

Bilaga 3B - Skuggor

Layout A

17 st Senvion M122, 3 MW

Totalhöjd 150 meter

Project:

140330_Grönhult_MKBKompl

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Företagsenhet 1002
SE-962 80 Jokkmokk

Jenny Longworth / jenny.longworth@vattenfall.com

Calculated:

2014-05-28 00:57/2.9.269

SHADOW - Main Result

Calculation: 140408 M122 17kv 89HH Shadow

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) [VAXJO /KRONOBER G]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.36	1.52	2.62	6.08	8.82	7.64	6.65	5.42	4.02	2.68	1.38	0.88

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

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Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
409	397	495	583	613	613	635	922	1,288	1,401	703	456	8,516

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: 120531_GH2mCont_2mScan_5mTop

Obstacles not used in calculation

Eye height: 1.5 m

Grid resolution: 10.0 m

WTGs

	Swedish RT90 2.5gonV 0:-15-RT90 (SE)				Row data/Description	WTG type			Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
	East	North	Z			Valid	Manufact.	Type-generator				Calculation distance [m]	RPM [RPM]
A1	1,358,439	6,365,530	272.8	[m]	REpower 3.0M122 3000 122....	Yes	REpower	3.0M122-3,000	3,000	122.0	89.0	2,500	0.0
A10	1,360,678	6,366,135	271.3		REpower 3.0M122 3000 122....	Yes	REpower	3.0M122-3,000	3,000	122.0	89.0	2,500	0.0
A11	1,360,231	6,364,523	281.8		REpower 3.0M122 3000 122....	Yes	REpower	3.0M122-3,000	3,000	122.0	89.0	2,500	0.0
A12	1,360,807	6,365,141	270.0		REpower 3.0M122 3000 122....	Yes	REpower	3.0M122-3,000	3,000	122.0	89.0	2,500	0.0
A13	1,361,225	6,365,690	270.0		REpower 3.0M122 3000 122....	Yes	REpower	3.0M122-3,000	3,000	122.0	89.0	2,500	0.0
A14	1,361,607	6,365,391	270.8		REpower 3.0M122 3000 122....	Yes	REpower	3.0M122-3,000	3,000	122.0	89.0	2,500	0.0
A15	1,361,214	6,364,706	277.0		REpower 3.0M122 3000 122....	Yes	REpower	3.0M122-3,000	3,000	122.0	89.0	2,500	0.0
A16	1,361,858	6,364,781	278.5		REpower 3.0M122 3000 122....	Yes	REpower	3.0M122-3,000	3,000	122.0	89.0	2,500	0.0
A17	1,361,557	6,364,376	281.9		REpower 3.0M122 3000 122....	Yes	REpower	3.0M122-3,000	3,000	122.0	89.0	2,500	0.0
A2	1,358,455	6,365,132	293.4		REpower 3.0M122 3000 122....	Yes	REpower	3.0M122-3,000	3,000	122.0	89.0	2,500	0.0
A3	1,358,269	6,364,731	311.1		REpower 3.0M122 3000 122....	Yes	REpower	3.0M122-3,000	3,000	122.0	89.0	2,500	0.0
A4	1,357,827	6,364,349	295.3		REpower 3.0M122 3000 122....	Yes	REpower	3.0M122-3,000	3,000	122.0	89.0	2,500	0.0
A5	1,357,826	6,363,944	268.4		REpower 3.0M122 3000 122....	Yes	REpower	3.0M122-3,000	3,000	122.0	89.0	2,500	0.0
A6	1,358,471	6,364,158	261.0		REpower 3.0M122 3000 122....	Yes	REpower	3.0M122-3,000	3,000	122.0	89.0	2,500	0.0
A7	1,358,818	6,364,562	287.1		REpower 3.0M122 3000 122....	Yes	REpower	3.0M122-3,000	3,000	122.0	89.0	2,500	0.0
A8	1,359,241	6,364,153	278.0		REpower 3.0M122 3000 122....	Yes	REpower	3.0M122-3,000	3,000	122.0	89.0	2,500	0.0
A9	1,360,036	6,365,568	270.0		REpower 3.0M122 3000 122....	Yes	REpower	3.0M122-3,000	3,000	122.0	89.0	2,500	0.0

Shadow receptor-Input

No.	Name	Swedish RT90 2.5gonV 0:-15-RT90 (SE)				Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode	
		East	North	Z	Width [m]					
1	1	1,354,439	6,365,935	231.9	5.0	5.0	2.0	0.0	0.0	"Green house mode"
2	2	1,354,303	6,365,863	228.0	5.0	5.0	2.0	0.0	0.0	"Green house mode"
3	3	1,355,719	6,366,777	230.0	5.0	5.0	2.0	0.0	0.0	"Green house mode"
4	4	1,355,823	6,366,785	228.0	5.0	5.0	2.0	0.0	0.0	"Green house mode"
5	5	1,356,247	6,366,773	220.8	5.0	5.0	2.0	0.0	0.0	"Green house mode"

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SHADOW - Main Result

Calculation: 140408 M122 17kvk 89HH Shadow

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Swedish RT90 2.5gonV 0:-15-RT90 (SE)

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
6 6		1,356,082	6,365,087	238.0	5.0	5.0	2.0	0.0	0.0	"Green house mode"
7 7		1,356,579	6,366,515	237.5	5.0	5.0	2.0	0.0	0.0	"Green house mode"
8 8		1,356,602	6,365,151	223.5	5.0	5.0	2.0	0.0	0.0	"Green house mode"
9 9		1,355,989	6,364,921	223.7	5.0	5.0	2.0	0.0	0.0	"Green house mode"
10 10		1,355,455	6,364,908	260.8	5.0	5.0	2.0	0.0	0.0	"Green house mode"
11 11		1,356,610	6,364,688	204.8	5.0	5.0	2.0	0.0	0.0	"Green house mode"
12 12		1,357,661	6,365,318	239.4	5.0	5.0	2.0	0.0	0.0	"Green house mode"
13 13		1,358,186	6,366,173	238.8	5.0	5.0	2.0	0.0	0.0	"Green house mode"
14 14		1,359,151	6,365,788	250.8	5.0	5.0	2.0	0.0	0.0	"Green house mode"
15 15		1,359,233	6,363,491	249.6	5.0	5.0	2.0	0.0	0.0	"Green house mode"
17 17		1,355,333	6,364,842	245.5	5.0	5.0	2.0	0.0	0.0	"Green house mode"
18 18		1,358,766	6,363,488	243.7	5.0	5.0	2.0	0.0	0.0	"Green house mode"
19 19		1,358,001	6,363,183	217.1	5.0	5.0	2.0	0.0	0.0	"Green house mode"
20 20		1,357,381	6,363,228	204.0	5.0	5.0	2.0	0.0	0.0	"Green house mode"
21 21		1,357,226	6,363,318	206.2	5.0	5.0	2.0	0.0	0.0	"Green house mode"
23 23		1,360,701	6,363,648	259.7	5.0	5.0	2.0	0.0	0.0	"Green house mode"
24 24		1,361,391	6,363,808	280.0	5.0	5.0	2.0	0.0	0.0	"Green house mode"
26 26		1,362,356	6,365,303	284.8	5.0	5.0	2.0	0.0	0.0	"Green house mode"
27 27		1,362,521	6,365,953	278.0	5.0	5.0	2.0	0.0	0.0	"Green house mode"
28 28		1,361,906	6,366,738	260.8	5.0	5.0	2.0	0.0	0.0	"Green house mode"
29 29		1,360,812	6,366,711	272.4	5.0	5.0	2.0	0.0	0.0	"Green house mode"
30 30		1,360,247	6,366,836	262.8	5.0	5.0	2.0	0.0	0.0	"Green house mode"
31 31		1,359,762	6,366,416	259.0	5.0	5.0	2.0	0.0	0.0	"Green house mode"
32 32		1,359,427	6,365,846	262.2	5.0	5.0	2.0	0.0	0.0	"Green house mode"
33 33		1,353,748	6,365,145	228.1	5.0	5.0	2.0	0.0	0.0	"Green house mode"
35 35		1,362,402	6,364,363	270.8	5.0	5.0	2.0	0.0	0.0	"Green house mode"
36 36		1,362,389	6,365,360	289.1	5.0	5.0	2.0	0.0	0.0	"Green house mode"
37 37		1,362,749	6,365,140	286.0	5.0	5.0	2.0	0.0	0.0	"Green house mode"
38 38		1,358,924	6,363,405	248.0	5.0	5.0	2.0	0.0	0.0	"Green house mode"

Calculation Results

Shadow receptor

No.	Name	Shadow, worst case		Max shadow hours per day	Shadow, expected values
		Shadow hours per year [h/year]	Shadow days per year [days/year]		Shadow hours per year [h/year]
1 1		0:00	0	0:00	0:00
2 2		0:00	0	0:00	0:00
3 3		0:00	0	0:00	0:00
4 4		0:00	0	0:00	0:00
5 5		0:00	0	0:00	0:00
6 6		11:15	76	0:16	1:54
7 7		11:53	83	0:13	1:08
8 8		29:11	125	0:33	4:30
9 9		10:35	65	0:15	1:45
10 10		1:01	11	0:09	0:09
11 11		36:31	153	0:23	7:16
12 12		99:25	214	0:37	16:47
13 13		83:20	123	1:03	7:25
14 14		96:23	188	1:04	14:05
15 15		32:54	122	0:26	8:22
17 17		0:00	0	0:00	0:00
18 18		34:43	106	0:29	9:40
19 19		4:43	27	0:14	1:21
20 20		5:25	29	0:15	1:42
21 21		25:25	79	0:34	7:25
23 23		1:21	17	0:06	0:23
24 24		9:55	48	0:22	2:41

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SHADOW - Main Result**Calculation:** 140408 M122 17kvk 89HH Shadow

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No.	Name	Shadow, worst case		Max shadow hours per day	Shadow, expected values
		Shadow hours per year [h/year]	Shadow days per year [days/year]		Shadow hours per year [h/year]
26	26	77:56	210	0:43	13:13
27	27	29:15	126	0:30	3:49
28	28	28:48	94	0:29	3:08
29	29	99:39	78	1:59	9:03
30	30	57:43	94	1:10	5:21
31	31	65:31	162	0:45	7:06
32	32	97:24	220	1:11	13:30
33	33	0:00	0	0:00	0:00
35	35	67:24	156	0:43	16:11
36	36	64:27	206	0:39	10:29
37	37	29:02	117	0:36	5:16
38	38	24:23	85	0:25	6:14

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

No.	Name	Worst case [h/year]	Expected [h/year]
A1	REpower 3.0M122 3000 122.0 !O! hub: 89.0 m (TOT: 150.0 m) (548)	134:56	22:17
A10	REpower 3.0M122 3000 122.0 !O! hub: 89.0 m (TOT: 150.0 m) (541)	137:58	15:55
A11	REpower 3.0M122 3000 122.0 !O! hub: 89.0 m (TOT: 150.0 m) (537)	46:46	8:43
A12	REpower 3.0M122 3000 122.0 !O! hub: 89.0 m (TOT: 150.0 m) (539)	26:42	3:41
A13	REpower 3.0M122 3000 122.0 !O! hub: 89.0 m (TOT: 150.0 m) (538)	61:53	8:02
A14	REpower 3.0M122 3000 122.0 !O! hub: 89.0 m (TOT: 150.0 m) (549)	61:42	11:13
A15	REpower 3.0M122 3000 122.0 !O! hub: 89.0 m (TOT: 150.0 m) (536)	27:18	4:55
A16	REpower 3.0M122 3000 122.0 !O! hub: 89.0 m (TOT: 150.0 m) (547)	98:02	16:27
A17	REpower 3.0M122 3000 122.0 !O! hub: 89.0 m (TOT: 150.0 m) (544)	41:30	7:17
A2	REpower 3.0M122 3000 122.0 !O! hub: 89.0 m (TOT: 150.0 m) (542)	91:47	12:43
A3	REpower 3.0M122 3000 122.0 !O! hub: 89.0 m (TOT: 150.0 m) (543)	63:20	8:22
A4	REpower 3.0M122 3000 122.0 !O! hub: 89.0 m (TOT: 150.0 m) (540)	83:08	12:07
A5	REpower 3.0M122 3000 122.0 !O! hub: 89.0 m (TOT: 150.0 m) (533)	45:19	9:14
A6	REpower 3.0M122 3000 122.0 !O! hub: 89.0 m (TOT: 150.0 m) (534)	37:00	9:08
A7	REpower 3.0M122 3000 122.0 !O! hub: 89.0 m (TOT: 150.0 m) (545)	16:28	2:41
A8	REpower 3.0M122 3000 122.0 !O! hub: 89.0 m (TOT: 150.0 m) (535)	15:09	4:25
A9	REpower 3.0M122 3000 122.0 !O! hub: 89.0 m (TOT: 150.0 m) (546)	93:11	11:28

