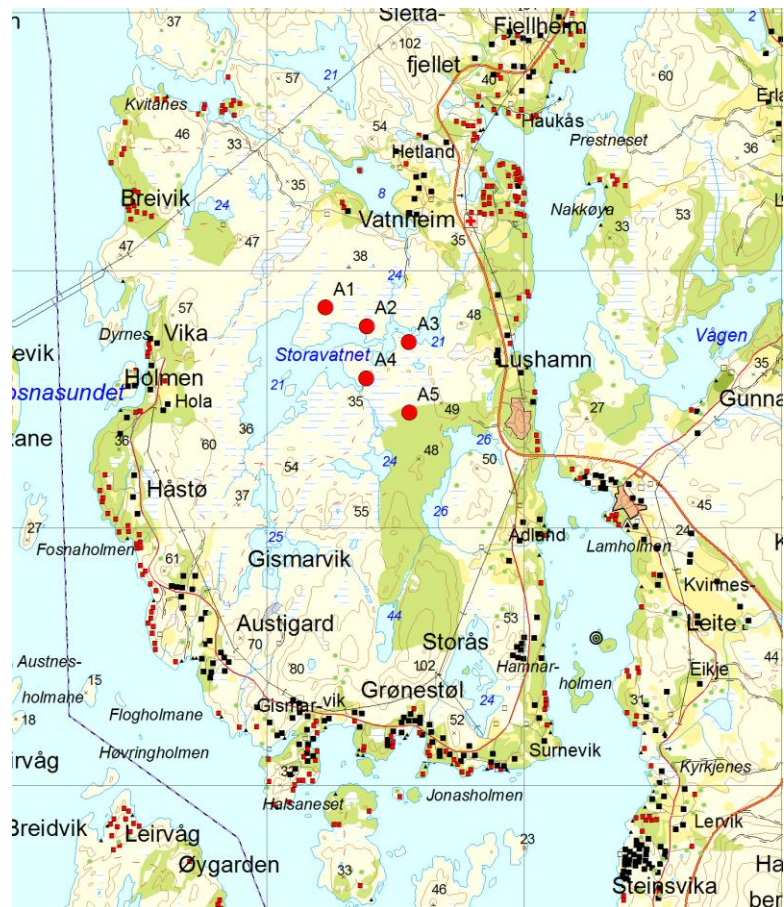


KJELLER  
VINDTEKNIKK

# Gismarvik, Tysvær kommune, Rogaland

## Skyggekast og synlighet

Report: KVT/TR/2011/R074



Rapportnummer <b>KVT/TR/2011/R074</b>	Dato 25.08.11
Rapporttittel <b>Gismarvik, Tysvær kommune, Rogaland</b> <b>Beregninger av skyggekast og synlighet</b>	Klassifisering Begrenset til kunde Utgave nummer 0
Kunde <b>Fred Olsen Renewable AS og Haugaland Kraft AS</b>	Antall sider 21+vedlegg
Kundens referanse <b>Pål Gjesdal (FOR) og Reidar Pedersen (HK)</b>	Status Endelig
<b>Sammendrag</b> <p>Det er utført beregninger av skyggekast og laget synlighetskart for den planlagte vindparken i Gismarvik i Tysvær kommune i Rogaland. Beregningene er basert på N50 kart og vinddata fra Vindkart for Norge. Layout for vindparken er mottatt fra kunde. Data for skydekke er hentet fra en meteorologisk stasjon i området.</p> <p>Det finnes ingen krav eller retningslinjer for skyggekast fra vindparker i Norge, retningslinjene for Sverige er derfor lagt til grunn for vurdering av resultatet fra skyggekastberegningene. Den svenske retningslinjen for teoretisk skyggekast ("worst case") blir oversteget for 63 bygninger ved Gismarvik vindpark. Grensen for faktisk forventet skyggekast på 8 timer/år blir oversteget for 17 mottakere. Flere av disse mottakerne ligger i dag i ly av skogen, og vil derfor kunne oppleve mindre skyggekast enn beregningene viser. Ett av husene ligger godt eksponert mot vindparken. For denne mottakeren vil det kunne være noen problemer med skyggekast, slik at det kan være nødvendig med avbøtende tiltak. Forutsatt at skogen ikke fjernes vil konsekvensen av skyggekast være liten for de øvrige mottakerne.</p> <p>Synlighetskartet er laget for et område som strekker seg 20km ut fra vindparkgrensen. Terrenget er flatt i området mot vest slik at turbinene vil være synlig noen steder ut til 20km fra vindparken.</p>	
<b>Forbehold</b> Selv om det i arbeidet med denne rapporten, så langt vi kjenner til, er benyttet oppdaterte analysemetoder, og vi i vårt arbeid forsøker å gi et så godt resultat som mulig, kan Kjeller vindteknikk AS ikke holdes ansvarlig for resultatene i rapporten eller for framtidig bruk av denne, og heller ikke for eventuelle direkte eller indirekte tap som skyldes eventuelle feil i rapporten.	

