

MILJÖKONSEKVENSBESKRIVNING NÄVLINGE

Bilaga 7 Skuggberäkning

SHADOW - Main Result

Calculation: RS3.1.0 10 x Vestas V162@169m HH [TES]_Faktisk skuggtid

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) [LUND]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1,72 1,80 3,22 6,40 9,28 8,04 7,22 5,93 4,57 3,22 1,98 1,28

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
333 340 472 690 772 546 502 709 1 165 1 502 1 067 479 8 576

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: CONTOURLINE_Nävlinge_210902_1.v
Receptor grid resolution: 1,0 m

All coordinates are in
Swedish UTM 33-SWREF99 (SE)



Scale 1:150 000
New WTG Shadow receptor

WTGs

	Easting	Northing	Z	Row data/Description	WTG type					Shadow data		
					Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Calculation distance	RPM
			[m]				[kW]	[m]	[m]	[m]	[RPM]	
1	424 769	6 217 099	145,6	N1	Yes	VESTAS	V162-7.2-7 200	7 200	162,0	169,0	1 784	9,5
2	426 943	6 217 063	140,0	N2	Yes	VESTAS	V162-7.2-7 200	7 200	162,0	169,0	1 784	9,5
3	425 873	6 216 755	133,2	N3	Yes	VESTAS	V162-7.2-7 200	7 200	162,0	169,0	1 784	9,5
4	427 160	6 216 420	148,1	N4	Yes	VESTAS	V162-7.2-7 200	7 200	162,0	169,0	1 784	9,5
5	424 806	6 216 396	132,6	N5	Yes	VESTAS	V162-7.2-7 200	7 200	162,0	169,0	1 784	9,5
6	426 558	6 215 937	150,0	N6	Yes	VESTAS	V162-7.2-7 200	7 200	162,0	169,0	1 784	9,5
7	424 780	6 215 541	117,6	N7	Yes	VESTAS	V162-7.2-7 200	7 200	162,0	169,0	1 784	9,5
8	423 972	6 215 509	115,0	N8	Yes	VESTAS	V162-7.2-7 200	7 200	162,0	169,0	1 784	9,5
9	425 189	6 214 898	144,4	N9	Yes	VESTAS	V162-7.2-7 200	7 200	162,0	169,0	1 784	9,5
10	424 354	6 214 864	135,0	N10	Yes	VESTAS	V162-7.2-7 200	7 200	162,0	169,0	1 784	9,5

Shadow receptor-Input

No.	Name	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
A 1		425 633	6 218 731	125,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
B 2		427 517	6 218 663	117,1	5,0	5,0	1,0	0,0	"Green house mode"	1,0
C 3		425 135	6 218 614	122,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
D 4		425 048	6 218 507	125,6	5,0	5,0	1,0	0,0	"Green house mode"	1,0
E 5		425 833	6 218 129	138,6	5,0	5,0	1,0	0,0	"Green house mode"	1,0
F 6		423 861	6 217 950	92,6	5,0	5,0	1,0	0,0	"Green house mode"	1,0
G 7		425 930	6 217 944	138,9	5,0	5,0	1,0	0,0	"Green house mode"	1,0
H 8		428 252	6 217 814	94,4	5,0	5,0	1,0	0,0	"Green house mode"	1,0
I 9		423 602	6 217 798	94,9	5,0	5,0	1,0	0,0	"Green house mode"	1,0
J 10		428 231	6 217 773	95,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
K 11		428 245	6 217 753	95,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
L 12		423 478	6 217 612	112,4	5,0	5,0	1,0	0,0	"Green house mode"	1,0
M 13		423 773	6 217 488	95,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
N 14		428 883	6 217 266	45,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
O 15		428 668	6 217 181	54,8	5,0	5,0	1,0	0,0	"Green house mode"	1,0
P 16		428 681	6 217 154	52,6	5,0	5,0	1,0	0,0	"Green house mode"	1,0
Q 17		428 655	6 217 103	54,5	5,0	5,0	1,0	0,0	"Green house mode"	1,0
R 18		423 469	6 216 980	100,8	5,0	5,0	1,0	0,0	"Green house mode"	1,0
S 19		428 425	6 216 977	68,1	5,0	5,0	1,0	0,0	"Green house mode"	1,0
T 20		428 657	6 216 951	52,1	5,0	5,0	1,0	0,0	"Green house mode"	1,0

To be continued on next page...

SHADOW - Main Result

Calculation: RS3.1.0 10 x Vestas V162@169m HH [TES]_Faktisk skuggtid

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No.	Name	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
U 21		428 325	6 216 949	71,4	5,0	5,0	1,0	0,0	"Green house mode"	1,0
V 22		428 612	6 216 827	57,1	5,0	5,0	1,0	0,0	"Green house mode"	1,0
W 23		428 571	6 216 780	60,1	5,0	5,0	1,0	0,0	"Green house mode"	1,0
X 24		428 779	6 216 730	50,8	5,0	5,0	1,0	0,0	"Green house mode"	1,0
Y 25		428 149	6 216 559	80,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
Z 26		428 491	6 216 551	65,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AA 27		428 369	6 216 294	71,8	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AB 28		423 074	6 216 247	100,6	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AC 29		422 496	6 216 034	104,1	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AD 30		428 482	6 215 939	91,3	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AE 31		422 533	6 215 933	100,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AF 32		422 449	6 215 843	105,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AG 33		422 315	6 215 603	94,7	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AH 34		422 931	6 215 570	101,2	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AI 35		422 918	6 215 546	100,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AJ 36		427 892	6 215 529	100,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AK 37		422 964	6 215 499	102,2	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AL 38		422 224	6 215 440	90,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AM 39		422 144	6 215 416	90,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AN 40		427 897	6 215 400	105,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AO 41		427 961	6 215 348	108,5	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AP 42		427 886	6 215 344	105,2	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AQ 43		427 648	6 214 993	120,9	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AR 44		427 252	6 214 992	150,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AS 45		427 941	6 214 985	110,8	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AT 46		422 496	6 214 644	100,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AU 47		422 360	6 214 540	86,2	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AV 48		427 095	6 214 444	146,9	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AW 49		426 586	6 214 134	150,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AX 50		426 166	6 213 831	150,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AY 51		425 366	6 213 723	140,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
AZ 52		425 387	6 213 691	140,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BA 53		424 919	6 213 686	137,5	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BB 54		425 025	6 213 649	139,3	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BC 55		424 485	6 213 627	143,1	5,0	5,0	1,0	0,0	"Green house mode"	1,0
BD 56		425 262	6 213 612	140,0	5,0	5,0	1,0	0,0	"Green house mode"	1,0

Calculation Results

Shadow receptor

Shadow, expected values

No.	Name	Shadow hours per year [h/year]
A 1		0:00
B 2		0:29
C 3		0:19
D 4		0:43
E 5		4:10
F 6		2:27
G 7		5:42
H 8		4:10
I 9		2:14
J 10		4:20
K 11		4:16
L 12		2:23
M 13		5:50
N 14		0:00
O 15		3:42
P 16		3:47
Q 17		1:48
R 18		7:40
S 19		5:59
T 20		4:35

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SHADOW - Main Result

Calculation: RS3.1.0 10 x Vestas V162@169m HH [TES]_Faktisk skuggtid

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Shadow, expected values

No.	Name	Shadow hours per year [h/year]
	U 21	7:02
	V 22	5:02
	W 23	5:27
	X 24	1:56
	Y 25	19:12
	Z 26	7:45
	AA 27	13:38
	AB 28	2:55
	AC 29	1:54
	AD 30	6:28
	AE 31	2:07
	AF 32	2:04
	AG 33	2:14
	AH 34	8:00
	AI 35	8:09
	AJ 36	0:00
	AK 37	9:23
	AL 38	2:22
	AM 39	0:00
	AN 40	6:27
	AO 41	5:50
	AP 42	7:23
	AQ 43	0:00
	AR 44	0:00
	AS 45	4:46
	AT 46	8:06
	AU 47	0:00
	AV 48	0:00
	AW 49	6:24
	AX 50	0:00
	AY 51	0:00
	AZ 52	0:00
	BA 53	0:00
	BB 54	0:00
	BC 55	0:00
	BD 56	0:00