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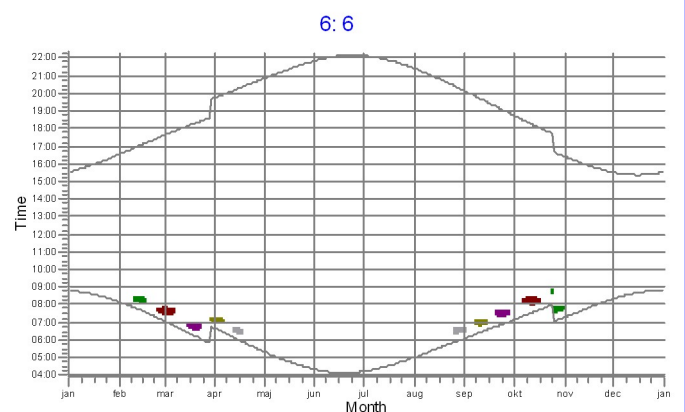
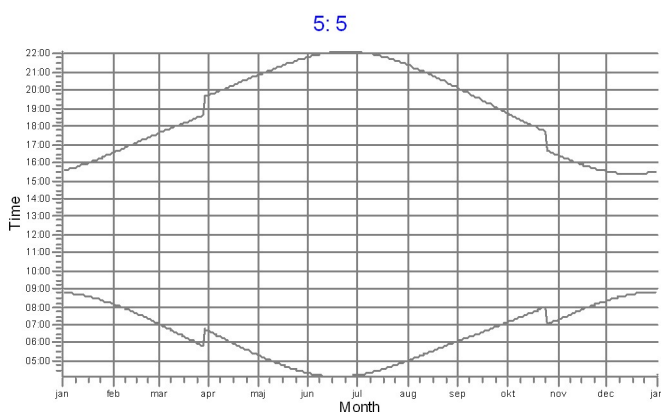
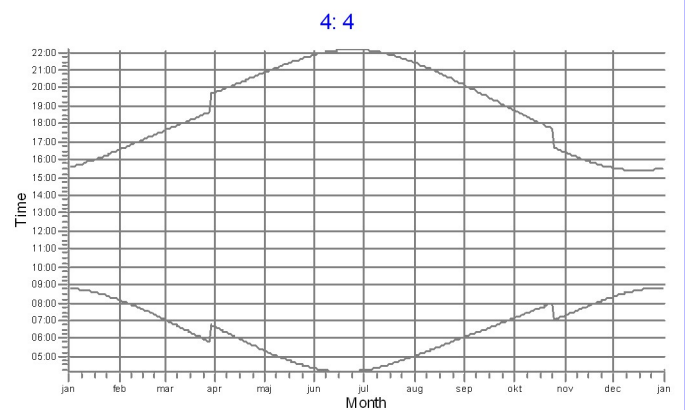
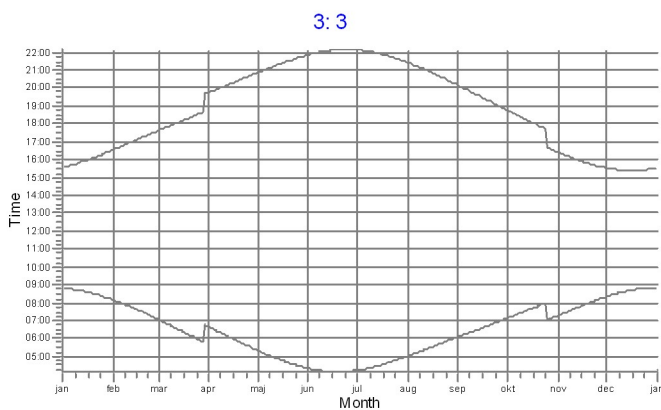
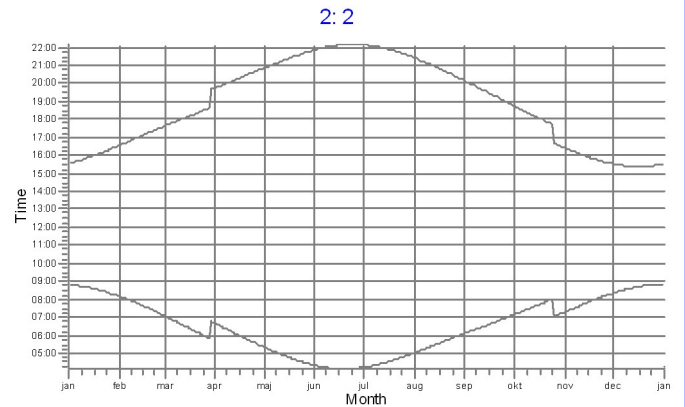
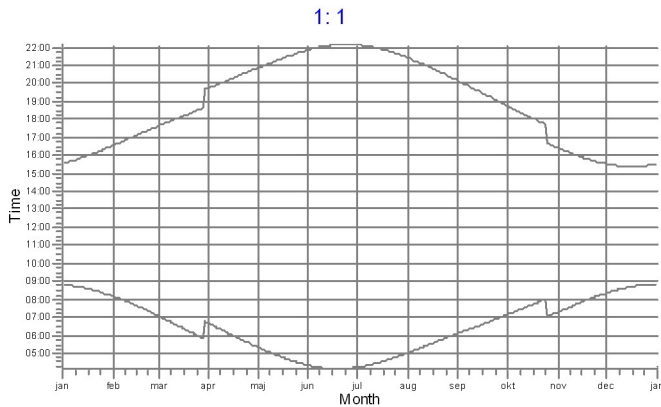
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SHADOW - Calendar, graphical

Calculation: 140408 M122 17kvv 89HH Shadow



WTGs

- A5: REpower 3.0M122 3000 122.0 !OI hub: 89.0 m (TOT: 150.0 m) (533)
- A4: REpower 3.0M122 3000 122.0 !OI hub: 89.0 m (TOT: 150.0 m) (540)
- A2: REpower 3.0M122 3000 122.0 !OI hub: 89.0 m (TOT: 150.0 m) (542)

- A3: REpower 3.0M122 3000 122.0 !OI hub: 89.0 m (TOT: 150.0 m) (543)
- A1: REpower 3.0M122 3000 122.0 !OI hub: 89.0 m (TOT: 150.0 m) (548)

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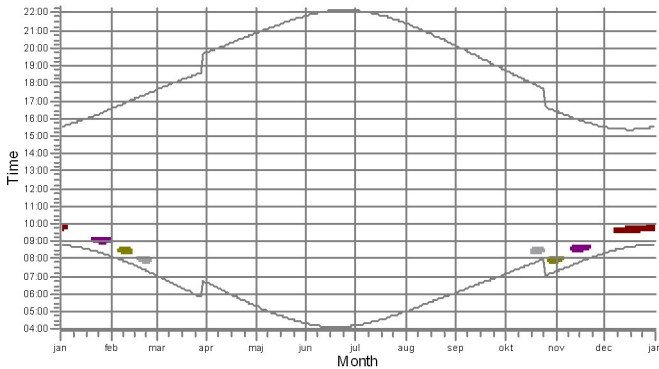
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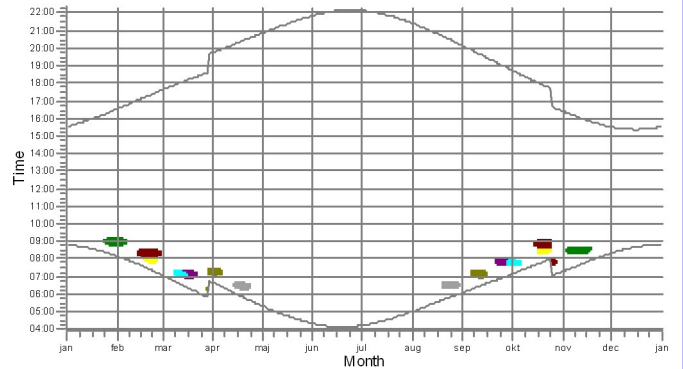
SHADOW - Calendar, graphical

Calculation: 140408 M122 17kv 89HH Shadow

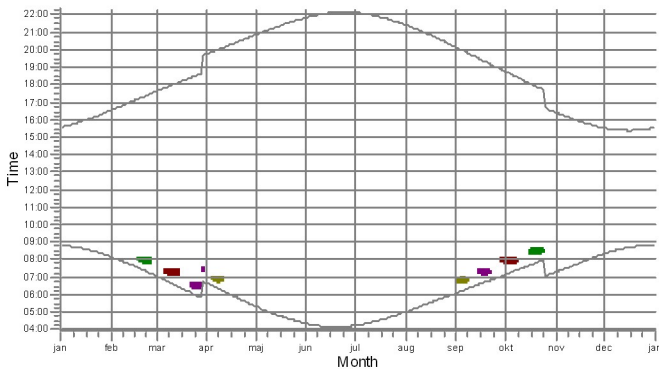
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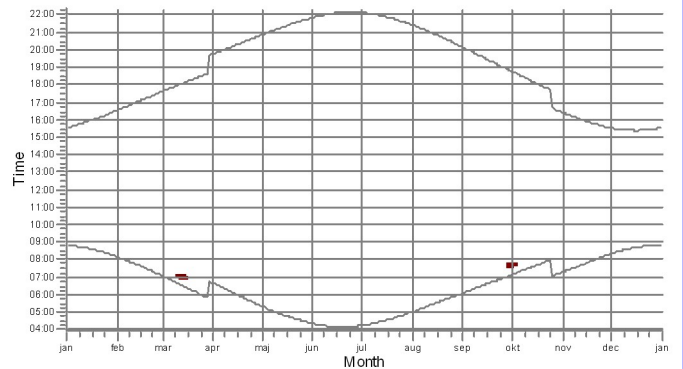
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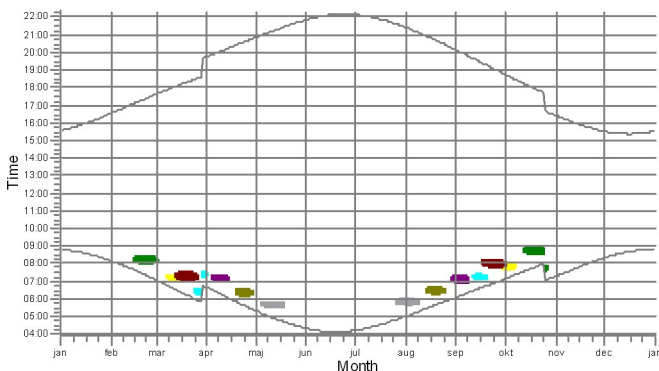
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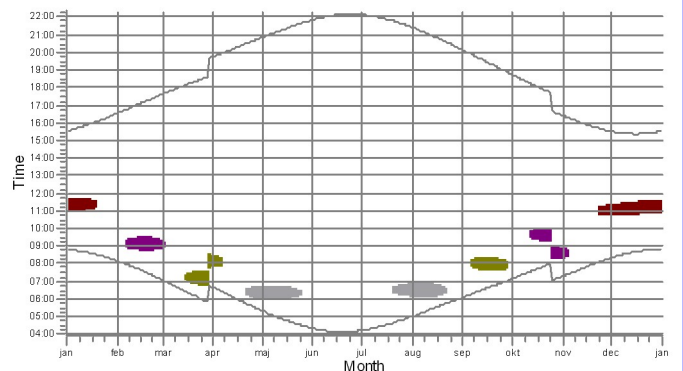
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11: 11



12: 12



WTGs

- A5: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (533)
- A6: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (534)
- A4: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (540)
- A2: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (542)

- A3: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (543)
- A7: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (545)
- A1: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (548)