Revisjonshistorie				
Utgave	Dato	Antall eksemplarer	Kommentar	Distribusjon
0		Elektronisk		

	Navn	Dato	Signatur
Utført av	Tove Risberg	25.08.2011	Tove Risberg
Kontrollert av	Anne Line Løvholm	25.08.2011	Anne Line Løvholm
Godkjent av	Lars Tallhaug	25/8-2011	Lars Tallhaug

# Innhold

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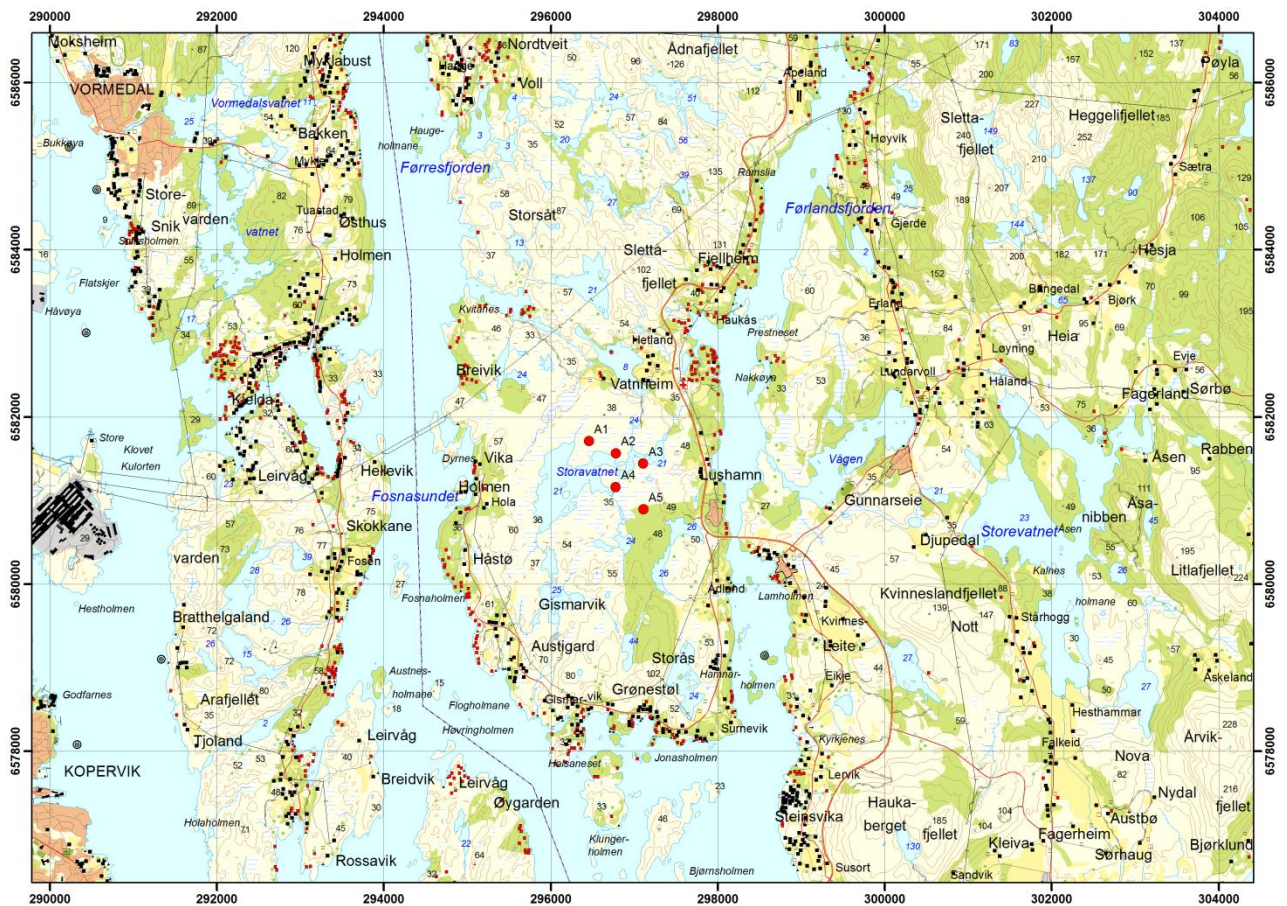


