

VINDIN AB OY

PJELAX VINDKRAFTSPARK

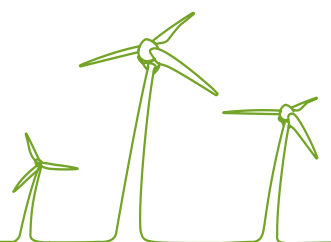
MILJÖKONSEKVENSBESKRIVNING

BILAGA 3. Skuggbildningsmodelleringar



ALT 1.

Pjelax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124
real case, no forest



Project:

Pjelax

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13.6.2014 15:00 / 1

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Hans Vadbäck / hans.vadbäck@fcg.fi

Calculated:

12.6.2014 15:28/2.8.579

SHADOW - Main Result

Calculation: Pjelax N131 x 30 x HH144 + Svaskulla V112 x 5 x HH124 (real case, no forest)

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) [UMEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,02	2,84	3,78	6,14	8,62	9,94	7,42	5,13	4,32	3,43	1,58	0,96

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

Pjelax mätmast 7.11.2012->

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
489	594	538	505	707	379	1 240	1 460	717	639	729	638	8 637

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

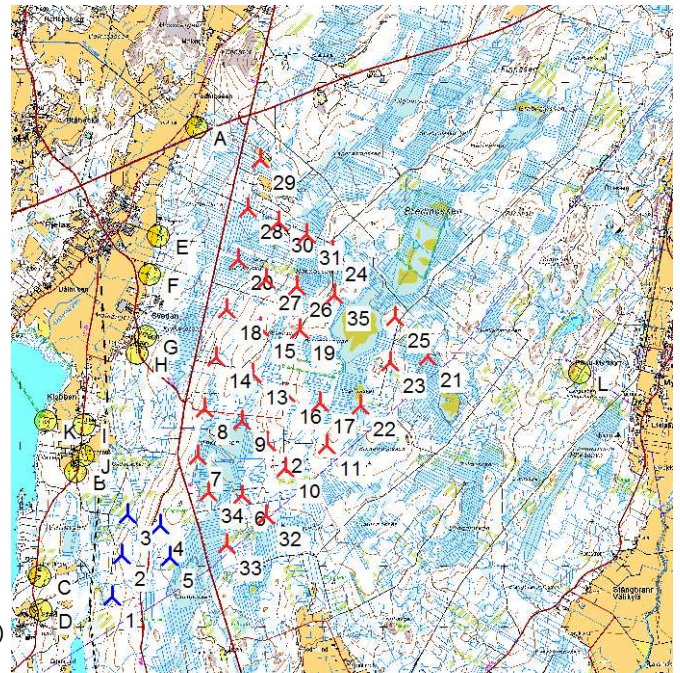
A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:

Height contours used: Height Contours: Tjock_Pjelax_korkeuskäyrät.wpo (1)

Obstacles not used in calculation

Eye height: 1,5 m

Grid resolution: 10,0 m



Scale 1:125 000

★ New WTG

● Shadow receptor

WTGs

ETRS 89 Zone: 35

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

[m]

1	209 519	6 924 515	14,3	VESTAS V112 3075	112,0	!O! hu...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8
2	209 669	6 925 195	21,5	VESTAS V112 3075	112,0	!O! hu...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8
3	209 768	6 925 865	13,6	VESTAS V112 3075	112,0	!O! hu...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8
4	210 312	6 925 688	32,5	VESTAS V112 3075	112,0	!O! hu...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8
5	210 468	6 925 158	31,7	VESTAS V112 3075	112,0	!O! hu...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8
6	211 658	6 926 173	36,0	3			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
7	210 931	6 926 851	35,0	5			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
8	211 046	6 927 628	35,0	13			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
9	211 663	6 927 415	35,0	6			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
10	212 377	6 926 641	50,0	8			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
11	213 056	6 927 024	58,8	9			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
12	212 075	6 927 068	42,1	7			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
13	211 841	6 928 191	41,5	12			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
14	211 233	6 928 461	33,8	14			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
15	211 962	6 928 954	42,8	15			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
16	212 386	6 927 877	51,3	11			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
17	212 939	6 927 714	59,6	10			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
18	211 406	6 929 267	27,9	17			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
19	212 611	6 928 926	55,0	16			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
20	211 593	6 930 079	23,3	20			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
21	214 727	6 928 477	45,0	28			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
22	213 612	6 927 667	57,5	30			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
23	214 105	6 928 388	57,9	29			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
24	213 156	6 930 224	47,7	25			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
25	214 179	6 929 140	57,5	27			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
26	212 568	6 929 639	44,5	18			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
27	212 056	6 929 748	33,6	19			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
28	211 762	6 930 925	28,9	21			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
29	211 962	6 931 732	31,2	23			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
30	212 264	6 930 708	31,4	22			Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3

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Project:

Pjelax

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Calculated:

12.6.2014 15:28/2.8.579

SHADOW - Main Result

Calculation: Pjelax N131 x 30 x HH144 + Svaskulla V112 x 5 x HH124 (real case, no forest)

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ETRS 89 Zone: 35				WTG type				Shadow data			
East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM
		[m]									
31	212 724	6 930 502	38,3 24	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
32	212 064	6 925 850	39,4 2	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
33	211 412	6 925 364	33,5 1	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
34	211 109	6 926 227	35,0 4	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
35	213 176	6 929 506	51,4 26	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3

Shadow receptor-Input

ETRS 89 Zone: 35										
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	Bostad (Kullström)	210 919	6 932 257	14,1	5,0	5,0	1,0	0,0	0,0	"Green house mode"
B	Bostad (Nygård)	208 906	6 926 580	5,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
C	Fritidsbostad (Sjölund)	208 330	6 924 837	3,1	5,0	5,0	1,0	0,0	0,0	"Green house mode"
D	Bostad (Rönnlund)	208 344	6 924 294	10,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
E	Bostad (Östman)	210 277	6 930 461	6,7	5,0	5,0	1,0	0,0	0,0	"Green house mode"
F	Bostad (Östthag)	210 137	6 929 833	6,2	5,0	5,0	1,0	0,0	0,0	"Green house mode"
G	Bostad (Grannas)	210 065	6 928 808	16,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
H	Bostad (Kristinestadsvägen 1268)	209 928	6 928 534	17,7	5,0	5,0	1,0	0,0	0,0	"Green house mode"
I	Bostad (Skrattnäsvägen 973)	209 062	6 927 362	5,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
J	Bostad (Sörhannus)	209 038	6 926 853	5,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
K	Fritidsbostad (Klobbskatan)	208 413	6 927 416	9,1	5,0	5,0	1,0	0,0	0,0	"Green house mode"
L	Fritidsbostad (?)	217 234	6 928 218	64,5	5,0	5,0	1,0	0,0	0,0	"Green house mode"

Calculation Results

Shadow receptor

		Shadow, expected values
No.	Name	Shadow hours per year [h/year]
A	Bostad (Kullström)	3:37
B	Bostad (Nygård)	3:54
C	Fritidsbostad (Sjölund)	3:11
D	Bostad (Rönnlund)	6:18
E	Bostad (Östman)	5:02
F	Bostad (Östthag)	3:20
G	Bostad (Grannas)	6:14
H	Bostad (Kristinestadsvägen 1268)	6:31
I	Bostad (Skrattnäs väg 973)	0:53
J	Bostad (Sörhannus)	1:49
K	Fritidsbostad (Klobbskatan)	0:00
L	Fritidsbostad (?)	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
1	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (957)	17:25	3:29
2	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (958)	29:45	7:04
3	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (959)	26:40	4:42
4	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (960)	4:21	0:52
5	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (961)	0:00	0:00
6	3	0:00	0:00
7	5	0:00	0:00
8	13	16:18	3:12
9	6	0:00	0:00
10	8	0:00	0:00

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Project:

Pjelax

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SHADOW - Main Result

Calculation: Pjelax N131 x 30 x HH144 + Svaskulla V112 x 5 x HH124 (real case, no forest)

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
11	9	0:00	0:00
12	7	0:00	0:00
13	12	0:00	0:00
14	14	20:12	4:00
15	15	0:00	0:00
16	11	0:00	0:00
17	10	0:00	0:00
18	17	36:38	8:27
19	16	0:00	0:00
20	20	17:06	3:22
21	28	0:00	0:00
22	30	0:00	0:00
23	29	0:00	0:00
24	25	0:00	0:00
25	27	0:00	0:00
26	18	0:00	0:00
27	19	0:00	0:00
28	21	17:45	3:34
29	23	11:26	2:10
30	22	0:00	0:00
31	24	0:00	0:00
32	2	0:00	0:00
33	1	0:00	0:00
34	4	0:00	0:00
35	26	0:00	0:00

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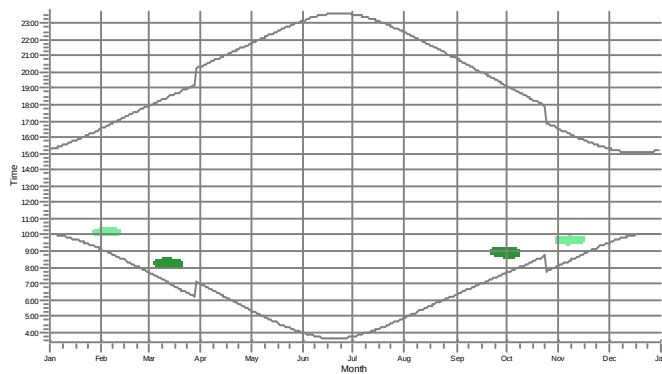
Calculated:
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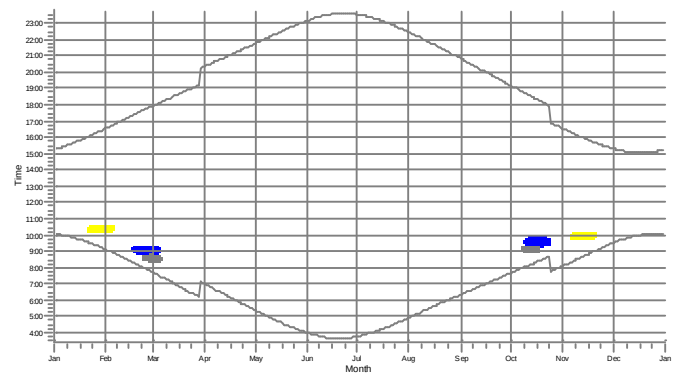
SHADOW - Calendar, graphical

Calculation: Pjelax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124 (real case, no forest)

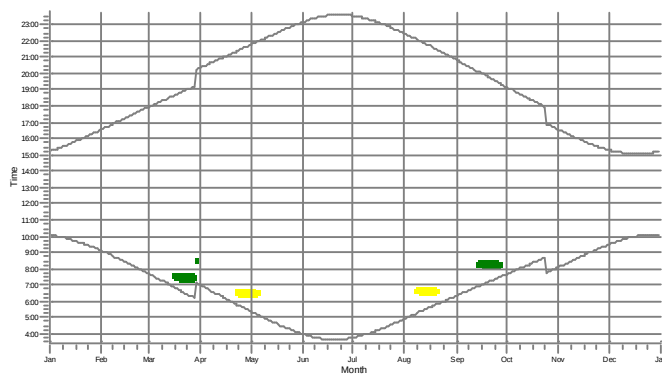
A: Bostad (Kullström)



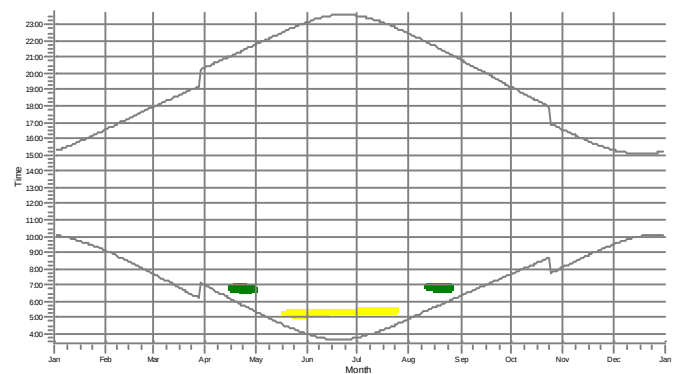
B: Bostad (Nygård)



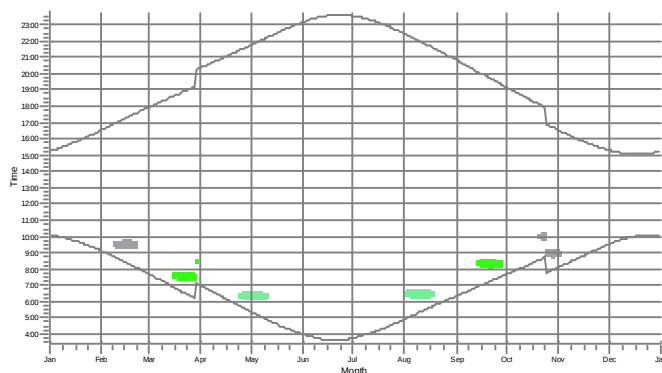
C: Fritidsbostad (Sjölund)



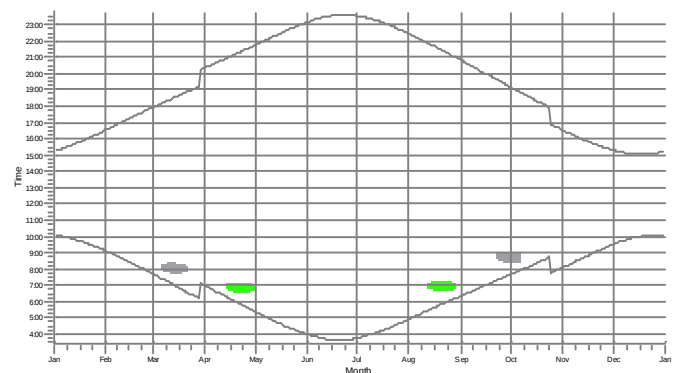
D: Bostad (Rönnlund)



E: Bostad (Östman)



F: Bostad (Östthag)



WTGs

1: VESTAS V112 3075 112.0 IO! hub: 124,0 m (TOT: 180,0 m) (957)
2: VESTAS V112 3075 112.0 IO! hub: 124,0 m (TOT: 180,0 m) (958)
3: VESTAS V112 3075 112.0 IO! hub: 124,0 m (TOT: 180,0 m) (959)

4: VESTAS V112 3075 112.0 IO! hub: 124,0 m (TOT: 180,0 m) (960)
18: 17
20: 20

28: 21
29: 23

Project:

Pjelax

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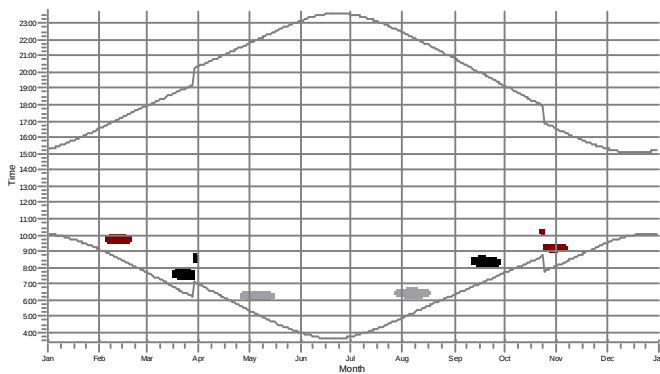
Hans Vadbäck / hans.vadbäck@fcg.fi

Calculated:

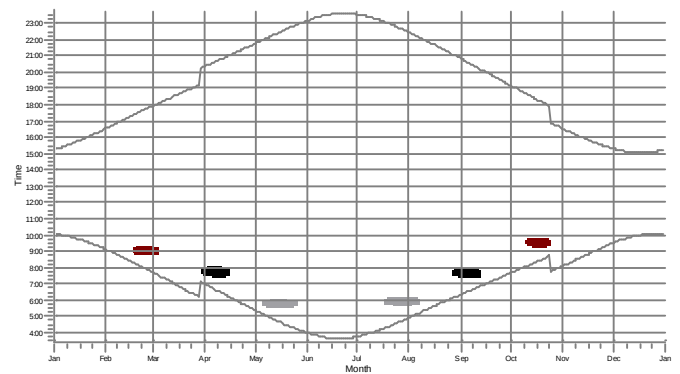
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SHADOW - Calendar, graphical**Calculation:** Pjelax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124 (real case, no forest)

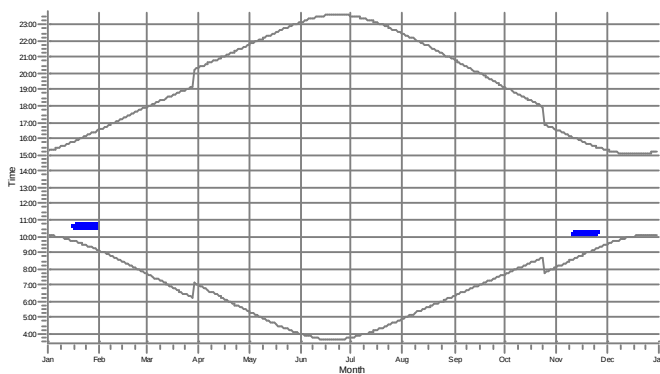
G: Bostad (Grannas)



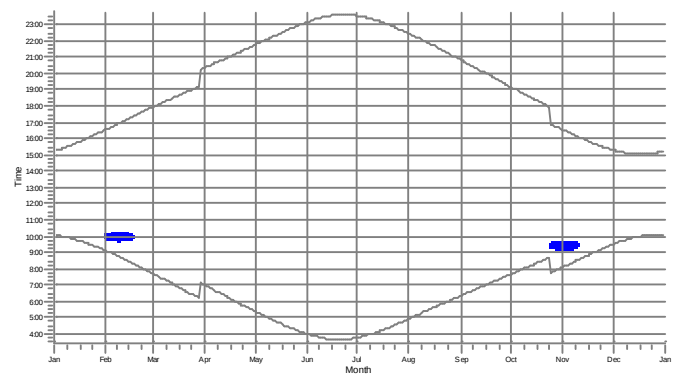
H: Bostad (Kristinestadsvägen 1268)



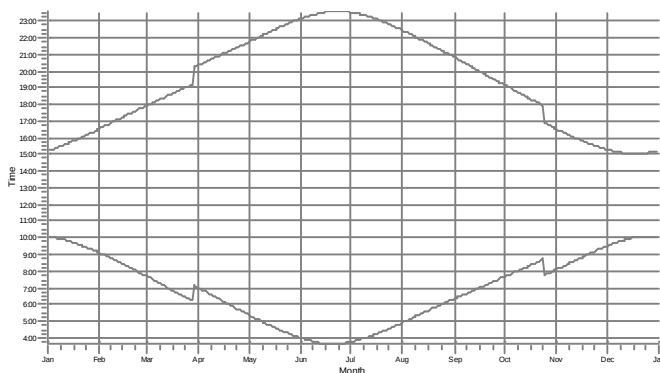
I: Bostad (Skrattnäsavägen 973)



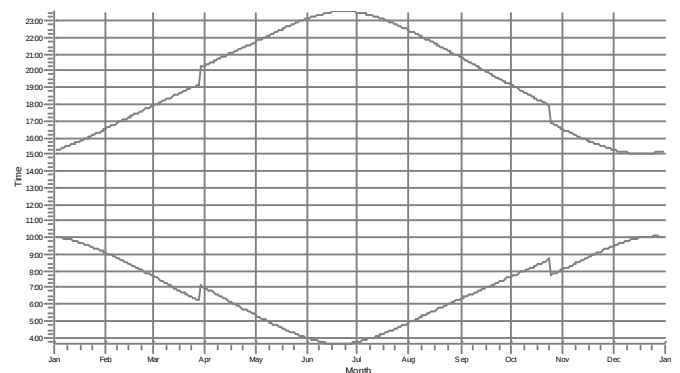
J: Bostad (Sörhannus)



K: Fritidsbostad (Klobbskatan)



L: Fritidsbostad (?)