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

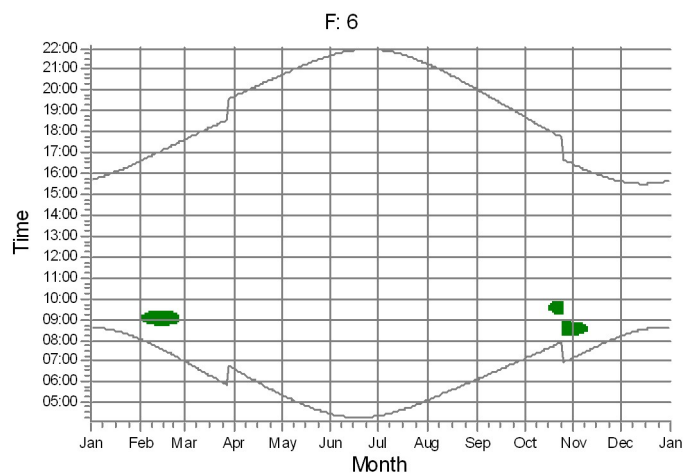
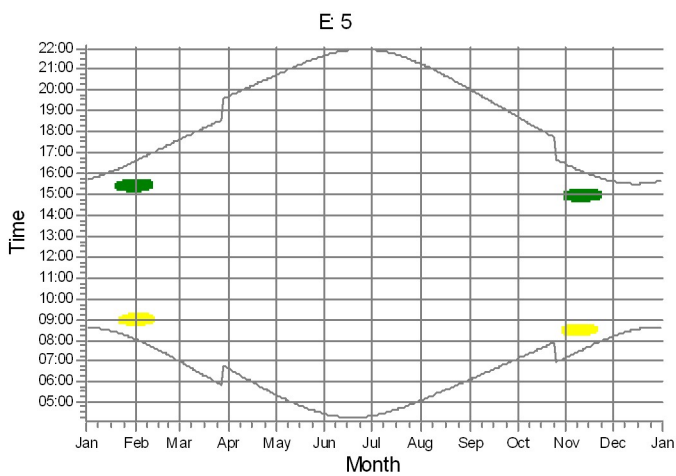
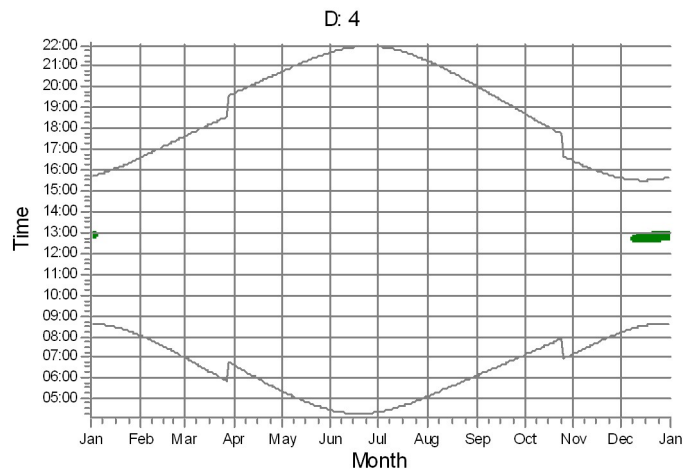
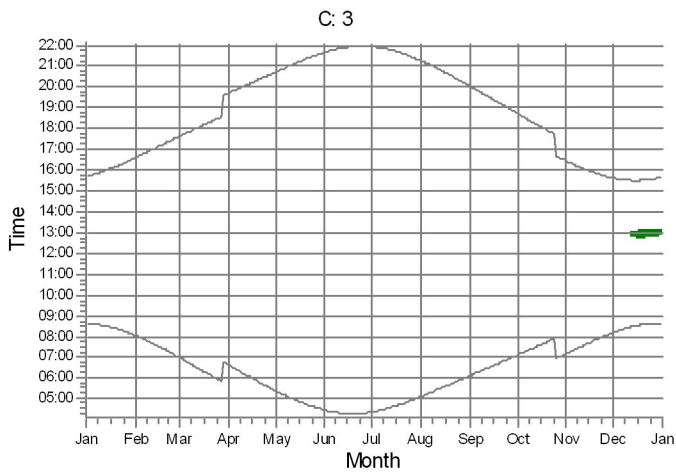
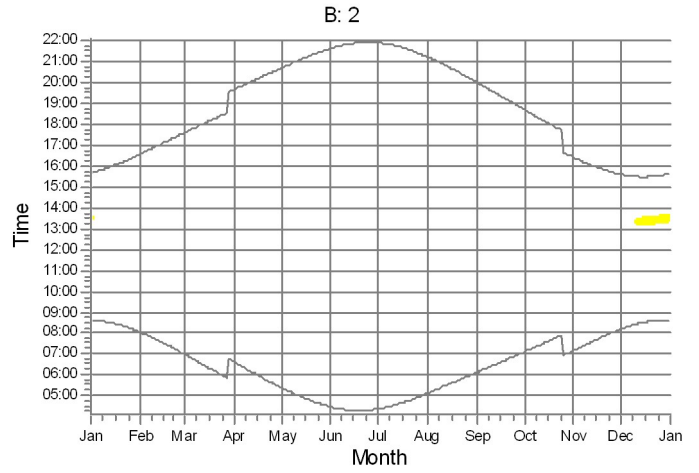
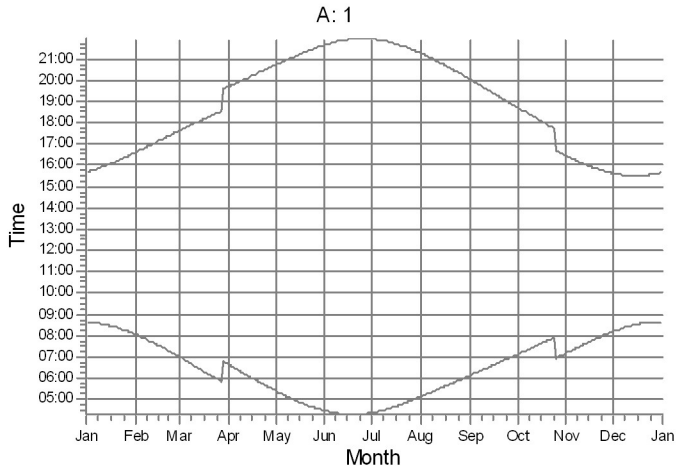
No.	Name	Expected [h/year]
1	N1	20:08
2	N2	38:22
3	N3	1:11
4	N4	31:09
5	N5	3:58
6	N6	16:30
7	N7	0:00
8	N8	29:20
9	N9	6:24
10	N10	2:29

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

The calculation of the total expected values for a given receptor assumes a weighted average directional reduction for all WTGs contributing to shadow flicker within the same day. In the case where shadow flicker from different WTGs is not concurrent within the day, the total expected time at a given receptor may deviate marginally from the individual flicker time caused by each turbine separately.

SHADOW - Calendar, graphical

Calculation: RS3.1.0 10 x Vestas V162@169m HH [TES]_Faktisk skuggtid

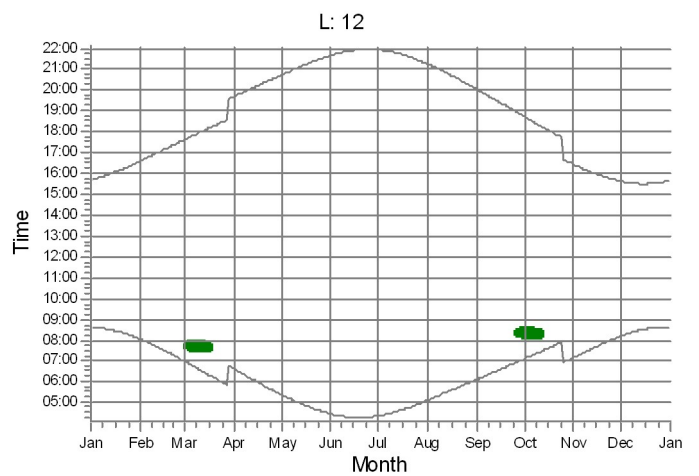
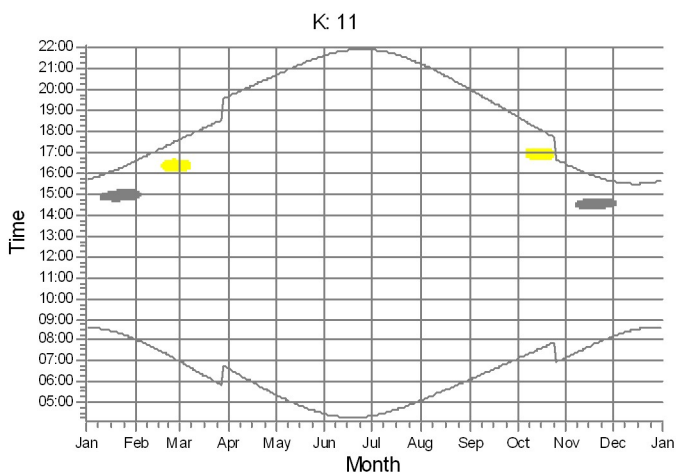
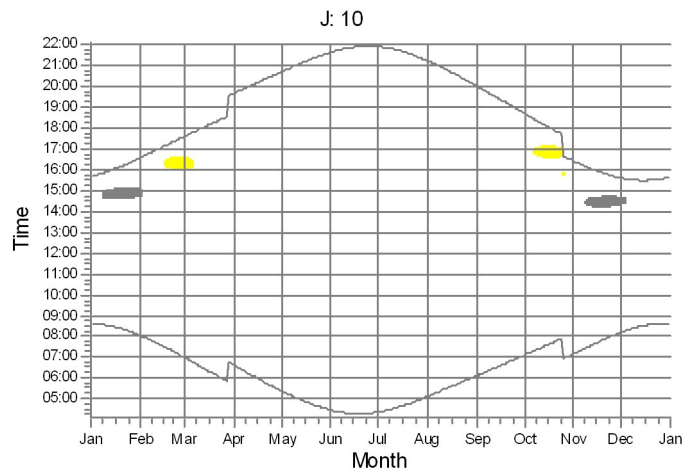
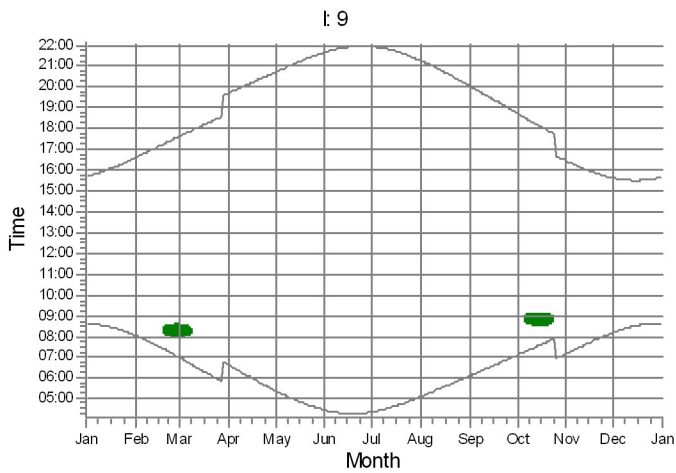
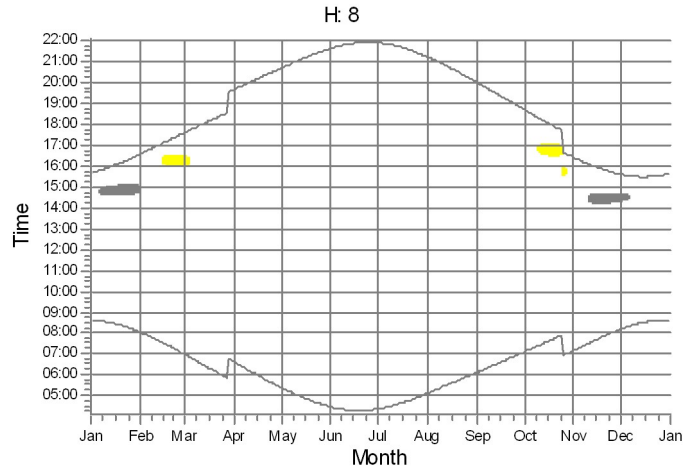
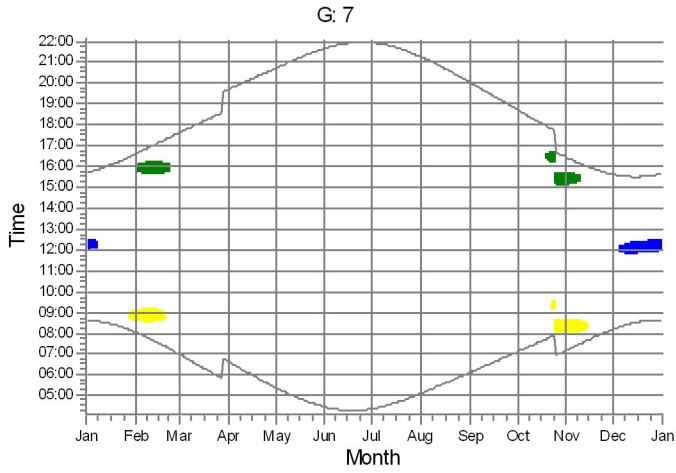