# 1 Innledning

Det er gjort skyggekastberegninger og synlighetsanalyse for Gismarvik vindpark i Tysvær kommune i Rogaland. Koordinatene for vindturbinene og type turbin er gitt av Haugaland Kraft AS. Vindstatistikk er hentet fra Vindkart for Norge og kartgrunnlag for parken er hentet fra N50 kartdatabasen som Kjeller Vindteknikk har tilgjengelig. Solsannsynlighet er hentet fra met.no.

For parken er det ut fra kartgrunnlaget vurdert hvilke bebyggelse som kan være utsatt for skyggekast fra vindparken. Utvelgelsen er gjort ut fra N50 kartgrunnlag og fra flyfoto fra [www.norgebilder.no](http://www.norgebilder.no).

Synlighetskartet er beregnet ut til et område som strekker seg 20km fra vindparken. En oversikt over området med turbiner er vist i Figur 1.



Figur 1: Oversiktskart over området for Gismarvik vindpark. Turbinene er vist med røde prikker.

## 2 Grunnlag og metodikk skyggekast

En vindturbin i drift vil gi roterende skygger til landskapet rundt, dette kan være sjenerende. Skyggen av en stillestående turbin oppfattes normalt som uproblematisk. Hvor og når skyggekast oppstår avhenger av lokaliseringen i forhold til vindparken, lokal topografi, solens posisjon på himmelen, skydekke og vindforhold. Man får mest skyggekast når solen står lavt, slik at skyggene blir lange. Effekten av skyggene avtar med avstanden fra vindturbinene, dette fordi turbinbladene da vil dekke en mindre del av solskiven slik at skyggen blir mer diffus.

### 2.1 Grenseverdier

Det finnes i dag ingen norske retningslinjer for grenseverdier for hva som aksepteres av skyggekast. For Sverige er det utarbeidet retningslinjer (Boverket), som gir følgende grenseverdier.

- Teoretisk skyggetid ("worst case") < 30 timer/år
- Faktisk forventet skyggetid < 8 timer/år
- Faktisk forventet skyggetid < 30 minutter/dag

Verdiene gitt ovenfor er retningslinjer for maksimal tid med skyggekast, men er ingen endelige krav. Det er den faktiske skyggetiden som vil være avgjørende for hvor sterkt den berørte befolkningen blir påvirket av skyggekastene.

### 2.2 Datagrunnlag

Skyggemottakere for beregning av skyggekast er basert på bygninger fra N50 kart og [www.norgebilder.no](http://www.norgebilder.no). Bruksområdet og bruksomfanget til de ulike bygningene er ikke kartlagt. Alle hus innenfor en avstand på 1.5 km fra nærmeste turbin er tatt med i beregningene. For beskrivelse av topografi er det benyttet høydekoter med ekvidistanse på 20m rundt vindparken. Etter samtaler med oppdragsgiver er det antatt at området i vindparken jevnes ut som følge av at området skal klargjøres for industri. Dette fører til at turbinene merket A2 - A5 er antatt å ligge på en høyde på 24.5m, mens den siste turbinen A1 er antatt å ligge på 30m.

Det er beregnet skyggekast for turbiner av Siemens-101 2.3MW vindturbiner med navhøyde på 80m. Rotordiameteren til denne turbintypen er på 101m. Driftstiden for parken er beregnet ut fra at turbinen roterer kun mellom hastighetene på 3.5m/s og 25m/s, som er det hastighetsintervallet hvor turbinen generer kraft.