WTGs

 3: VESTAS V112 3075 112.0 IO! hub: 124,0 m (TOT: 180,0 m) (959)
 8: 13

 14: 14
 18: 17

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Pjelax

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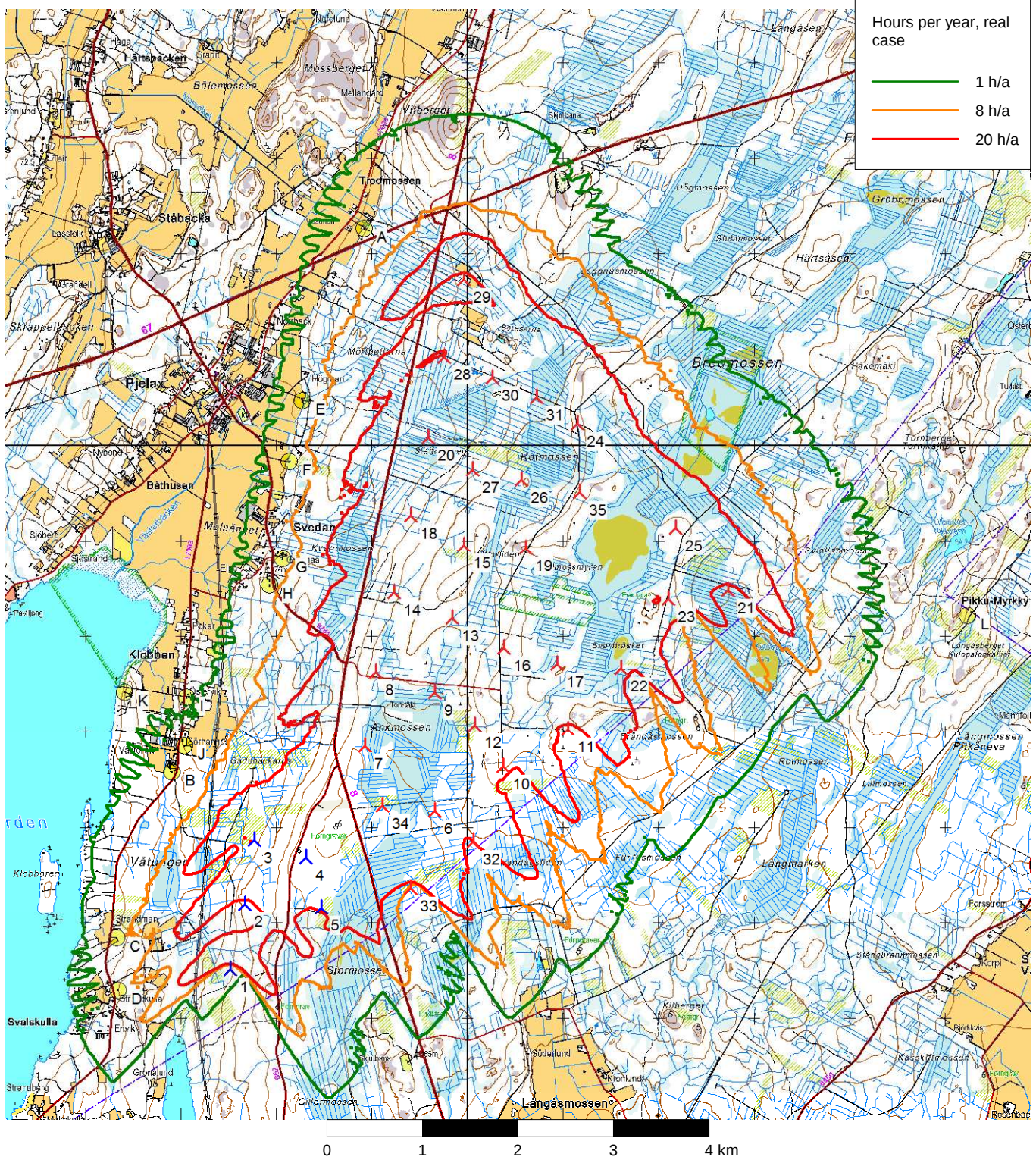
Hans Vadback / hans.vadback@fcg.fi

Calculated:
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SHADOW - Map

Calculation: Pjelax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124 (real case, no forest)



Map: Maastokartta , Print scale 1:60 000, Map center ETRS 89 Zone: 35 East: 211 975 North: 6 928 266

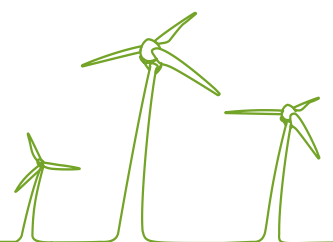
New WTG

Shadow receptor

Flicker map level: Height Contours: Tjock_Pjelax_korkeuskäyrät.wpo (1)

ALT 2.

Pjelax V126 x 23 x HH137 + Svalskulla V112 x 5 x HH124
real case, no forest



Project:

Pjelax

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Calculated:

13.6.2014 15:16/2.8.579

SHADOW - Main Result

Calculation: Pjelax V126 x 23 x HH137 + Svalskulla V112 x 5 x HH124 (real case, no forest)

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) [UMEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,02	2,84	3,78	6,14	8,62	9,94	7,42	5,13	4,32	3,43	1,58	0,96

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

Pjelax mätmast 7.11.2012->

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
488	593	537	505	706	378	1238	1457	716	638	727	637	8621

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

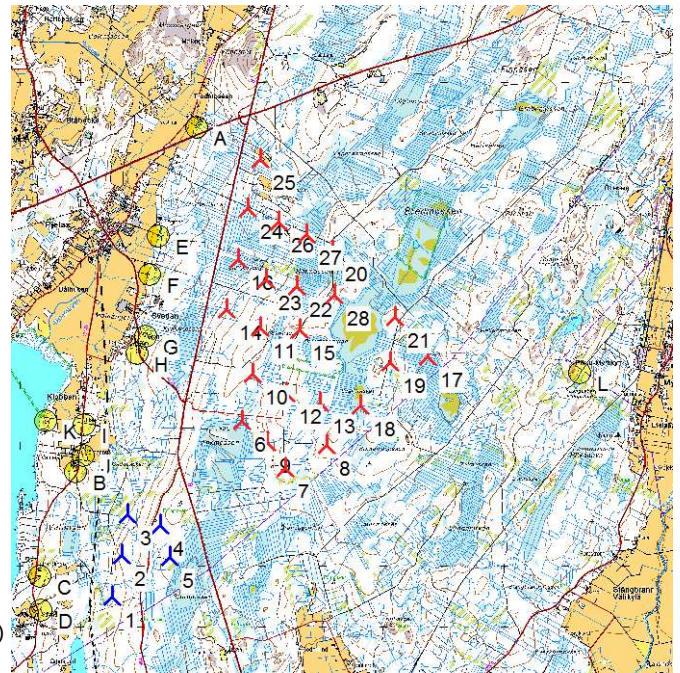
A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:

Height contours used: Tjock_Pjelax_korkeuskäyrät.wpo (1)

Obstacles not used in calculation

Eye height: 1,5 m

Grid resolution: 10,0 m



Scale 1:125 000

★ New WTG

● Shadow receptor

WTGs

ETRS 89 Zone: 35			Z	Row data/Description	WTG type			Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
East	North				Valid	Manufact.	Type-generator				Calculation distance [m]	RPM [RPM]
			[m]									
1	209 519	6 924 515	14,3	VESTAS V112 3075 ...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8
2	209 669	6 925 195	21,5	VESTAS V112 3075 ...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8
3	209 768	6 925 865	13,6	VESTAS V112 3075 ...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8
4	210 312	6 925 688	32,5	VESTAS V112 3075 ...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8
5	210 468	6 925 158	31,7	VESTAS V112 3075 ...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8
6	211 663	6 927 415	35,0	6	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
7	212 377	6 926 641	50,0	8	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
8	213 056	6 927 024	58,8	9	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
9	212 075	6 927 068	42,1	7	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
10	211 841	6 928 191	41,5	12	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
11	211 962	6 928 954	42,8	15	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
12	212 386	6 927 877	51,3	11	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
13	212 939	6 927 714	59,6	10	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
14	211 406	6 929 267	27,9	17	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
15	212 611	6 928 926	55,0	16	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
16	211 593	6 930 079	23,3	20	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
17	214 727	6 928 477	45,0	28	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
18	213 612	6 927 667	57,5	30	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
19	214 105	6 928 388	57,9	29	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
20	213 156	6 930 224	47,7	25	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
21	214 179	6 929 140	57,5	27	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
22	212 568	6 929 639	44,5	18	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
23	212 056	6 929 748	38,3	19	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
24	211 762	6 930 925	28,9	21	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
25	211 962	6 931 732	31,2	23	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
26	212 264	6 930 708	31,4	22	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
27	212 724	6 930 502	38,3	24	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
28	213 176	6 929 506	51,4	26	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0

Project:

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Calculated:

13.6.2014 15:16/2.8.579

SHADOW - Main Result

Calculation: Pjelax V126 x 23 x HH137 + Svaskulla V112 x 5 x HH124 (real case, no forest)

Shadow receptor-Input

No.	Name	ETRS 89 Zone: 35				Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
		East	North	Z							
				[m]	[m]	[m]	[m]		[°]	[°]	
A	Bostad (Kullström)	210 919	6 932 257	14,1	5,0	5,0	1,0		0,0	0,0	"Green house mode"
B	Bostad (Nygård)	208 906	6 926 580	5,0	5,0	5,0	1,0		0,0	0,0	"Green house mode"
C	Fritidsbostad (Sjölund)	208 330	6 924 837	3,1	5,0	5,0	1,0		0,0	0,0	"Green house mode"
D	Bostad (Rönnlund)	208 344	6 924 294	10,0	5,0	5,0	1,0		0,0	0,0	"Green house mode"
E	Bostad (Östman)	210 277	6 930 461	6,7	5,0	5,0	1,0		0,0	0,0	"Green house mode"
F	Bostad (Östthagen)	210 137	6 929 833	6,2	5,0	5,0	1,0		0,0	0,0	"Green house mode"
G	Bostad (Grannas)	210 065	6 928 808	16,0	5,0	5,0	1,0		0,0	0,0	"Green house mode"
H	Bostad (Kristinestadsvägen 1268)	209 928	6 928 534	17,7	5,0	5,0	1,0		0,0	0,0	"Green house mode"
I	Bostad (Skrattnäs vägen 973)	209 062	6 927 362	5,0	5,0	5,0	1,0		0,0	0,0	"Green house mode"
J	Bostad (Sörhannus)	209 038	6 926 853	5,0	5,0	5,0	1,0		0,0	0,0	"Green house mode"
K	Fritidsbostad (Klobbskatan)	208 413	6 927 416	9,1	5,0	5,0	1,0		0,0	0,0	"Green house mode"
L	Fritidsbostad (?)	217 234	6 928 218	64,5	5,0	5,0	1,0		0,0	0,0	"Green house mode"

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values
		Shadow hours per year [h/year]
A	Bostad (Kullström)	3:18
B	Bostad (Nygård)	3:53
C	Fritidsbostad (Sjölund)	3:10
D	Bostad (Rönnlund)	6:18
E	Bostad (Östman)	4:39
F	Bostad (Östthagen)	3:04
G	Bostad (Grannas)	2:32
H	Bostad (Kristinestadsvägen 1268)	2:31
I	Bostad (Skrattnäs vägen 973)	0:53
J	Bostad (Sörhannus)	1:49
K	Fritidsbostad (Klobbskatan)	0:00
L	Fritidsbostad (?)	0:00

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

No.	Name	Worst case	Expected
		[h/year]	[h/year]
1	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (957)	17:25	3:28
2	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (958)	29:45	7:03
3	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (959)	26:40	4:41
4	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (960)	4:21	0:52
5	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (961)	0:00	0:00
6	6	0:00	0:00
7	7	0:00	0:00
8	8	0:00	0:00
9	9	0:00	0:00
10	10	0:00	0:00
11	11	0:00	0:00
12	12	0:00	0:00
13	13	0:00	0:00
14	14	33:47	7:44
15	15	0:00	0:00
16	16	15:44	3:05
17	17	0:00	0:00
18	18	0:00	0:00
19	19	0:00	0:00
20	20	0:00	0:00
21	21	0:00	0:00
22	22	0:00	0:00

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Project:

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Calculated:

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SHADOW - Main Result

Calculation: Pjelax V126 x 23 x HH137 + Svaskulla V112 x 5 x HH124 (real case, no forest)

...continued from previous page

No.	Name	Worst case	Expected
		[h/year]	[h/year]
23	19	0:00	0:00
24	21	16:21	3:14
25	23	10:36	2:00
26	22	0:00	0:00
27	24	0:00	0:00
28	26	0:00	0:00

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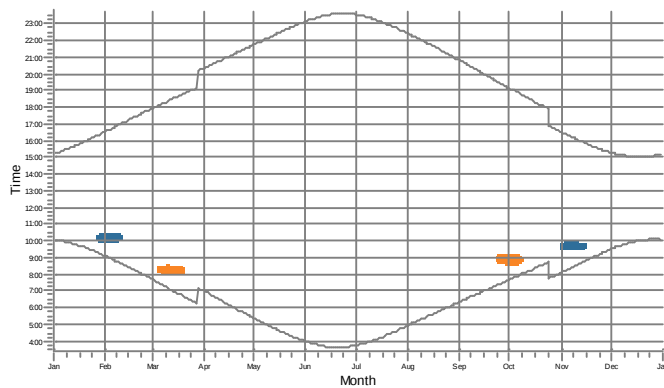
Hans Vadbäck / hans.vadback@fcg.fi

Calculated:

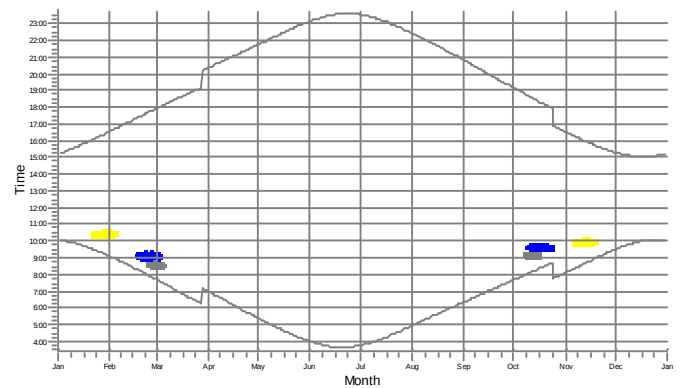
13.6.2014 15:16/2.8.579

SHADOW - Calendar, graphical**Calculation:** Pjelax V126 x 23 x HH137 + Svalskulla V112 x 5 x HH124 (real case, no forest)

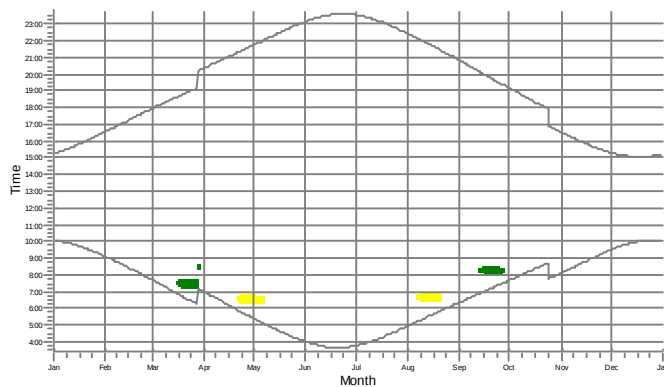
A: Bostad (Kullström)



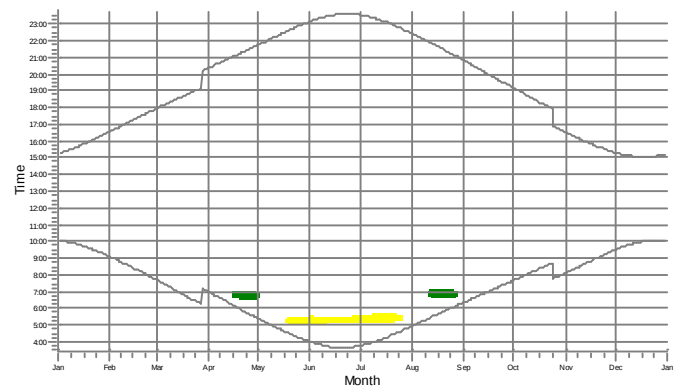
B: Bostad (Nygård)



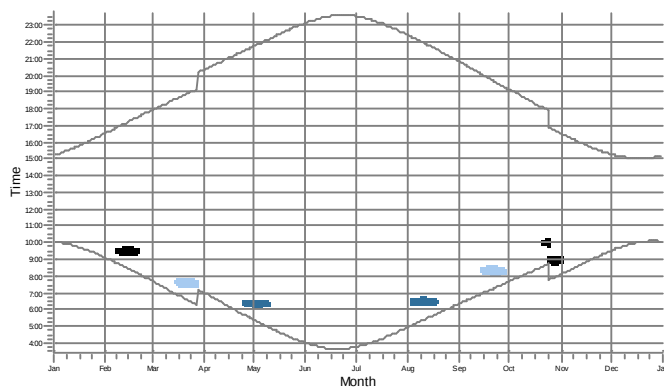
C: Fritidsbostad (Sjölund)



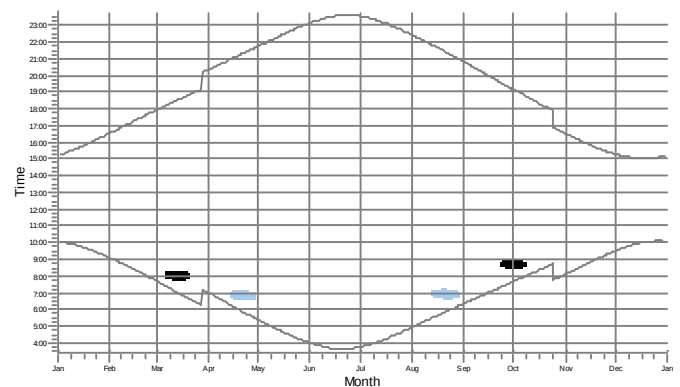
D: Bostad (Rönnlund)



E: Bostad (Östman)



F: Bostad (Östthåg)



WTGs

1: VESTAS V112 3075 112.0 IO! hub: 124.0 m (TOT: 180.0 m) (957)

2: VESTAS V112 3075 112.0 IO! hub: 124.0 m (TOT: 180.0 m) (958)

3: VESTAS V112 3075 112.0 IO! hub: 124.0 m (TOT: 180.0 m) (959)

4: VESTAS V112 3075 112.0 IO! hub: 124.0 m (TOT: 180.0 m) (960)

14: 17

16: 20

24: 21

25: 23

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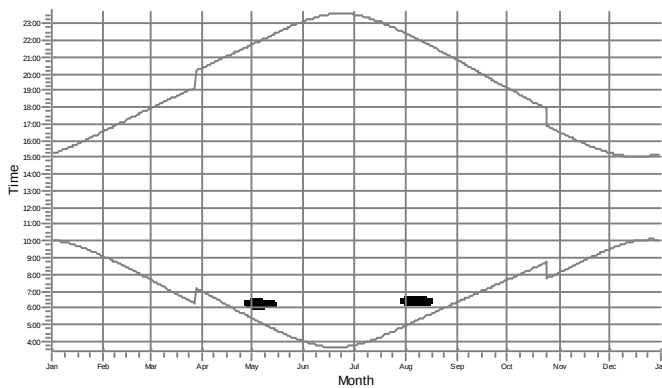
Hans Vadbäck / hans.vadbäck@fcg.fi

Calculated:

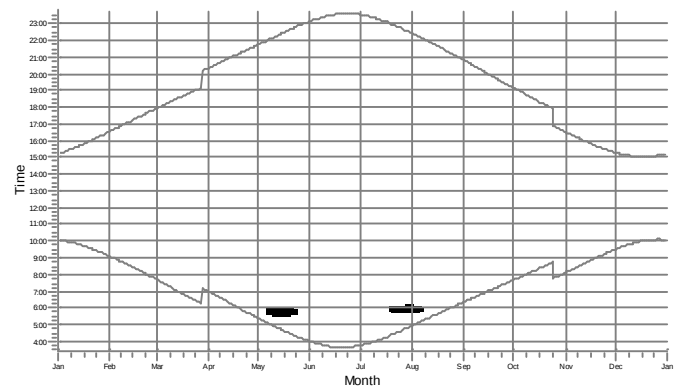
13.6.2014 15:16/2.8.579

SHADOW - Calendar, graphical**Calculation:** Pjelax V126 x 23 x HH137 + Svalskulla V112 x 5 x HH124 (real case, no forest)

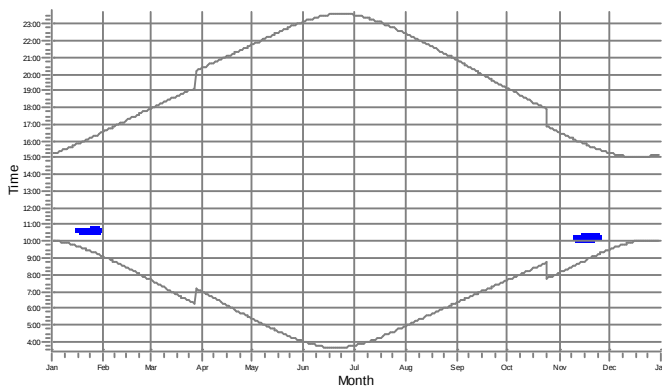
G: Bostad (Grannas)



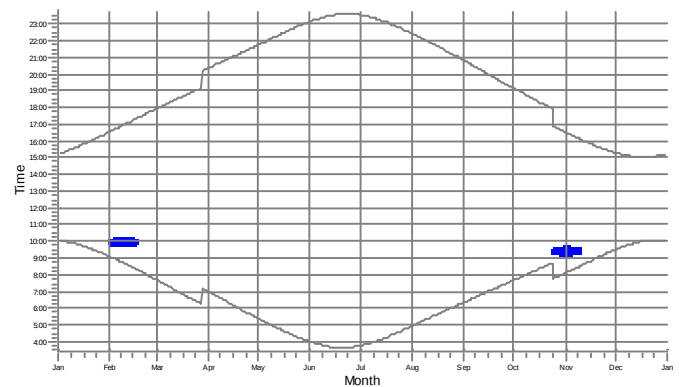
H: Bostad (Kristinestadsvägen 1268)



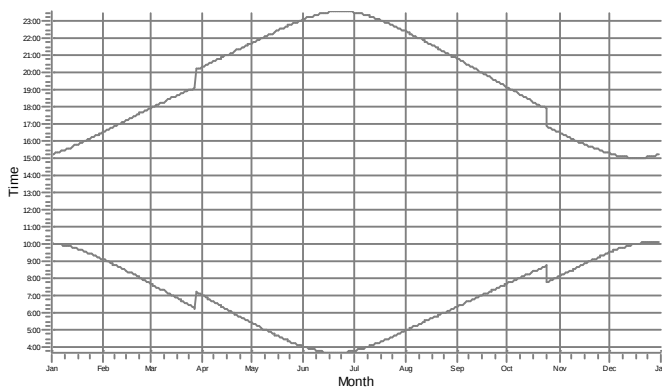
I: Bostad (Skrattnäsvägen 973)



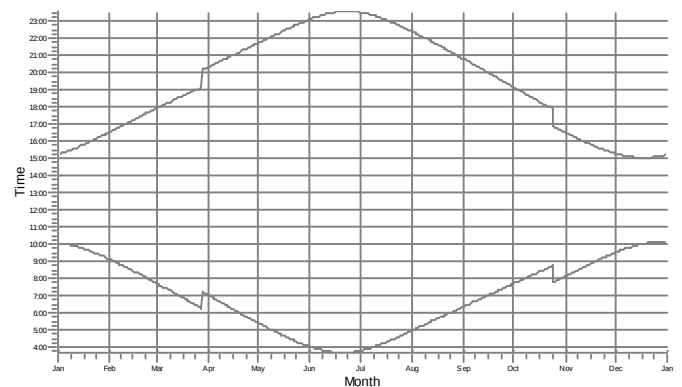
J: Bostad (Sörhannus)



K: Fritidsbostad (Klobbskatan)



L: Fritidsbostad (?)