WTGs

1: N1 2: N2

SHADOW - Calendar, graphical

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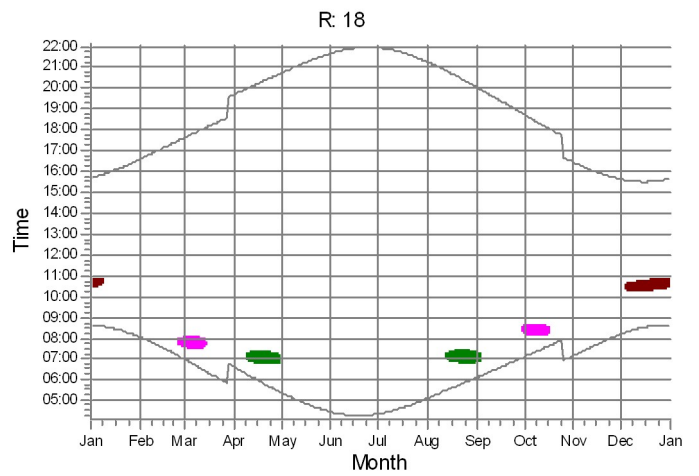
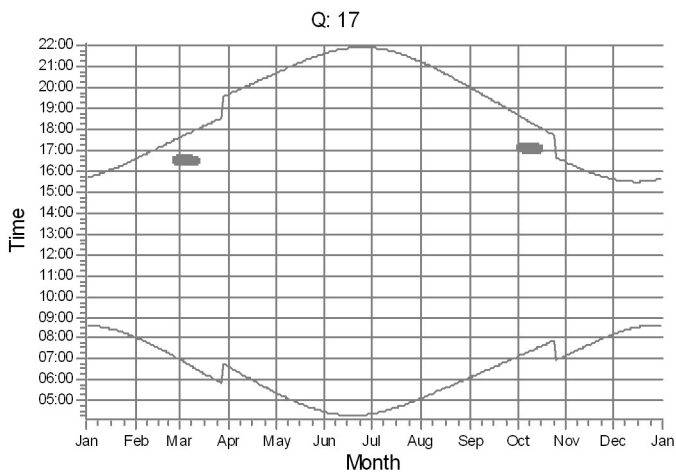
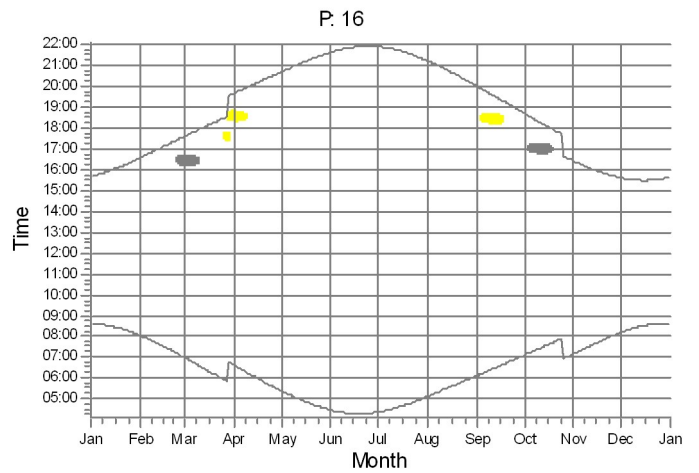
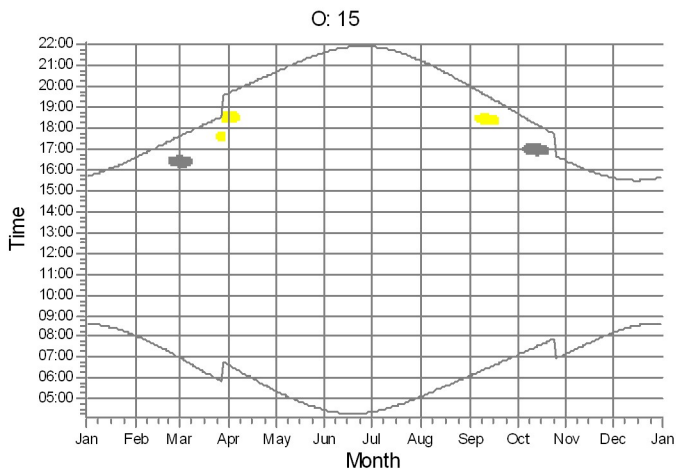
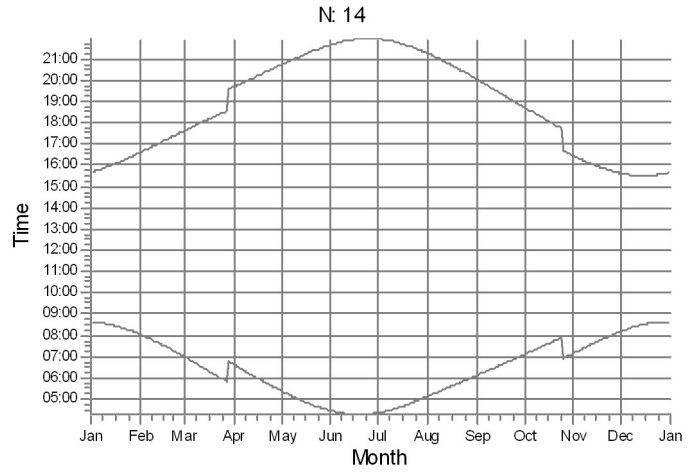
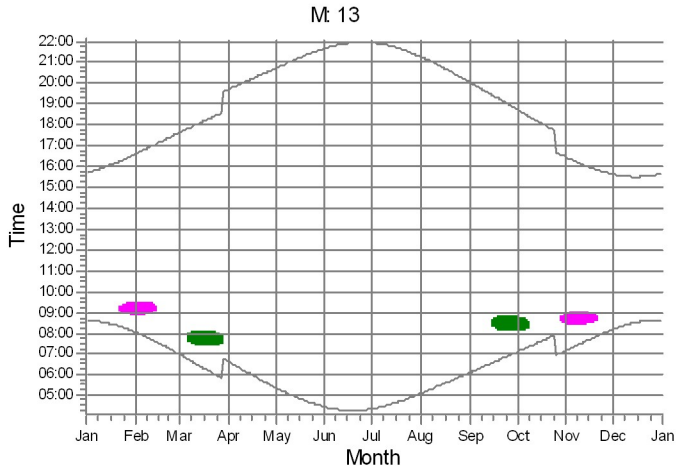


