

Project:

Muonio 090327

Printed/Page

2009.11.30 14:58 / 1

Licensed user:

wpd Scandinavia AB
 Ferkens Gränd 3
 SE-111 30 Stockholm
 +46 733 99 00 40

Calculated:

2009.11.13 16:39/2.6.1.252

SHADOW - Main Result**Calculation:** MUO WWD-3/100 100m 091112**Assumptions for shadow calculations**

Maximum distance for influence

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

Please look in WTG table

Minimum sun height over horizon for influence

3 °

Day step for calculation

1 days

Time step for calculation

1 minutes

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

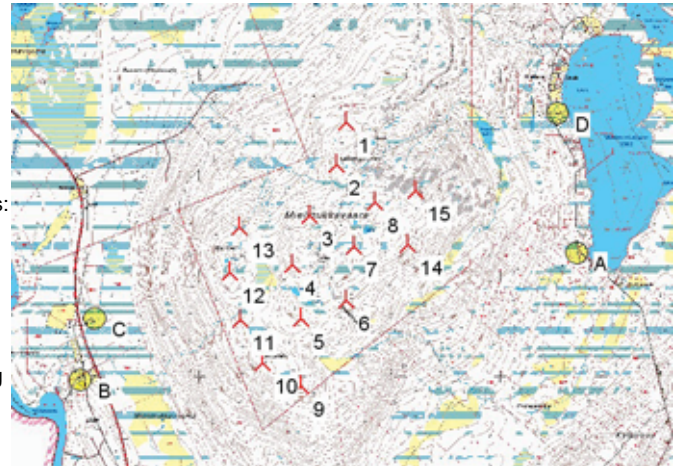
To avoid flicker from WTGs not visible a ZVI calculation is performed before the flicker calculation. The ZVI calculation is based on the following assumptions

Height contours used: Height Contours: Height contours shp.wpo (11)

Obstacles not used in calculation

Eye height: 2,0 m

Grid resolution: 10 m



New WTG

Scale 1:75 000

Shadow receptor

WTGs

KKJ Zone: 2				WTG type				Shadow data				
East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Calculation distance	RPM	
KKJ Zone: 2			[m]				[kW]	[m]	[m]	[m]	[RPM]	
1	2 477 469	7 555 523	425,0	WINWIND WWD-3/100 3...Yes	WINWIND	WWD-3/100-3 000	3 000	100,0	100,0	1 946	0,0	
2	2 477 369	7 555 107	441,8	WINWIND WWD-3/100 3...Yes	WINWIND	WWD-3/100-3 000	3 000	100,0	100,0	1 946	0,0	
3	2 477 105	7 554 599	450,3	WINWIND WWD-3/100 3...Yes	WINWIND	WWD-3/100-3 000	3 000	100,0	100,0	1 946	0,0	
4	2 476 933	7 554 111	472,5	WINWIND WWD-3/100 3...Yes	WINWIND	WWD-3/100-3 000	3 000	100,0	100,0	1 946	0,0	
5	2 477 021	7 553 575	462,1	WINWIND WWD-3/100 3...Yes	WINWIND	WWD-3/100-3 000	3 000	100,0	100,0	1 946	0,0	
6	2 477 469	7 553 751	447,5	WINWIND WWD-3/100 3...Yes	WINWIND	WWD-3/100-3 000	3 000	100,0	100,0	1 946	0,0	
7	2 477 545	7 554 295	465,0	WINWIND WWD-3/100 3...Yes	WINWIND	WWD-3/100-3 000	3 000	100,0	100,0	1 946	0,0	
8	2 477 753	7 554 731	460,0	WINWIND WWD-3/100 3...Yes	WINWIND	WWD-3/100-3 000	3 000	100,0	100,0	1 946	0,0	
9	2 477 021	7 552 899	439,7	WINWIND WWD-3/100 3...Yes	WINWIND	WWD-3/100-3 000	3 000	100,0	100,0	1 946	0,0	
10	2 476 633	7 553 131	455,0	WINWIND WWD-3/100 3...Yes	WINWIND	WWD-3/100-3 000	3 000	100,0	100,0	1 946	0,0	
11	2 476 413	7 553 563	430,0	WINWIND WWD-3/100 3...Yes	WINWIND	WWD-3/100-3 000	3 000	100,0	100,0	1 946	0,0	
12	2 476 305	7 554 031	450,0	WINWIND WWD-3/100 3...Yes	WINWIND	WWD-3/100-3 000	3 000	100,0	100,0	1 946	0,0	
13	2 476 405	7 554 479	440,0	WINWIND WWD-3/100 3...Yes	WINWIND	WWD-3/100-3 000	3 000	100,0	100,0	1 946	0,0	
14	2 478 081	7 554 307	443,0	WINWIND WWD-3/100 3...Yes	WINWIND	WWD-3/100-3 000	3 000	100,0	100,0	1 946	0,0	
15	2 478 157	7 554 843	450,0	WINWIND WWD-3/100 3...Yes	WINWIND	WWD-3/100-3 000	3 000	100,0	100,0	1 946	0,0	

Shadow receptor-Input

KKJ Zone: 2										
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	E	2 479 766	7 554 219	246,1	1,0	1,0	1,0	-180,0	90,0	"Green house mode"
B	SW	2 474 825	7 552 958	261,1	1,0	1,0	1,0	-180,0	90,0	"Green house mode"
C	W	2 474 961	7 553 568	251,0	1,0	1,0	1,0	-180,0	90,0	"Green house mode"
D	NE	2 479 575	7 555 610	241,7	1,0	1,0	1,0	-180,0	90,0	"Green house mode"

Calculation Results

Shadow receptor

Shadow, worst case

No.	Name	Shadow hours per year	Shadow days per year	Max shadow hours per day
		[h/year]	[days/year]	[h/day]
A	E	7:44	43	0:14
B	SW	14:19	81	0:14
C	W	21:28	96	0:23

Continued on next page...