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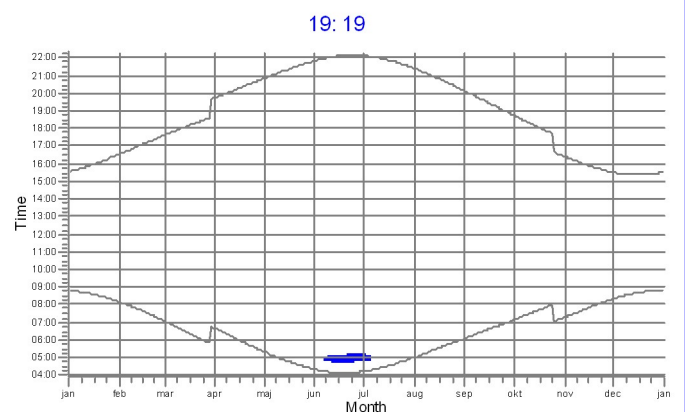
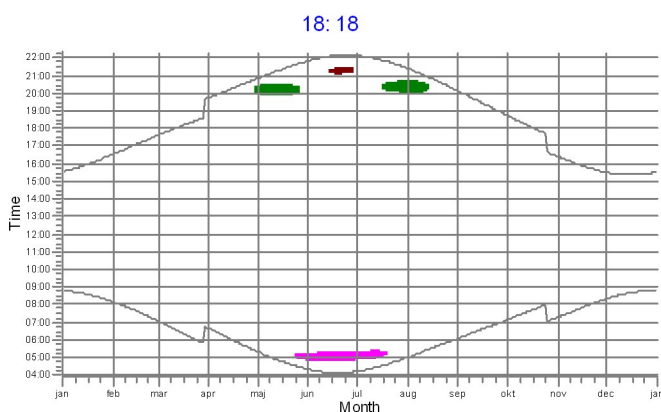
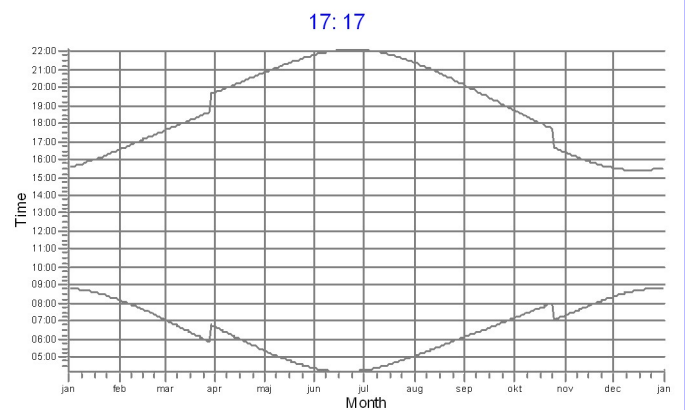
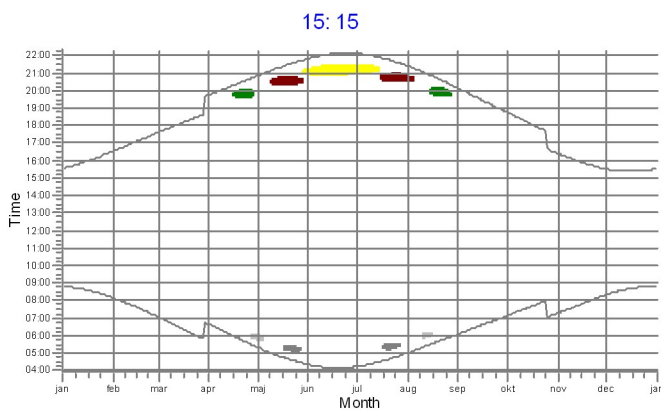
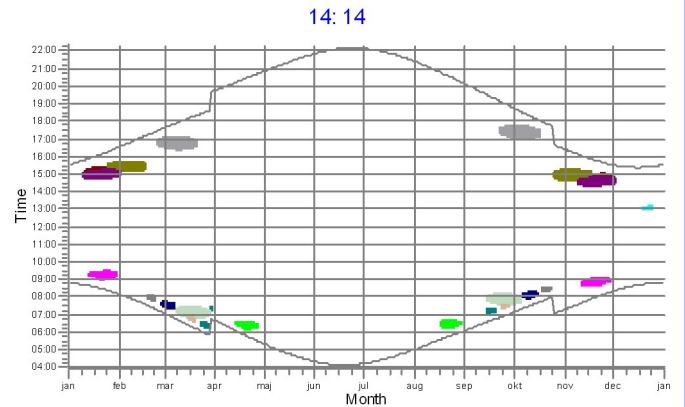
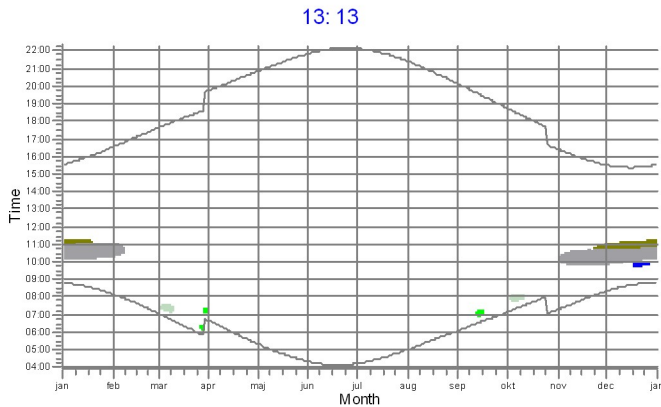
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- A8: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (535)
- A15: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (536)
- A11: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (537)
- A13: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (538)
- A12: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (539)
- A4: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (540)

- A10: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (541)
- A2: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (542)
- A3: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (543)
- A17: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (544)
- A7: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (545)
- A9: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (546)
- A1: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (548)
- A14: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (549)

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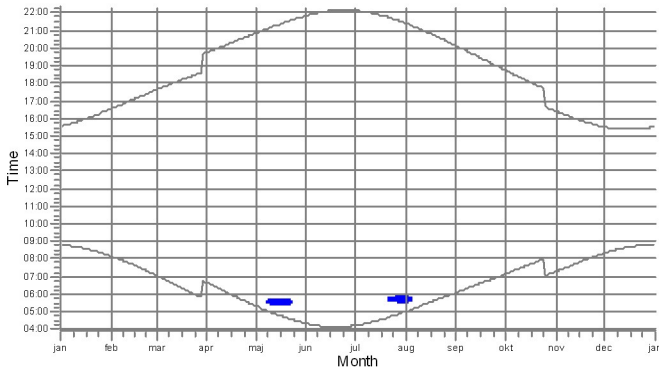
Calculated:

2014-05-28 00:57/2.9.269

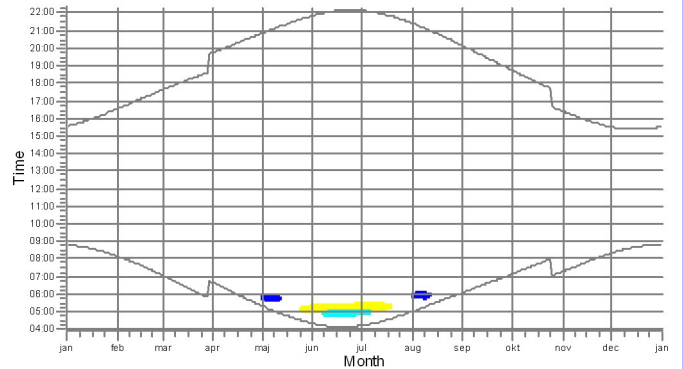
SHADOW - Calendar, graphical

Calculation: 140408 M122 17kv 89HH Shadow

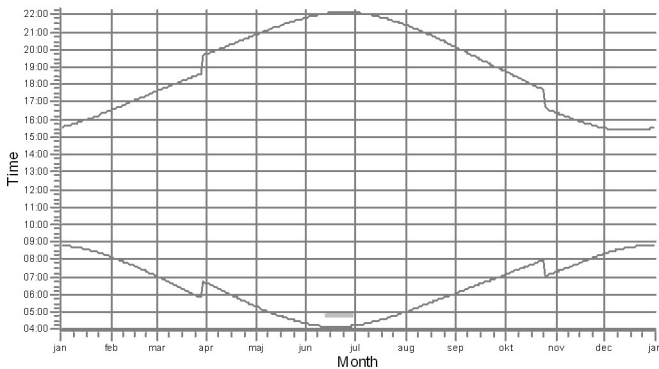
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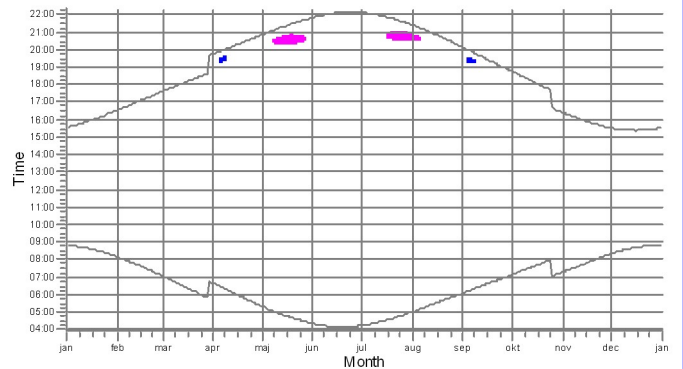
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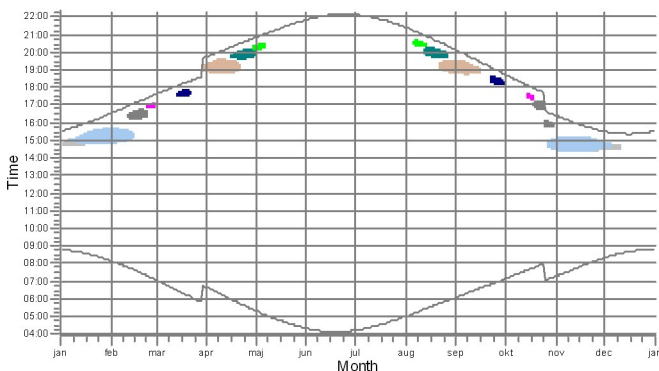
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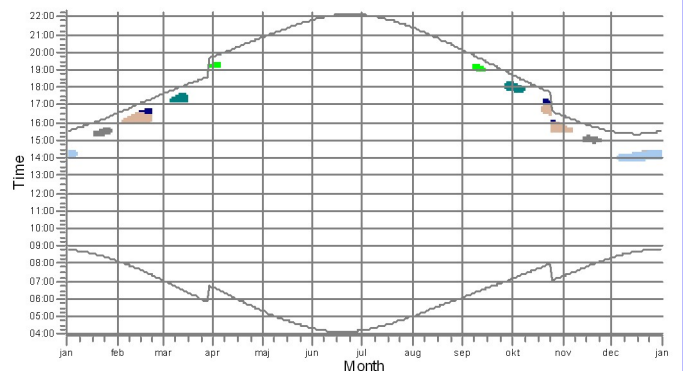
24: 24



26: 26



27: 27



WTGs

- A6: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (534)
- A8: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (535)
- A15: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (536)
- A11: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (537)
- A13: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (538)
- A12: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (539)

- A10: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (541)
- A17: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (544)
- A7: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (545)
- A9: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (546)
- A16: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (547)
- A14: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (549)

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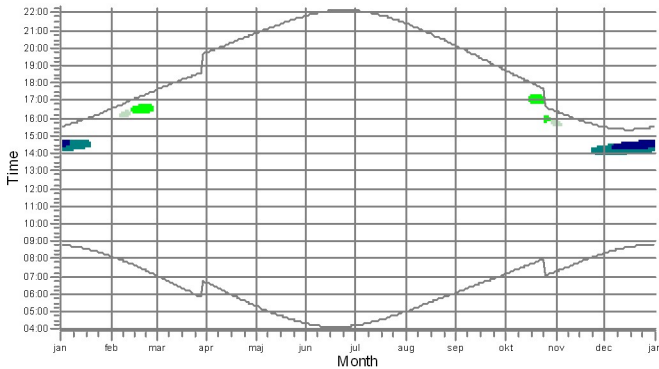
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2014-05-28 00:57/2.9.269