WTGs

3: VESTAS V112 3075 112.0 IO! hub: 124.0 m (TOT: 180.0 m) (959)

14: 17

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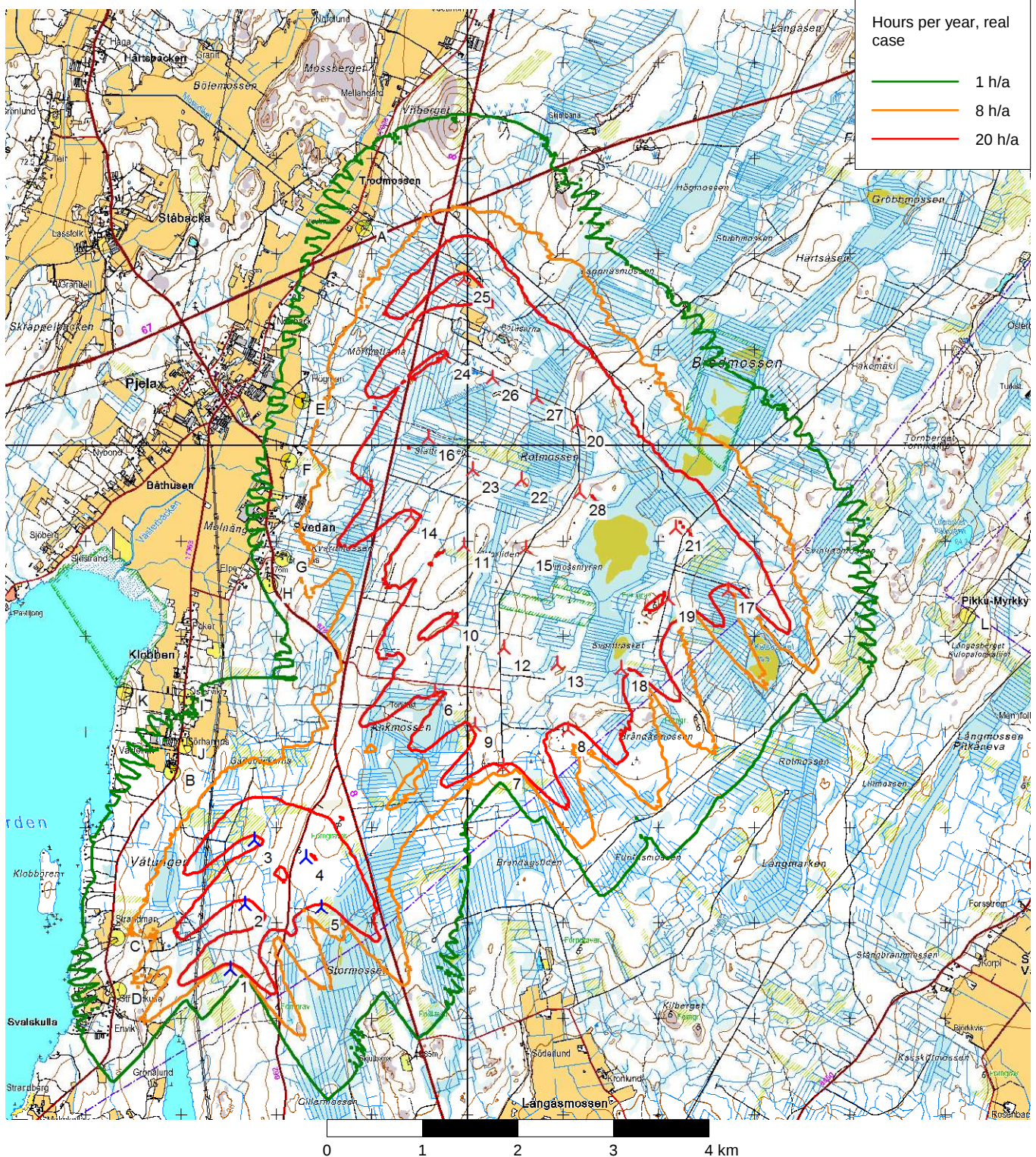
Hans Vadback / hans.vadback@fcg.fi
Calculated:

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SUUNNITTELU JA TEKNIikka

SHADOW - Map

Calculation: Pjelax V126 x 23 x HH137 + Svalskulla V112 x 5 x HH124 (real case, no forest)



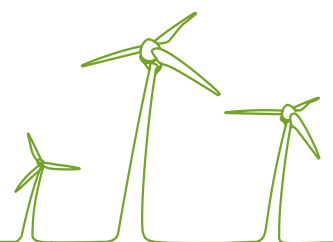
New WTG

Shadow receptor

Flicker map level: Height Contours: Tjock_Pjelax_korkeuskäyrät.wpo (1)

ALT 1.

Pjelax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124
real case, forest 20-20-15



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Calculated:

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SHADOW - Main Result

Calculation: Pjelax N131 x 30 x HH144 + Svaskulla V112 x 5 x HH124 (real case, forest 20-20-15)

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) [UMEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,02	2,84	3,78	6,14	8,62	9,94	7,42	5,13	4,32	3,43	1,58	0,96

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

Pjelax mätmast 7.11.2012->

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
489	594	538	505	707	379	1240	1460	717	639	729	638	8637

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: Tjock_Pjelax_korkeuskäyrät.wpo (1)

Area object(s) used in calculation:

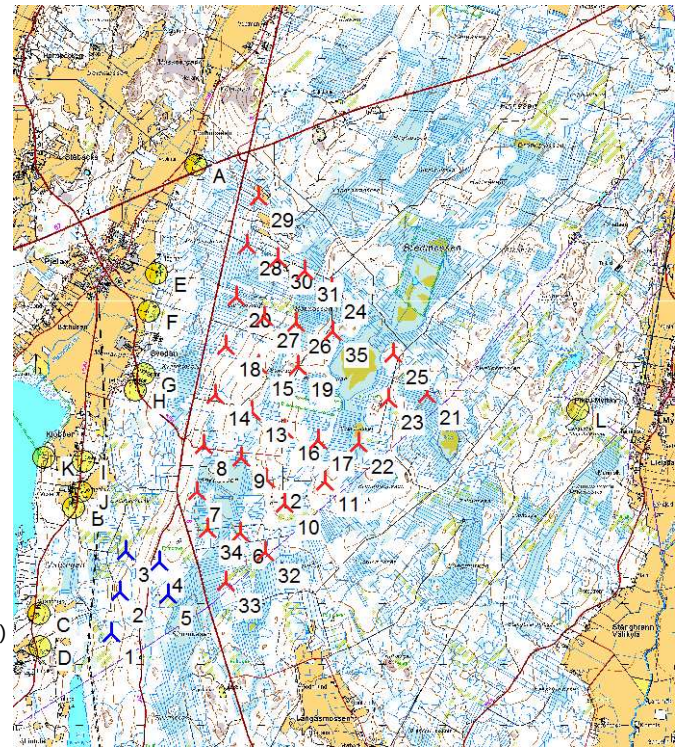
ZVI rakennuskanta

ZVI Corine

Obstacles not used in calculation

Eye height: 1,5 m

Grid resolution: 10,0 m



Scale 1:125 000

▲ New WTG

● Shadow receptor

WTGs

ETRS 89 Zone: 35				Row data/Description	WTG type		Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
East	North	Z			Valid	Manuf.				Calculation distance [m]	RPM [RPM]
			[m]								
1	209 519	6 924 515	14,3	VESTAS V112 3075 112.0 !O! hu...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709 12,8
2	209 669	6 925 195	21,5	VESTAS V112 3075 112.0 !O! hu...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709 12,8
3	209 768	6 925 865	13,6	VESTAS V112 3075 112.0 !O! hu...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709 12,8
4	210 312	6 925 688	32,5	VESTAS V112 3075 112.0 !O! hu...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709 12,8
5	210 468	6 925 158	31,7	VESTAS V112 3075 112.0 !O! hu...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709 12,8
6	211 658	6 926 173	36,0		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
7	210 931	6 926 851	35,0		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
8	211 046	6 927 628	35,0		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
9	211 663	6 927 415	35,0		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
10	212 377	6 926 641	50,0		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
11	213 056	6 927 024	58,8		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
12	212 075	6 927 068	42,1		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
13	211 841	6 928 191	41,5		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
14	211 233	6 928 461	33,8		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
15	211 962	6 928 954	42,8		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
16	212 386	6 927 877	51,3		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
17	212 939	6 927 714	59,6		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
18	211 406	6 929 267	27,9		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
19	212 611	6 928 926	55,0		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
20	211 593	6 930 079	23,3		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
21	214 727	6 928 477	45,0		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
22	213 612	6 927 667	57,5		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
23	214 105	6 928 388	57,9		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
24	213 156	6 930 224	47,7		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
25	214 179	6 929 140	57,5		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
26	212 568	6 929 639	44,5		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3
27	212 056	6 929 748	33,6		Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721 10,3

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Calculated:

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SHADOW - Main Result

Calculation: Pjelax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124 (real case, forest 20-20-15)

...continued from previous page

ETRS 89 Zone: 35				WTG type				Shadow data			
East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM [RPM]
		[m]									
28	211 762	6 930 925	28,9 21	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
29	211 962	6 931 732	31,2 23	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
30	212 264	6 930 708	31,4 22	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
31	212 724	6 930 502	38,3 24	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
32	212 064	6 925 850	39,4 2	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
33	211 412	6 925 364	33,5 1	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
34	211 109	6 926 227	35,0 4	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
35	213 176	6 929 506	51,4 26	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3

Shadow receptor-Input

ETRS 89 Zone: 35										
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	Bostad (Kullström)	210 919	6 932 257	14,1	5,0	5,0	1,0	0,0	0,0	"Green house mode"
B	Bostad (Nygård)	208 906	6 926 580	5,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
C	Fritidsbostad (Sjölund)	208 330	6 924 837	3,1	5,0	5,0	1,0	0,0	0,0	"Green house mode"
D	Bostad (Rönnlund)	208 344	6 924 294	10,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
E	Bostad (Östman)	210 277	6 930 461	6,7	5,0	5,0	1,0	0,0	0,0	"Green house mode"
F	Bostad (Östthag)	210 137	6 929 833	6,2	5,0	5,0	1,0	0,0	0,0	"Green house mode"
G	Bostad (Grannas)	210 065	6 928 808	16,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
H	Bostad (Kristinestadvägen 1268)	209 928	6 928 534	17,7	5,0	5,0	1,0	0,0	0,0	"Green house mode"
I	Bostad (Skrattnäsvägen 973)	209 062	6 927 362	5,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
J	Bostad (Sörhannus)	209 038	6 926 853	5,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
K	Fritidsbostad (Klobbskatan)	208 413	6 927 416	9,1	5,0	5,0	1,0	0,0	0,0	"Green house mode"
L	Fritidsbostad (?)	217 234	6 928 218	64,5	5,0	5,0	1,0	0,0	0,0	"Green house mode"

Calculation Results

Shadow receptor

		Shadow, expected values
No.	Name	Shadow hours per year [h/year]
A	Bostad (Kullström)	0:00
B	Bostad (Nygård)	0:00
C	Fritidsbostad (Sjölund)	0:00
D	Bostad (Rönnlund)	0:00
E	Bostad (Östman)	0:00
F	Bostad (Östthag)	0:00
G	Bostad (Grannas)	0:00
H	Bostad (Kristinestadvägen 1268)	0:00
I	Bostad (Skrattnäsvägen 973)	0:53
J	Bostad (Sörhannus)	1:49
K	Fritidsbostad (Klobbskatan)	0:00
L	Fritidsbostad (?)	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
1	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (957)	0:00	0:00
2	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (958)	0:00	0:00
3	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (959)	16:47	2:42
4	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (960)	0:00	0:00
5	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (961)	0:00	0:00
6	3	0:00	0:00
7	5	0:00	0:00

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Project:

Pjelax

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Calculated:

13.6.2014 17:25/2.8.579

SHADOW - Main Result

Calculation: Pjelax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124 (real case, forest 20-20-15)

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
8	13	0:00	0:00
9	6	0:00	0:00
10	8	0:00	0:00
11	9	0:00	0:00
12	7	0:00	0:00
13	12	0:00	0:00
14	14	0:00	0:00
15	15	0:00	0:00
16	11	0:00	0:00
17	10	0:00	0:00
18	17	0:00	0:00
19	16	0:00	0:00
20	20	0:00	0:00
21	28	0:00	0:00
22	30	0:00	0:00
23	29	0:00	0:00
24	25	0:00	0:00
25	27	0:00	0:00
26	18	0:00	0:00
27	19	0:00	0:00
28	21	0:00	0:00
29	23	0:00	0:00
30	22	0:00	0:00
31	24	0:00	0:00
32	2	0:00	0:00
33	1	0:00	0:00
34	4	0:00	0:00
35	26	0:00	0:00

Project:

Pjelax

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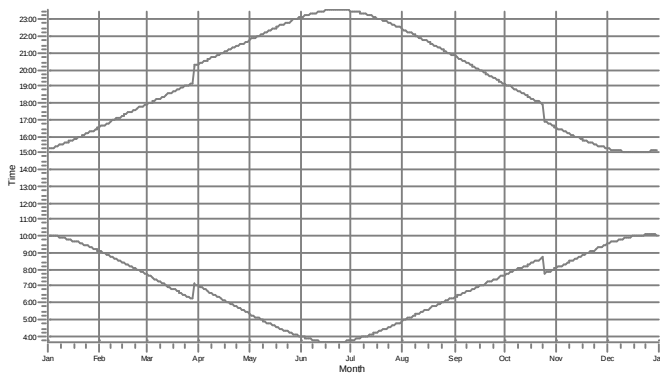
Calculated:

13.6.2014 17:25/2.8.579

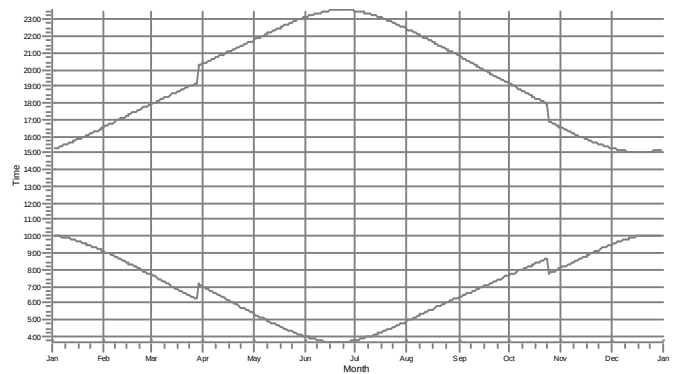
SHADOW - Calendar, graphical

Calculation: Pjelax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124 (real case, forest 20-20-15)

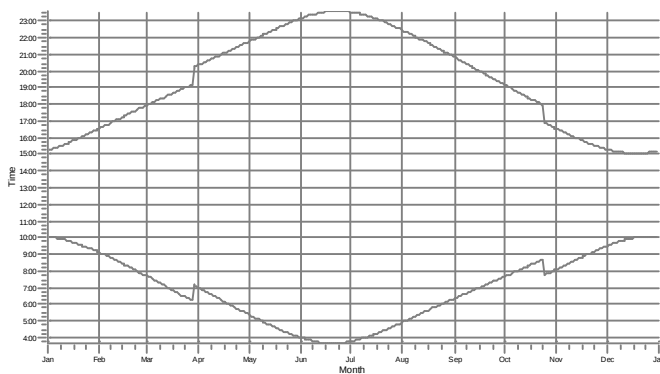
A: Bostad (Kullström)



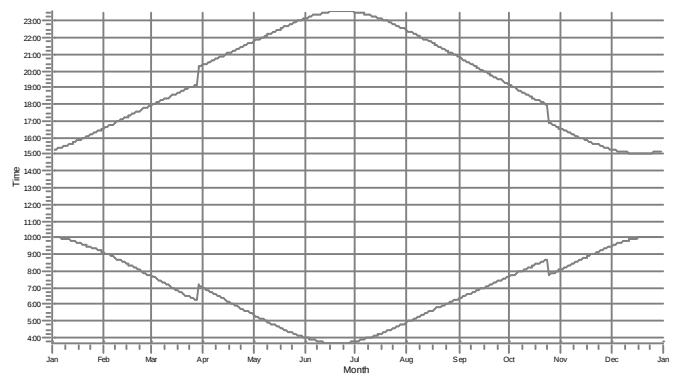
B: Bostad (Nygård)



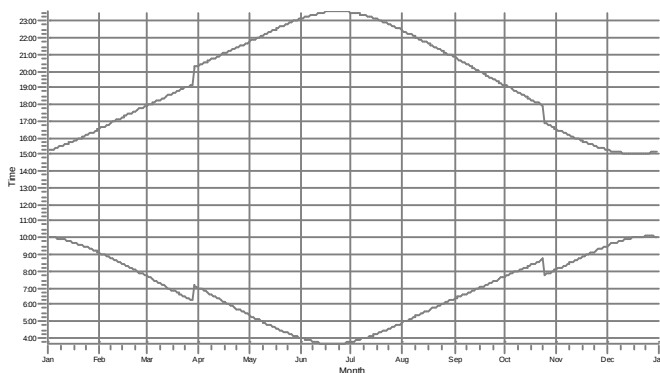
C: Fritidsbostad (Sjölund)



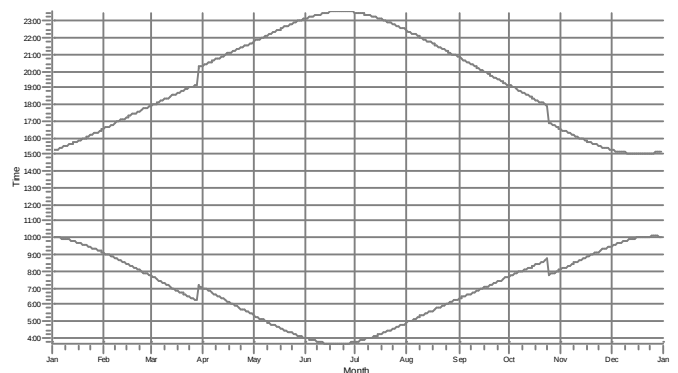
D: Bostad (Rönnlund)



E: Bostad (Östman)



F: Bostad (Östthag)



WTGs

Project:

Pjelax

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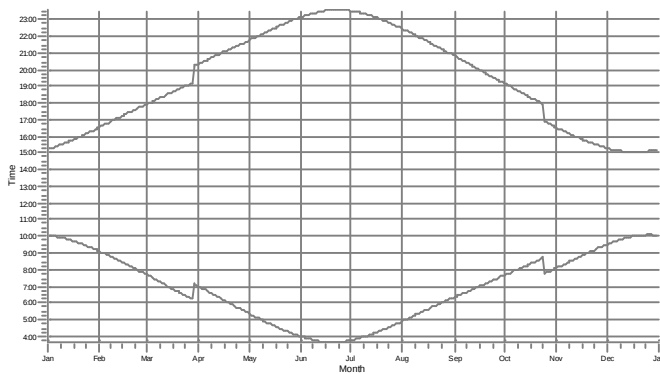
Hans Vadbäck / hans.vadback@fcg.fi