Project:

Muonio 090327

Printed/Page

2009.11.30 14:58 / 2

Licensed user:

wpd Scandinavia AB
 Ferkens Gränd 3
 SE-111 30 Stockholm
 +46 733 99 00 40

Calculated:

2009.11.13 16:39/2.6.1.252

SHADOW - Main Result**Calculation:** MUO WWD-3/100 100m 091112

...continued from previous page

Shadow, worst case

No.	Name	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
D	NE	3:18	18	0:15

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

No.	Name	Worst case [h/year]
1	WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (16)	0:00
2	WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (17)	0:00
3	WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (18)	0:00
4	WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (19)	0:00
5	WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (20)	0:00
6	WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (21)	0:00
7	WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (22)	0:00
8	WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (23)	0:00
9	WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (24)	0:00
10	WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (25)	5:54
11	WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (26)	8:55
12	WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (27)	14:01
13	WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (28)	6:57
14	WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (29)	3:22
15	WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (30)	7:40

Project:

Muonio 090327

Printed/Page

2009.11.30 14:58 / 3

Licensed user:

wpd Scandinavia AB
 Ferrens Gränd 3
 SE-111 30 Stockholm
 +46 733 99 00 40

Calculated:

2009.11.13 16:39/2.6.1.252

SHADOW - Calendar**Calculation:** MUO WWD-3/100 100m 091112 **Shadow receptor:** A - E**Assumptions for shadow calculations**

Maximum distance for influence No limit
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 1 minutes

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December		
1		09:48	07:50	06:40	04:27			03:35	20:30 (15)	05:49	07:36	08:34	11:00	
		15:33	17:30	20:24	22:23			23:26	10	20:40 (15)	21:02	18:55	15:45	13:30
2		09:44	07:46	06:35	04:23		20:22 (15)	03:40	20:29 (15)	05:52	07:40	08:38	11:06	
		15:37	17:33	20:28	22:28	5	20:27 (15)	23:21	12	20:41 (15)	20:58	18:51	15:41	13:25
3		09:40	07:42	06:31	04:18		20:20 (15)	03:45	20:29 (15)	05:56	07:43	08:42	11:13	
		15:42	17:37	20:31	22:32	9	20:29 (15)	23:16	13	20:42 (15)	20:54	18:47	15:36	13:19
4		09:36	07:37	06:27	04:13		20:20 (15)	03:51	20:28 (15)	06:00	07:47	08:47	11:19	
		15:46	17:41	20:35	22:37	11	20:31 (15)	23:11	13	20:41 (15)	20:49	18:42	15:32	13:13
5	12:11	09:31	07:33	06:22	04:08		20:19 (15)	03:55	20:28 (15)	06:03	07:50	08:51	11:26	
	12:53	15:51	17:45	20:39	22:42	12	20:31 (15)	23:06	14	20:42 (15)	20:45	18:38	15:28	13:07
6	12:00	09:27	07:29	06:18	04:04		20:18 (15)	04:00	20:27 (15)	06:07	07:54	08:55	11:34	
	13:05	15:55	17:49	20:43	22:46	14	20:32 (15)	23:01	14	20:41 (15)	20:41	18:34	15:24	13:00
7	11:52	09:23	07:25	06:14	03:59		20:18 (15)	04:05	20:28 (15)	06:11	07:58	09:00	11:43	
	13:14	16:00	17:52	20:46	22:51	13	20:31 (15)	22:56	13	20:41 (15)	20:36	18:30	15:19	12:52
8	11:45	09:18	07:21	06:10	03:54		20:17 (15)	04:10	20:28 (15)	06:14	08:01	09:04	11:54	
	13:22	16:04	17:56	20:50	22:56	14	20:31 (15)	22:51	12	20:40 (15)	20:32	18:26	15:15	12:42
9	11:38	09:14	07:16	06:05	03:49		20:18 (15)	04:14	20:29 (15)	06:18	08:05	09:09	12:14	