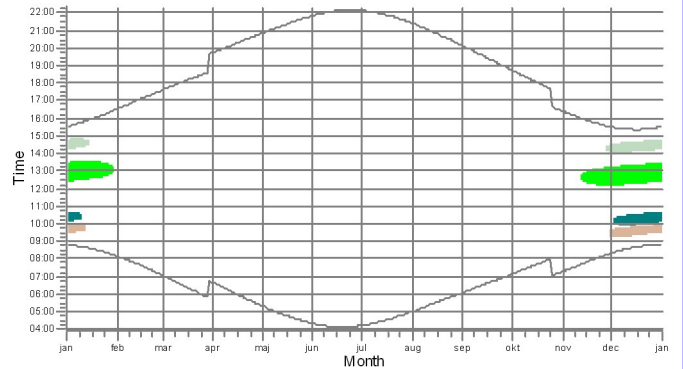
SHADOW - Calendar, graphical

Calculation: 140408 M122 17vkv 89HH Shadow

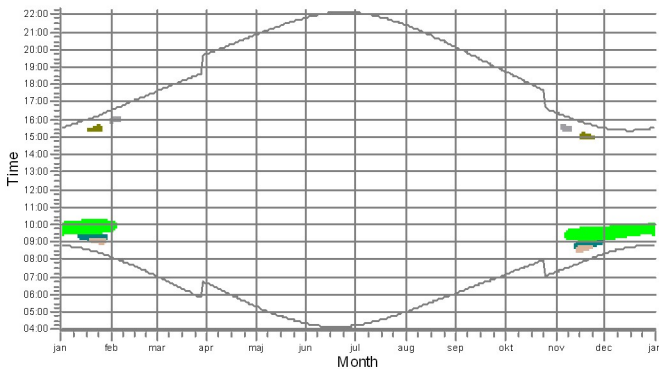
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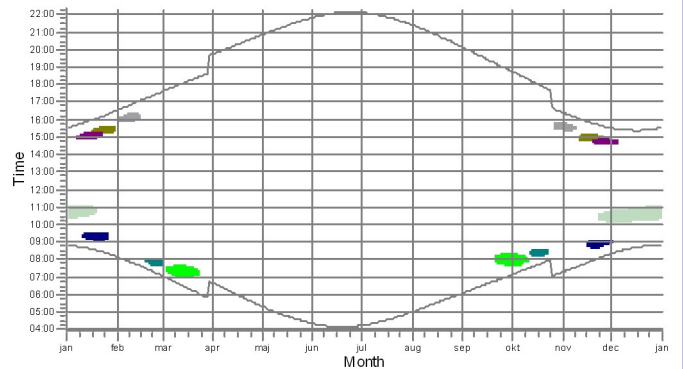
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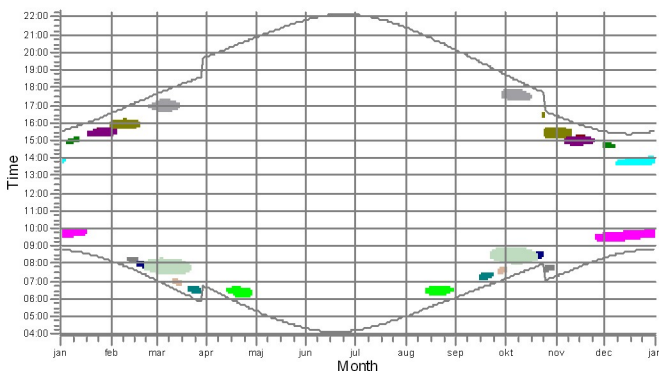
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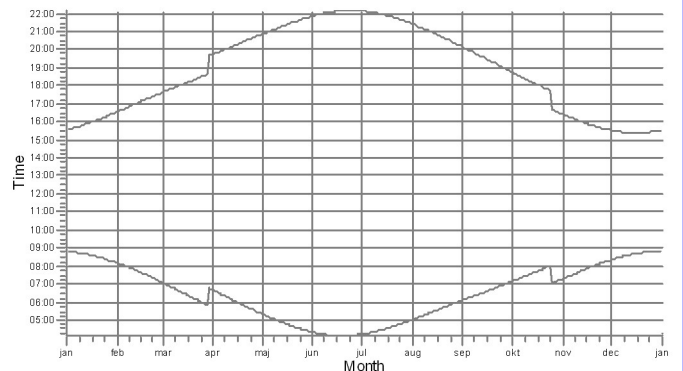
31: 31



32: 32



33: 33



WTGs

- A5: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (533)
- A15: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (536)
- A11: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (537)
- A13: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (538)
- A12: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (539)
- A4: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (540)
- A10: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (541)

- A2: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (542)
- A3: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (543)
- A7: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (545)
- A9: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (546)
- A1: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (548)
- A14: REpower 3.0M122 3000 122.0 IO! hub: 89.0 m (TOT: 150.0 m) (549)

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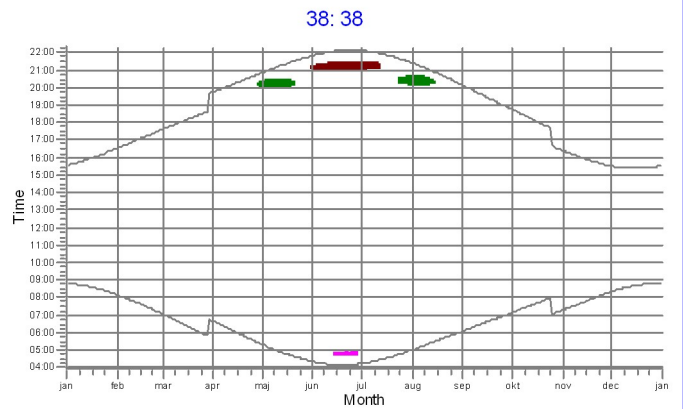
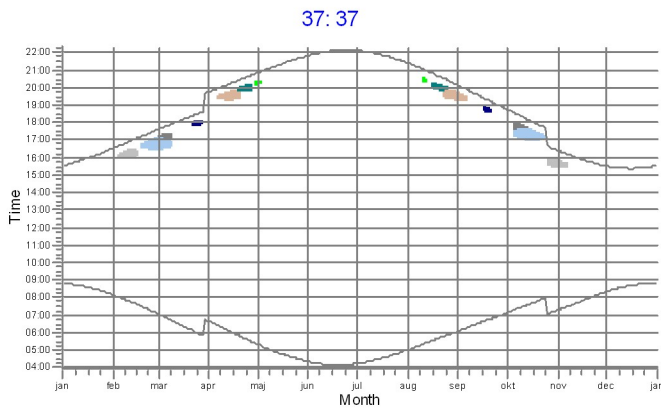
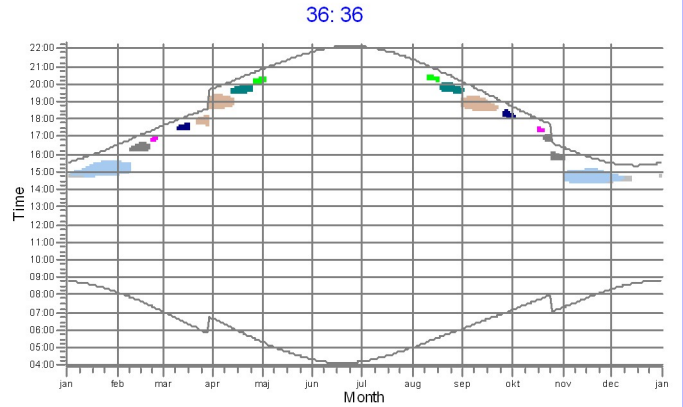
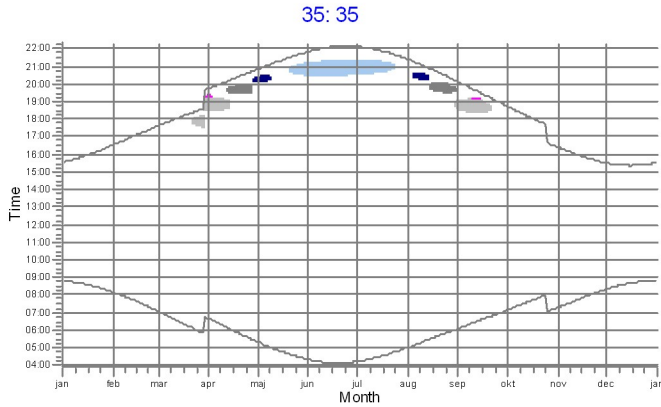
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Calculated:

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SHADOW - Calendar, graphical

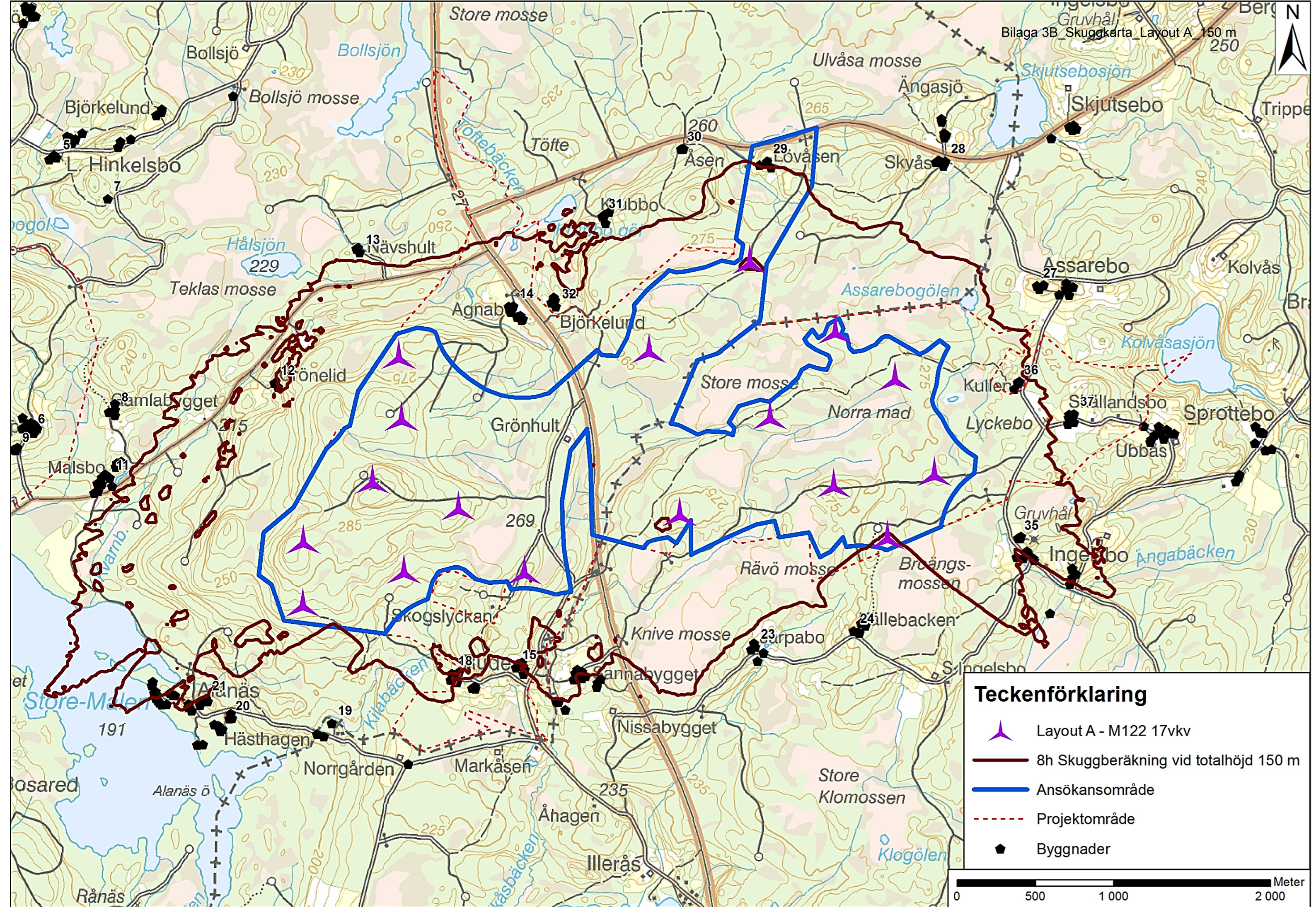
Calculation: 140408 M122 17kvv 89HH Shadow




WTGs

- A5: REpower 3.0M122 3000 122.0 !OI hub: 89.0 m (TOT: 150.0 m) (533)
- A15: REpower 3.0M122 3000 122.0 !OI hub: 89.0 m (TOT: 150.0 m) (536)
- A11: REpower 3.0M122 3000 122.0 !OI hub: 89.0 m (TOT: 150.0 m) (537)
- A13: REpower 3.0M122 3000 122.0 !OI hub: 89.0 m (TOT: 150.0 m) (538)
- A12: REpower 3.0M122 3000 122.0 !OI hub: 89.0 m (TOT: 150.0 m) (539)
- A4: REpower 3.0M122 3000 122.0 !OI hub: 89.0 m (TOT: 150.0 m) (540)

- A10: REpower 3.0M122 3000 122.0 !OI hub: 89.0 m (TOT: 150.0 m) (541)
- A17: REpower 3.0M122 3000 122.0 !OI hub: 89.0 m (TOT: 150.0 m) (544)
- A9: REpower 3.0M122 3000 122.0 !OI hub: 89.0 m (TOT: 150.0 m) (546)
- A16: REpower 3.0M122 3000 122.0 !OI hub: 89.0 m (TOT: 150.0 m) (547)
- A14: REpower 3.0M122 3000 122.0 !OI hub: 89.0 m (TOT: 150.0 m) (549)



