1)