	13:29	16:08	18:00	20:54	23:01	14	20:32 (15)	22:46	11	20:40 (15)	20:28	18:21	15:11	12:22
10	11:32	09:10	07:12	06:01	03:44		20:18 (15)	04:19	20:30 (15)	06:22	08:08	09:13		
	13:36	16:13	18:04	20:58	23:06	13	20:31 (15)	22:41	9	20:39 (15)	20:24	18:17	15:06	
11	11:26	09:06	07:08	05:57	03:39		20:19 (15)	04:24	20:32 (15)	06:25	08:12	09:18		
	13:42	16:17	18:07	21:01	23:11	11	20:30 (15)	22:36	3	20:35 (15)	20:19	18:13	15:02	
12	11:21	09:02	07:04	05:52	03:33		20:20 (15)	04:28	20:29 (15)	06:29	08:16	09:22		
	13:49	16:21	18:11	21:05	23:17	9	20:29 (15)	22:32	20:15	18:09	14:58			
13	11:16	08:57	07:00	05:48	03:28		20:22 (15)	04:32	20:28 (15)	06:32	08:20	09:27		
	13:55	16:26	18:15	21:09	23:22	6	20:28 (15)	22:27	20:11	18:05	14:54			
14	11:11	08:53	06:56	05:44	03:23		19:15 (14)	04:37	20:29 (15)	06:36	08:23	09:31		
	14:01	16:30	18:18	21:13	23:28	12	19:27 (14)	22:22	20:07	18:01	14:49			
15	11:06	08:49	06:51	05:39	03:17		19:13 (14)	04:41	20:30 (15)	06:39	08:27	09:36		
	14:06	16:34	18:22	21:17	23:33	13	19:26 (14)	22:18	20:02	17:56	14:45			
16	11:01	08:45	06:47	05:35	03:11		19:13 (14)	04:45	20:31 (15)	06:43	08:31	09:41		
	14:12	16:38	18:26	21:21	23:39	13	19:26 (14)	22:13	19:58	17:52	14:40			
17	10:56	08:40	06:43	05:30	03:06		19:12 (14)	04:50	20:32 (15)	06:46	08:34	09:46		
	14:18	16:42	18:29	21:25	23:45	14	19:26 (14)	22:09	19:54	17:48	14:36			
18	10:51	08:36	06:39	05:26	03:00		19:13 (14)	04:54	20:33 (15)	06:50	08:38	09:50		
	14:23	16:46	18:33	21:29	23:52	12	19:25 (14)	22:04	19:50	17:44	14:32			
19	10:46	08:32	06:35	05:22	02:47		19:13 (14)	04:58	20:34 (15)	06:54	08:42	09:55		
	14:28	16:50	18:37	21:33	23:58	11	19:24 (14)	00:58	22:00	19:45	17:40	14:27		
20	10:42	08:28	06:30	05:17	02:40		19:15 (14)	05:02	20:40	06:57	08:46	10:00		
	14:34	16:54	18:40	21:37	00:05	8	19:23 (14)	00:47	21:55	19:41	17:35	14:23		
21	10:37	08:24	06:26	05:13	02:33			02:29	20:36 (15)	07:01	08:50	10:05		
	14:39	16:58	18:44	21:41	00:13			00:37	21:51	19:37	17:31	14:18		
22	10:33	08:19	06:22	05:08	02:25			02:38	05:10	19:23 (14)	07:04	08:54	10:10	
	14:44	17:02	18:47	21:45	00:21			00:28	21:46	19:25 (14)	19:33	17:27	14:14	
23	10:28	08:15	06:18	05:04	02:16			02:46	05:14	19:19 (14)	07:08	08:58	10:16	
	14:49	17:06	18:51	21:49	00:30			00:21	21:42	19:27 (14)	19:29	17:23	14:09	
24	10:24	08:11	06:13	04:59	02:06			02:53	05:18	19:17 (14)	07:11	09:02	10:21	
	14:54	17:10	18:55	21:53	00:40			00:14	21:37	19:28 (14)	19:24	17:19	14:04	
25	10:19	08:07	06:09	04:55	01:52			03:00	05:22	19:16 (14)	07:15	08:06	10:26	
	14:59	17:14	18:58	21:57	00:54			00:07	21:33	19:29 (14)	19:20	16:14	14:00	
26	10:15	08:03	06:05	04:50	00:48			03:00	05:26	19:15 (14)	07:18	08:09	10:31	
	15:04	17:18	19:02	22:02	00:46			00:00	21:29	19:29 (14)	19:16	16:10	13:55	
27	10:10	07:58	06:01	04:46				03:06	05:30	19:15 (14)	07:22	08:14	10:37	
	15:09	17:22	19:06	22:06				23:54	21:24	19:29 (14)	19:12	16:06	13:50	
28	10:06	07:54	05:57	04:41				03:12	05:33	19:15 (14)	07:25	08:18	10:42	
	15:14	17:26	19:09	22:10				23:48	21:20	19:28 (14)	19:08	16:02	13:45	
29	10:02		06:52	04:37				03:18	05:37	19:16 (14)	07:29	08:22	10:48	
	15:19		20:13	22:15				23:43	21:15	19:28 (14)	19:03	15:58	13:40	
30	09:57		06:48	04:32				03:24	05:41	19:16 (14)	07:32	08:26	10:54	
	15:23		20:17	22:19				23:37	21:11	19:26 (14)	18:59	15:53	13:35	
31	09:53		06:44					03:30	20:32 (15)	19:17 (14)		08:30		
	15:28		20:20					23:32	7	20:39 (15)	21:07	6	19:23 (14)	
Potential sun hours	93	215	361	472	646	720	708	543	227	400	290	151	14	
Total, worst case				99	131		7							