Teckenförklaring

-  Layout A - M122 17kv
-  8h Skuggberäkning vid totalhöjd 150 m
-  Ansökansområde
-  Projektområde
-  Byggnader

0 500 1000 2000 Meter

Bilaga 3B - Skuggor

Layout A

17 st Senvion M122, 3 MW

Totalhöjd 200 meter

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SHADOW - Main Result

Calculation: 140408 M122 17vkv 139HH Shadow

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) [VAXJO /KRONOBER G]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.36	1.52	2.62	6.08	8.82	7.64	6.65	5.42	4.02	2.68	1.38	0.88

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

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Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
416	404	504	593	623	623	645	938	1,310	1,425	715	464	8,661

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: 120531_GH2mCont_2mScan_5mTop
Obstacles not used in calculation

Eye height: 1.5 m

Grid resolution: 10.0 m

WTGs

	Swedish RT90 2.5gonV 0:-15-RT90 (SE)				Row data/Description	WTG type			Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
	East	North	Z			Valid	Manufact.	Type-generator				Calculation distance [m]	RPM [RPM]
A1	1,358,439	6,365,530	272.8		REpower 3.0M122 3000 122....	No	REpower	3.0M122-3,000	3,000	122.0	139.0	1,722	0.0
A10	1,360,678	6,366,135	271.3		REpower 3.0M122 3000 122....	No	REpower	3.0M122-3,000	3,000	122.0	139.0	1,722	0.0
A11	1,360,231	6,364,523	281.8		REpower 3.0M122 3000 122....	No	REpower	3.0M122-3,000	3,000	122.0	139.0	1,722	0.0
A12	1,360,807	6,365,141	270.0		REpower 3.0M122 3000 122....	No	REpower	3.0M122-3,000	3,000	122.0	139.0	1,722	0.0
A13	1,361,225	6,365,690	270.0		REpower 3.0M122 3000 122....	No	REpower	3.0M122-3,000	3,000	122.0	139.0	1,722	0.0
A14	1,361,607	6,365,391	270.8		REpower 3.0M122 3000 122....	No	REpower	3.0M122-3,000	3,000	122.0	139.0	1,722	0.0
A15	1,361,214	6,364,706	277.0		REpower 3.0M122 3000 122....	No	REpower	3.0M122-3,000	3,000	122.0	139.0	1,722	0.0
A16	1,361,858	6,364,781	278.5		REpower 3.0M122 3000 122....	No	REpower	3.0M122-3,000	3,000	122.0	139.0	1,722	0.0
A17	1,361,557	6,364,376	281.9		REpower 3.0M122 3000 122....	No	REpower	3.0M122-3,000	3,000	122.0	139.0	1,722	0.0
A2	1,358,455	6,365,132	293.4		REpower 3.0M122 3000 122....	No	REpower	3.0M122-3,000	3,000	122.0	139.0	1,722	0.0
A3	1,358,269	6,364,731	311.1		REpower 3.0M122 3000 122....	No	REpower	3.0M122-3,000	3,000	122.0	139.0	1,722	0.0
A4	1,357,827	6,364,349	295.3		REpower 3.0M122 3000 122....	No	REpower	3.0M122-3,000	3,000	122.0	139.0	1,722	0.0
A5	1,357,826	6,363,944	268.4		REpower 3.0M122 3000 122....	No	REpower	3.0M122-3,000	3,000	122.0	139.0	1,722	0.0
A6	1,358,471	6,364,158	261.0		REpower 3.0M122 3000 122....	No	REpower	3.0M122-3,000	3,000	122.0	139.0	1,722	0.0
A7	1,358,818	6,364,562	287.1		REpower 3.0M122 3000 122....	No	REpower	3.0M122-3,000	3,000	122.0	139.0	1,722	0.0
A8	1,359,241	6,364,153	278.0		REpower 3.0M122 3000 122....	No	REpower	3.0M122-3,000	3,000	122.0	139.0	1,722	0.0
A9	1,360,036	6,365,568	270.0		REpower 3.0M122 3000 122....	No	REpower	3.0M122-3,000	3,000	122.0	139.0	1,722	0.0

Shadow receptor-Input

No.	Name	Swedish RT90 2.5gonV 0:-15-RT90 (SE)				Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode	
		East	North	Z	Width [m]					
1	1	1,354,439	6,365,935	231.9	5.0	5.0	2.0	0.0	0.0	"Green house mode"
2	2	1,354,303	6,365,863	228.0	5.0	5.0	2.0	0.0	0.0	"Green house mode"
3	3	1,355,719	6,366,777	230.0	5.0	5.0	2.0	0.0	0.0	"Green house mode"
4	4	1,355,823	6,366,785	228.0	5.0	5.0	2.0	0.0	0.0	"Green house mode"
5	5	1,356,247	6,366,773	220.8	5.0	5.0	2.0	0.0	0.0	"Green house mode"

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SHADOW - Main Result

Calculation: 140408 M122 17vkv 139HH Shadow

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Swedish RT90 2.5gonV 0:-15-RT90 (SE)

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
6 6		1,356,082	6,365,087	238.0	5.0	5.0	2.0	0.0	0.0	"Green house mode"
7 7		1,356,579	6,366,515	237.5	5.0	5.0	2.0	0.0	0.0	"Green house mode"
8 8		1,356,602	6,365,151	223.5	5.0	5.0	2.0	0.0	0.0	"Green house mode"
9 9		1,355,989	6,364,921	223.7	5.0	5.0	2.0	0.0	0.0	"Green house mode"
10 10		1,355,455	6,364,908	260.8	5.0	5.0	2.0	0.0	0.0	"Green house mode"
11 11		1,356,610	6,364,688	204.8	5.0	5.0	2.0	0.0	0.0	"Green house mode"
12 12		1,357,661	6,365,318	239.4	5.0	5.0	2.0	0.0	0.0	"Green house mode"
13 13		1,358,186	6,366,173	238.8	5.0	5.0	2.0	0.0	0.0	"Green house mode"
14 14		1,359,151	6,365,788	250.8	5.0	5.0	2.0	0.0	0.0	"Green house mode"
15 15		1,359,233	6,363,491	249.6	5.0	5.0	2.0	0.0	0.0	"Green house mode"
17 17		1,355,333	6,364,842	245.5	5.0	5.0	2.0	0.0	0.0	"Green house mode"
18 18		1,358,766	6,363,488	243.7	5.0	5.0	2.0	0.0	0.0	"Green house mode"
19 19		1,358,001	6,363,183	217.1	5.0	5.0	2.0	0.0	0.0	"Green house mode"
20 20		1,357,381	6,363,228	204.0	5.0	5.0	2.0	0.0	0.0	"Green house mode"
21 21		1,357,226	6,363,318	206.2	5.0	5.0	2.0	0.0	0.0	"Green house mode"
23 23		1,360,701	6,363,648	259.7	5.0	5.0	2.0	0.0	0.0	"Green house mode"
24 24		1,361,391	6,363,808	280.0	5.0	5.0	2.0	0.0	0.0	"Green house mode"
26 26		1,362,356	6,365,303	284.8	5.0	5.0	2.0	0.0	0.0	"Green house mode"
27 27		1,362,521	6,365,953	278.0	5.0	5.0	2.0	0.0	0.0	"Green house mode"
28 28		1,361,906	6,366,738	260.8	5.0	5.0	2.0	0.0	0.0	"Green house mode"
29 29		1,360,812	6,366,711	272.4	5.0	5.0	2.0	0.0	0.0	"Green house mode"
30 30		1,360,247	6,366,836	262.8	5.0	5.0	2.0	0.0	0.0	"Green house mode"
31 31		1,359,762	6,366,416	259.0	5.0	5.0	2.0	0.0	0.0	"Green house mode"
32 32		1,359,427	6,365,846	262.2	5.0	5.0	2.0	0.0	0.0	"Green house mode"
33 33		1,353,748	6,365,145	228.1	5.0	5.0	2.0	0.0	0.0	"Green house mode"
35 35		1,362,402	6,364,363	270.8	5.0	5.0	2.0	0.0	0.0	"Green house mode"
36 36		1,362,389	6,365,360	289.1	5.0	5.0	2.0	0.0	0.0	"Green house mode"
37 37		1,362,749	6,365,140	286.0	5.0	5.0	2.0	0.0	0.0	"Green house mode"
38 38		1,358,924	6,363,405	248.0	5.0	5.0	2.0	0.0	0.0	"Green house mode"

Calculation Results

Shadow receptor

No.	Name	Shadow, worst case		Max shadow hours per day	Shadow, expected values
		Shadow hours per year [h/year]	Shadow days per year [days/year]		Shadow hours per year [h/year]
1 1		0:00	0	0:00	0:00
2 2		0:00	0	0:00	0:00
3 3		0:00	0	0:00	0:00
4 4		0:00	0	0:00	0:00
5 5		0:00	0	0:00	0:00
6 6		0:00	0	0:00	0:00
7 7		0:00	0	0:00	0:00
8 8		6:48	26	0:20	0:52
9 9		0:00	0	0:00	0:00
10 10		0:00	0	0:00	0:00
11 11		20:51	79	0:23	3:43
12 12		141:24	276	0:54	24:55
13 13		79:47	119	0:53	7:24
14 14		98:05	207	1:04	14:29
15 15		20:28	83	0:20	5:22
17 17		0:00	0	0:00	0:00
18 18		30:52	91	0:30	8:25
19 19		0:00	0	0:00	0:00
20 20		0:00	0	0:00	0:00
21 21		7:03	32	0:17	2:04
23 23		7:27	30	0:20	1:53
24 24		17:53	64	0:23	4:49

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SHADOW - Main Result**Calculation:** 140408 M122 17vkv 139HH Shadow

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No.	Name	Shadow, worst case		Max shadow hours per day	Shadow, expected values
		Shadow hours per year [h/year]	Shadow days per year [days/year]		Shadow hours per year [h/year]
26	26	96:05	189	0:56	17:46
27	27	41:09	124	0:28	5:19
28	28	32:28	102	0:25	3:49
29	29	141:26	106	1:56	13:42
30	30	41:54	80	0:57	4:07
31	31	76:20	172	0:50	8:26
32	32	110:10	232	1:07	16:00
33	33	0:00	0	0:00	0:00
35	35	31:23	72	0:37	7:52
36	36	85:51	192	0:47	15:19
37	37	45:00	115	0:48	8:43
38	38	16:59	53	0:25	4:46

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

No.	Name	Worst case [h/year]	Expected [h/year]
A1	REpower 3.0M122 3000 122.0 !O! hub: 139.0 m (TOT: 200.0 m) (382)	119:18	23:27
A10	REpower 3.0M122 3000 122.0 !O! hub: 139.0 m (TOT: 200.0 m) (375)	137:50	17:00
A11	REpower 3.0M122 3000 122.0 !O! hub: 139.0 m (TOT: 200.0 m) (371)	42:25	7:17
A12	REpower 3.0M122 3000 122.0 !O! hub: 139.0 m (TOT: 200.0 m) (373)	21:50	2:58
A13	REpower 3.0M122 3000 122.0 !O! hub: 139.0 m (TOT: 200.0 m) (372)	93:46	13:08
A14	REpower 3.0M122 3000 122.0 !O! hub: 139.0 m (TOT: 200.0 m) (383)	81:53	16:05
A15	REpower 3.0M122 3000 122.0 !O! hub: 139.0 m (TOT: 200.0 m) (370)	27:47	5:19
A16	REpower 3.0M122 3000 122.0 !O! hub: 139.0 m (TOT: 200.0 m) (381)	73:00	9:17
A17	REpower 3.0M122 3000 122.0 !O! hub: 139.0 m (TOT: 200.0 m) (378)	46:54	8:24
A2	REpower 3.0M122 3000 122.0 !O! hub: 139.0 m (TOT: 200.0 m) (376)	78:42	10:48
A3	REpower 3.0M122 3000 122.0 !O! hub: 139.0 m (TOT: 200.0 m) (377)	54:26	6:47
A4	REpower 3.0M122 3000 122.0 !O! hub: 139.0 m (TOT: 200.0 m) (374)	62:36	8:51
A5	REpower 3.0M122 3000 122.0 !O! hub: 139.0 m (TOT: 200.0 m) (367)	53:30	12:29
A6	REpower 3.0M122 3000 122.0 !O! hub: 139.0 m (TOT: 200.0 m) (368)	19:50	3:20
A7	REpower 3.0M122 3000 122.0 !O! hub: 139.0 m (TOT: 200.0 m) (379)	41:15	3:58
A8	REpower 3.0M122 3000 122.0 !O! hub: 139.0 m (TOT: 200.0 m) (369)	7:27	1:53
A9	REpower 3.0M122 3000 122.0 !O! hub: 139.0 m (TOT: 200.0 m) (380)	109:49	13:34