WTGs



SHADOW - Calendar, graphical

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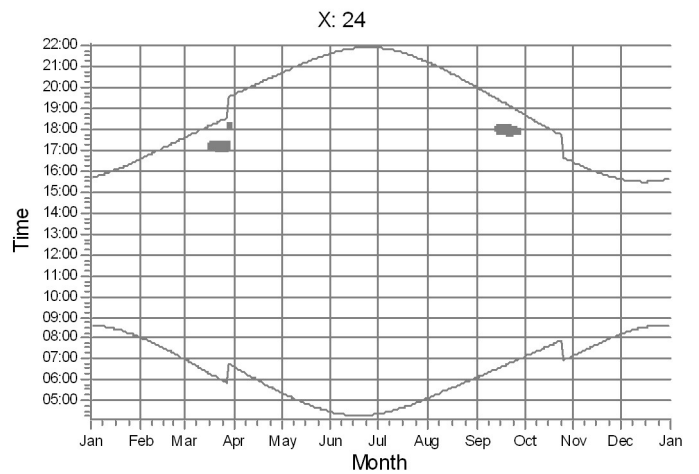
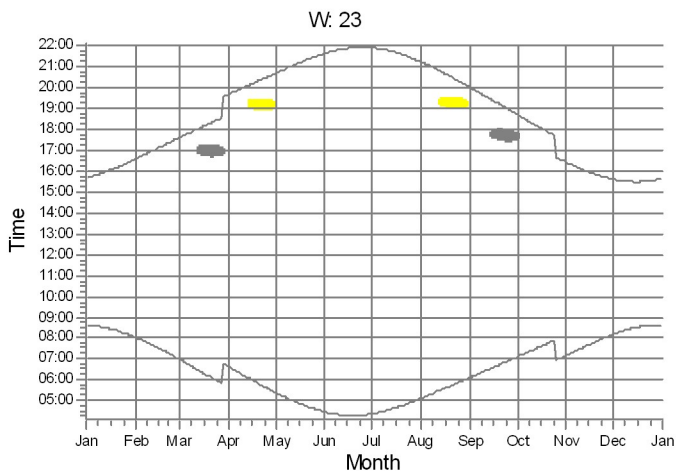
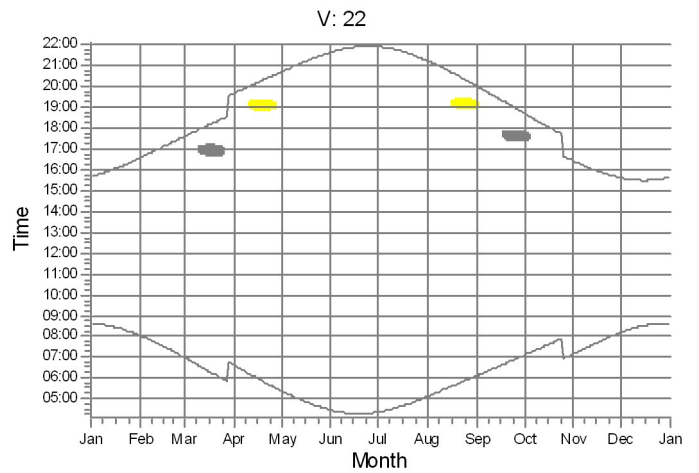
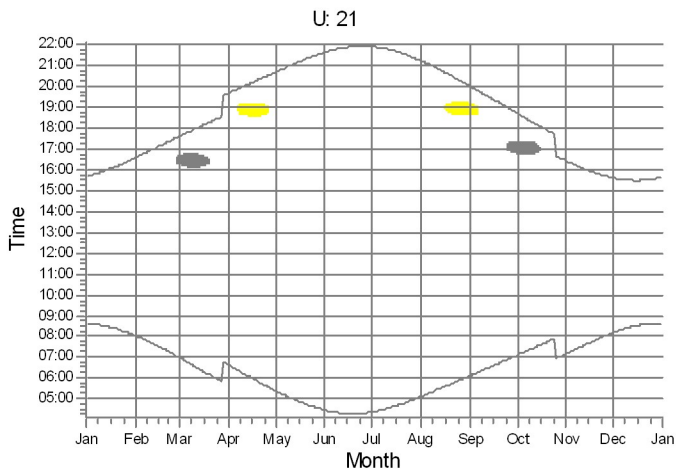
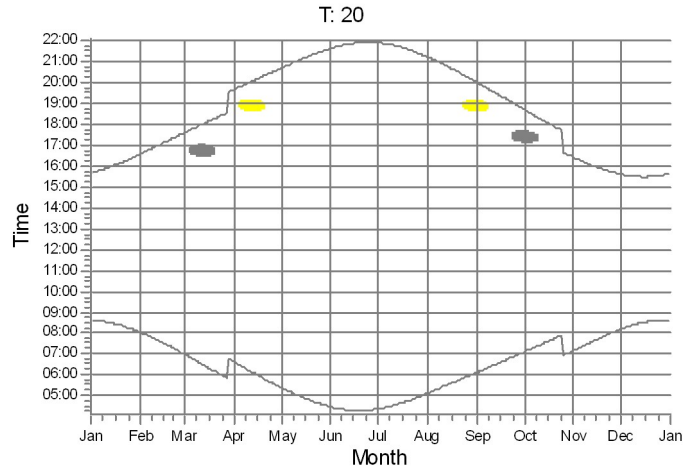
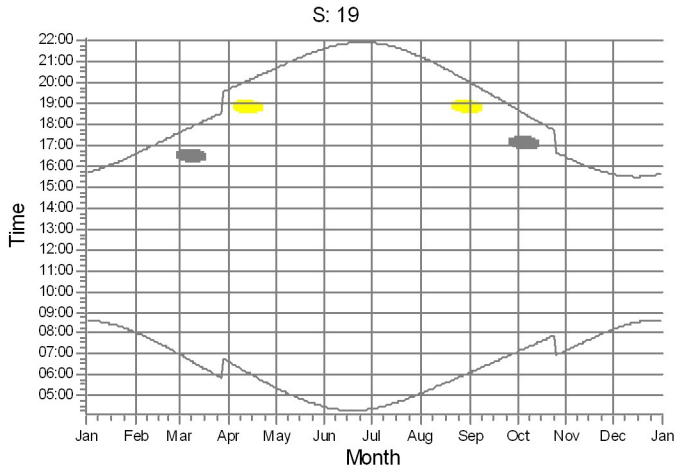