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Last time (hh:mm) with flicker	(WTG causing flicker last time)
	Minutes with flicker		

Project:

Muonio 090327

Printed/Page

2009.11.30 14:58 / 4

Licensed user:

wpd Scandinavia AB
 Ferrens Gränd 3
 SE-111 30 Stockholm
 +46 733 99 00 40

Calculated:

2009.11.13 16:39/2.6.1.252

SHADOW - Calendar**Calculation:** MUO WWD-3/100 100m 091112 **Shadow receptor:** B - SW**Assumptions for shadow calculations**

Maximum distance for influence No limit
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 1 minutes

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1		09:49	07:50	06:40	04:28	06:11 (11)	05:12 (12)	03:36	05:49	07:36	08:34	11:00
		15:33	17:30	20:24	22:24	10 06:21 (11)	05:24 (12)	23:26	21:03	18:55	15:45	13:31
2		09:45	07:46	06:36	04:23	06:10 (11)	05:12 (12)	03:41	06:24 (11)	05:53	07:40	08:39
		15:38	17:34	20:28	22:28	12 06:22 (11)	05:23 (12)	23:21	4 06:28 (11)	20:58	18:51	15:41
3		09:40	07:42	06:32	04:19	06:09 (11)	05:12 (12)	03:46	06:21 (11)	05:57	07:44	08:43
		15:42	17:38	20:32	22:33	13 06:22 (11)	05:23 (12)	23:16	8 06:29 (11)	20:54	18:47	15:37
4		09:36	07:38	06:27	04:14	06:08 (11)	05:12 (12)	03:51	06:20 (11)	06:00	07:47	08:47
		15:47	17:42	20:36	22:37	14 06:22 (11)	05:22 (12)	23:11	11 06:31 (11)	20:50	18:43	15:33
5	12:10	09:32	07:34	06:23	04:09	06:08 (11)	05:14 (12)	03:56	06:19 (11)	06:04	07:51	08:51
	12:55	15:51	17:45	20:39	22:42	14 06:22 (11)	05:22 (12)	23:06	12 06:31 (11)	20:45	18:39	15:28
6	12:00	09:27	07:30	06:19	04:04	06:09 (11)	05:15 (12)	04:01	06:19 (11)	06:08	07:54	08:56
	13:06	15:56	17:49	20:43	22:47	14 06:23 (11)	05:22 (12)	23:01	13 06:32 (11)	20:41	18:35	15:24
7	11:51	09:23	07:25	06:14	03:59	06:09 (11)	05:15 (12)	04:06	06:18 (11)	06:11	07:58	09:00
	13:15	16:00	17:53	20:47	22:52	13 06:22 (11)	05:20 (12)	22:56	14 06:32 (11)	20:37	18:30	15:20
8	11:44	09:19	07:21	06:10	03:54	06:09 (11)	05:17 (12)	04:10	06:18 (11)	06:15	08:02	09:05
	13:23	16:05	17:57	20:51	22:56	12 06:21 (11)	05:19 (12)	22:51	14 06:32 (11)	20:33	18:26	15:16
9	11:38	09:15	07:17	06:06	03:49	06:10 (11)		04:15	06:18 (11)	06:18	08:05	09:09
	13:30	16:09	18:00	20:54	23:01	10 06:20 (11)		22:46	14 06:32 (11)	20:28	18:22	15:11
10	11:32	09:10	07:13	06:01	03:44	06:12 (11)		04:20	06:18 (11)	06:22	08:09	09:13
	13:37	16:13	18:04	20:58	23:07	7 06:19 (11)		22:42	13 06:31 (11)	20:24	18:18	15:07
11	11:27	09:06	07:09	05:57	03:39			04:24	06:19 (11)	06:26	08:13	09:18
	13:43	16:18	18:08	21:02	23:12			22:37	12 06:31 (11)	20:20	18:14	15:03
12	11:21	09:02	07:04	05:53	03:34			04:29	06:19 (11)	06:29	08:16	09:22
	13:50	16:22	18:11	21:06	23:17			22:32	10 06:29 (11)	20:16	18:09	14:58
13	11:16	08:58	07:00	05:48	03:29			04:33	06:19 (12)	06:33	08:20	09:27
	13:56	16:26	18:15	21:10	23:22			22:27	6 06:28 (11)	20:11	18:05	14:54
14	11:11	08:53	06:56	05:44	03:23			04:37	06:18 (12)	06:36	08:24	09:32
	14:02	16:30	18:19	21:13	6 07:21 (10)	23:28		22:23	14 05:32 (12)	20:07	18:01	14:50
15	11:06	08:49	06:52	05:40	07:13 (10)	03:18		04:42	05:19 (12)	06:40	08:27	09:36
	14:07	16:34	18:22	21:17	10 07:23 (10)	23:34		22:18	14 05:33 (12)	20:03	17:57	14:45
16	11:01	08:45	06:48	05:35	07:12 (10)	03:12		04:46	05:19 (12)	06:44	08:31	09:41
	14:13	16:39	18:26	21:21	11 07:23 (10)	23:39		22:14	13 05:32 (12)	20:00	17:53	14:41
17	10:56	08:41	06:43	05:31	07:11 (10)	03:06		04:50	05:19 (12)	06:47	08:35	09:46
	14:18	16:43	18:30	21:25	13 07:24 (10)	23:45		22:09	13 05:32 (12)	20:00	17:54	14:37
18	10:51	08:37	06:39	05:27	07:11 (10)	03:00		04:54	05:20 (12)	06:50	08:39	09:51
	14:24	16:47	18:33	21:29	12 07:23 (10)	23:52		22:05	13 05:33 (12)	20:05	17:50	14:32
19	10:47	08:32	06:35	05:22	07:11 (10)	02:48	02:09	04:58	05:19 (12)	06:54	08:43	09:56
	14:29	16:51	18:37	21:33	12 07:23 (10)	23:58	00:58	22:00	13 05:32 (12)	20:00	17:46	14:28
20	10:42	08:28	06:31	05:18	07:11 (10)	02:41	00:51	05:02	05:20 (12)	06:58	08:46	10:01
	14:34	16:55	18:41	21:37	11 07:22 (10)	00:05	00:46	21:56	13 05:33 (12)	20:00	17:42	14:23
21	10:37	08:24	06:27	05:13	07:12 (10)	02:34	00:40	05:07	05:20 (12)	07:01	08:50	10:06
	14:40	16:59	18:44	21:41	9 07:21 (10)	00:13	00:37	21:51	12 05:32 (12)	20:00	17:32	14:19
22	10:33	08:20	06:22	05:09	07:14 (10)	02:26	00:39	05:11	05:22 (12)	07:05	08:54	10:11
	14:45	17:03	18:48	21:45	4 07:18 (10)	00:21	00:28	21:47	10 05:32 (12)	20:00	17:28	14:14
23	10:28	08:16	06:18	05:04	07:17 (10)	02:17	00:27	05:15	05:22 (12)	07:00	08:58	10:16
	14:50	17:07	18:52	21:49	00:30	05:10 (12)	00:21	21:42	8 05:30 (12)	20:00	17:23	14:10
24	10:24	08:11	06:14	05:00	07:16 (10)	02:07	00:24	05:18	05:24 (12)	07:00	08:58	10:16
	14:55	17:11	18:55	21:54	00:40	05:22 (12)	00:14	21:38	5 05:29 (12)	20:00	17:19	14:05
25	10:19	08:07	06:10	04:55	01:54	05:10 (12)	00:01	05:22		07:13 (10)	07:15	14:06
	15:00	17:15	18:59	21:58	00:53	05:23 (12)	00:07	21:33	13 07:26 (10)	19:21	16:15	14:00
26	10:15	08:03	06:05	04:51	01:18	05:10 (12)	00:01	05:26		07:14 (10)	07:19	14:00
	15:05	17:19	19:02	22:02	01:39	05:23 (12)	00:01	21:29	12 07:26 (10)	19:16	16:11	13:56
27	10:11	07:59	06:01	04:46		05:09 (12)	00:07	05:30		07:13 (10)	07:22	14:00
	15:10	17:22	19:06	22:06		05:23 (12)	00:07	21:25	12 07:25 (10)	19:12	16:07	13:51
28	10:06	07:55	05:57	04:42		05:10 (12)	00:13	05:34		07:14 (10)	07:26	14:00
	15:14	17:26	19:10	22:11		05:23 (12)	00:13	21:20	10 07:24 (10)	19:08	16:02	13:46
29	10:02		06:53	04:37		05:10 (12)	00:19	05:38		07:15 (10)	07:29	14:00
	15:19		20:13	22:15		05:23 (12)	00:19	21:16	7 07:22 (10)	19:04	15:58	13:41
30	09:57		06:49	04:33	7 06:13 (11)		00:25	05:42		07:33	08:26	14:00
	15:24		20:17	22:19	7 06:20 (11)		00:25	21:11		19:00	15:54	13:36
31	09:53		06:44			05:10 (12)	00:30	05:45			08:30	
	15:29		20:21			05:23 (12)	00:30	21:07			15:50	
Potential sun hours	93	215	361	472	622	720	708	543	400	290	151	14
Total, worst case				95	262	66	213	223				