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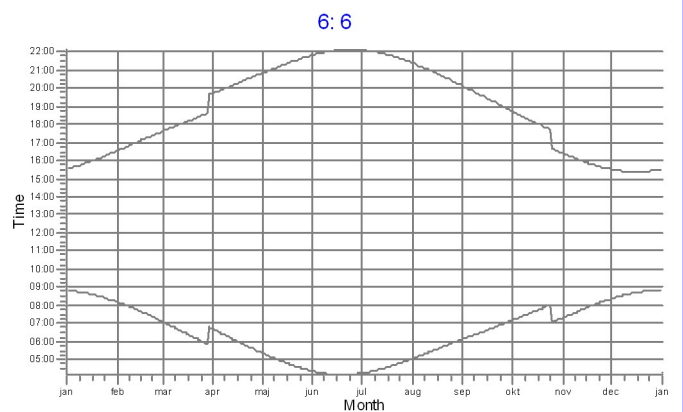
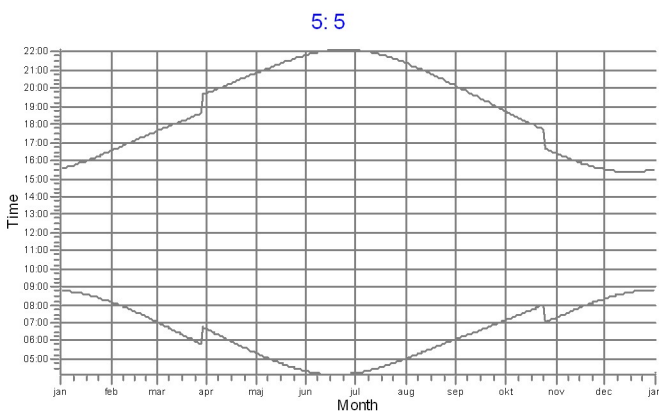
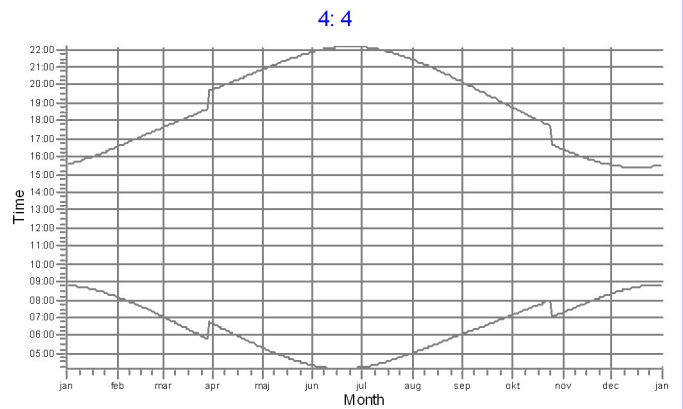
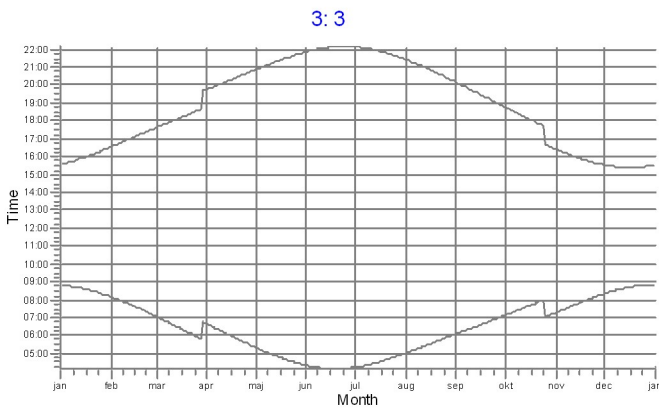
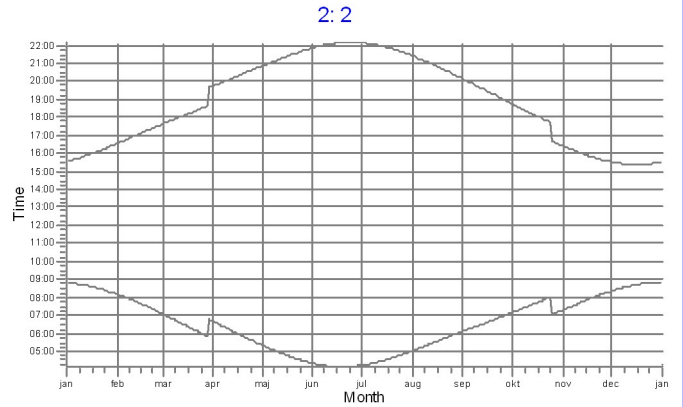
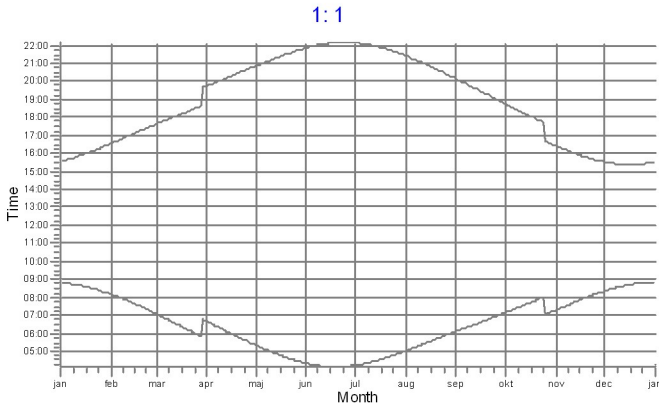
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SHADOW - Calendar, graphical

Calculation: 140408 M122 17vkv 139HH Shadow



WTGs

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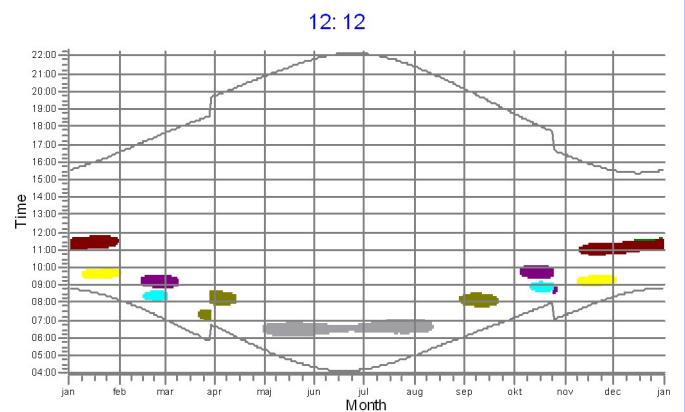
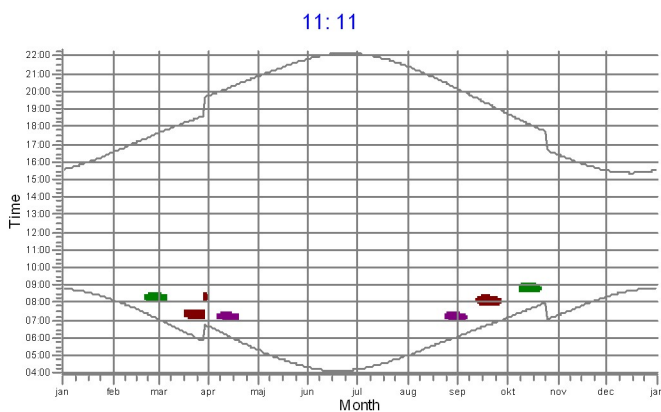
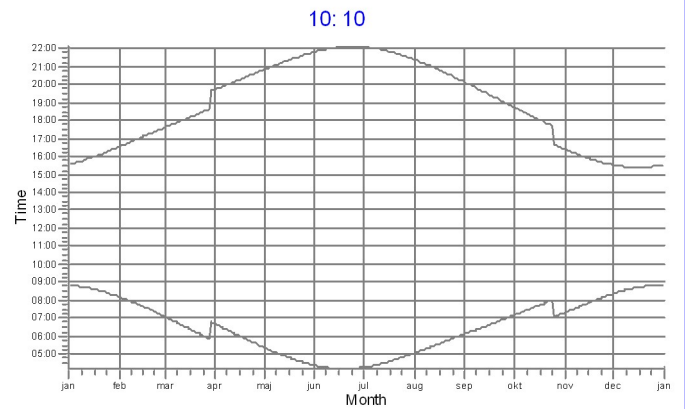
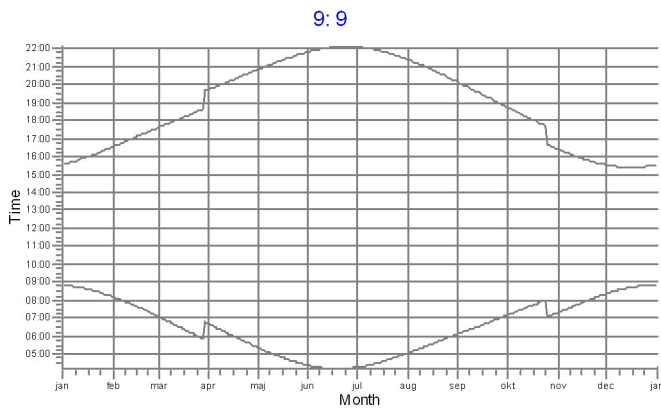
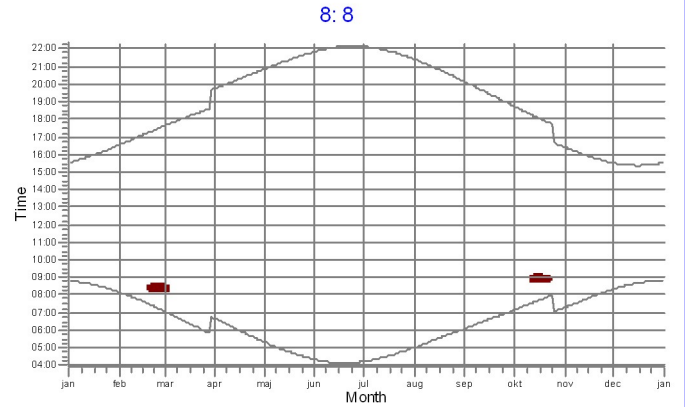
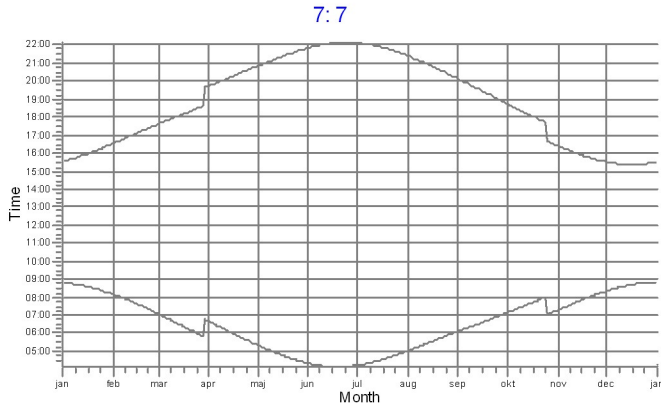
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SHADOW - Calendar, graphical

Calculation: 140408 M122 17vkv 139HH Shadow



WTGs

- A5: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (367)
- A6: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (368)
- A4: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (374)
- A2: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (376)

- A3: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (377)
- A7: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (379)
- A1: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (382)

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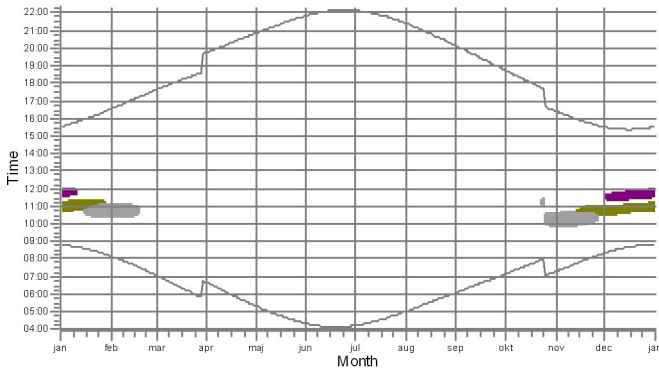
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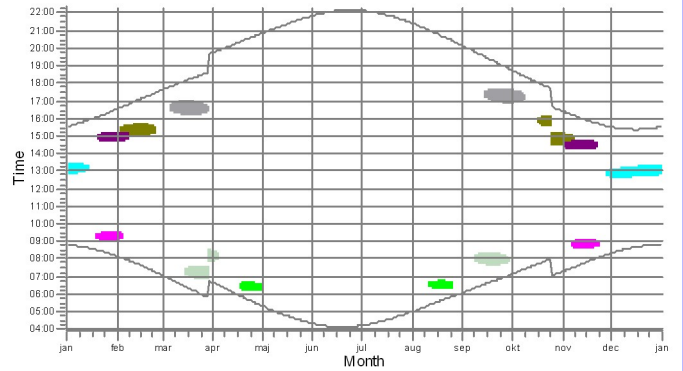
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Calculation: 140408 M122 17vkv 139HH Shadow