WTGs



SHADOW - Calendar, graphical

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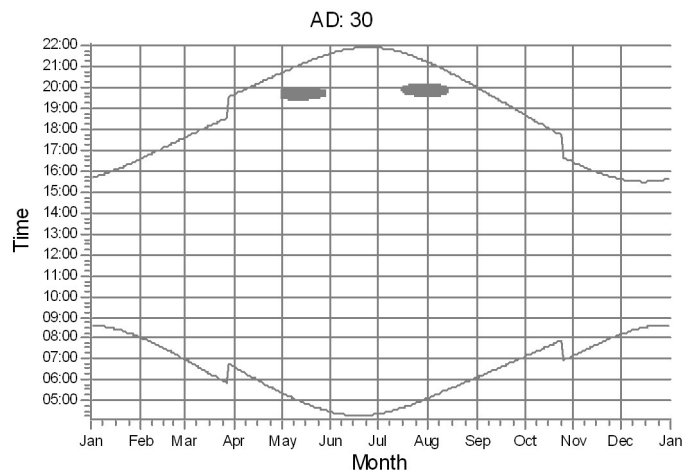
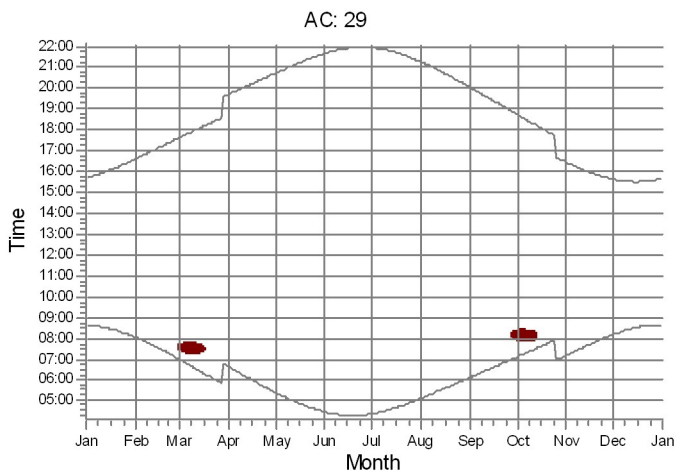
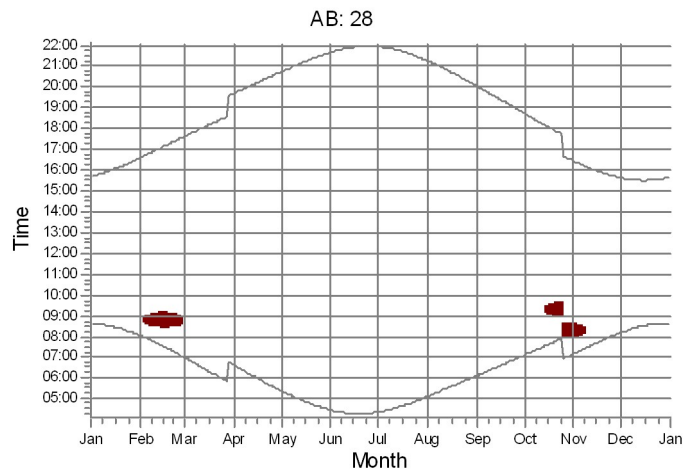
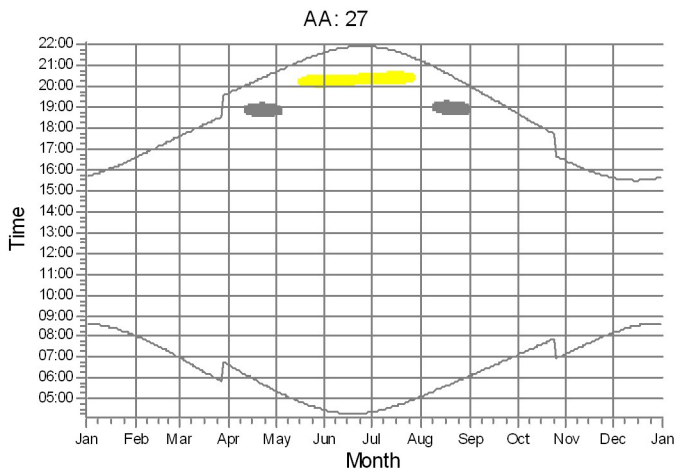
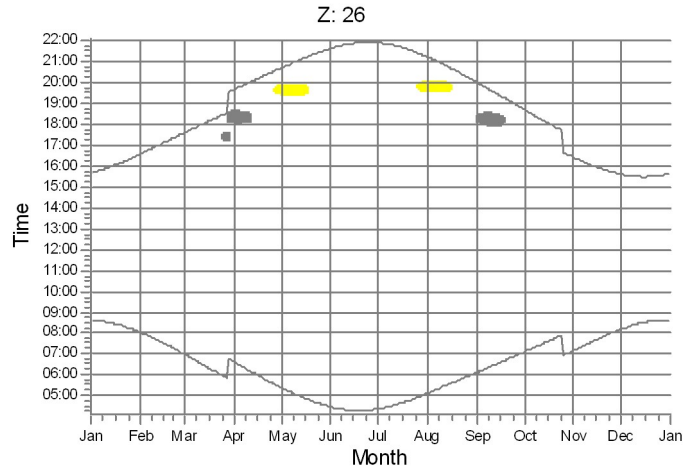
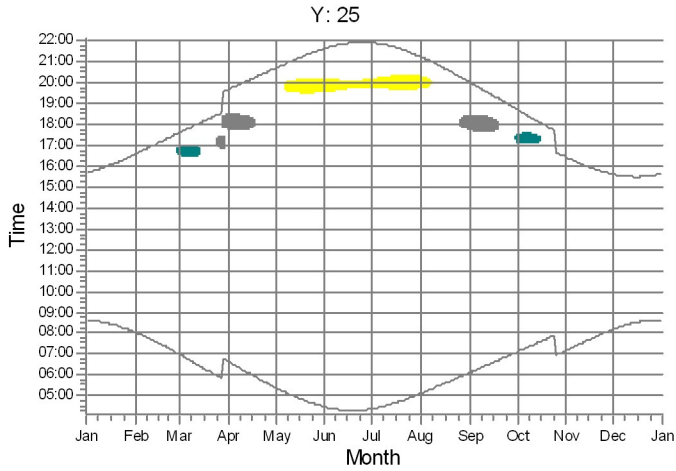


WTGs



SHADOW - Calendar, graphical

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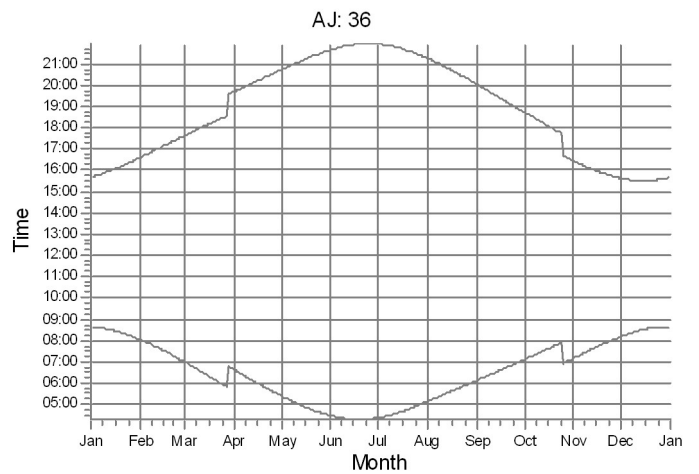
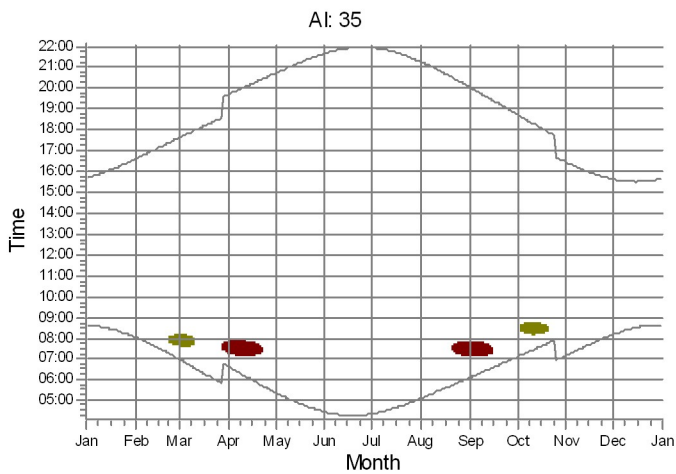
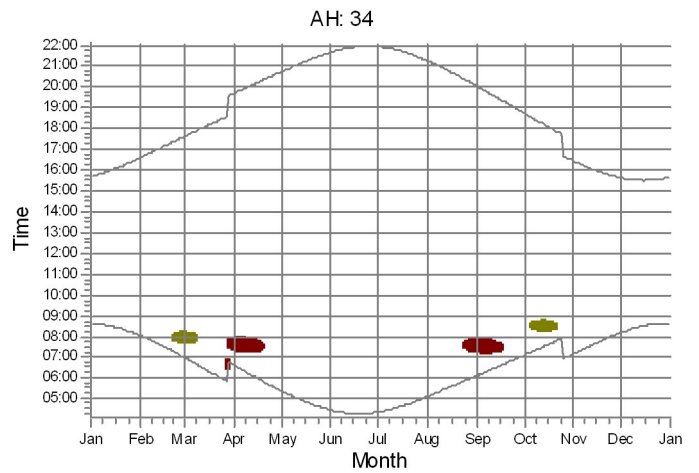
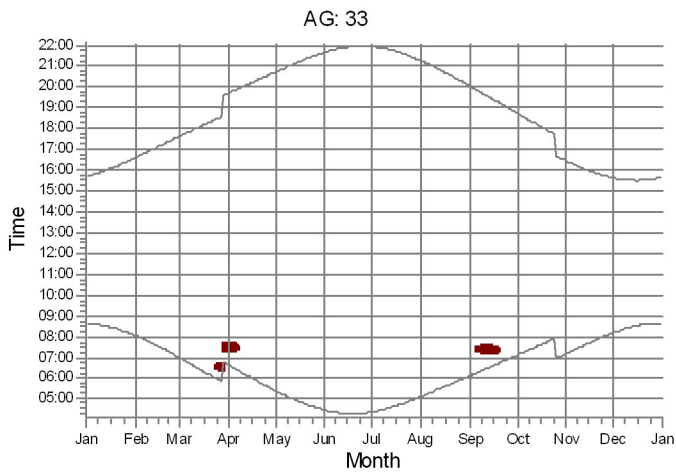
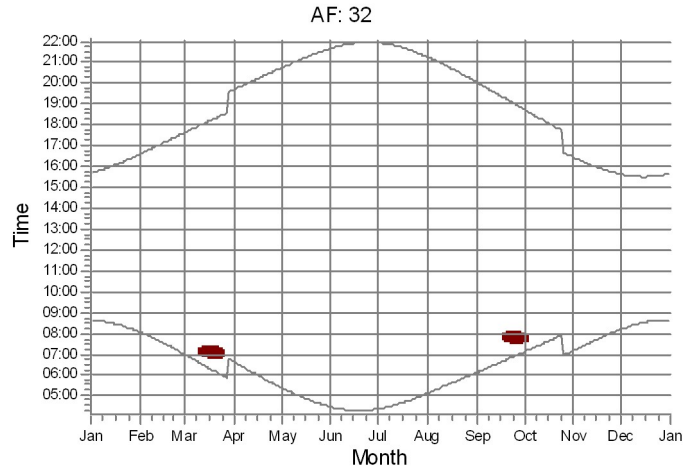
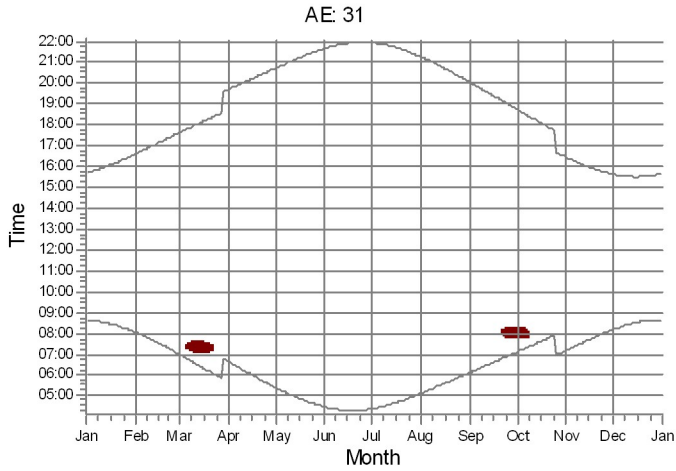