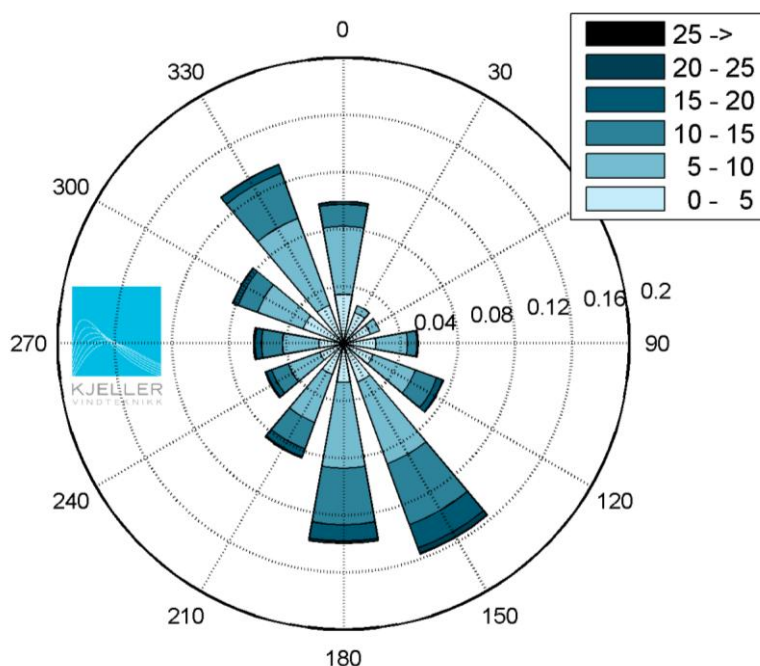
Solstatistikk er hentet fra den meteorologiske stasjonen Nedre Vats. Dataene er hentet fra [www.eklima.no](http://www.eklima.no) som driftes av Det Norske Meteorologiske Institutt. Nedre Vats ligger i Vindafjord kommune, med koordinatene Ø: 315995, N: 6598444 i UTM32, WGS84. Stasjonen er valgt for nedlasting av data fordi Nedre Vats er den meteorologiske stasjonen med data for skydekke som ligger nærmest, og i tilsvarende terreng som den planlagte vindparken.

Månedlig midlere skydekke er hentet fra stasjonen, som har observasjoner fra januar 2000 og frem til januar 2011. Ut fra månedlig midlere skydekke er månedlig solsannsynlighet beregnet, og gitt i Tabell 1.

Tabell 1: Beregnet solsannsynlighet for Nedre Vats.

Måned	1	2	3	4	5	6	7	8	9	10	11	12
Solsannsynlighet	0.27	0.29	0.28	0.30	0.35	0.30	0.26	0.24	0.26	0.28	0.28	0.30

Vindforholdene er gitt ved hastighetsfordeling og frekvensfordeling for et WRF punkt hentet fra resultatene i Vindkartet for Norge (NVE, 2009). Vindforholdene er for navhøyde på 80m. Vindrosen for parken er vist i Figur 2. Som man ser fra vindrosen er hovedvindretningen fra sør-sørøst og for nord-nordvest for Gismarvik.



Figur 2: Vindrose beregnet for Gismarvik.

## 2.3 Metodikk

Ved beregning av skyggekast fra vindturbiner er det gjort noen antagelser og forenklinger, basert på tidligere erfaring og metodikk fra andre land på grunn av manglende retningslinjer i Norge.

Dersom turbinen står stille vil den ikke gi sjenerende skygger. Timer med stillestående turbiner inkluderes derfor ikke i antall timer med skyggekast. Skyggen elimineres helt eller delvis dersom solen er dekket av skyer. Dersom vindretningen ikke er den samme som solens innfallsvinkel vil omfanget av skyggekast bli mindre. Dette er fordi vindturbinene dreier med vindretningen for å oppnå høyest mulig energiproduksjon. På grunnlag av dette benyttes derfor både vindstatistikk for området og solstatistikk for beregning av skyggekast.

Situasjoner hvor bebyggelsen er plassert mer enn 1.5km fra nærmeste turbin, solen står lavere enn 3° over horisonten eller rotorbladene dekker mindre enn 20% av solskiven er ikke inkludert i beregningene. Det er antatt at skyggeeffekten i disse situasjonene er så diffuse at de er neglisjerbare. Dette er basert på tyske retningslinjer (EMD, 2008), samt på anbefalingen i konsekvensutredningen fra NVE.

Skyggekastmottakerne er lokalisert ved hjelp av flyfoto fra [www.norgebilder.no](http://www.norgebilder.no). Alle bygninger er markert uten nærmere undersøkelse om de er i bruk eller ikke. Det er antatt at bygningene har vinduer på alle sider, dermed vil det alltid være vinduer rettet mot vindparken. Vinduene

er satt til en størrelse på 2m\*2m og plassert 1m over bakkenivå. Resultatet vil derfor være følsomt for plassering og størrelsen av skyggemottakerne. Det er ikke tatt hensyn til at skog vil begrense mottatt skyggekast i beregningene.