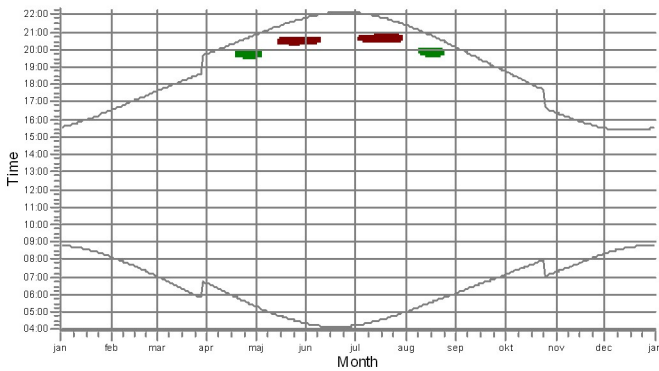
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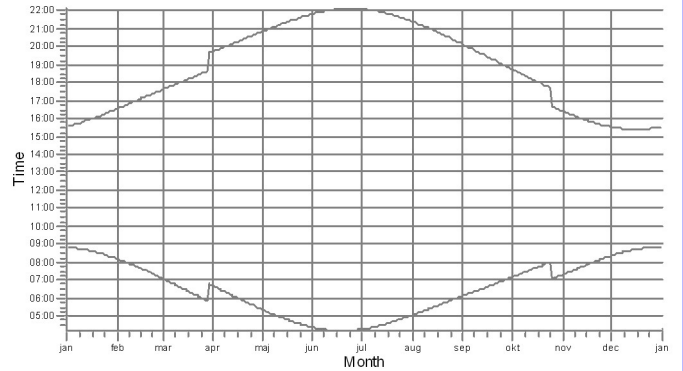
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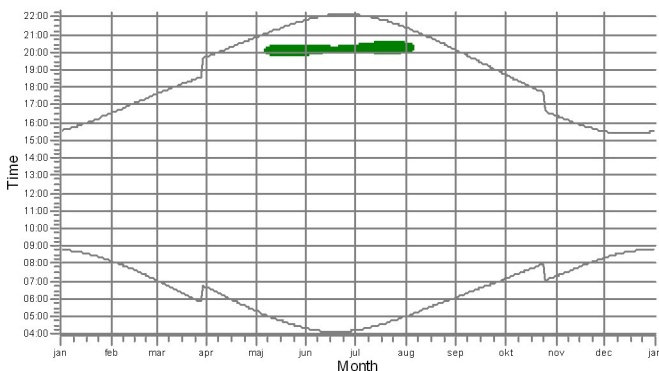
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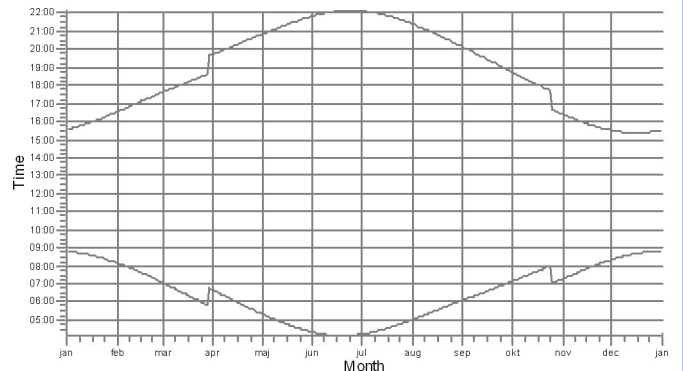
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18: 18



19: 19



WTGs

- A5: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (367)
- A11: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (371)
- A4: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (374)
- A10: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (375)
- A2: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (376)

- A3: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (377)
- A7: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (379)
- A9: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (380)
- A1: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (382)

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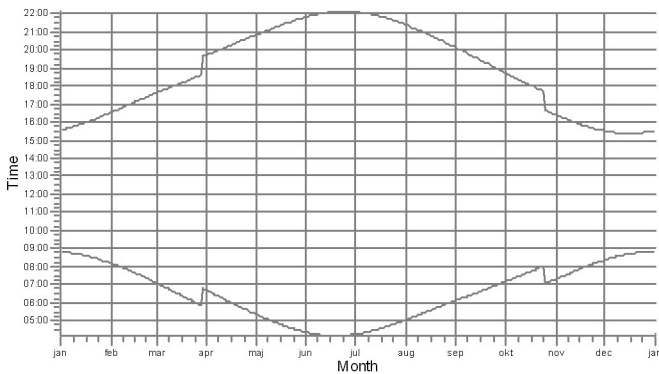
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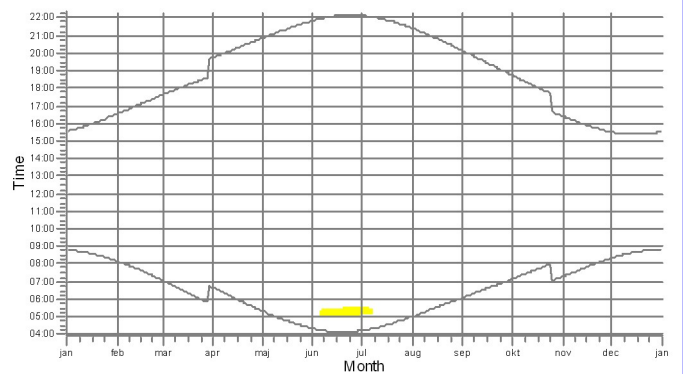
SHADOW - Calendar, graphical

Calculation: 140408 M122 17vkv 139HH Shadow

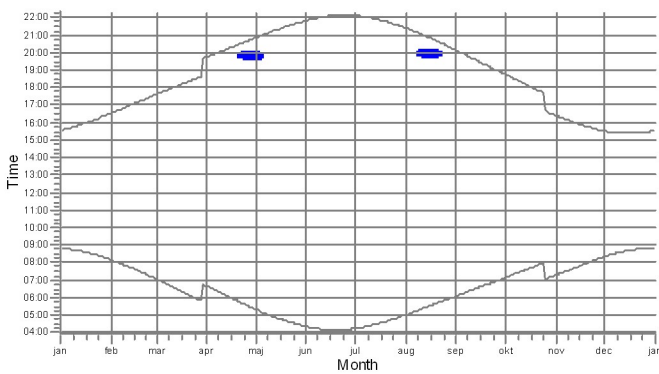
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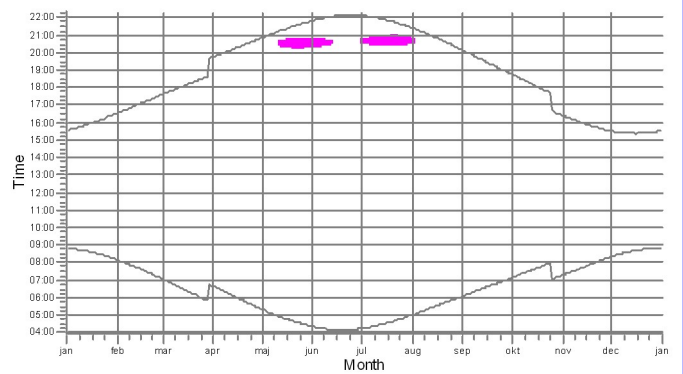
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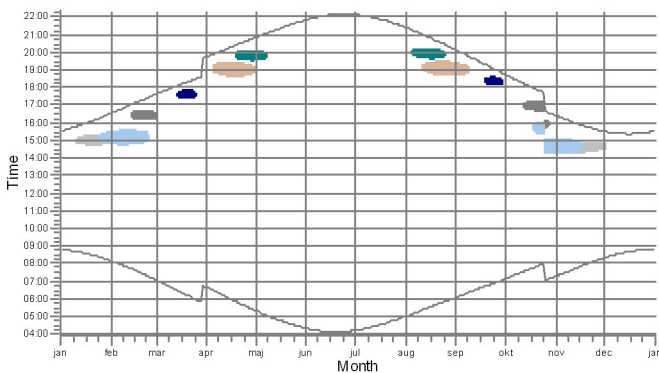
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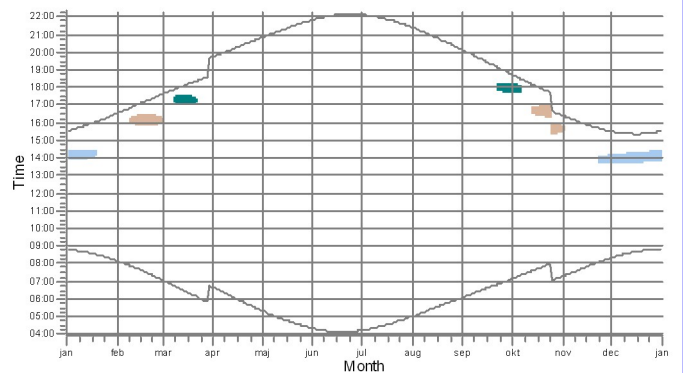
24: 24



26: 26



27: 27



WTGs

- A6: REpower 3.0M122 3000 122.0 !OI! hub: 139.0 m (TOT: 200.0 m) (368)
- A8: REpower 3.0M122 3000 122.0 !OI! hub: 139.0 m (TOT: 200.0 m) (369)
- A15: REpower 3.0M122 3000 122.0 !OI! hub: 139.0 m (TOT: 200.0 m) (370)
- A11: REpower 3.0M122 3000 122.0 !OI! hub: 139.0 m (TOT: 200.0 m) (371)
- A13: REpower 3.0M122 3000 122.0 !OI! hub: 139.0 m (TOT: 200.0 m) (372)

- A12: REpower 3.0M122 3000 122.0 !OI! hub: 139.0 m (TOT: 200.0 m) (373)
- A17: REpower 3.0M122 3000 122.0 !OI! hub: 139.0 m (TOT: 200.0 m) (378)
- A16: REpower 3.0M122 3000 122.0 !OI! hub: 139.0 m (TOT: 200.0 m) (381)
- A14: REpower 3.0M122 3000 122.0 !OI! hub: 139.0 m (TOT: 200.0 m) (383)

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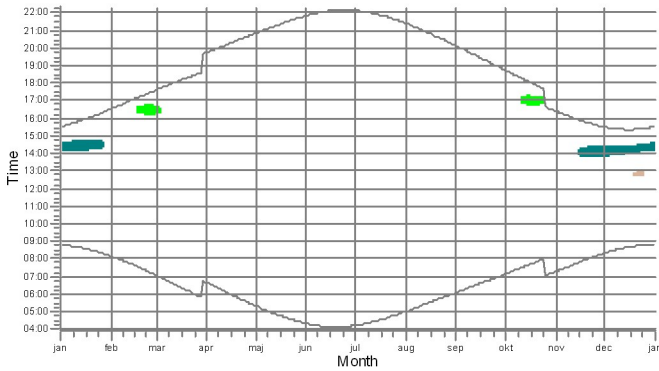
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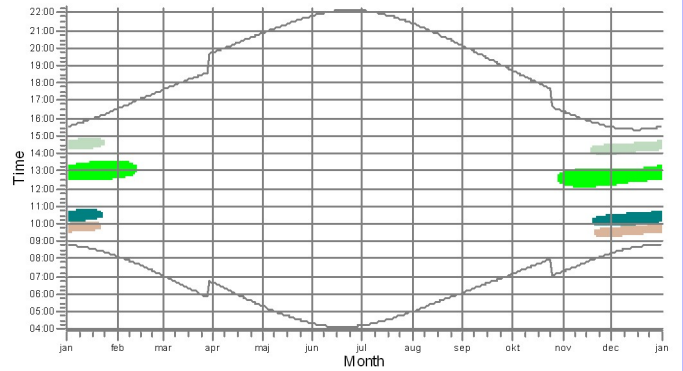
SHADOW - Calendar, graphical