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Last time (hh:mm) with flicker	(WTG causing flicker last time)
	Minutes with flicker		

Project:

Muonio 090327

Printed/Page

2009.11.30 14:58 / 5

Licensed user:

wpd Scandinavia AB
 Ferrens Gränd 3
 SE-111 30 Stockholm
 +46 733 99 00 40

Calculated:

2009.11.13 16:39/2.6.1.252

SHADOW - Calendar**Calculation:** MUO WWD-3/100 100m 091112 **Shadow receptor:** C - W**Assumptions for shadow calculations**

Maximum distance for influence No limit
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 1 minutes

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	January	February	March	April	May	June
1		09:49	07:50	06:40	08:30 (10)	04:28
		15:33	17:30	20:24	13 08:43 (10)	22:24
2		09:45	07:46	06:36	08:31 (10)	04:23
		15:38	17:34	20:28	11 08:42 (10)	22:28
3		09:40	07:42	06:31	08:32 (10)	04:19
		15:42	17:38	20:32	9 08:41 (10)	22:33
4		09:36	07:38	06:27		04:14
		15:47	17:42	20:36		22:37
5	12:10	09:32	07:34	06:23		04:09
	12:54	15:51	17:45	20:39		22:42
6	12:00	09:27	07:30	06:19		04:04
	13:06	15:56	17:49	20:43		22:47
7	11:52	09:23	07:25	06:14		03:59
	13:15	16:00	17:53	20:47		22:52
8	11:45	09:19	07:21	06:10		03:54
	13:23	16:05	17:57	20:51		22:57
9	11:38	09:15	07:17	06:06		03:49
	13:30	16:09	18:00	20:54		23:02
10	11:32	09:10	07:13	06:01		03:44
	13:37	16:13	18:04	20:58		23:07
11	11:27	09:06	07:09	05:57	07:40 (11)	03:39
	13:43	16:18	18:08	21:02	4 07:44 (11)	23:12
12	11:21	09:02	07:04	05:53	07:37 (11)	03:34
	13:49	16:22	18:11	21:06	10 07:47 (11)	23:17
13	11:16	08:58	07:00	05:48	07:35 (11)	03:29
	13:55	16:26	18:15	21:10	13 07:48 (11)	23:22
14	11:11	08:53	06:56	05:44	07:34 (11)	03:23
	14:01	16:30	18:19	21:13	15 07:49 (11)	23:28
15	11:06	08:49	06:52	05:40	07:33 (11)	03:18
	14:07	16:34	18:22	21:17	16 07:49 (11)	23:34
16	11:01	08:45	06:48	05:35	07:33 (11)	03:12
	14:13	16:39	18:26	21:21	16 07:49 (11)	23:40
17	10:56	08:41	06:43	05:31	07:33 (11)	03:06
	14:18	16:43	18:30	21:25	16 07:49 (11)	23:46
18	10:51	08:37	06:39	05:27	07:33 (11)	03:00
	14:24	16:47	18:33	21:29	15 07:48 (11)	23:52
19	10:47	08:32	06:35	05:22	07:33 (11)	02:47
	14:29	16:51	18:37	21:33	14 07:47 (11)	23:58
20	10:42	08:28	06:31	05:18	07:34 (11)	02:41
	14:34	16:55	18:41	21:37	12 07:46 (11)	00:05
21	10:38	08:24	06:27	05:13	07:36 (11)	02:33
	14:40	16:59	18:44	21:41	8 07:44 (11)	00:13
22	10:33	08:20	06:22	05:09		02:25
	14:45	17:03	18:48	21:45		02:21
23	10:28	08:16	06:18	05:04		02:17
	14:50	17:07	18:52	21:49		00:30
24	10:24	08:11	06:14	05:00		02:06
	14:55	17:11	18:55	21:54		00:40
25	10:20	08:07	06:10	04:55		01:53
	15:00	17:15	18:59	21:58		00:54
26	10:15	08:03	06:05	04:51		01:34
	15:05	17:19	19:02	22:02		00:46
27	10:11	07:59	06:01	07:35 (10)	04:46	
	15:09	17:22	19:06	7 07:42 (10)	22:06	
28	10:06	07:55	05:57	07:33 (10)	04:42	
	15:14	17:26	19:10	10 07:43 (10)	22:11	
29	10:02		06:53	08:32 (10)	04:37	
	15:19		20:13	12 08:44 (10)	22:15	
30	09:58		06:48	08:32 (10)	04:33	
	15:24		20:17	13 08:45 (10)	22:19	
31	09:53		06:44	08:31 (10)		
	15:29		20:21	14 08:45 (10)		
Potential sun hours	93	215	361	472	645	720
Total, worst case			56	172	399	20

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)		Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:

Muonio 090327

Printed/Page

2009.11.30 14:58 / 6

Licensed user:

wpd Scandinavia AB
 Ferksens Gränd 3
 SE-111 30 Stockholm
 +46 733 99 00 40

Calculated:

2009.11.13 16:39/2.6.1.252

SHADOW - Calendar**Calculation:** MUO WWD-3/100 100m 091112 **Shadow receptor:** C - W**Assumptions for shadow calculations**