WTGs



SHADOW - Calendar, graphical

Calculation: RS3.1.0 10 x Vestas V162@169m HH [TES]_Faktisk skuggtid

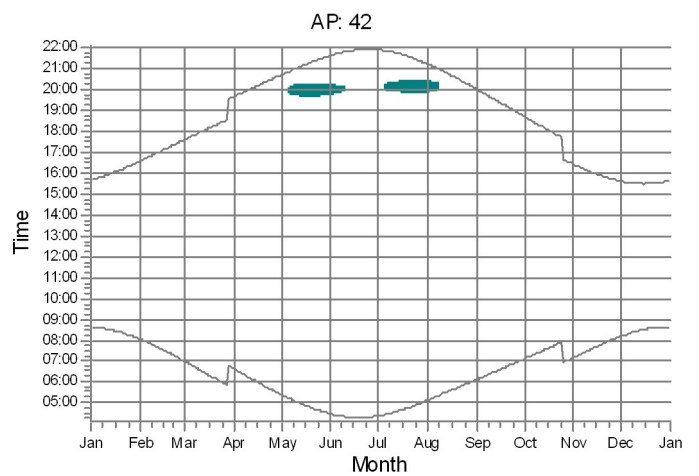
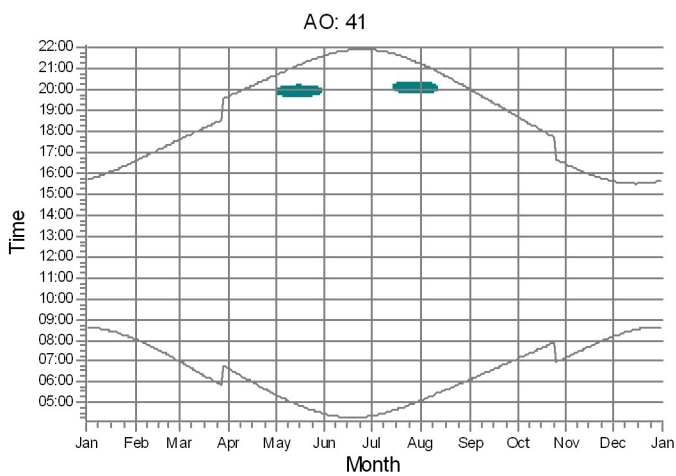
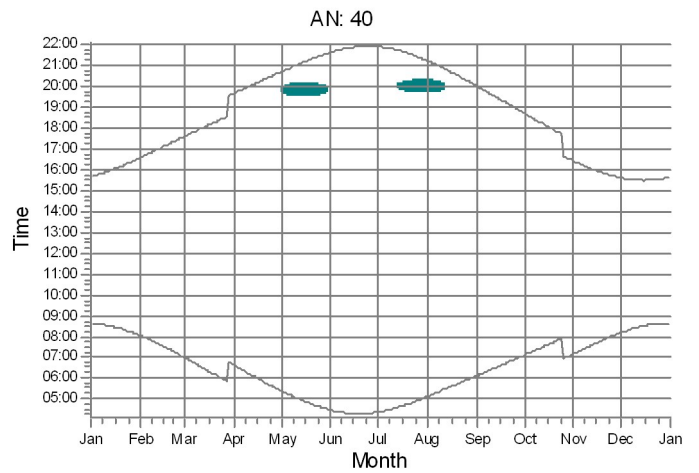
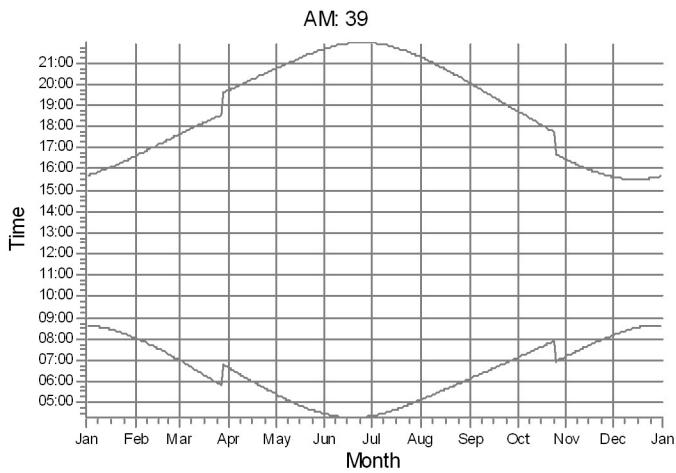
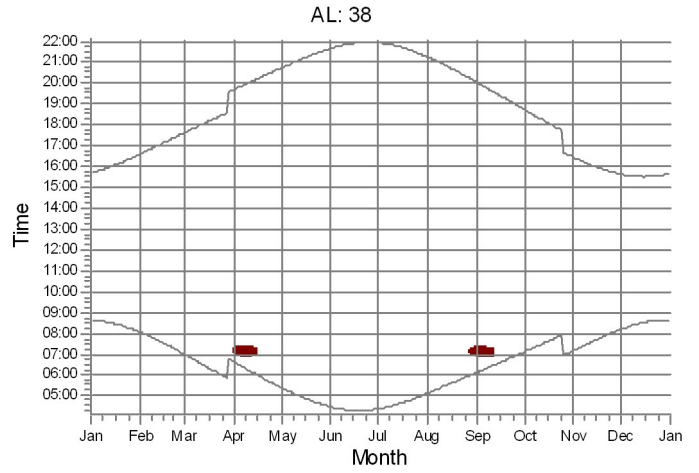
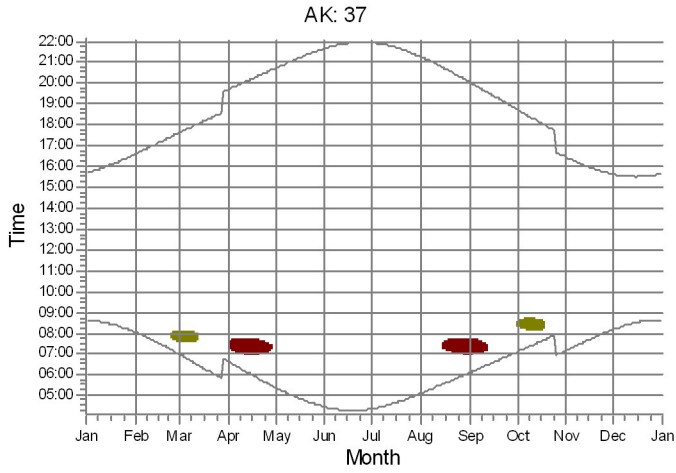