Calculated:

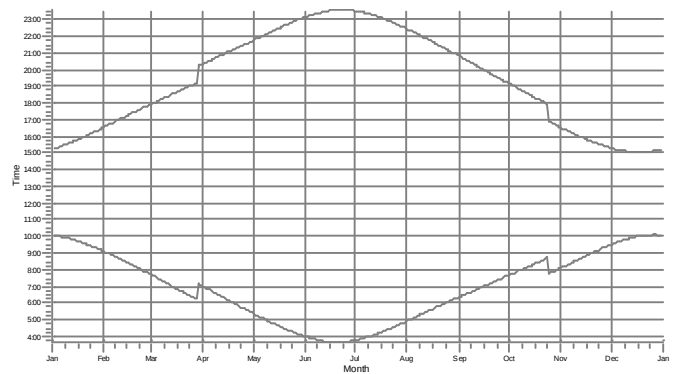
13.6.2014 17:25/2.8.579

SHADOW - Calendar, graphical**Calculation:** Pjelax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124 (real case, forest 20-20-15)

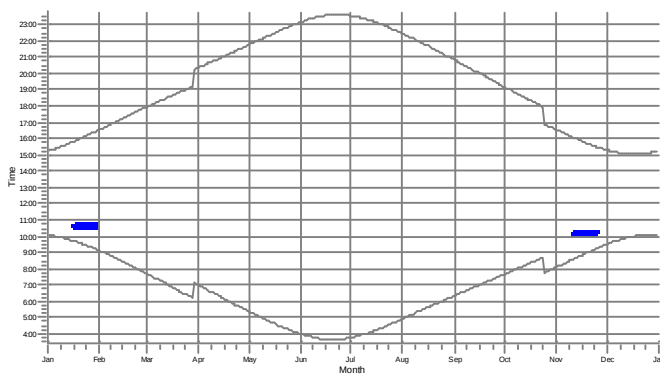
G: Bostad (Grannas)



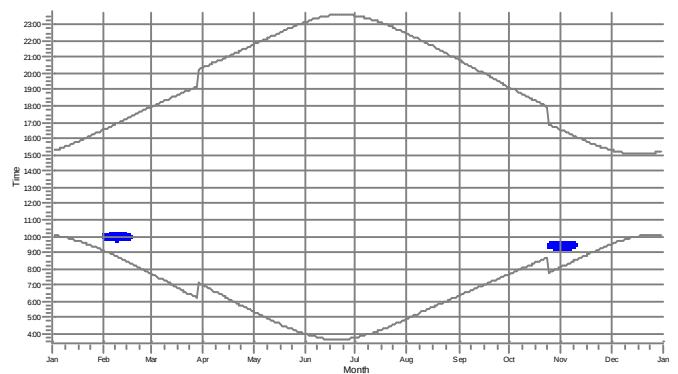
H: Bostad (Kristinestadsvägen 1268)



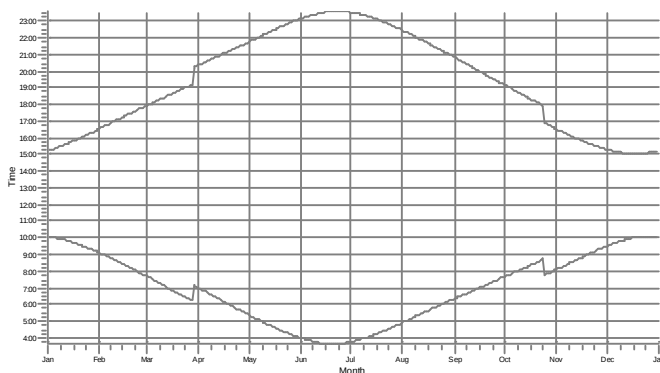
I: Bostad (Skrattnäs vägen 973)



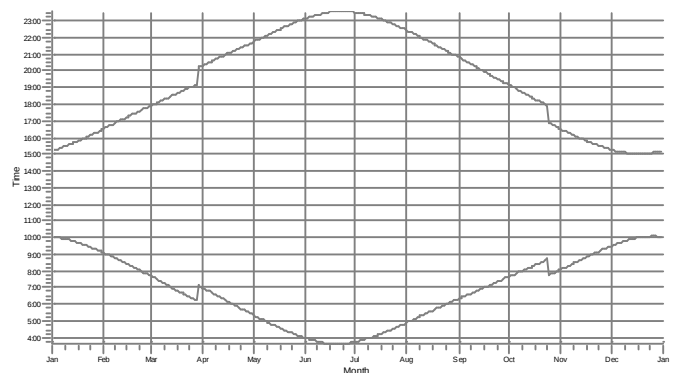
J: Bostad (Sörhannus)



K: Fritidsbostad (Klobbskatan)



L: Fritidsbostad (?)



WTGs

3: VESTAS V112 3075 112.0 IO! hub: 124,0 m (TOT: 180,0 m) (959)

Project:
Pjelax

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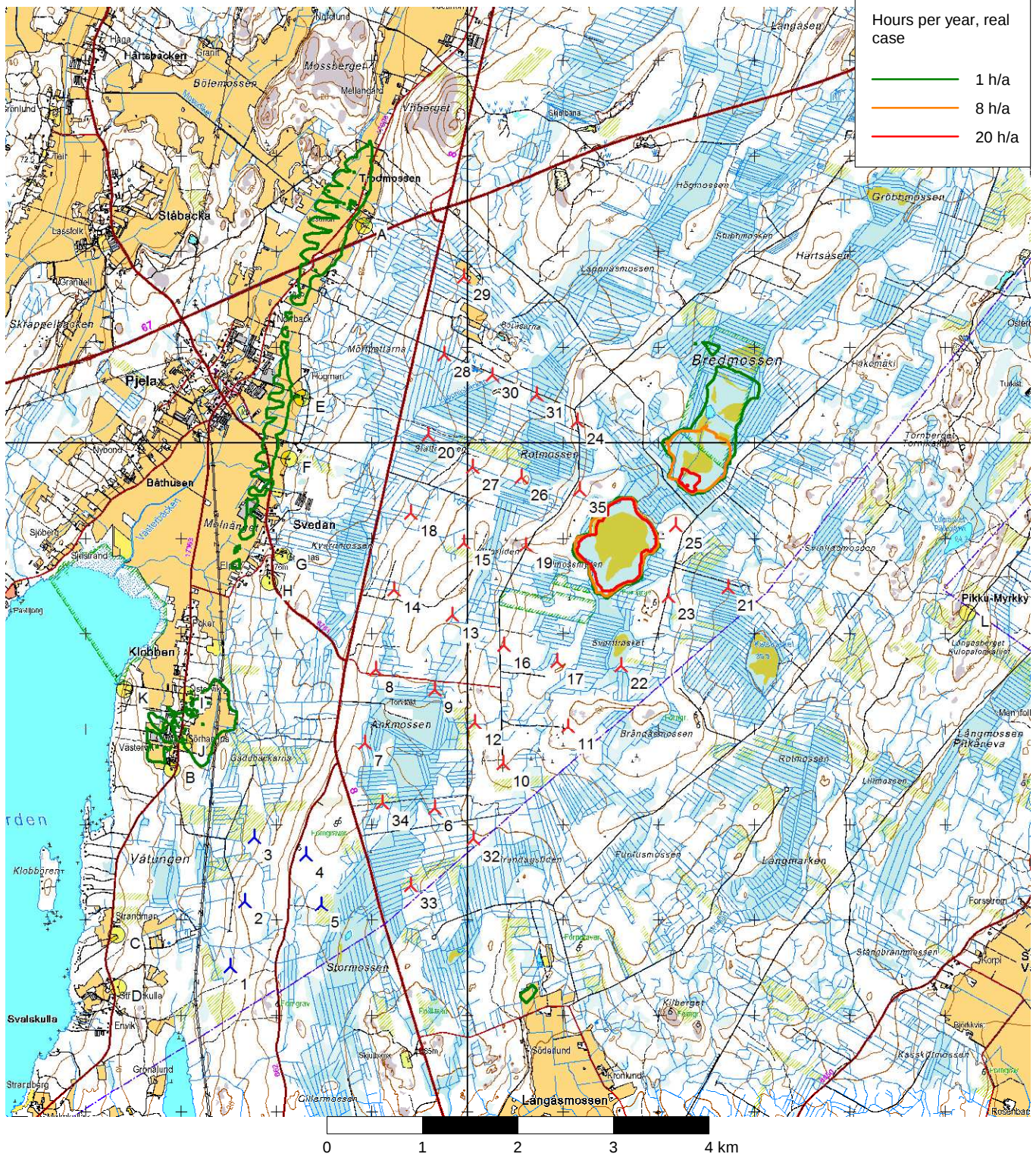
Hans Vadback / hans.vadback@fcg.fi

Calculated:
13.6.2014 17:25/2.8.579

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SHADOW - Map

Calculation: Pjelax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124 (real case, forest 20-20-15)



 Svalskulla V112 x 5 x HH124

 Pjelax N131 X 30 X HH144

 Bostad - Asuinrakennus

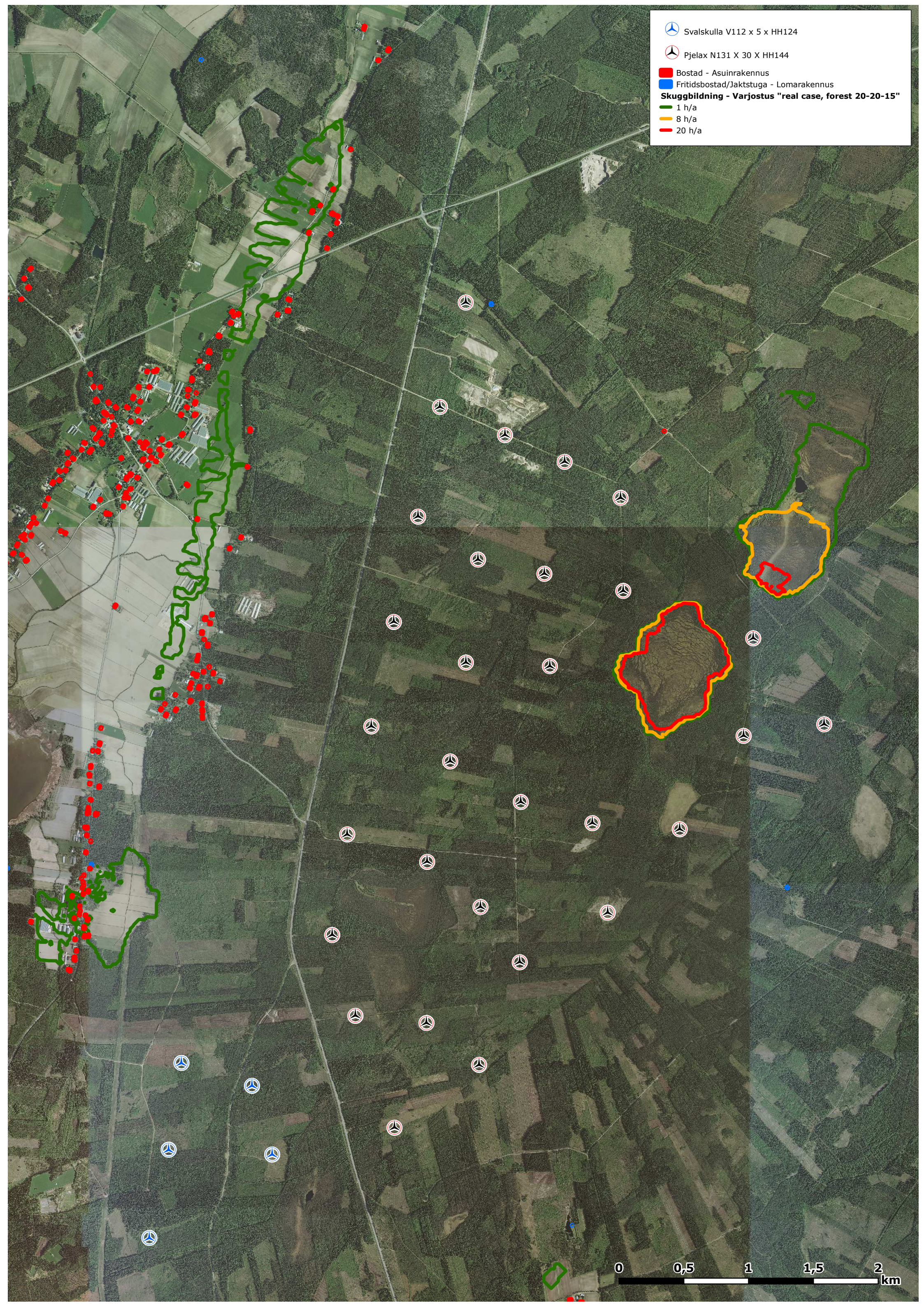
 Fritidsbostad/Jaktstuga - Lomarakennus

Skuggbildning - Varjostus "real case, forest 20-20-15"

 1 h/a

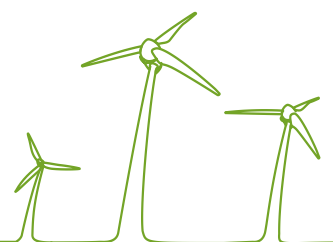
 8 h/a

 20 h/a



ALT 2.

Pjelax V126 x 23 x HH137 + Svalskulla V112 x 5 x HH124
real case, forest 20-20-15



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Calculated:

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SHADOW - Main Result

Calculation: Pjelax V126 x 23 x HH137 + Svalskulla V112 x 5 x HH124 (real case, forest 20-20-15)

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) [UMEA]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
S	1,02	2,84	3,78	6,14	8,62	9,94	7,42	5,13	4,32	3,43	1,58	0,96

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

Pjelax mätmast 7.11.2012->

Operational time

	N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
Hours	488	593	537	505	706	378	1238	1457	716	638	727	637	8621

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: Tjock_Pjelax_korkeuskäyrät.wpo (1)

Area object(s) used in calculation:

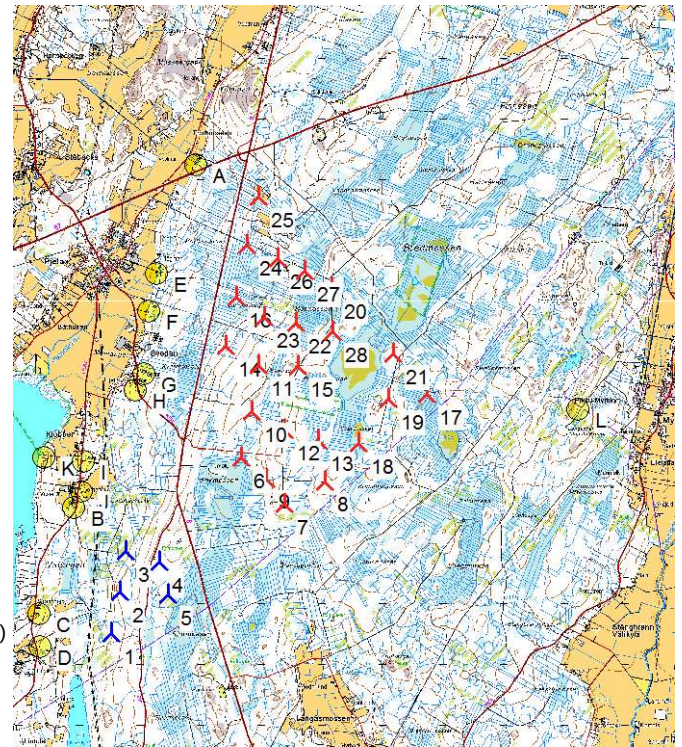
ZVI rakennuskanta

ZVI Corine

Obstacles not used in calculation

Eye height: 1,5 m

Grid resolution: 10,0 m



Scale 1:125 000

▲ New WTG

● Shadow receptor

WTGs

ETRS 89 Zone: 35			Row data/Description	WTG type			Shadow data				
East	North	Z		Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM [RPM]
		[m]									
1	209 519	6 924 515	14,3 VESTAS V112 3075 ...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8
2	209 669	6 925 195	21,5 VESTAS V112 3075 ...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8
3	209 768	6 925 865	13,6 VESTAS V112 3075 ...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8
4	210 312	6 925 688	32,5 VESTAS V112 3075 ...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8
5	210 468	6 925 158	31,7 VESTAS V112 3075 ...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8
6	211 663	6 927 415	35,0 6	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
7	212 377	6 926 641	50,0 8	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
8	213 056	6 927 024	58,8 9	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
9	212 075	6 927 068	42,1 7	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
10	211 841	6 928 191	41,5 12	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
11	211 962	6 928 954	42,8 15	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
12	212 386	6 927 877	51,3 11	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
13	212 939	6 927 714	59,6 10	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
14	211 406	6 929 267	27,9 17	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
15	212 611	6 928 926	55,0 16	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
16	211 593	6 930 079	23,3 20	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
17	214 727	6 928 477	45,0 28	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
18	213 612	6 927 667	57,5 30	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
19	214 105	6 928 388	57,9 29	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
20	213 156	6 930 224	47,7 25	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
21	214 179	6 929 140	57,5 27	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
22	212 568	6 929 639	44,5 18	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
23	212 056	6 929 748	33,6 19	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
24	211 762	6 930 925	28,9 21	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
25	211 962	6 931 732	31,2 23	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
26	212 264	6 930 708	31,4 22	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
27	212 724	6 930 502	38,3 24	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
28	213 176	6 929 506	51,4 26	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0

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Calculated:

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SHADOW - Main Result

Calculation: Pjelax V126 x 23 x HH137 + Svaskulla V112 x 5 x HH124 (real case, forest 20-20-15)

Shadow receptor-Input

No.	Name	ETRS 89 Zone: 35			Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
		East	North	Z						
				[m]	[m]	[m]	[m]	[°]	[°]	
A	Bostad (Kullström)	210 919	6 932 257	14,1	5,0	5,0	1,0	0,0	0,0	"Green house mode"
B	Bostad (Nygård)	208 906	6 926 580	5,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
C	Fritidsbostad (Sjölund)	208 330	6 924 837	3,1	5,0	5,0	1,0	0,0	0,0	"Green house mode"
D	Bostad (Rönnlund)	208 344	6 924 294	10,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
E	Bostad (Östman)	210 277	6 930 461	6,7	5,0	5,0	1,0	0,0	0,0	"Green house mode"
F	Bostad (Östthagen)	210 137	6 929 833	6,2	5,0	5,0	1,0	0,0	0,0	"Green house mode"
G	Bostad (Grannas)	210 065	6 928 808	16,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
H	Bostad (Kristinestadsvägen 1268)	209 928	6 928 534	17,7	5,0	5,0	1,0	0,0	0,0	"Green house mode"
I	Bostad (Skrattnäs vägen 973)	209 062	6 927 362	5,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
J	Bostad (Sörhannus)	209 038	6 926 853	5,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
K	Fritidsbostad (Klobbskatan)	208 413	6 927 416	9,1	5,0	5,0	1,0	0,0	0,0	"Green house mode"
L	Fritidsbostad (?)	217 234	6 928 218	64,5	5,0	5,0	1,0	0,0	0,0	"Green house mode"

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values
		Shadow hours per year [h/year]
A	Bostad (Kullström)	0:00
B	Bostad (Nygård)	0:00
C	Fritidsbostad (Sjölund)	0:00
D	Bostad (Rönnlund)	0:00
E	Bostad (Östman)	0:00
F	Bostad (Östthagen)	0:00
G	Bostad (Grannas)	0:00
H	Bostad (Kristinestadsvägen 1268)	0:00
I	Bostad (Skrattnäs vägen 973)	0:53
J	Bostad (Sörhannus)	1:49
K	Fritidsbostad (Klobbskatan)	0:00
L	Fritidsbostad (?)	0:00

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

No.	Name	Worst case	Expected
		[h/year]	[h/year]
1	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (957)	0:00	0:00
2	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (958)	0:00	0:00
3	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (959)	16:47	2:42
4	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (960)	0:00	0:00
5	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (961)	0:00	0:00
6	6	0:00	0:00
7	7	0:00	0:00
8	8	0:00	0:00
9	9	0:00	0:00
10	10	0:00	0:00
11	11	0:00	0:00
12	12	0:00	0:00
13	13	0:00	0:00
14	14	0:00	0:00
15	15	0:00	0:00
16	16	0:00	0:00
17	17	0:00	0:00
18	18	0:00	0:00
19	19	0:00	0:00
20	20	0:00	0:00
21	21	0:00	0:00
22	22	0:00	0:00

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Calculated:

13.6.2014 16:15/2.8.579

SHADOW - Main Result**Calculation:** Pjelax V126 x 23 x HH137 + Svaskulla V112 x 5 x HH124 (real case, forest 20-20-15)

...continued from previous page

No.	Name	Worst case	Expected
		[h/year]	[h/year]
23	19	0:00	0:00
24	21	0:00	0:00
25	23	0:00	0:00
26	22	0:00	0:00
27	24	0:00	0:00
28	26	0:00	0:00

Project:

Pjelax

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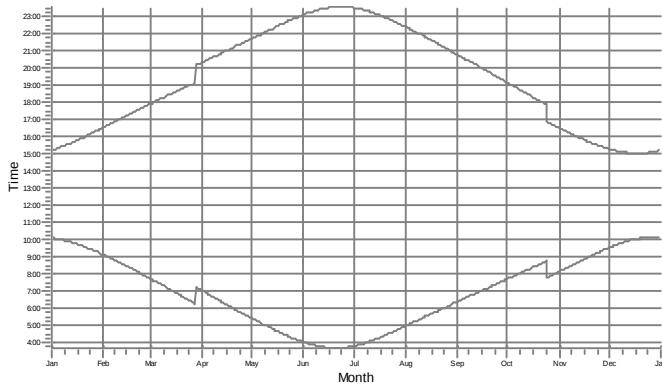
Hans Vadbäck / hans.vadback@fcg.fi

Calculated:

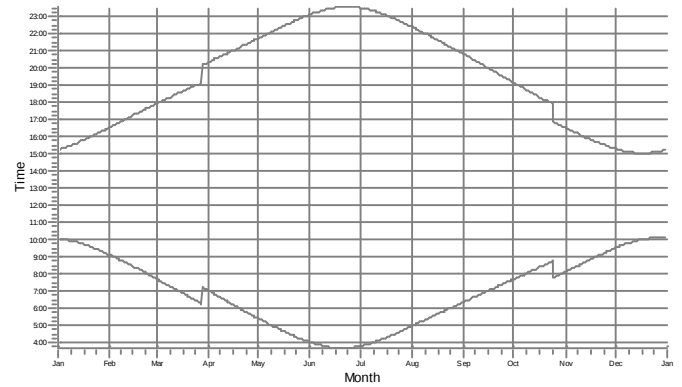
13.6.2014 16:15/2.8.579

SHADOW - Calendar, graphical**Calculation:** Pjelax V126 x 23 x HH137 + Svalskulla V112 x 5 x HH124 (real case, forest 20-20-15)

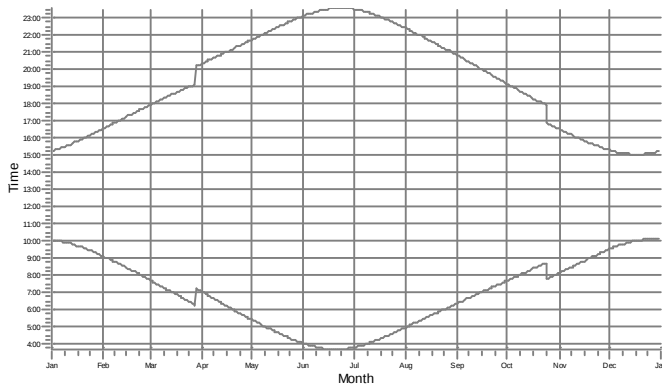
A: Bostad (Kullström)



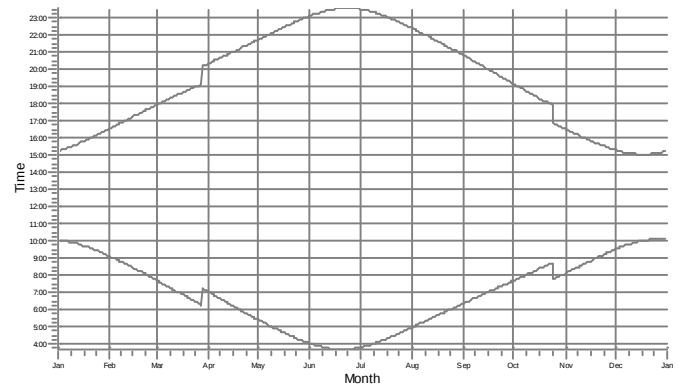
B: Bostad (Nygård)



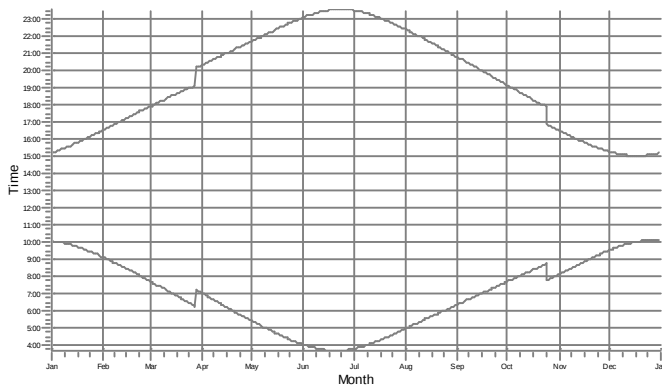
C: Fritidsbostad (Sjölund)



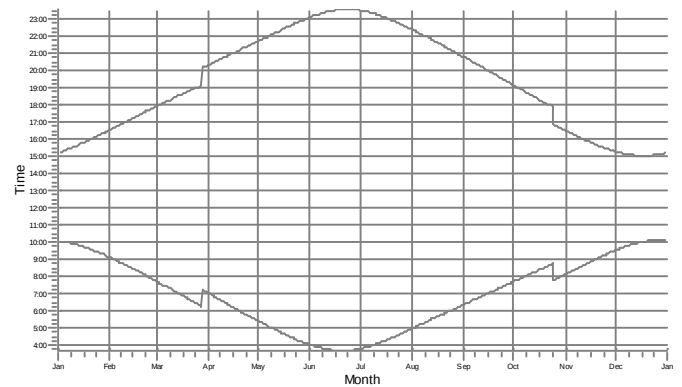
D: Bostad (Rönnlund)



E: Bostad (Östman)



F: Bostad (Östgård)



WTGs

Project:

Pjelax

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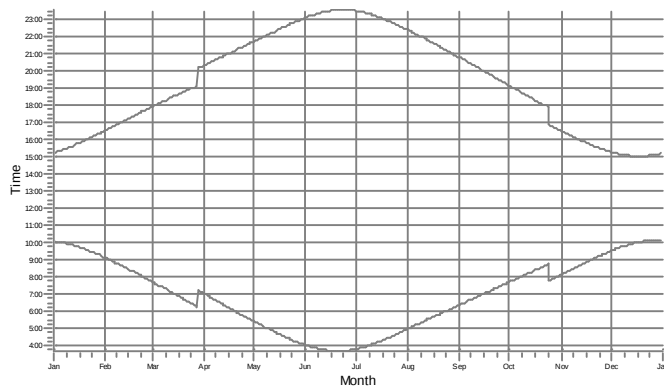
Calculated:

13.6.2014 16:15/2.8.579

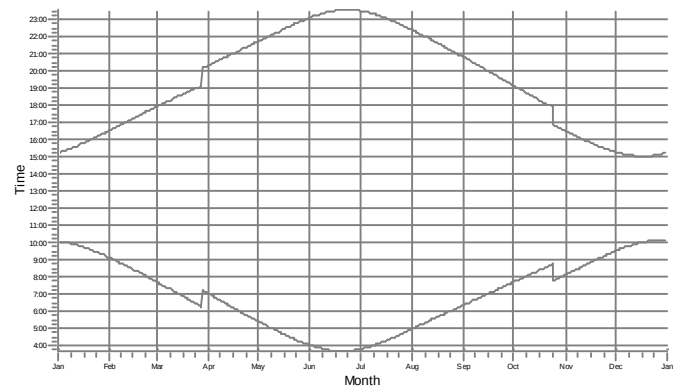
SHADOW - Calendar, graphical

Calculation: Pjelax V126 x 23 x HH137 + Svalskulla V112 x 5 x HH124 (real case, forest 20-20-15)

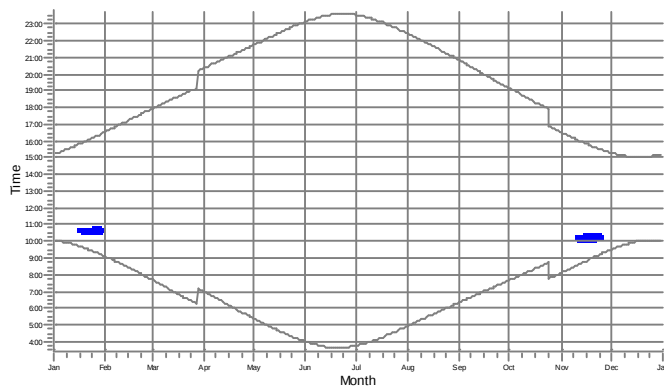
G: Bostad (Grannas)



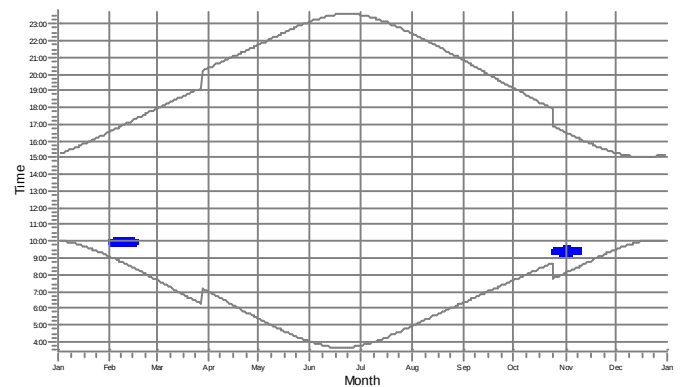
H: Bostad (Kristinestadvägen 1268)



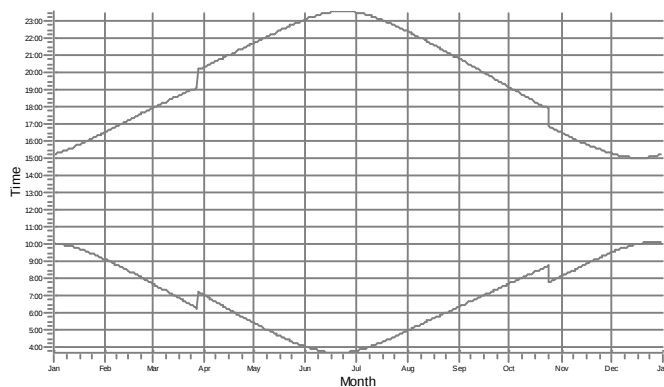
I: Bostad (Skrattnäsvägen 973)



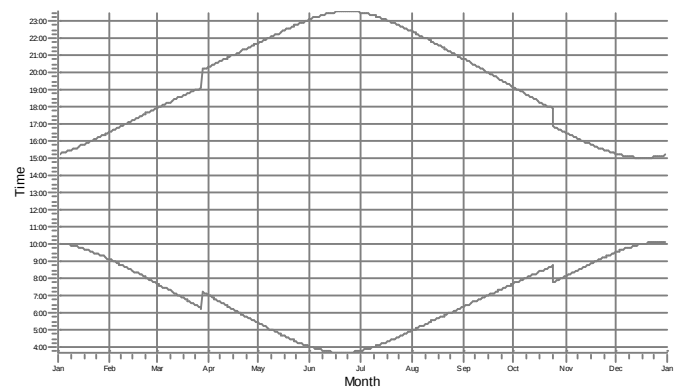
J: Bostad (Sörhannus)



K: Fritidsbostad (Klobbskatan)



L: Fritidsbostad (?)



WTGs

3: VESTAS V112 3075 112.0 IO! hub: 124.0 m (TOT: 180.0 m) (959)

Project:

Pjelax

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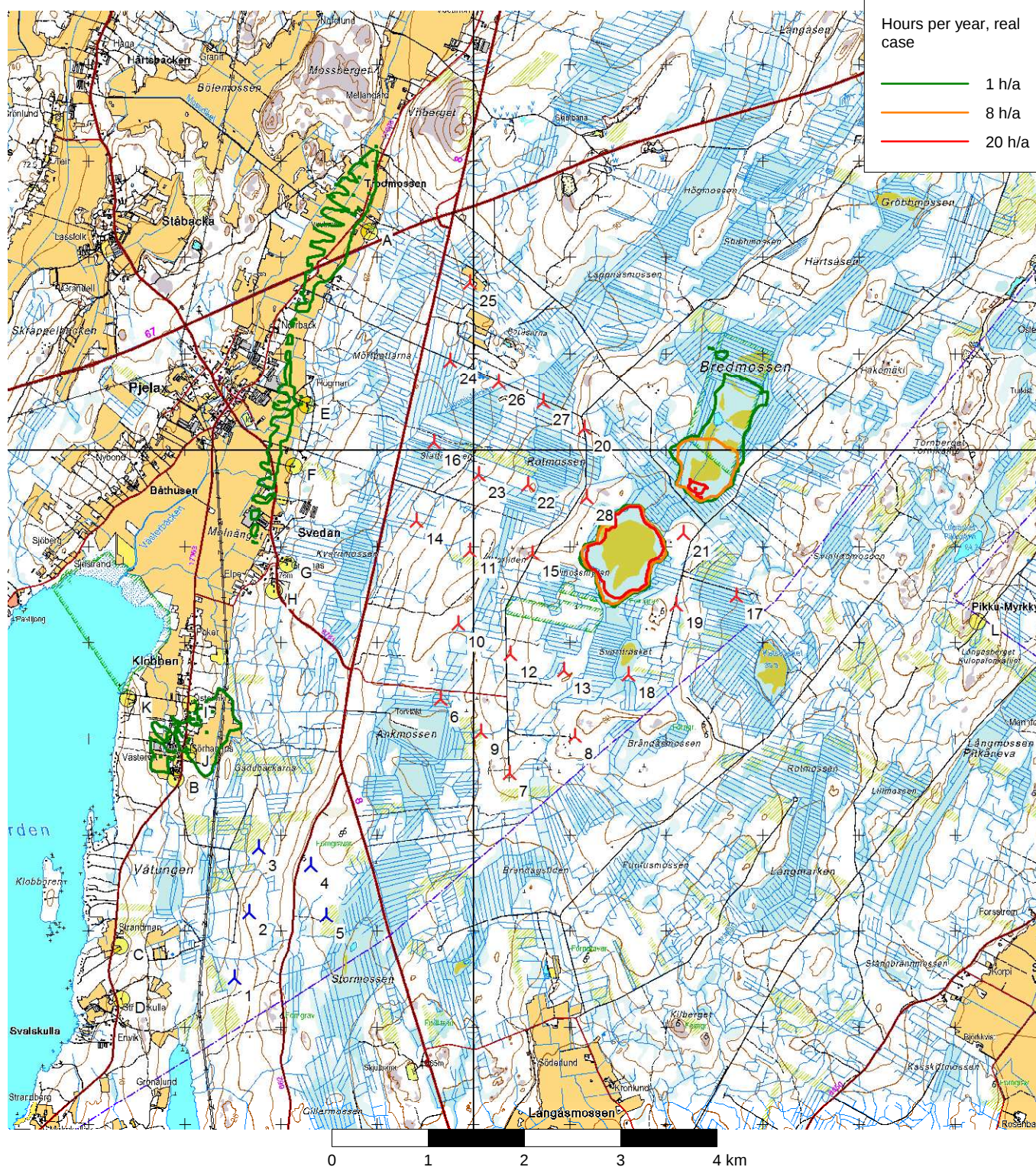
Hans Vadback / hans.vadback@fcg.fi

Calculated:

13.6.2014 16:15/2.8.579

SHADOW - Map

Calculation: Pjelax V126 x 23 x HH137 + Svalskulla V112 x 5 x HH124 (real case, forest 20-20-15)



Map: Maastokartta , Print scale 1:60 000, Map center ETRS 89 Zone: 35 East: 211 975 North: 6 928 266

New WTG

Shadow receptor

Flicker map level: Height Contours: Tjock_Pjelax_korkeuskäyrät.wpo (1)

 Svalskulla V112 x 5 x HH124

 Pjelax V126 X 23 X HH137

 Bostad - Asuinrakennus

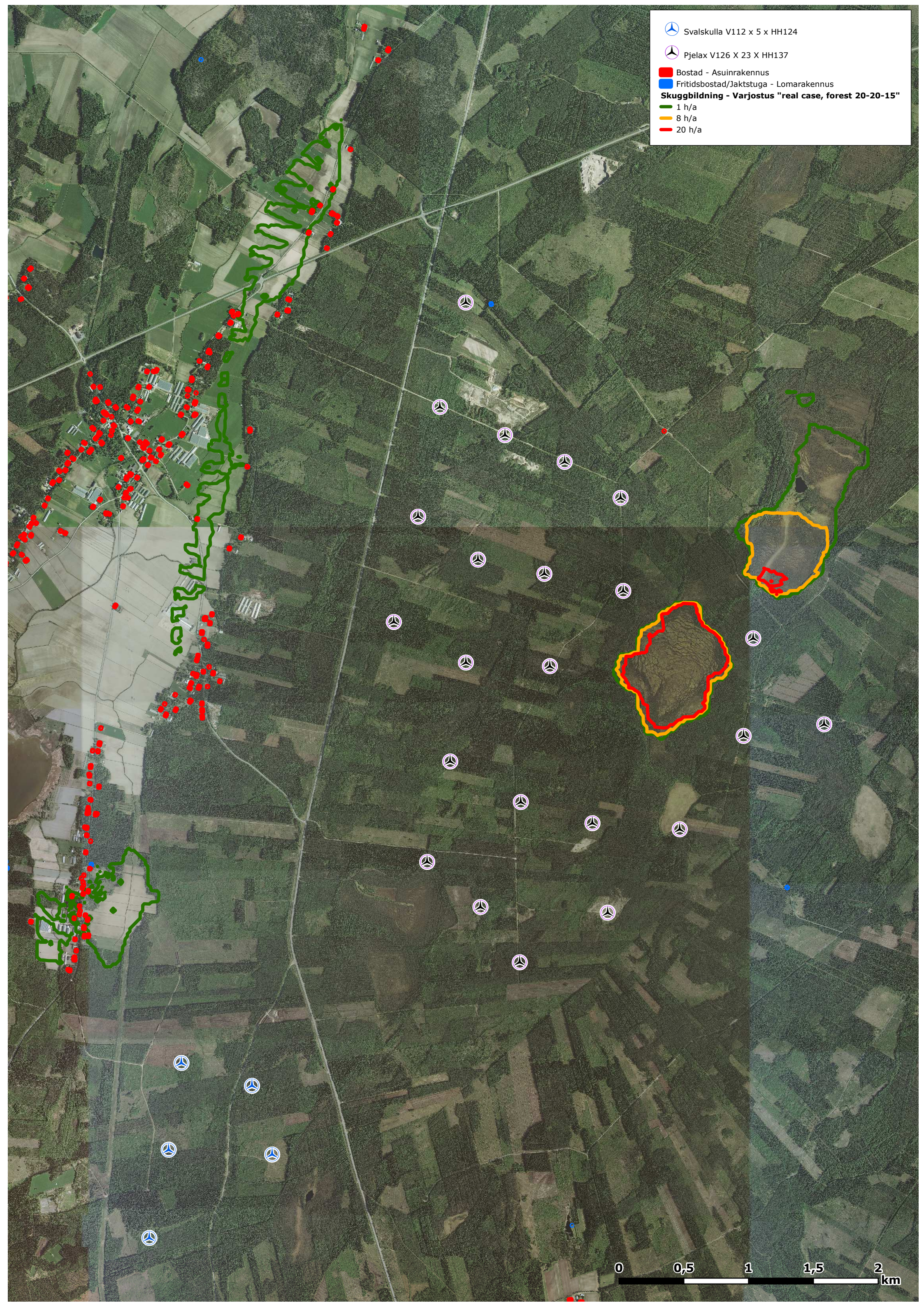
 Fritidsbostad/Jaktstuga - Lomarakennus

Skuggbildning - Varjostus "real case, forest 20-20-15"

 1 h/a

 8 h/a

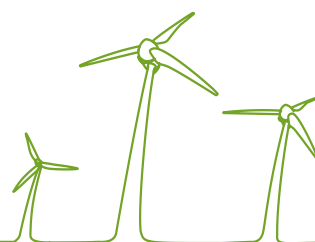
 20 h/a



SAMMANTAGNA KONSEKVENSER

Pjelax N131 x 30 x HH144
Svalskulla V112 x 5 x HH124
Böle
Kristinestad Norr
Gamla Närpesvägen

real case, no forest



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Calculated:
17.6.2014 11:38/2.8.579**FCG**
SUUNNITTELU JA TEKNIikka**SHADOW - Main Result****Calculation:** Pjelax N131 x 30 x HH144 + Svaskulla V112 x 5 x HH124 + Böle + Kristinestad Norr + Gamla Närpesvägen (real case, no forest)**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) [UMEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,02	2,84	3,78	6,14	8,62	9,94	7,42	5,13	4,32	3,43	1,58	0,96

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

Pjelax mätmast 7.11.2012->

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
484	587	532	500	699	375	1 227	1 444	710	632	721	631	8 543

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

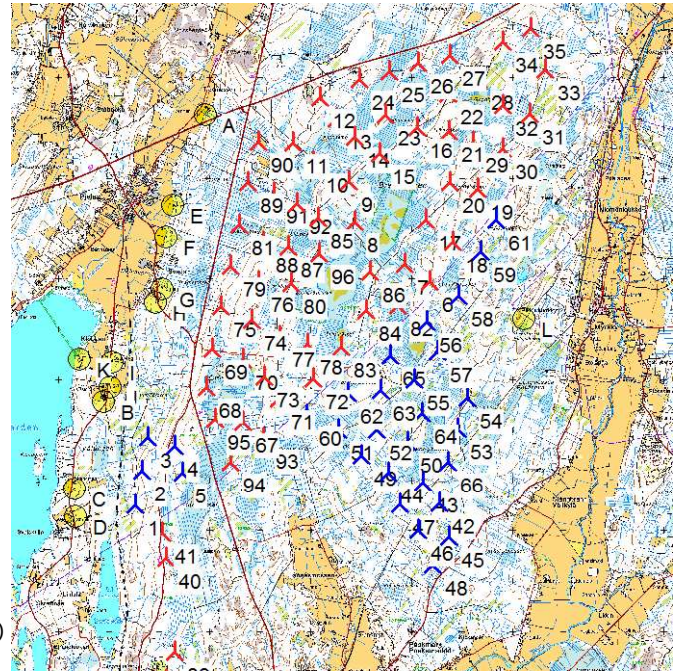
A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:

Height contours used: Tjock_Pjelax_korkeuskäyrät.wpo (1)

Obstacles not used in calculation

Eye height: 1,5 m

Grid resolution: 10,0 m



Scale 1:150 000

New WTG

Shadow receptor

WTGs

ETRS 89 Zone: 35				WTG type			Shadow data				
East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM [RPM]
		[m]									
1	209 519	6 924 515	14,3 VESTAS V112 3075 ...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8
2	209 669	6 925 195	21,5 VESTAS V112 3075 ...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8
3	209 768	6 925 865	13,6 VESTAS V112 3075 ...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8
4	210 312	6 925 688	32,5 VESTAS V112 3075 ...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8
5	210 468	6 925 158	31,7 VESTAS V112 3075 ...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8
6	215 364	6 928 951	61,3 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
7	214 868	6 929 311	53,7 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
8	213 874	6 930 140	55,0 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
9	213 751	6 930 944	47,8 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
10	213 057	6 931 331	40,0 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
11	212 656	6 931 710	42,8 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
12	213 192	6 932 608	62,1 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
13	213 513	6 932 187	47,0 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
14	213 882	6 931 816	43,3 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
15	214 363	6 931 492	49,6 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
16	215 109	6 932 001	55,0 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
17	215 294	6 930 177	54,9 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
18	215 824	6 929 738	62,7 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
19	216 324	6 930 795	75,6 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
20	215 753	6 930 925	62,5 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
21	215 749	6 931 935	67,4 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
22	215 727	6 932 678	54,5 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
23	214 488	6 932 264	51,2 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
24	213 974	6 932 965	55,0 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
25	214 561	6 933 125	47,5 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
26	215 135	6 933 288	47,5 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
27	215 761	6 933 442	45,0 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
28	216 342	6 932 962	60,0 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
29	216 214	6 931 726	65,0 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
30	216 806	6 931 590	67,7 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0

To be continued on next page...