Maximum distance for influence No limit
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 1 minutes

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	July	August	September	October	November	December
1		03:36 06:29 (12) 05:49 07:39 (11) 07:36 08:34 11:00				
2		23:27 16 06:45 (12) 21:03 4 07:43 (11) 18:55 15:45 13:31				
3		03:41 06:29 (12) 05:53 07:40 08:39 11:06				
4		23:21 17 06:46 (12) 20:58 18:51 15:41 13:25				
5		03:46 06:29 (12) 05:56 07:44 08:43 11:13				
6		23:16 16 06:45 (12) 20:54 18:47 15:37 13:20				
7		03:51 06:30 (12) 06:00 07:47 08:47 11:19				
8		23:11 14 06:44 (12) 20:50 18:43 15:33 13:14				
9		03:56 06:30 (12) 06:04 07:51 08:51 11:27				
10		23:06 13 06:43 (12) 20:46 18:39 15:28 13:07				
11		04:01 06:31 (12) 06:08 07:54 08:56 11:34				
12		23:01 11 06:42 (12) 20:41 18:35 15:24 13:01				
13		04:06 06:33 (12) 06:11 07:58 09:00 11:43				
14		22:56 7 06:40 (12) 20:37 18:30 15:20 12:53				
15		04:10 06:15 08:02 09:05 11:54				
16		22:51 20:33 18:26 15:16 12:43				
17		04:15 06:18 08:27 (10) 08:05 09:09 12:12				
18		22:46 20:28 8 08:35 (10) 18:22 15:11 12:26				
19		04:20 06:22 08:25 (10) 08:09 09:13				
20	5 05:38 (13) 22:42 20:24 10 08:35 (10) 18:18 15:07					
21	05:37 (13) 04:24 06:26 08:23 (10) 08:13 09:18					
22	8 05:45 (13) 22:37 20:20 12 08:35 (10) 18:14 15:03					
23	05:36 (13) 04:29 06:29 08:23 (10) 08:16 09:23					
24	9 05:45 (13) 22:32 20:16 13 08:36 (10) 18:09 14:58					
25	05:36 (13) 04:33 06:33 08:22 (10) 08:20 09:27					
26	10 05:46 (13) 22:28 20:11 13 08:35 (10) 18:05 14:54					
27	05:35 (13) 04:37 06:36 08:23 (10) 08:24 09:32					
28	12 05:47 (13) 22:23 20:07 12 08:35 (10) 18:01 14:50					
29	05:35 (13) 04:42 06:40 08:23 (10) 08:27 09:36					
30	13 05:48 (13) 22:18 20:03 10 08:33 (10) 17:57 14:45					
31	05:35 (13) 04:46 06:43 08:25 (10) 08:31 09:41					
32	13 05:48 (13) 22:14 19:59 7 08:32 (10) 17:53 14:41					
33	05:34 (13) 04:50 06:47 08:35 09:46					
34	14 05:48 (13) 22:09 19:54 17:48 14:37					
35	05:35 (13) 04:54 06:50 08:39 09:51					
36	14 05:49 (13) 22:05 19:50 17:44 14:32					
37	05:34 (13) 04:58 06:54 08:43 09:56					
38	00:58 15 05:49 (13) 22:00 19:46 17:40 14:28					
39	02:21 05:34 (13) 05:02 06:58 08:46 10:01					
40	00:47 14 05:48 (13) 21:56 19:42 17:36 14:23					
41	02:30 05:35 (13) 05:06 19:01 17:36 14:23					
42	00:37 14 05:49 (13) 21:51 19:37 17:32 14:19					
43	02:39 05:35 (13) 05:10 07:40 (11) 07:05 08:54 10:11					
44	00:29 13 05:48 (13) 21:47 8 07:48 (11) 19:33 17:28 14:16					
45	02:46 05:35 (13) 05:14 07:38 (11) 07:08 08:58 10:14					
46	00:21 19 06:39 (12) 21:42 12 07:50 (11) 19:29 17:23 14:10					
47	02:54 05:35 (13) 05:18 07:37 (11) 07:12 09:02 10:21					
48	00:14 22 06:41 (12) 21:38 14 07:51 (11) 19:25 17:19 14:05					
49	03:00 05:37 (13) 05:22 07:35 (11) 07:15 08:06 10:26					
50	00:07 22 06:42 (12) 21:33 16 07:51 (11) 19:21 16:15 14:00					
51	03:00 05:38 (13) 05:26 07:35 (11) 07:19 08:10 10:32					
52	00:01 22 06:44 (12) 21:29 16 07:51 (11) 19:16 16:11 13:56					
53	03:07 05:39 (13) 05:30 07:35 (11) 07:22 08:14 10:37					
54	23:55 20 06:44 (12) 21:25 16 07:51 (11) 19:12 16:07 13:51					
55	03:13 06:30 (12) 05:34 07:35 (11) 07:26 08:18 10:43					
56	23:49 15 06:45 (12) 21:20 16 07:51 (11) 19:08 16:02 13:46					
57	03:19 06:29 (12) 05:38 07:35 (11) 07:29 08:22 10:48					
58	23:43 16 06:45 (12) 21:16 14 07:49 (11) 19:04 15:58 13:41					
59	03:25 06:29 (12) 05:42 07:36 (11) 07:33 08:26 10:54					
60	23:37 16 06:45 (12) 21:11 13 07:49 (11) 19:00 15:54 13:36					
61	03:30 06:28 (12) 05:45 07:37 (11) 08:30					
62	23:32 17 06:45 (12) 21:07 10 07:47 (11) 15:50					
Potential sun hours	708	543	400	290	151	14
Total, worst case	323	229	89			

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Last time (hh:mm) with flicker	(WTG causing flicker last time)
	Minutes with flicker		

Project:

Muonio 090327

Printed/Page

2009.11.30 14:58 / 7

Licensed user:

wpd Scandinavia AB
 Ferkens Gränd 3
 SE-111 30 Stockholm
 +46 733 99 00 40

Calculated:

2009.11.13 16:39/2.6.1.252

SHADOW - Calendar**Calculation:** MUO WWD-3/100 100m 091112 **Shadow receptor:** D - NE**Assumptions for shadow calculations**

Maximum distance for influence No limit
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 1 minutes

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1		09:49	07:50	06:40	04:27			03:35	05:49	07:36	08:34	11:00
		15:32	17:30	20:24	22:24			23:26	21:02	18:55	15:45	13:30
2		09:44	07:46	06:35	04:23			03:40	05:52	07:40	08:38	11:07
		15:37	17:33	20:28	22:28			23:21	20:58	18:51	15:41	13:24
3		09:40	07:42	06:31	04:18			03:45	05:56	07:43	08:43	11:13
		15:42	17:37	20:31	22:33			23:16	20:54	18:47	15:36	13:18
4		09:36	07:38	06:27	04:13			03:50	06:00	07:47	08:47	11:20
		15:46	17:41	20:35	22:37			23:11	20:49	18:42	15:32	13:12
5	12:12	09:31	07:33	06:22	04:08			03:55	06:03	07:50	08:51	11:27
	12:51	15:51	17:45	20:39	22:42			23:06	20:45	18:38	15:28	13:06
6	12:01	09:27	07:29	06:18	04:03			04:00	06:07	07:54	08:56	11:35
	13:04	15:55	17:49	20:43	22:47			23:01	20:41	18:34	15:24	12:59
7	11:53	09:23	07:25	06:14	03:59			04:05	06:11	07:58	09:00	11:44
	13:13	16:00	17:52	20:46	22:52			22:56	20:37	18:30	15:19	12:51
8	11:45	09:19	07:21	06:10	03:54			04:10	06:14	08:01	09:04	11:55
	13:21	16:04	17:56	20:50	22:56			22:51	20:32	18:26	15:15	12:41
9	11:39	09:14	07:17	06:05	03:49			04:14	06:18	08:05	09:09	11:51
	13:28	16:08	18:00	20:54	23:01			22:46	20:28	18:21	15:11	11:47
10	11:33	09:10	07:12	06:01	03:44			04:19	06:21	08:09	09:13	
	13:35	16:13	18:04	20:58	23:06			22:41	20:24	18:17	15:06	
11	11:27	09:06	07:08	05:57	03:38			04:23	06:25	08:12	09:18	
	13:42	16:17	18:07	21:02	23:12			22:37	20:19	18:13	15:02	
12	11:21	09:02	07:04	05:52	03:33			04:28	06:29	08:16	09:22	
	13:48	16:21	18:11	21:05	23:17			22:32	20:15	18:09	14:58	
13	11:16	08:57	07:00	05:48	03:28			04:32	06:32	08:20	09:27	
	13:54	16:25	18:15	21:09	23:22			22:27	20:11	18:05	14:53	
14	11:11	08:53	06:56	05:44	03:22			04:37	06:36	08:23	09:32	
	14:00	16:30	18:18	21:13	23:28			22:23	20:07	18:01	14:49	
15	11:06	08:49	06:51	05:39	03:17			04:41	06:39	08:27	09:36	
	14:06	16:34	18:22	21:17	23:34			22:18	20:02	17:56	14:45	
16	11:01	08:45	06:47	05:35	03:11			04:45	06:43	08:31	09:41	
	14:12	16:38	18:26	21:21	23:40			22:13	19:58	17:52	14:40	
17	10:56	08:41	06:43	16:26 (15)	05:30			04:49	06:46	08:35	09:46	
	14:17	16:42	18:29	21:25	23:46			22:09	19:54	17:48	14:36	
18	10:51	08:36	06:39	16:25 (15)	05:26			04:54	06:50	08:38	09:51	
	14:23	16:46	18:33	21:29	23:52			22:04	19:50	17:44	14:31	
19	10:47	08:32	06:35	16:25 (15)	05:22		02:07	04:58	06:54	17:16 (15)	08:42	09:56
	14:28	16:50	18:37	21:33	23:59		00:59	22:00	19:46	17:19 (15)	17:40	14:27
20	10:42	08:28	06:30	16:24 (15)	05:17		02:19	05:02	06:57	17:12 (15)	08:46	10:01
	14:33	16:54	18:40	21:37	00:06		00:47	21:55	19:41	17:21 (15)	17:35	14:22
21	10:37	08:24	06:26	16:24 (15)	05:13		02:29	05:06	07:01	17:10 (15)	08:50	10:06
	14:39	16:58	18:44	21:41	00:13		00:37	21:51	19:37	17:22 (15)	17:31	14:18
22	10:33	08:19	06:22	16:24 (15)	05:08		02:38	05:10	07:04	17:09 (15)	08:54	10:11
	14:44	17:02	18:47	21:45	00:21		00:29	21:46	19:33	17:22 (15)	17:27	14:13
23	10:28	08:15	06:18	16:25 (15)	05:04		02:45	05:14	07:08	17:09 (15)	08:58	10:16
	14:49	17:06	18:51	21:49	00:30		00:21	21:42	19:29	17:23 (15)	17:23	14:09
24	10:24	08:11	06:13	16:28 (15)	04:59		02:53	05:18	07:11	17:08 (15)	09:02	10:21
	14:54	17:10	18:55	21:53	00:41		00:14	21:37	19:24	17:22 (15)	17:19	14:04
25	10:19	08:07	06:09	16:33 (15)	04:55		02:59	05:22	07:15	17:08 (15)	08:06	10:26
	14:59	17:14	18:58	21:58	00:55		00:07	21:33	19:20	17:21 (15)	16:14	13:59
26	10:15	08:03	06:05	16:37 (15)	04:50		03:06	05:26	07:18	17:08 (15)	08:10	10:32
	15:04	17:18	19:02	22:02	20:45		00:01	21:29	19:16	17:20 (15)	16:10	13:55
27	10:11	07:58	06:01	16:37 (15)	04:46		03:06	05:30	07:22	17:10 (15)	08:14	10:37
	15:09	17:22	19:06	22:06			23:55	21:24	19:12	17:18 (15)	16:06	13:50
28	10:06	07:54	05:57	16:37 (15)	04:41		03:12	05:33	07:25		08:18	10:43
	15:14	17:26	19:09	22:10			23:49	21:20	19:08		16:02	13:45
29	10:02		06:52	16:37 (15)	04:37		03:18	05:37	07:29		08:22	10:48
	15:18		20:13	22:15			23:43	21:15	19:03		15:57	13:40
30	09:57		06:48	16:37 (15)	04:32		03:24	05:41	07:32		08:26	10:54
	15:23		20:17	22:19			23:37	21:11	18:59		15:53	13:35
31	09:53		06:44				03:29	05:45			08:30	
	15:28		20:20				23:32	21:07			15:49	
Potential sun hours	92	214	361	472	641	720	708	543	400	290	150	38
Total, worst case			100						98			