Calculation: 140408 M122 17kv 139HH Shadow

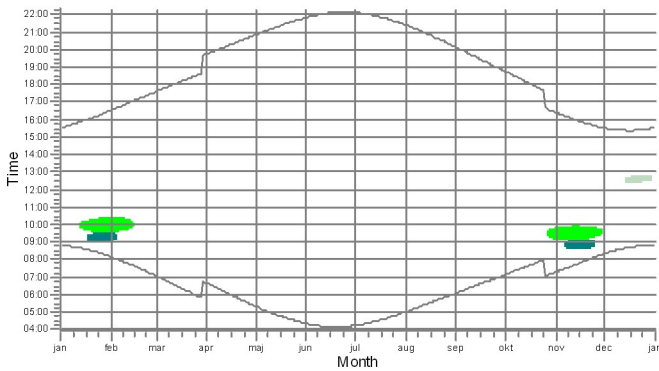
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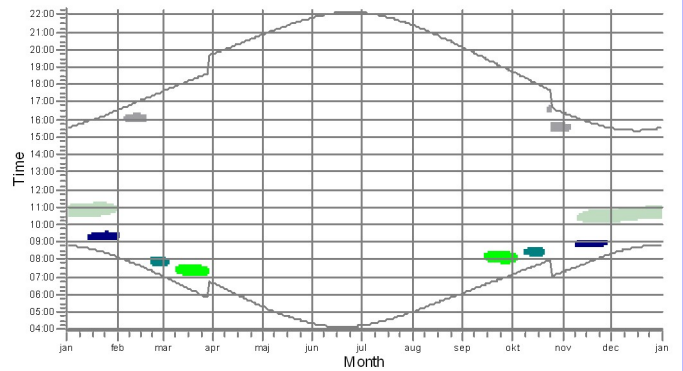
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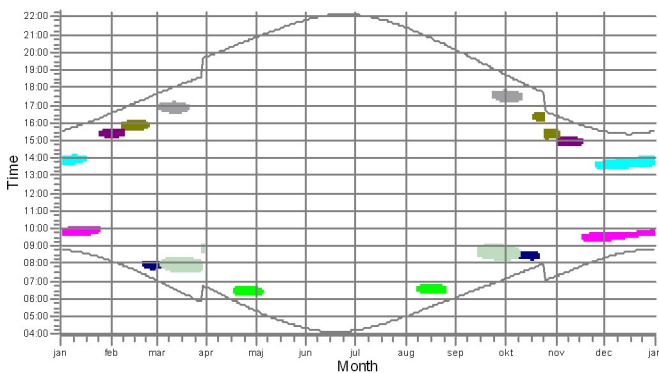
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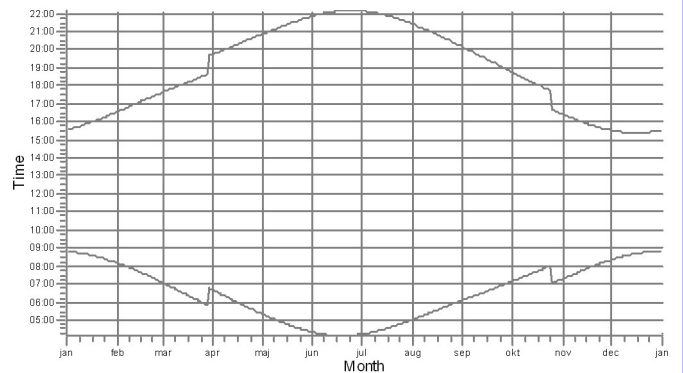
31: 31



32: 32



33: 33



WTGs

- A11: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (371)
- A13: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (372)
- A12: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (373)
- A10: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (375)
- A2: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (376)

- A3: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (377)
- A7: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (379)
- A9: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (380)
- A1: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (382)
- A14: REpower 3.0M122 3000 122.0 IOI hub: 139.0 m (TOT: 200.0 m) (383)

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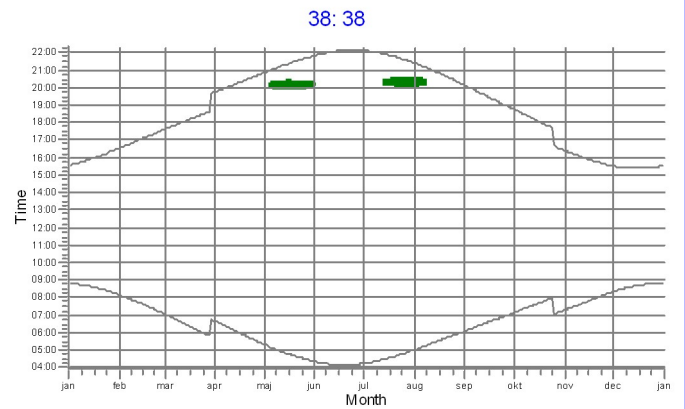
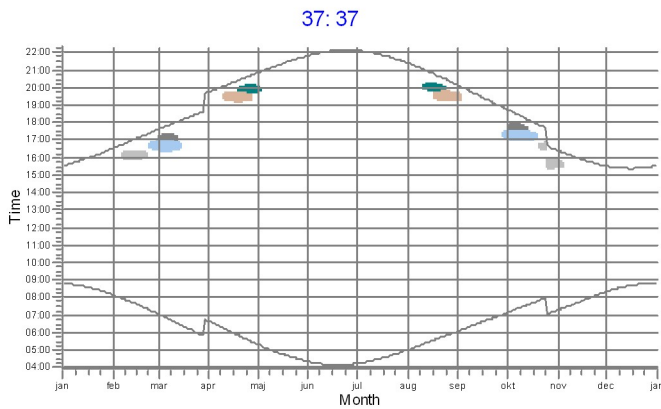
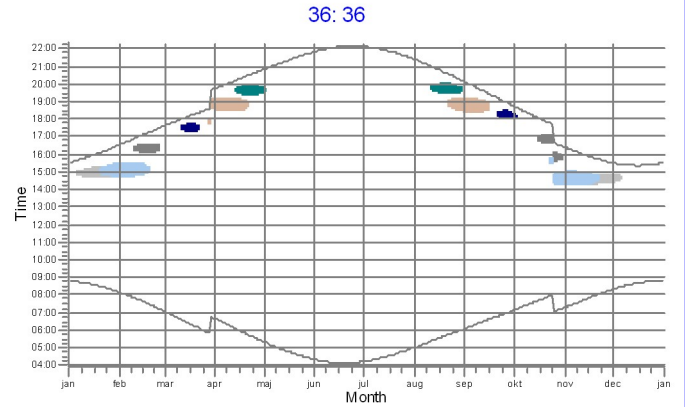
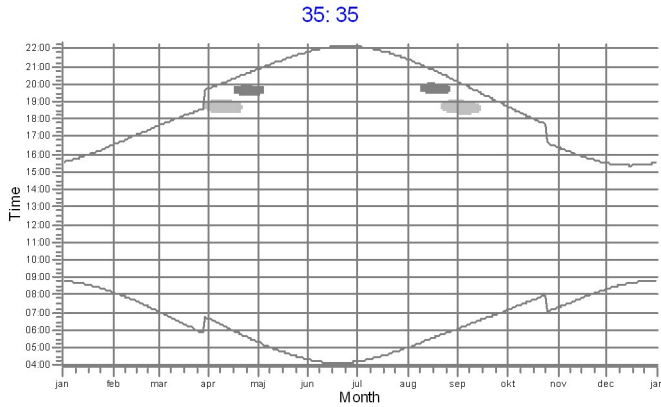
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SHADOW - Calendar, graphical

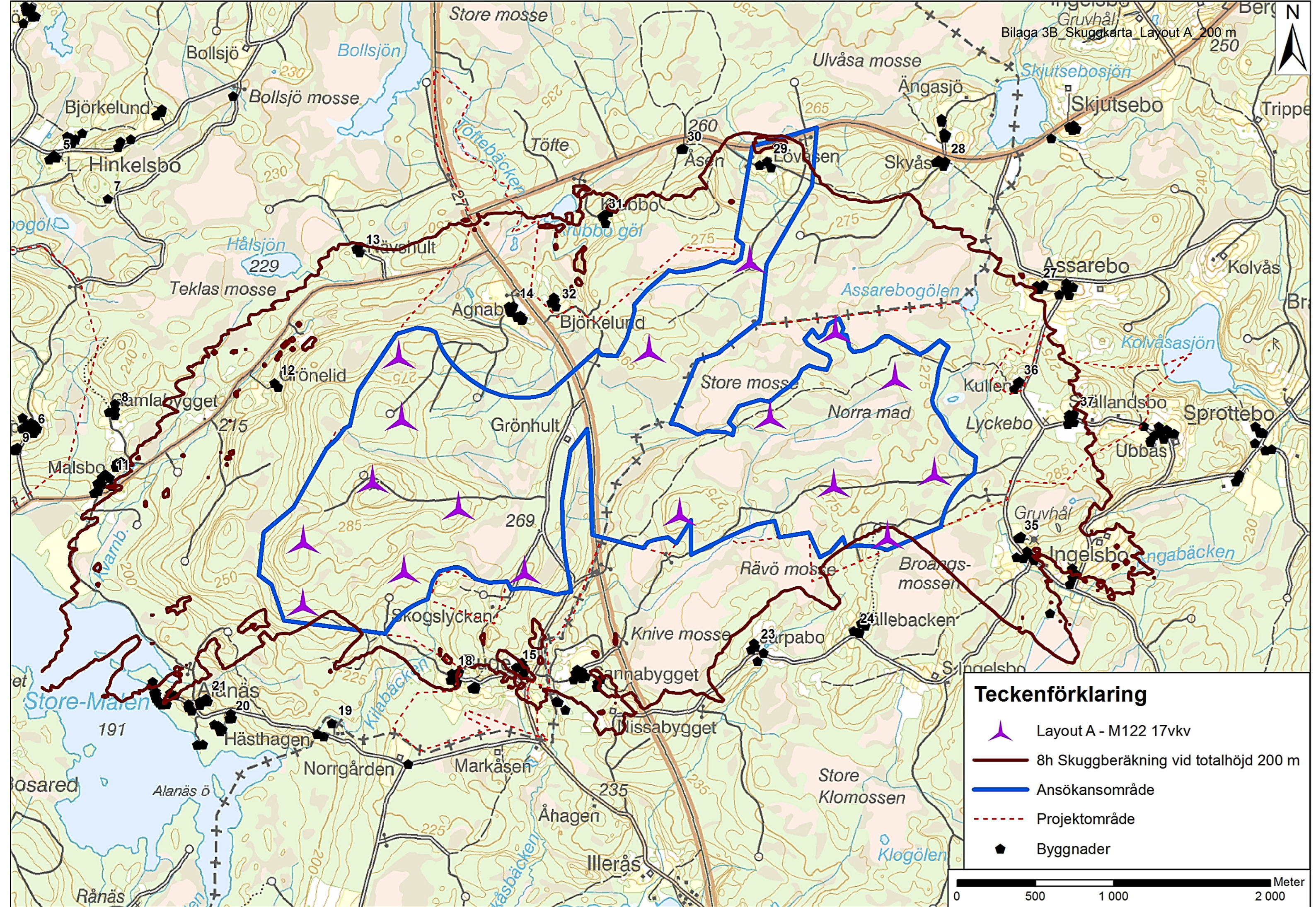
Calculation: 140408 M122 17vkv 139HH Shadow



WTGs

- A5: REpower 3.0M122 3000 122.0 !OI! hub: 139.0 m (TOT: 200.0 m) (367)
- A15: REpower 3.0M122 3000 122.0 !OI! hub: 139.0 m (TOT: 200.0 m) (370)
- A13: REpower 3.0M122 3000 122.0 !OI! hub: 139.0 m (TOT: 200.0 m) (372)
- A12: REpower 3.0M122 3000 122.0 !OI! hub: 139.0 m (TOT: 200.0 m) (373)

- A17: REpower 3.0M122 3000 122.0 !OI! hub: 139.0 m (TOT: 200.0 m) (378)
- A16: REpower 3.0M122 3000 122.0 !OI! hub: 139.0 m (TOT: 200.0 m) (381)
- A14: REpower 3.0M122 3000 122.0 !OI! hub: 139.0 m (TOT: 200.0 m) (383)



Teckenförklaring

-  Layout A - M122 17kv
-  8h Skuggberäkning vid totalhöjd 200 m
-  Ansökansområde
-  Projektområde
-  Byggnader

0 500 1000 2000 Meter