Project:

Pjelas

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Calculated:

17.6.2014 11:38/2.8.579

SHADOW - Main Result

Calculation: Pjelas N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124 + Böle + Kristinestad Norr + Gamla Närpesvägen (real case, no forest)

...continued from previous page

ETRS 89 Zone: 35				WTG type			Shadow data				
East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM
			[m]								
31	217 346	6 932 271	62,4 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
32	216 803	6 932 453	60,3 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
33	217 651	6 933 149	57,7 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
34	216 815	6 933 714	57,5 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
35	217 365	6 933 970	55,0 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
36	210 447	6 920 587	13,7 GAMESA G128 4500 ...	Yes	GAMESA	G128-4 500	4 500	128,0	160,0	2 000	12,0
37	209 808	6 920 560	27,0 GAMESA G128 4500 ...	Yes	GAMESA	G128-4 500	4 500	128,0	160,0	2 000	12,0
38	210 129	6 921 065	27,5 GAMESA G128 4500 ...	Yes	GAMESA	G128-4 500	4 500	128,0	160,0	2 000	12,0
39	210 317	6 921 612	30,0 GAMESA G128 4500 ...	Yes	GAMESA	G128-4 500	4 500	128,0	160,0	2 000	12,0
40	210 137	6 923 467	28,0 GAMESA G128 4500 ...	Yes	GAMESA	G128-4 500	4 500	128,0	160,0	2 000	12,0
41	210 069	6 923 970	30,0 GAMESA G128 4500 ...	Yes	GAMESA	G128-4 500	4 500	128,0	160,0	2 000	12,0
42	215 558	6 924 552	45,0 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
43	215 221	6 924 972	37,1 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
44	214 542	6 925 165	37,1 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
45	215 734	6 923 892	41,9 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
46	215 130	6 924 016	35,0 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
47	214 774	6 924 538	40,0 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
48	215 426	6 923 340	36,3 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
49	214 006	6 925 508	44,1 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
50	214 914	6 925 780	40,0 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
51	213 556	6 926 021	50,0 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
52	214 319	6 926 023	46,2 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
53	215 910	6 926 044	42,5 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
54	216 102	6 926 646	42,6 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
55	215 056	6 927 004	42,4 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
56	215 311	6 928 165	45,0 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
57	215 518	6 927 564	45,0 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
58	215 932	6 928 676	62,5 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
59	216 373	6 929 550	72,5 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
60	212 920	6 926 300	46,7 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
61	216 688	6 930 177	75,0 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
62	213 745	6 926 742	57,7 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
63	214 387	6 926 800	55,3 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
64	215 214	6 926 349	39,3 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
65	214 588	6 927 497	44,9 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
66	215 726	6 925 375	39,1 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
67	211 658	6 926 173	36,0 3	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
68	210 931	6 926 851	35,0 5	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
69	211 046	6 927 628	35,0 13	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
70	211 663	6 927 415	35,0 6	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
71	212 377	6 926 641	50,0 8	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
72	213 056	6 927 024	58,8 9	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
73	212 075	6 927 068	42,1 7	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
74	211 841	6 928 191	41,5 12	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
75	211 233	6 928 461	33,8 14	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
76	211 962	6 928 954	42,8 15	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
77	212 386	6 927 877	51,3 11	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
78	212 939	6 927 714	59,6 10	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
79	211 406	6 929 267	27,9 17	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
80	212 611	6 928 926	55,0 16	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
81	211 593	6 930 079	23,3 20	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
82	214 727	6 928 477	45,0 28	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
83	213 612	6 927 667	57,5 30	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
84	214 105	6 928 388	57,9 29	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
85	213 156	6 930 224	47,7 25	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
86	214 179	6 929 140	57,5 27	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
87	212 568	6 929 639	44,5 18	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
88	212 056	6 929 748	33,6 19	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
89	211 762	6 930 925	28,9 21	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
90	211 962	6 931 732	31,2 23	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
91	212 264	6 930 708	31,4 22	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3

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Project:

Pjelax

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Calculated:

17.6.2014 11:38/2.8.579

SHADOW - Main Result

Calculation: Pjelax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124 + Böle + Kristinestad Norr + Gamla Närpesvägen (real case, no forest)

...continued from previous page

ETRS 89 Zone: 35				WTG type			Shadow data				
East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Calculation distance	RPM
		[m]					[kW]	[m]	[m]	[m]	[RPM]
92	212 724	6 930 502	38,3 24	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
93	212 064	6 925 850	39,4 2	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
94	211 412	6 925 364	33,5 1	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
95	211 109	6 926 227	35,0 4	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
96	213 176	6 929 506	51,4 26	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3

Shadow receptor-Input

ETRS 89 Zone: 35										
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	Bostad (Kullström)	210 919	6 932 257	14,1	5,0	5,0	1,0	0,0	0,0	"Green house mode"
B	Bostad (Nygård)	208 906	6 926 580	5,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
C	Fritidsbostad (Sjölund)	208 330	6 924 837	3,1	5,0	5,0	1,0	0,0	0,0	"Green house mode"
D	Bostad (Rönnlund)	208 344	6 924 294	10,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
E	Bostad (Östman)	210 277	6 930 461	6,7	5,0	5,0	1,0	0,0	0,0	"Green house mode"
F	Bostad (Östthag)	210 137	6 929 833	6,2	5,0	5,0	1,0	0,0	0,0	"Green house mode"
G	Bostad (Grannas)	210 065	6 928 808	16,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
H	Bostad (Kristinestadsvägen 1268)	209 928	6 928 534	17,7	5,0	5,0	1,0	0,0	0,0	"Green house mode"
I	Bostad (Skrattnäsvägen 973)	209 062	6 927 362	5,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
J	Bostad (Sörhannus)	209 038	6 926 853	5,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
K	Fritidsbostad (Klobbskatan)	208 413	6 927 416	9,1	5,0	5,0	1,0	0,0	0,0	"Green house mode"
L	Fritidsbostad (?)	217 234	6 928 218	64,5	5,0	5,0	1,0	0,0	0,0	"Green house mode"

Calculation Results

Shadow receptor

		Shadow, expected values
No.	Name	Shadow hours per year [h/year]
A	Bostad (Kullström)	3:35
B	Bostad (Nygård)	3:51
C	Fritidsbostad (Sjölund)	3:54
D	Bostad (Rönnlund)	7:52
E	Bostad (Östman)	4:59
F	Bostad (Östthag)	3:18
G	Bostad (Grannas)	6:10
H	Bostad (Kristinestadsvägen 1268)	6:27
I	Bostad (Skrattnäsvägen 973)	0:52
J	Bostad (Sörhannus)	1:48
K	Fritidsbostad (Klobbskatan)	0:00
L	Fritidsbostad (?)	1:48

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

No.	Name	Worst case [h/year]	Expected [h/year]
1	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (957)	17:25	3:26
2	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (958)	29:45	6:59
3	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (959)	26:40	4:39
4	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (960)	4:21	0:51
5	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (961)	0:00	0:00
6	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1026)	0:00	0:00
7	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1027)	0:00	0:00
8	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1028)	0:00	0:00
9	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1029)	0:00	0:00
10	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1030)	0:00	0:00

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Pjelax

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Calculated:

17.6.2014 11:38/2.8.579

SHADOW - Main Result

Calculation: Pjelax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124 + Böle + Kristinestad Norr + Gamla Närpesvägen (real case, no forest)

...continued from previous page

No.	Name	Worst case		Expected	
		[h/year]		[h/year]	
11	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1031)	0:00	0:00	0:00	0:00
12	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1032)	0:00	0:00	0:00	0:00
13	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1033)	0:00	0:00	0:00	0:00
14	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1034)	0:00	0:00	0:00	0:00
15	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1035)	0:00	0:00	0:00	0:00
16	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1036)	0:00	0:00	0:00	0:00
17	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1037)	0:00	0:00	0:00	0:00
18	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1038)	0:00	0:00	0:00	0:00
19	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1039)	0:00	0:00	0:00	0:00
20	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1040)	0:00	0:00	0:00	0:00
21	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1041)	0:00	0:00	0:00	0:00
22	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1042)	0:00	0:00	0:00	0:00
23	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1043)	0:00	0:00	0:00	0:00
24	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1044)	0:00	0:00	0:00	0:00
25	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1045)	0:00	0:00	0:00	0:00
26	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1046)	0:00	0:00	0:00	0:00
27	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1047)	0:00	0:00	0:00	0:00
28	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1048)	0:00	0:00	0:00	0:00
29	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1049)	0:00	0:00	0:00	0:00
30	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1050)	0:00	0:00	0:00	0:00
31	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1051)	0:00	0:00	0:00	0:00
32	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1052)	0:00	0:00	0:00	0:00
33	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1053)	0:00	0:00	0:00	0:00
34	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1054)	0:00	0:00	0:00	0:00
35	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1055)	0:00	0:00	0:00	0:00
36	GAMESA G128 4500 128.0 !O! hub: 160,0 m (TOT: 224,0 m) (1057)	0:00	0:00	0:00	0:00
37	GAMESA G128 4500 128.0 !O! hub: 160,0 m (TOT: 224,0 m) (1058)	0:00	0:00	0:00	0:00
38	GAMESA G128 4500 128.0 !O! hub: 160,0 m (TOT: 224,0 m) (1059)	0:00	0:00	0:00	0:00
39	GAMESA G128 4500 128.0 !O! hub: 160,0 m (TOT: 224,0 m) (1060)	0:00	0:00	0:00	0:00
40	GAMESA G128 4500 128.0 !O! hub: 160,0 m (TOT: 224,0 m) (1061)	3:52	0:43	0:00	0:00
41	GAMESA G128 4500 128.0 !O! hub: 160,0 m (TOT: 224,0 m) (1062)	9:00	1:41	0:00	0:00
42	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1115)	0:00	0:00	0:00	0:00
43	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1116)	0:00	0:00	0:00	0:00
44	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1117)	0:00	0:00	0:00	0:00
45	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1118)	0:00	0:00	0:00	0:00
46	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1119)	0:00	0:00	0:00	0:00
47	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1120)	0:00	0:00	0:00	0:00
48	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1121)	0:00	0:00	0:00	0:00
49	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1122)	0:00	0:00	0:00	0:00
50	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1123)	0:00	0:00	0:00	0:00
51	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1124)	0:00	0:00	0:00	0:00
52	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1125)	0:00	0:00	0:00	0:00
53	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1126)	0:00	0:00	0:00	0:00
54	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1127)	0:00	0:00	0:00	0:00
55	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1128)	0:00	0:00	0:00	0:00
56	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1129)	0:00	0:00	0:00	0:00
57	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1130)	0:00	0:00	0:00	0:00
58	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1131)	9:01	1:48	0:00	0:00
59	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1132)	0:00	0:00	0:00	0:00
60	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1133)	0:00	0:00	0:00	0:00
61	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1134)	0:00	0:00	0:00	0:00
62	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1137)	0:00	0:00	0:00	0:00
63	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1138)	0:00	0:00	0:00	0:00
64	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1139)	0:00	0:00	0:00	0:00
65	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1140)	0:00	0:00	0:00	0:00
66	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1141)	0:00	0:00	0:00	0:00
67	3	0:00	0:00	0:00	0:00
68	5	0:00	0:00	0:00	0:00
69	13	16:18	3:10	0:00	0:00
70	6	0:00	0:00	0:00	0:00
71	8	0:00	0:00	0:00	0:00

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17.6.2014 11:38/2.8.579



SHADOW - Main Result

Calculation: Pjelax N131 x 30 x HH144 + Svaskulla V112 x 5 x HH124 + Böle + Kristinestad Norr + Gamla Närpesvägen (real case, no forest)

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
72	9	0:00	0:00
73	7	0:00	0:00
74	12	0:00	0:00
75	14	20:12	3:58
76	15	0:00	0:00
77	11	0:00	0:00
78	10	0:00	0:00
79	17	36:38	8:22
80	16	0:00	0:00
81	20	17:06	3:19
82	28	0:00	0:00
83	30	0:00	0:00
84	29	0:00	0:00
85	25	0:00	0:00
86	27	0:00	0:00
87	18	0:00	0:00
88	19	0:00	0:00
89	21	17:45	3:32
90	23	11:26	2:08
91	22	0:00	0:00
92	24	0:00	0:00
93	2	0:00	0:00
94	1	0:00	0:00
95	4	0:00	0:00
96	26	0:00	0:00

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Pjelax

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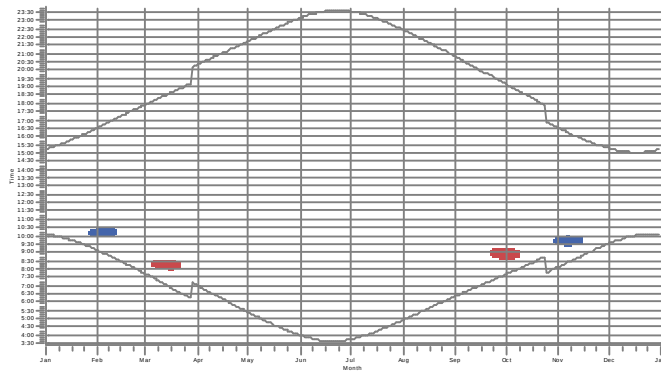
Hans Vadback / hans.vadback@fcg.fi
Calculated:
17.6.2014 11:38/2.8.579

FCG
SUUNNITTELU JA TEKNIikka

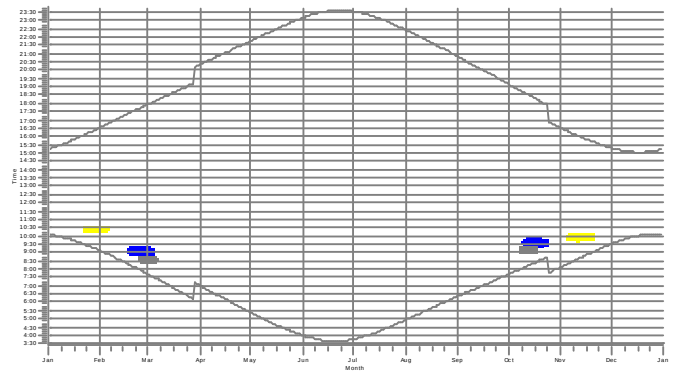
SHADOW - Calendar, graphical

Calculation: Pjelax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124 + Böle + Kristinestad Norr + Gamla Närpesvägen (real case, no forest)

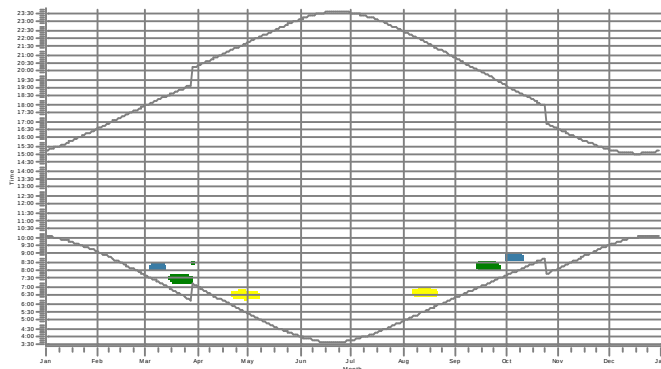
A: Bostad (Kullström)



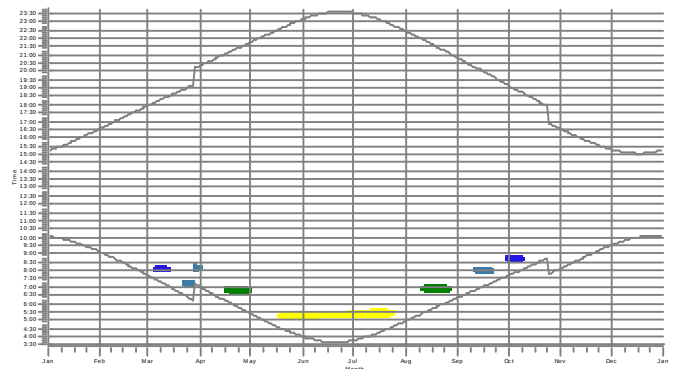
B: Bostad (Nygård)



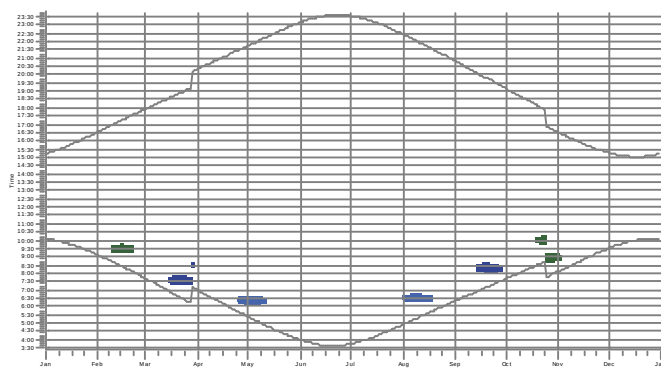
C: Fritidsbostad (Sjölund)



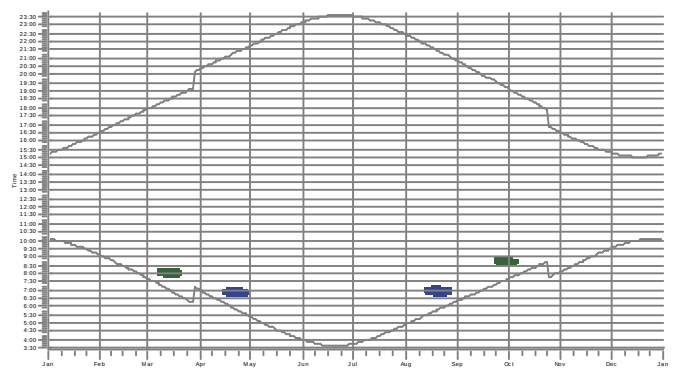
D: Bostad (Rönnlund)



E: Bostad (Östman)



F: Bostad (Östthag)



WTG's

1. VESTAS V112 3075 112.0 (OT) hub: 124.0 m (TOT: 180.0 m) (087)
2. VESTAS V112 3075 112.0 (OT) hub: 124.0 m (TOT: 180.0 m) (088)
3. VESTAS V112 3075 112.0 (OT) hub: 124.0 m (TOT: 180.0 m) (089)