WTGs



SHADOW - Calendar, graphical

Calculation: RS3.1.0 10 x Vestas V162@169m HH [TES]_Faktisk skuggtid

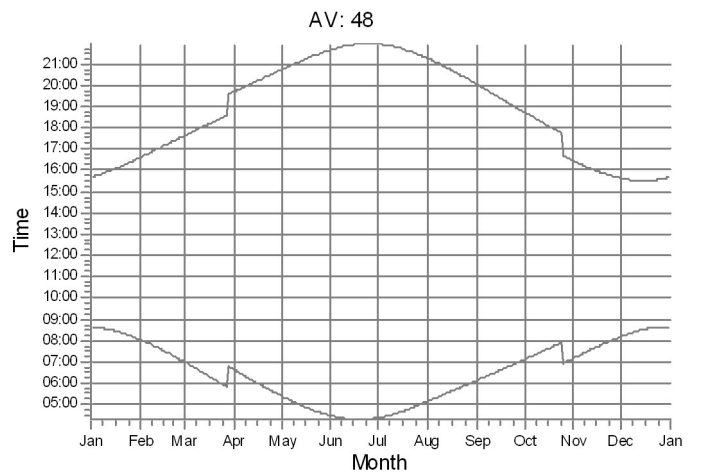
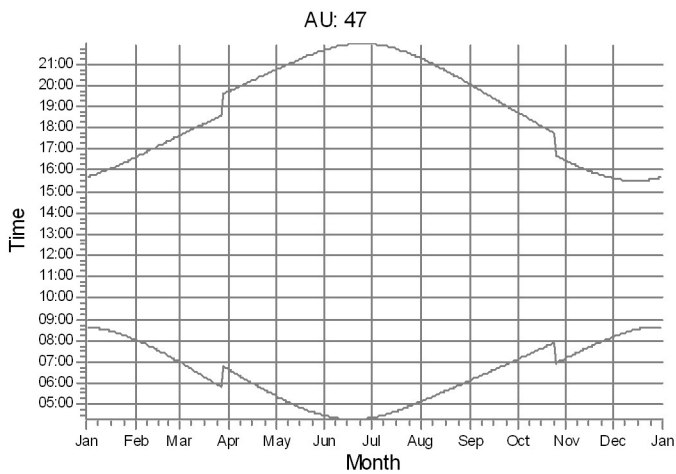
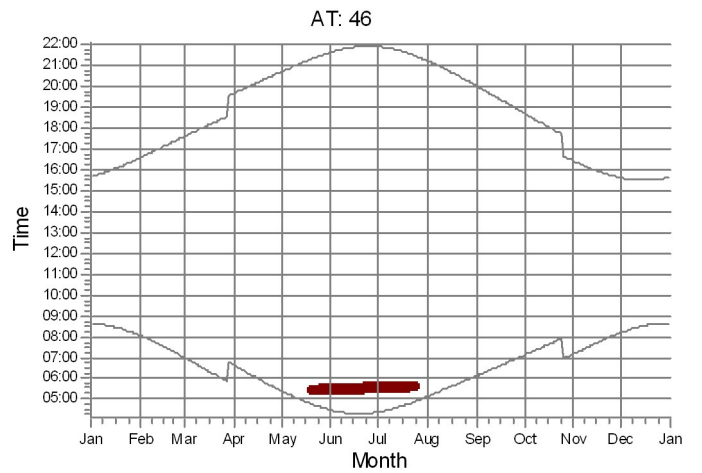
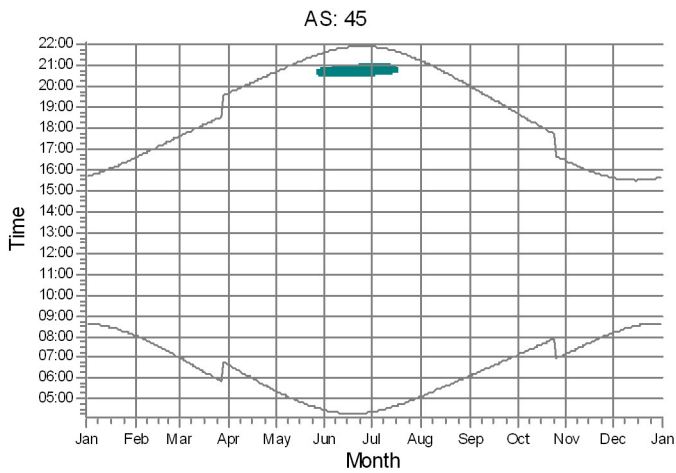
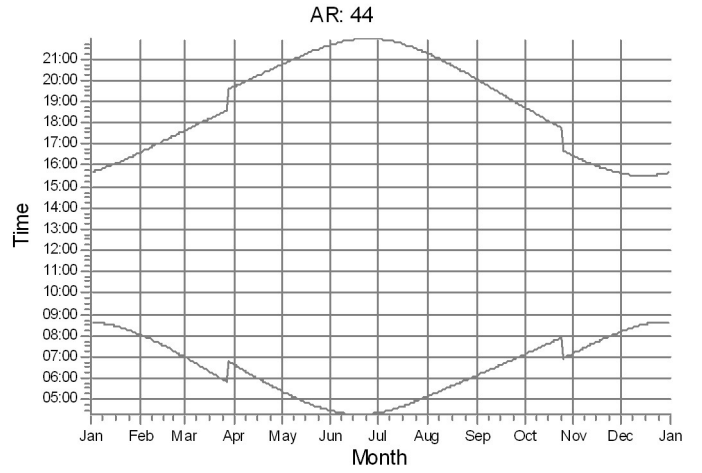
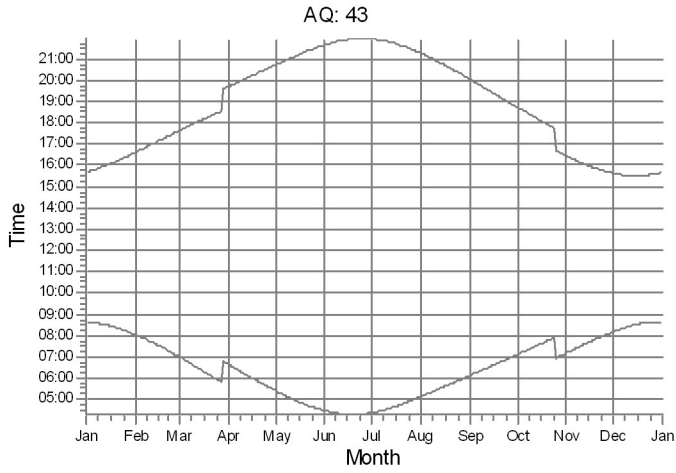


WTGs



SHADOW - Calendar, graphical

Calculation: RS3.1.0 10 x Vestas V162@169m HH [TES]_Faktisk skuggtid

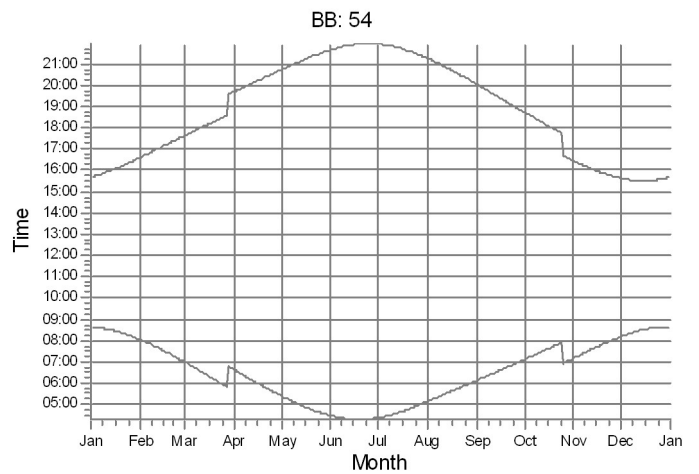
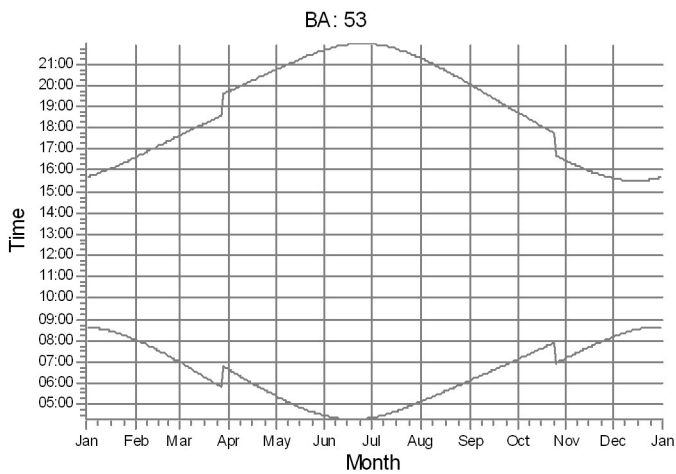
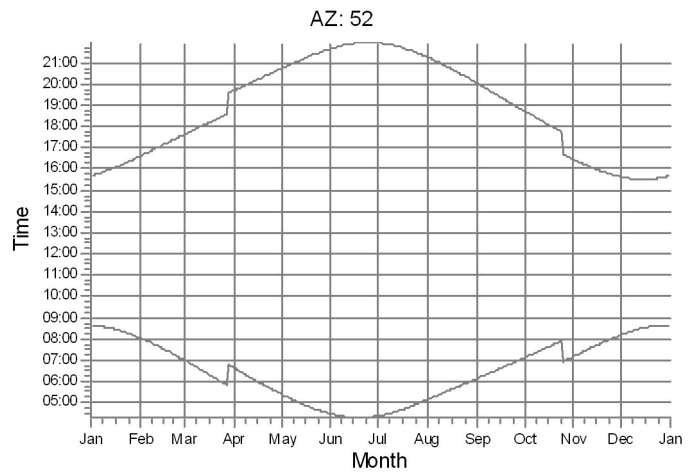
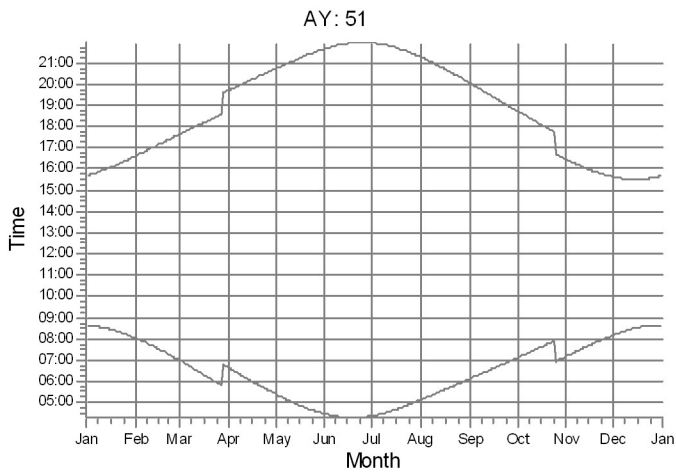
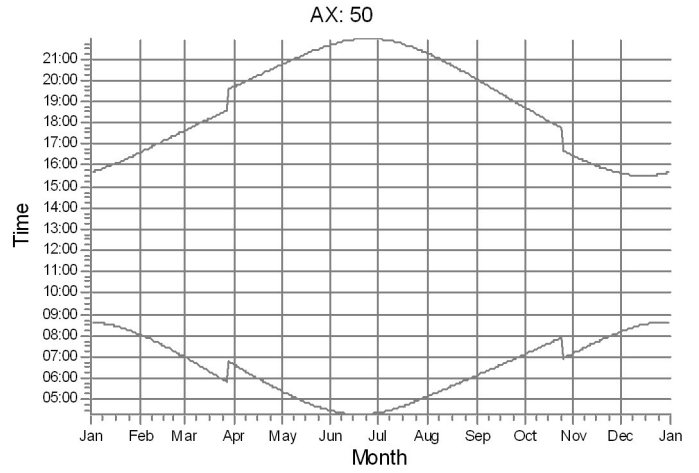
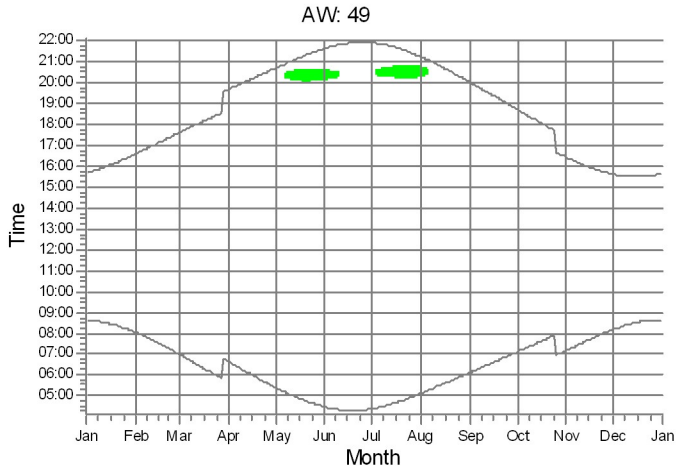