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Last time (hh:mm) with flicker	(WTG causing flicker last time)
	Minutes with flicker		

Project:

Muonio 090327

Printed/Page

2009.11.30 14:58 / 8

Licensed user:

wpd Scandinavia AB

Ferkens Gränd 3

SE-111 30 Stockholm

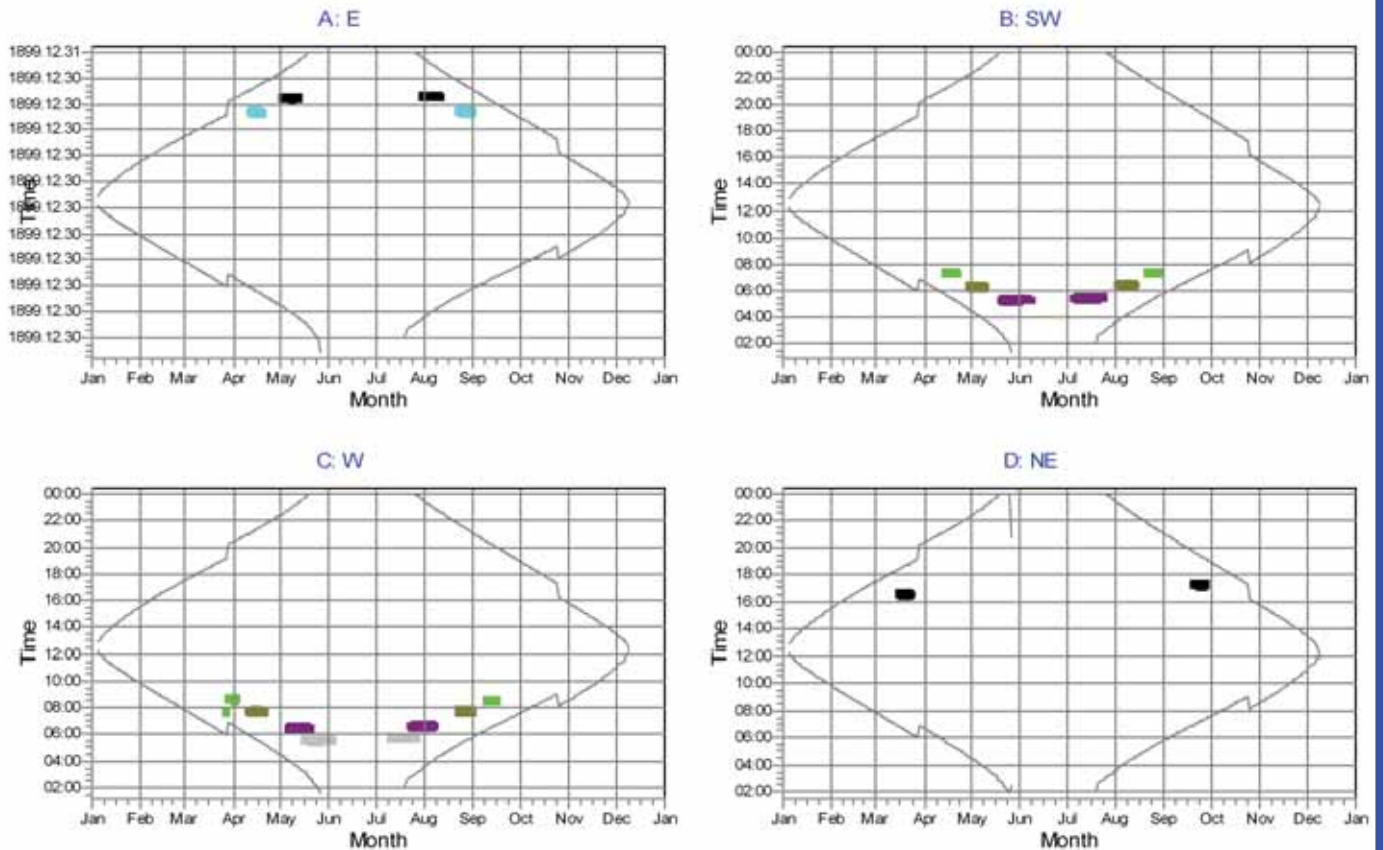
+46 733 99 00 40

Calculated:

2009.11.13 16:39/2.6.1.252

SHADOW - Calendar, graphical

Calculation: MUO WWD-3/100 100m 091112



WTGs

10: WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (25)
11: WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (26)
12: WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (27)
13: WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (28)
14: WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (29)
15: WINWIND WWD-3/100 3000 100.0 !O! hub: 100,0 m (30)

Project:

Muonio 090327

Printed/Page

2009.11.30 14:58 / 9

Licensed user:

wpd Scandinavia AB

Ferkens Gränd 3

SE-111 30 Stockholm

+46 733 99 00 40

Calculated:

2009.11.13 16:39/2.6.1.252

SHADOW - Muonio 1_25000

Calculation: MUO WWD-3/100 100m 091112

File: Muonio 1_25000.bmi