4. VESTAS V112 3075 112.0 (OT) hub: 124.0 m (TOT: 180.0 m) (090)
40. GAMESA G128 6500 128.0 (OT) hub: 180.0 m (TOT: 224.0 m) (1085)
41. GAMESA G128 6500 128.0 (OT) hub: 180.0 m (TOT: 224.0 m) (1086)

79: 17
81: 20
89: 21

90: 23

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Pjelax

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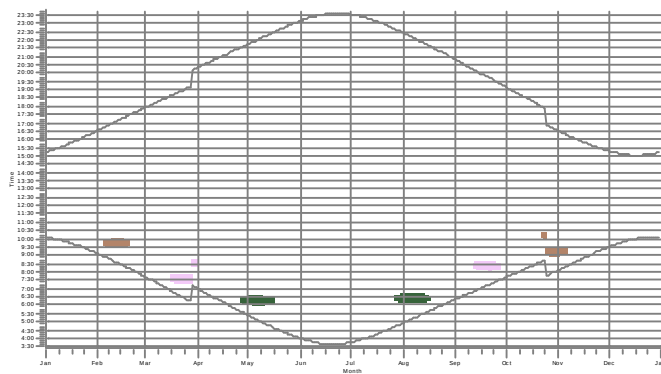
Calculated:
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FCG
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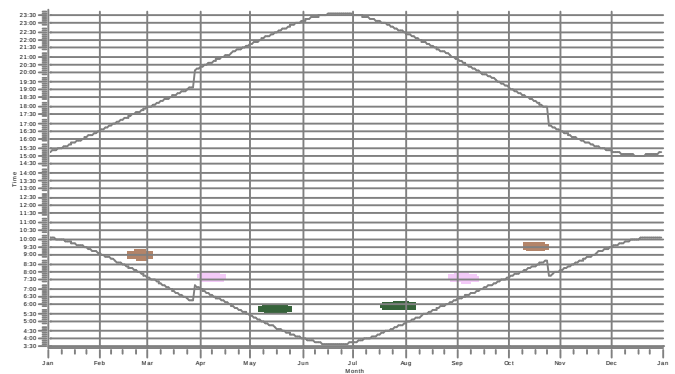
SHADOW - Calendar, graphical

Calculation: Pjelax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124 + Böle + Kristinestad Norr + Gamla Närpesvägen (real case, no forest)

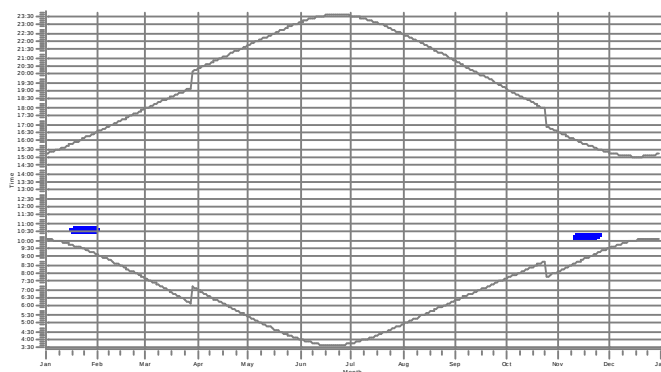
G: Bostad (Grannas)



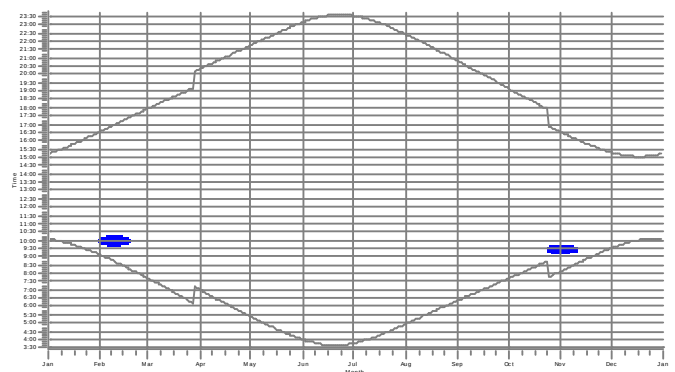
H: Bostad (Kristinestadvägen 1268)



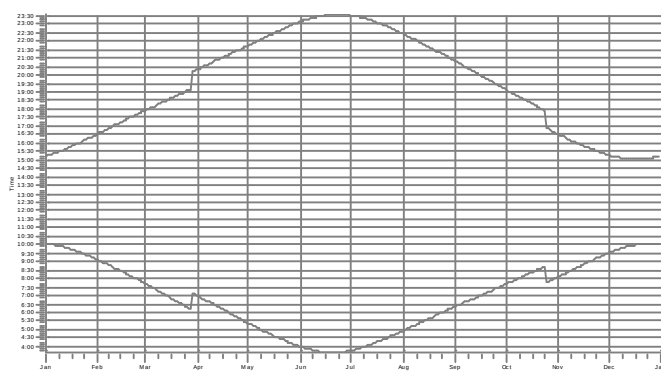
I: Bostad (Skrattnäs vägen 973)



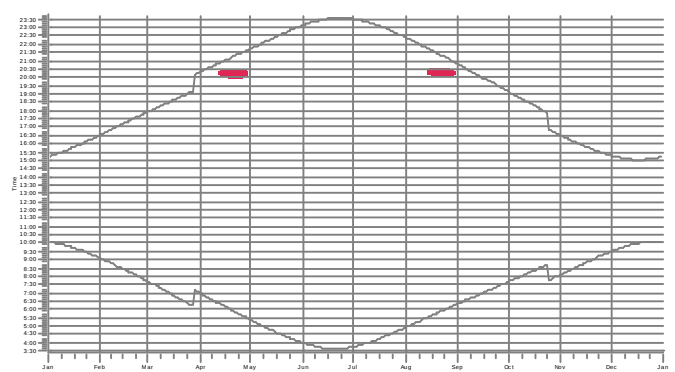
J: Bostad (Sörhannus)



K: Fritidsbostad (Klobbskatan)



L: Fritidsbostad (?)



WTG:

3 VESTAS V112 2075 112.0 (H: 124.0 m) (TOT: 180.0 m) (89)
SE VESTAS V126 3300 126.0 (H: 127.0 m) (TOT: 200.0 m) (131)

69:13

75:14

79:17

Project:

Pjælax

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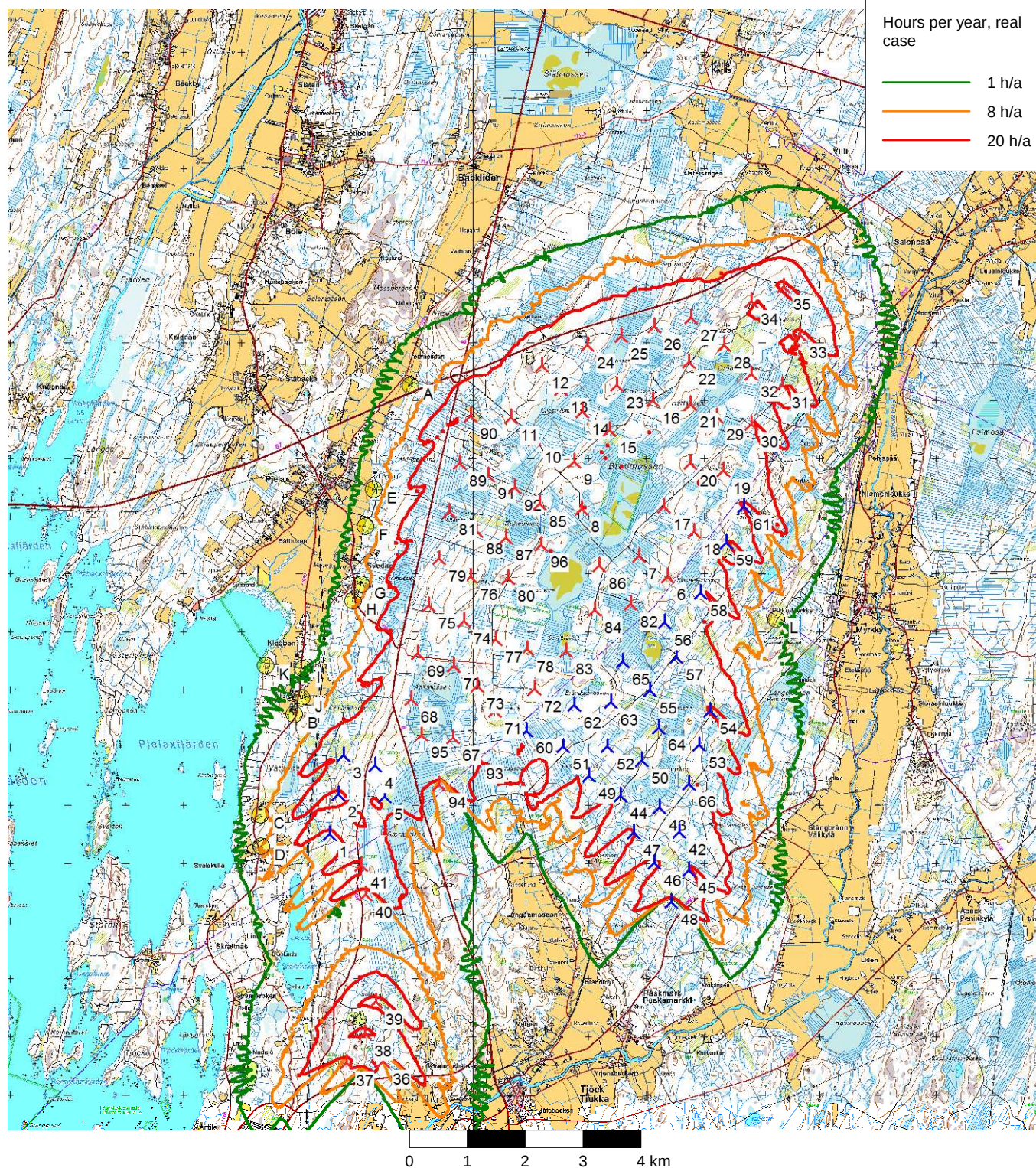
Hans Vadback / hans.vadback@fcg.fi

Calculated:

17.6.2014 11:38/2.8.579

SHADOW - Map

Calculation: Pjælax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124 + Böle + Kristinestad Norr + Gamla Närpesvägen (real case, no forest)



Map: Maastokartta, Print scale 1:100 000, Map center ETRS 89 Zone: 35 East: 211 975 North: 6 928 266

▲ New WTG

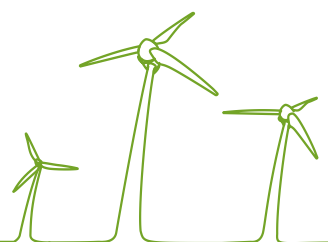
● Shadow receptor

Flicker map level: Height Contours: Tjock_Pjælax_korkeuskäyrät.wpo (1)

SAMMANTAGNA KONSEKVENSER

Pjelax N131 x 30 x HH144
Svalskulla V112 x 5 x HH124
Böle
Kristinestad Norr
Gamla Närpesvägen

real case, forest 20-20-15



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Calculated:
18.6.2014 14:51/2.8.579**FCG**
SUUNNITTELU JA TEKNIikka**SHADOW - Main Result****Calculation:** Pjelax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124 + Triventus Tjock + Innopower (real case, forest 20-20-15)**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) [UMEA]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,02	2,84	3,78	6,14	8,62	9,94	7,42	5,13	4,32	3,43	1,58	0,96	

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

Pjelax mätmast 7.11.2012->

Operational time

	N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
484	587	532	500	699	375	1 227	1 444	710	632	721	631	8 543	

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: Tjock_Pjelax_korkeuskäyrät.wpo (1)

Area object(s) used in calculation:

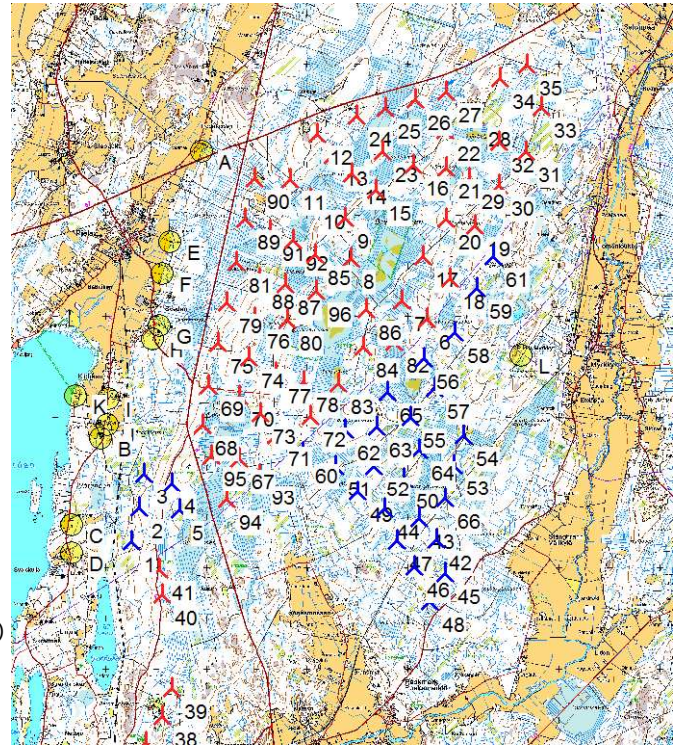
ZVI rakennuskanta

ZVI Corine

Obstacles not used in calculation

Eye height: 1,5 m

Grid resolution: 10,0 m



Scale 1:150 000

New WTG

Shadow receptor

WTGs

ETRS 89 Zone: 35				WTG type				Shadow data				
East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Calculation distance	RPM	
		[m]					[kW]	[m]	[m]	[m]	[RPM]	
1	209 519	6 924 515	14,3 VESTAS V112 3075 ...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8	
2	209 669	6 925 195	21,5 VESTAS V112 3075 ...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8	
3	209 768	6 925 865	13,6 VESTAS V112 3075 ...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8	
4	210 312	6 925 688	32,5 VESTAS V112 3075 ...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8	
5	210 468	6 925 158	31,7 VESTAS V112 3075 ...	Yes	VESTAS	V112-3 075	3 075	112,0	124,0	1 709	12,8	
6	215 364	6 928 951	61,3 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
7	214 868	6 929 311	53,7 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
8	213 874	6 930 140	55,0 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
9	213 751	6 930 944	47,8 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
10	213 057	6 931 331	40,0 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
11	212 656	6 931 710	42,8 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
12	213 192	6 932 608	62,1 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
13	213 513	6 932 187	47,0 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
14	213 882	6 931 816	43,3 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
15	214 363	6 931 492	49,6 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
16	215 109	6 932 001	55,0 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
17	215 294	6 930 177	54,9 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
18	215 824	6 929 738	62,7 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
19	216 324	6 930 795	75,6 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
20	215 753	6 930 925	62,5 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
21	215 749	6 931 935	67,4 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
22	215 727	6 932 678	54,5 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
23	214 488	6 932 264	51,2 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
24	213 974	6 932 965	55,0 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
25	214 561	6 933 125	47,5 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
26	215 135	6 933 288	47,5 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	
27	215 761	6 933 442	45,0 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0	

To be continued on next page...

Project:

Pjelax

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Calculated:

18.6.2014 14:51/2.8.579

SHADOW - Main Result

Calculation: Pjelax N131 x 30 x HH144 + Svaskulla V112 x 5 x HH124 + Triventus Tjock + Innopower (real case, forest 20-20-15)

...continued from previous page

ETRS 89 Zone: 35				WTG type			Shadow data				
East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM
			[m]								
28	216 342	6 932 962	60,0 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
29	216 214	6 931 726	65,0 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
30	216 806	6 931 590	67,7 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
31	217 346	6 932 271	62,4 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
32	216 803	6 932 453	60,3 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
33	217 651	6 933 149	57,7 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
34	216 815	6 933 714	57,5 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
35	217 365	6 933 970	55,0 VESTAS V126-3.3 Gr...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 715	0,0
36	210 447	6 920 587	13,7 GAMESA G128 4500 ...	Yes	GAMESA	G128-4 500	4 500	128,0	160,0	2 000	12,0
37	209 808	6 920 560	27,0 GAMESA G128 4500 ...	Yes	GAMESA	G128-4 500	4 500	128,0	160,0	2 000	12,0
38	210 129	6 921 065	27,5 GAMESA G128 4500 ...	Yes	GAMESA	G128-4 500	4 500	128,0	160,0	2 000	12,0
39	210 317	6 921 612	30,0 GAMESA G128 4500 ...	Yes	GAMESA	G128-4 500	4 500	128,0	160,0	2 000	12,0
40	210 137	6 923 467	28,0 GAMESA G128 4500 ...	Yes	GAMESA	G128-4 500	4 500	128,0	160,0	2 000	12,0
41	210 069	6 923 970	30,0 GAMESA G128 4500 ...	Yes	GAMESA	G128-4 500	4 500	128,0	160,0	2 000	12,0
42	215 558	6 924 552	45,0 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
43	215 221	6 924 972	37,1 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
44	214 542	6 925 165	37,1 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
45	215 734	6 923 892	41,9 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
46	215 130	6 924 016	35,0 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
47	214 774	6 924 538	40,0 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
48	215 426	6 923 340	36,3 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
49	214 006	6 925 508	44,1 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
50	214 914	6 925 780	40,0 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
51	213 556	6 926 021	50,0 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
52	214 319	6 926 023	46,2 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
53	215 910	6 926 044	42,5 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
54	216 102	6 926 646	42,6 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
55	215 056	6 927 004	42,4 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
56	215 311	6 928 165	45,0 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
57	215 518	6 927 564	45,0 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
58	215 932	6 928 676	62,5 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
59	216 373	6 929 550	72,5 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
60	212 920	6 926 300	46,7 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
61	216 688	6 930 177	75,0 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
62	213 745	6 926 742	57,7 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
63	214 387	6 926 800	55,3 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
64	215 214	6 926 349	39,3 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
65	214 588	6 927 497	44,9 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
66	215 726	6 925 375	39,1 VESTAS V126 3300 ...	Yes	VESTAS	V126-3 300	3 300	126,0	137,0	1 708	16,5
67	211 658	6 926 173	36,0 3	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
68	210 931	6 926 851	35,0 5	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
69	211 046	6 927 628	35,0 13	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
70	211 663	6 927 415	35,0 6	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
71	212 377	6 926 641	50,0 8	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
72	213 056	6 927 024	58,8 9	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
73	212 075	6 927 068	42,1 7	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
74	211 841	6 928 191	41,5 12	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
75	211 233	6 928 461	33,8 14	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
76	211 962	6 928 954	42,8 15	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
77	212 386	6 927 877	51,3 11	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
78	212 939	6 927 714	59,6 10	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
79	211 406	6 929 267	27,9 17	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
80	212 611	6 928 926	55,0 16	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
81	211 593	6 930 079	23,3 20	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
82	214 727	6 928 477	45,0 28	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
83	213 612	6 927 667	57,5 30	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
84	214 105	6 928 388	57,9 29	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
85	213 156	6 930 224	47,7 25	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
86	214 179	6 929 140	57,5 27	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
87	212 568	6 929 639	44,5 18	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
88	212 056	6 929 748	33,6 19	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3

To be continued on next page...