WTGs

6: N6 8: N8

SHADOW - Calendar, graphical

Calculation: RS3.1.0 10 x Vestas V162@169m HH [TES]_Faktisk skuggtid

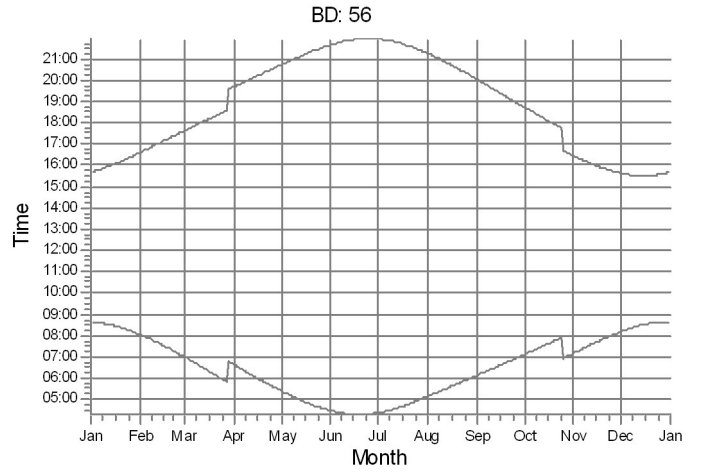
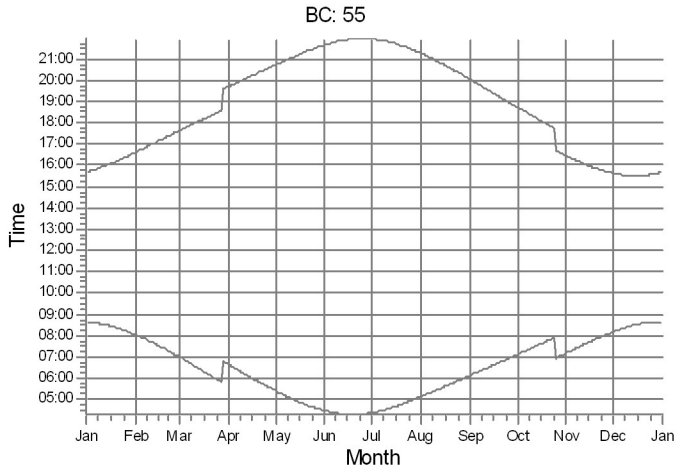


WTGs

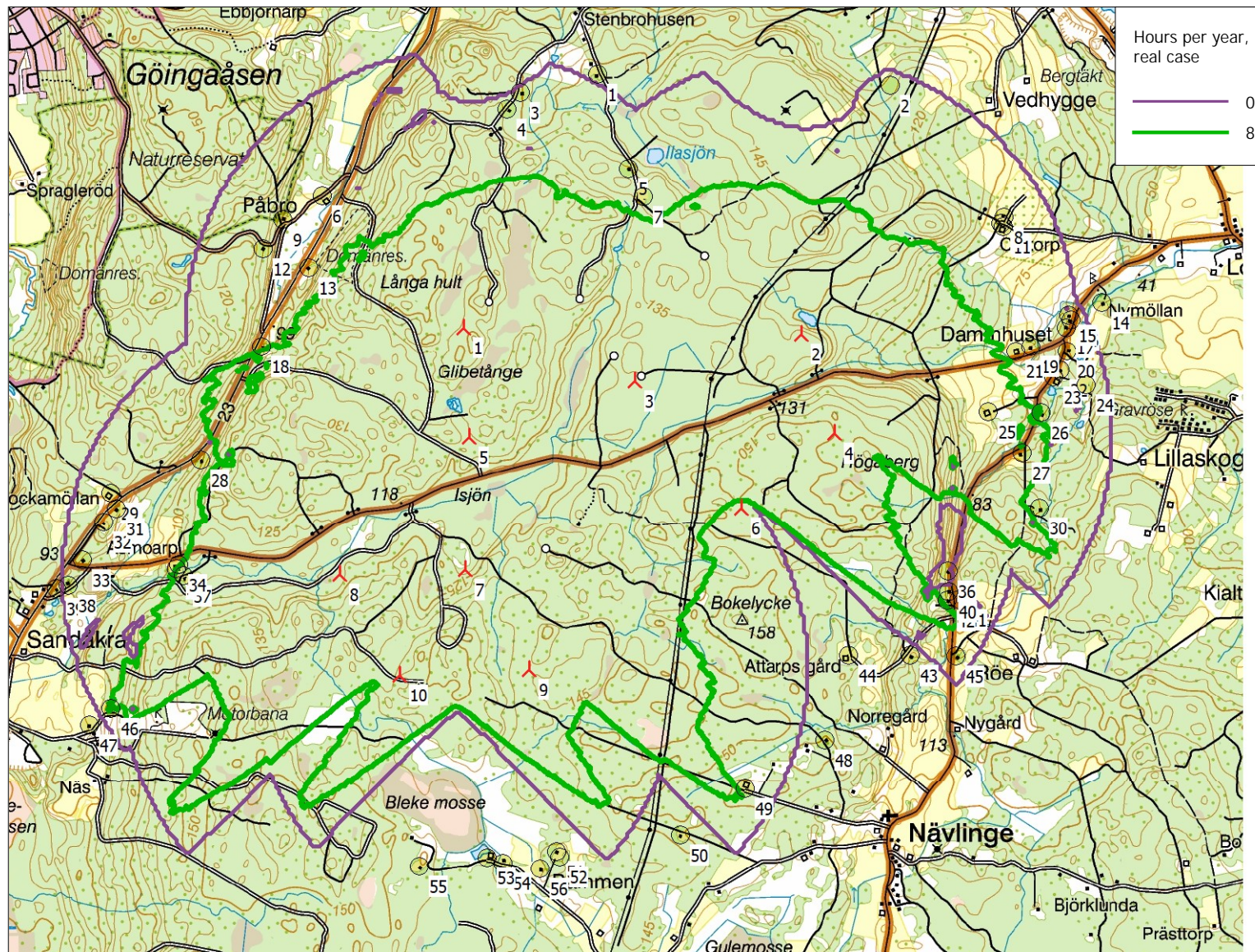
9: N9

SHADOW - Calendar, graphical

Calculation: RS3.1.0 10 x Vestas V162@169m HH [TES]_Faktisk skuggtid



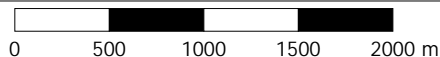
WTGs



Project:
Nävlinge_210902

Hours per year,
real case

— 0
— 8



Map: Terrängkarta, Print scale 1:40 000, Map center Swedish UTM 33-SWREF99 (SE) East: 425 904 North: 6 216 117

▲ New WTG

● Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_Nävlinge_210902_1.wpo (15)

Time step: 3 minutes, Day step: 7 days, Map resolution: 20 m, Visibility resolution: 10 m, Eye height: 1,5 m

SHADOW - Map

Calculation:

RS3.1.0 10 x Vestas V162@169m HH [TES]_Faktisk skuggtid

Licensed user:

Wind Sweden AB

Batterivägen 2

SE-311 39 Falkenberg

+46 723 158788

Mikael Palmqvist / mikael@wind-sweden.com

Calculated:

2023-04-11 12:21/3.6.355