Project:

Pjelax

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Calculated:

18.6.2014 14:51/2.8.579

SHADOW - Main Result

Calculation: Pjelax N131 x 30 x HH144 + Svaskulla V112 x 5 x HH124 + Triventus Tjock + Innopower (real case, forest 20-20-15)

...continued from previous page

ETRS 89 Zone: 35				WTG type			Shadow data				
East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Calculation distance	RPM
		[m]					[kW]	[m]	[m]	[m]	[RPM]
89	211 762	6 930 925	28,9 21	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
90	211 962	6 931 732	31,2 23	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
91	212 264	6 930 708	31,4 22	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
92	212 724	6 930 502	38,3 24	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
93	212 064	6 925 850	39,4 2	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
94	211 412	6 925 364	33,5 1	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
95	211 109	6 926 227	35,0 4	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3
96	213 176	6 929 506	51,4 26	Yes	NORDEX	N131/3000-3 000	3 000	131,0	144,0	1 721	10,3

Shadow receptor-Input

ETRS 89 Zone: 35										
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	Bostad (Kullström)	210 919	6 932 257	14,1	5,0	5,0	1,0	0,0	0,0	"Green house mode"
B	Bostad (Nygård)	208 906	6 926 580	5,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
C	Fritidsbostad (Sjölund)	208 330	6 924 837	3,1	5,0	5,0	1,0	0,0	0,0	"Green house mode"
D	Bostad (Rönnlund)	208 344	6 924 294	10,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
E	Bostad (Östman)	210 277	6 930 461	6,7	5,0	5,0	1,0	0,0	0,0	"Green house mode"
F	Bostad (Östthag)	210 137	6 929 833	6,2	5,0	5,0	1,0	0,0	0,0	"Green house mode"
G	Bostad (Grannas)	210 065	6 928 808	16,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
H	Bostad (Kristinestadvägen 1268)	209 928	6 928 534	17,7	5,0	5,0	1,0	0,0	0,0	"Green house mode"
I	Bostad (Skrattnäsvägen 973)	209 062	6 927 362	5,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
J	Bostad (Sörhannus)	209 038	6 926 853	5,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
K	Fritidsbostad (Klobbskatan)	208 413	6 927 416	9,1	5,0	5,0	1,0	0,0	0,0	"Green house mode"
L	Fritidsbostad (?)	217 234	6 928 218	64,5	5,0	5,0	1,0	0,0	0,0	"Green house mode"

Calculation Results

Shadow receptor

		Shadow, expected values
No.	Name	Shadow hours per year [h/year]
A	Bostad (Kullström)	0:00
B	Bostad (Nygård)	0:00
C	Fritidsbostad (Sjölund)	0:00
D	Bostad (Rönnlund)	0:00
E	Bostad (Östman)	0:00
F	Bostad (Östthag)	0:00
G	Bostad (Grannas)	0:00
H	Bostad (Kristinestadvägen 1268)	0:00
I	Bostad (Skrattnäs vägen 973)	0:52
J	Bostad (Sörhannus)	1:48
K	Fritidsbostad (Klobbskatan)	0:00
L	Fritidsbostad (?)	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
1	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (957)	0:00	0:00
2	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (958)	0:00	0:00
3	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (959)	16:47	2:41
4	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (960)	0:00	0:00
5	VESTAS V112 3075 112.0 !O! hub: 124,0 m (TOT: 180,0 m) (961)	0:00	0:00
6	VESTAS V126-3.3 GridStrea 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1026)	0:00	0:00
7	VESTAS V126-3.3 GridStrea 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1027)	0:00	0:00

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Project:

Pjelax

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Calculated:

18.6.2014 14:51/2.8.579

SHADOW - Main Result**Calculation:** Pjelax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124 + Triventus Tjock + Innopower (real case, forest 20-20-15)

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
8	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1028)	0:00	0:00
9	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1029)	0:00	0:00
10	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1030)	0:00	0:00
11	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1031)	0:00	0:00
12	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1032)	0:00	0:00
13	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1033)	0:00	0:00
14	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1034)	0:00	0:00
15	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1035)	0:00	0:00
16	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1036)	0:00	0:00
17	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1037)	0:00	0:00
18	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1038)	0:00	0:00
19	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1039)	0:00	0:00
20	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1040)	0:00	0:00
21	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1041)	0:00	0:00
22	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1042)	0:00	0:00
23	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1043)	0:00	0:00
24	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1044)	0:00	0:00
25	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1045)	0:00	0:00
26	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1046)	0:00	0:00
27	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1047)	0:00	0:00
28	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1048)	0:00	0:00
29	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1049)	0:00	0:00
30	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1050)	0:00	0:00
31	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1051)	0:00	0:00
32	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1052)	0:00	0:00
33	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1053)	0:00	0:00
34	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1054)	0:00	0:00
35	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1055)	0:00	0:00
36	GAMESA G128 4500 128.0 !O! hub: 160,0 m (TOT: 224,0 m) (1057)	0:00	0:00
37	GAMESA G128 4500 128.0 !O! hub: 160,0 m (TOT: 224,0 m) (1058)	0:00	0:00
38	GAMESA G128 4500 128.0 !O! hub: 160,0 m (TOT: 224,0 m) (1059)	0:00	0:00
39	GAMESA G128 4500 128.0 !O! hub: 160,0 m (TOT: 224,0 m) (1060)	0:00	0:00
40	GAMESA G128 4500 128.0 !O! hub: 160,0 m (TOT: 224,0 m) (1061)	0:00	0:00
41	GAMESA G128 4500 128.0 !O! hub: 160,0 m (TOT: 224,0 m) (1062)	0:00	0:00
42	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1115)	0:00	0:00
43	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1116)	0:00	0:00
44	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1117)	0:00	0:00
45	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1118)	0:00	0:00
46	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1119)	0:00	0:00
47	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1120)	0:00	0:00
48	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1121)	0:00	0:00
49	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1122)	0:00	0:00
50	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1123)	0:00	0:00
51	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1124)	0:00	0:00
52	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1125)	0:00	0:00
53	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1126)	0:00	0:00
54	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1127)	0:00	0:00
55	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1128)	0:00	0:00
56	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1129)	0:00	0:00
57	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1130)	0:00	0:00
58	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1131)	0:00	0:00
59	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1132)	0:00	0:00
60	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1133)	0:00	0:00
61	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1134)	0:00	0:00
62	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1137)	0:00	0:00
63	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1138)	0:00	0:00
64	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1139)	0:00	0:00
65	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1140)	0:00	0:00
66	VESTAS V126 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1141)	0:00	0:00
67	3	0:00	0:00
68	5	0:00	0:00

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Project:

Pjelax

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SHADOW - Main Result

Calculation: Pjelax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124 + Triventus Tjock + Innopower (real case, forest 20-20-15)

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No.	Name	Worst case	Expected
		[h/year]	[h/year]
69	13	0:00	0:00
70	6	0:00	0:00
71	8	0:00	0:00
72	9	0:00	0:00
73	7	0:00	0:00
74	12	0:00	0:00
75	14	0:00	0:00
76	15	0:00	0:00
77	11	0:00	0:00
78	10	0:00	0:00
79	17	0:00	0:00
80	16	0:00	0:00
81	20	0:00	0:00
82	28	0:00	0:00
83	30	0:00	0:00
84	29	0:00	0:00
85	25	0:00	0:00
86	27	0:00	0:00
87	18	0:00	0:00
88	19	0:00	0:00
89	21	0:00	0:00
90	23	0:00	0:00
91	22	0:00	0:00
92	24	0:00	0:00
93	2	0:00	0:00
94	1	0:00	0:00
95	4	0:00	0:00
96	26	0:00	0:00

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Pjelax

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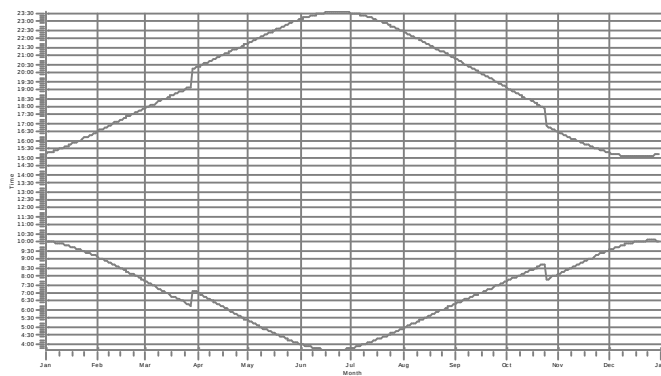
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18.6.2014 14:51/2.8.579

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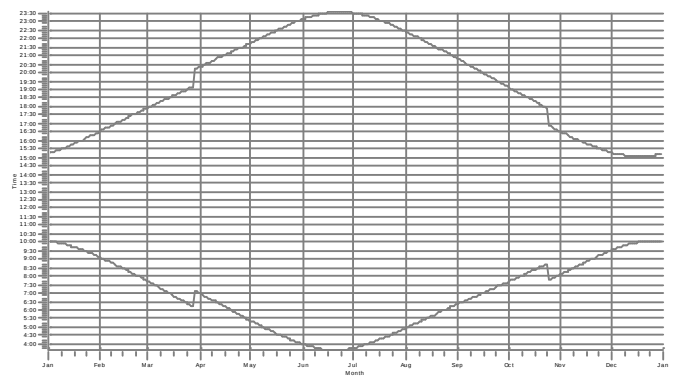
SHADOW - Calendar, graphical

Calculation: Pjelax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124 + Triventus Tjock + Innopower (real case, forest 20-20-15)

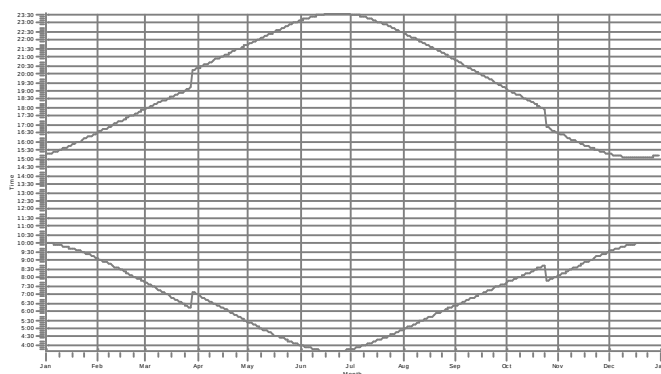
A: Bostad (Kullström)



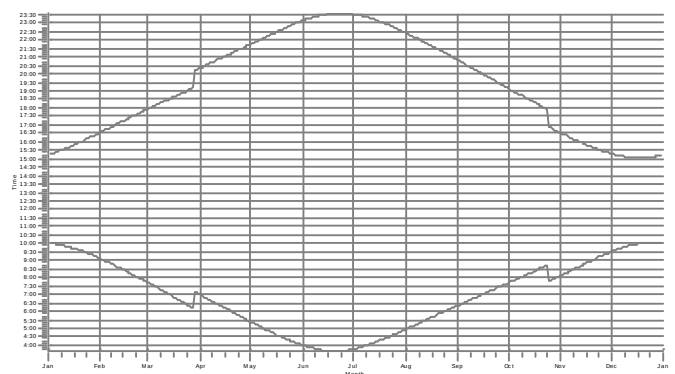
B: Bostad (Nygård)



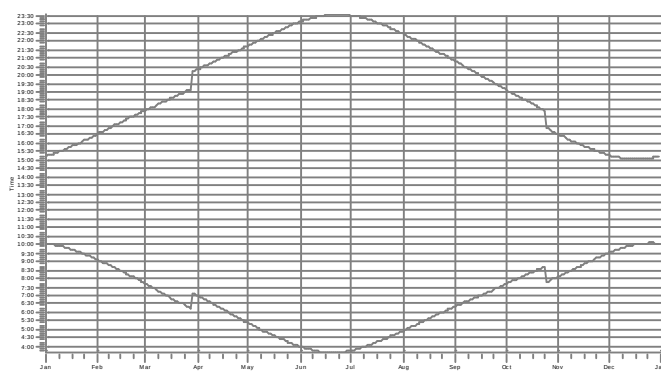
C: Fritidsbostad (Sjölund)



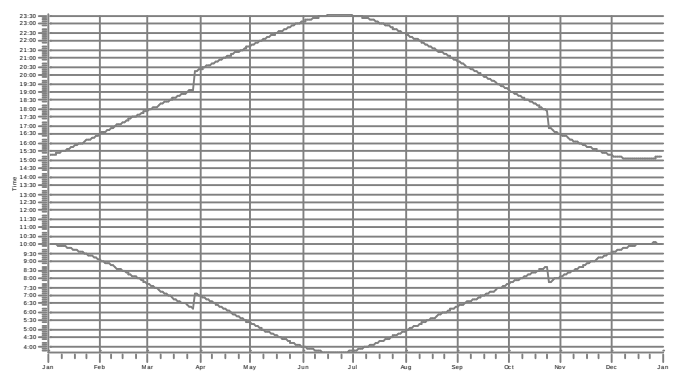
D: Bostad (Rönnlund)



E: Bostad (Östman)



F: Bostad (Östthag)



WTG1

Project:
Pjelax

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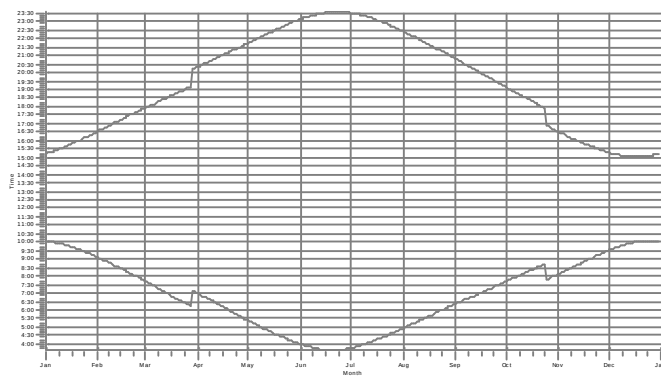
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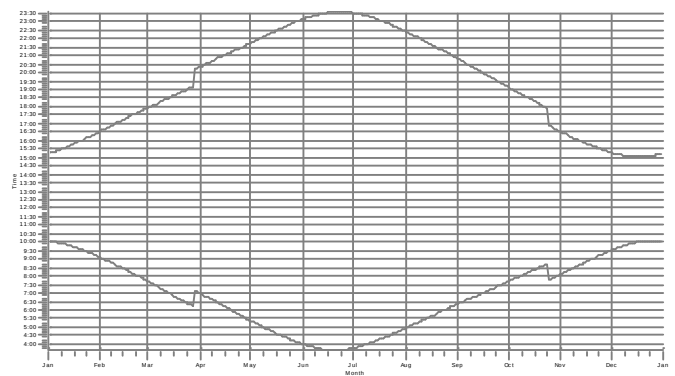
SHADOW - Calendar, graphical

Calculation: Pjelax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124 + Triventus Tjock + Innopower (real case, forest 20-20-15)

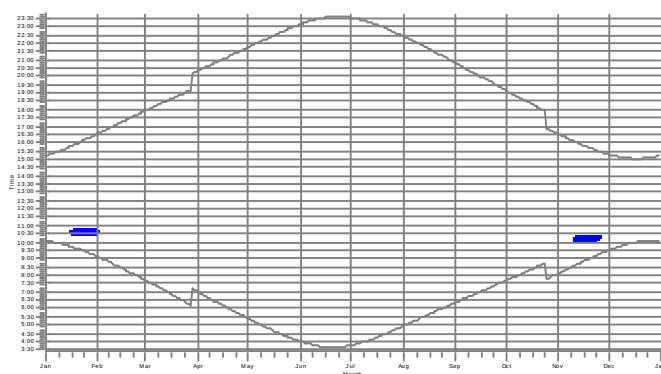
G: Bostad (Grannas)



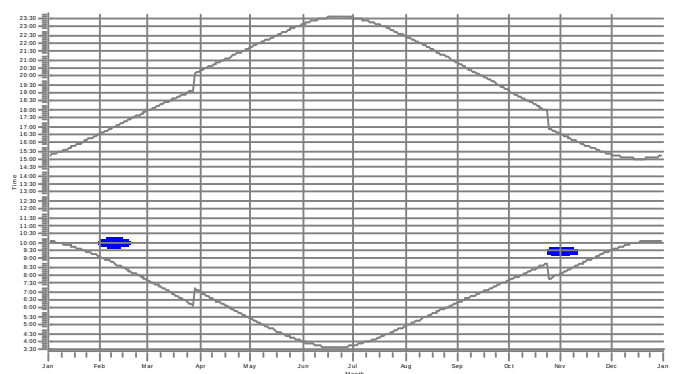
H: Bostad (Kristinestadsvägen 1268)



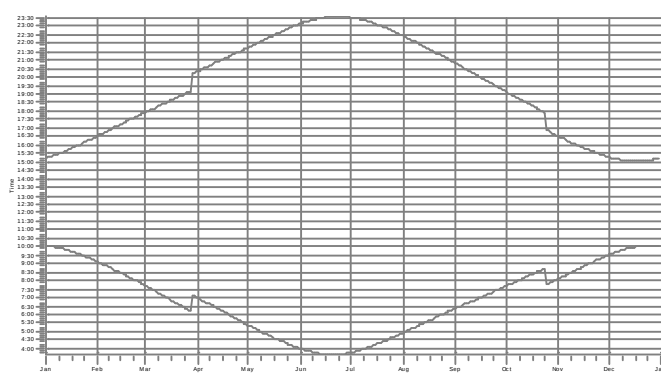
I: Bostad (Skrattnäs vägen 973)



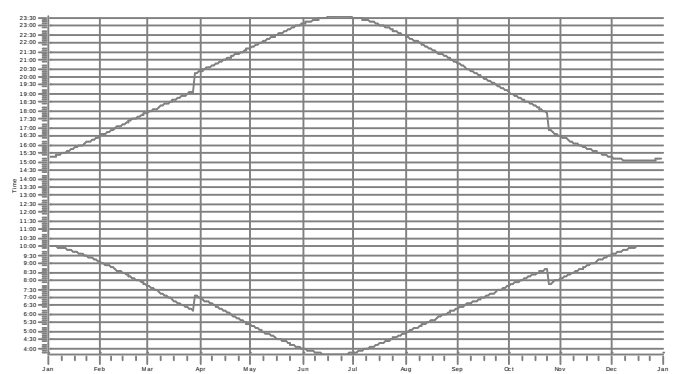
J: Bostad (Sörhannus)



K: Fritidsbostad (Klobbskatan)



L: Fritidsbostad (?)



WTG:

3 VESTAS V112 3075 112.0 (H: 124.0 m) (TOT: 180.0 m) (559)

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Pjelax

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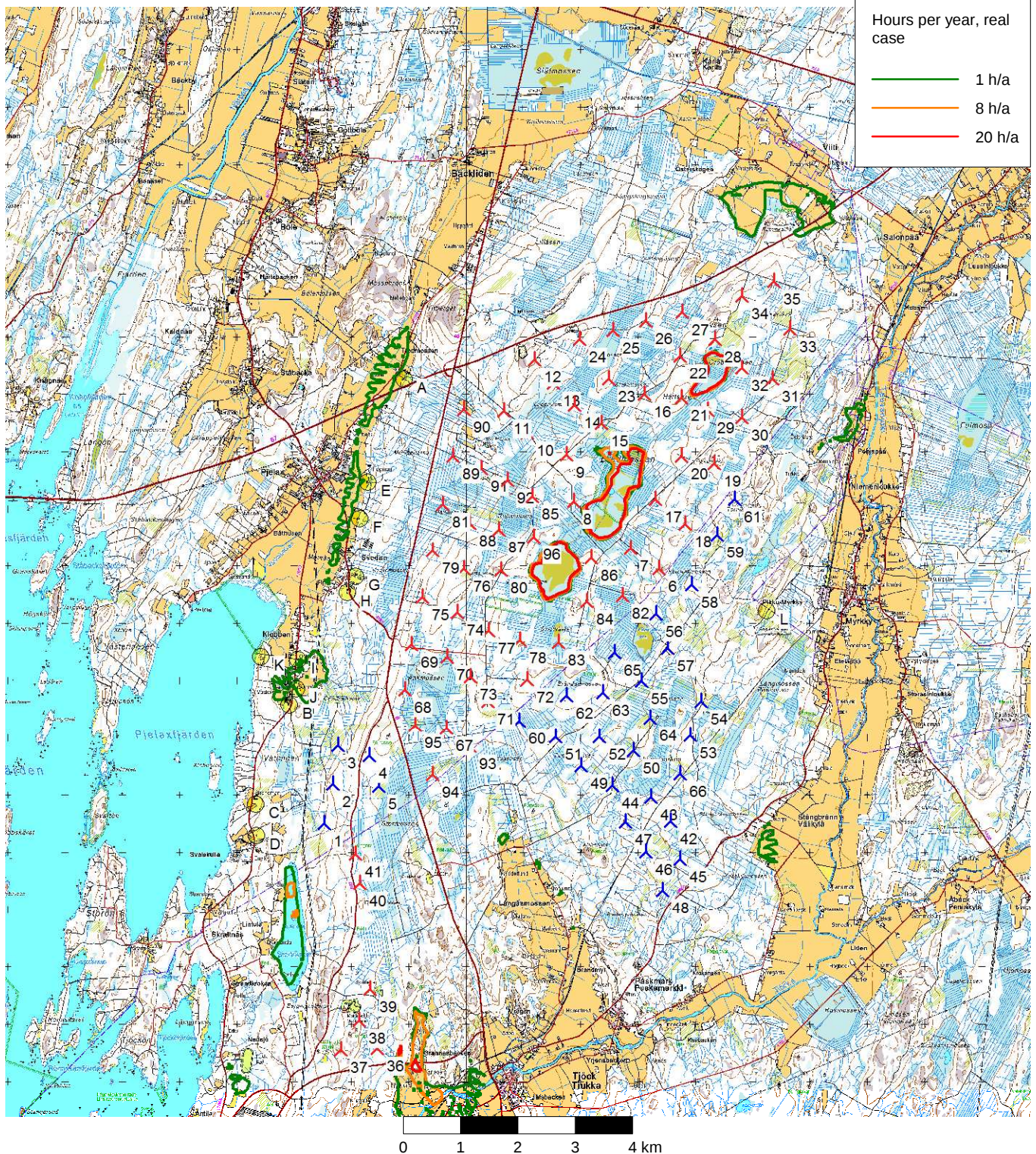
Hans Vadback / hans.vadback@fcg.fi

Calculated:
18.6.2014 14:51/2.8.579

FCG
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SHADOW - Map

Calculation: Pjelax N131 x 30 x HH144 + Svalskulla V112 x 5 x HH124 + Triventus Tjock + Innopower (real case, forest 20-20-15)



New WTG

Shadow receptor