Antall skyggetimer er beregnet hvert minutt dag for dag over et år. Oppløsningen i det beregnede kartet er på 10m\*10m. Solens posisjon er beregnet ut fra vindparkenes geografiske beliggenhet. Beregningene er utført ved bruk av programvaren WindPRO versjon 2.7(EMD, 2008).

## 2.4 Feilkilder og usikkerhet

Det er usikkerhet knyttet til meteorologiske data. Observasjonene av sol og skydekke er gjort i en avstand på 25km fra vindparken og tidsserien er bare over 10 år. Det er knyttet usikkerhet til den manuelle observasjonen og vurderingen av skydekket. Forventet frekvensfordeling og hastighetsfordeling for vindforholdene i vindparken er hentet fra Vindkart for Norge. Disse dataene har vist seg å ha en god korrelasjon med konkrete målinger, og det er derfor antatt at usikkerheten til frekvensfordelingen er lav.

Skyggemottakere er plassert ut fra N50 kart og [www.norgebilder.no](http://www.norgebilder.no). Det kan være endringer i bygningsmassen som ikke er inkludert i dette kartgrunnlaget. Det er heller ikke kartlagt hvilke av bygningene som er bebodd eller størrelsen på vinduene og retning i forhold til vindparkene. Hvordan bygningene er modellert med hensyn til retning og vindusplassering vil også bidra til usikkerhet i resultatet av skyggekastberegningen.

Det er gjort noen undersøkelser om det ligger trær, hekker eller annen skjermende vegetasjon i de ulike områdene. I området som kalles Mjåsund ligger det i dag et skogsholt mellom husene og E39. Dette skogsholtet vil antakeligvis skjerme for bebyggelsen slik det er i dag. Men om dette kommer til å være situasjonen fremover er usikkert. Det er derfor gjort beregninger uten å ta med denne skogen.

På grunnlag av dette er det derfor usikkerhet knyttet til beregningsresultatene. Denne usikkerheten er ikke estimert i denne analysen.

## 3 Skyggekast

### 3.1 Beregningsresultat

Skyggekast beregningen er gjort basert på spesifisert layout bestående av 5 turbiner. Turbinenes plassering er gitt i Tabell 2.

Tabell 2 Turbinkoordinater for Gismarvik vindpark

Turbnummer	Ø [UTM sone32]	N[UTM sone32]
1	296457	6581711
2	296778	6581566
3	297107	6581441
4	296777	6581162
5	297109	6580894

Driftstid for hver sektor er oppsummert i Tabell 3. Det er høyest driftstid for sørsørøstlig og sørlig sektor, samt fra nordnordvestlig sektor. Dette er i samsvar med vindrosen vist i Figur 2.

Tabell 3: Driftstid per sektor for Gismarvik vindpark.

Sektor	Driftstid [timer/år]
N	813
NNØ	231
ØNØ	221
Ø	428
ØSØ	610
SSØ	1 281
S	1 143
SSV	697
VSV	478
V	515
VNV	675
NNV	1 091
Total	8 182

I området rundt Gismarvik er det kartlagt 153 mottakere som vil bli utsatt for skyggekast. Tid med forventet skyggekast og "worst case" skyggekast er oppsummert i Tabell 4. Når grenseverdiene er oversteget, er verdiene markert med rødt.



Tabell 4: Beregnet tid med skyggekast for mottakere som blir utsatt for skyggekast.

Mottaker	Forventet skygge [t:min/år]	Forventet maksimal skygge [t:min/dag]	"Worst case" [t:min/år]
I	0:38	0:03	4:25
J	0:36	0:03	4:15
M	0:42	0:03	4:52
N	0:43	0:03	5:01
O	0:44	0:03	5:09
P	0:44	0:03	5:08
Q	0:44	0:03	5:08
R	0:45	0:03	5:11
S	0:47	0:03	5:29
T	1:04	0:03	7:17
U	11:32	0:12	59:28
V	10:45	0:12	55:28
W	12:33	0:13	65:10
X	10:16	0:12	53:02
Y	9:36	0:12	49:32
Z	12:27	0:14	64:59
AA	6:55	0:11	35:11
AB	9:33	0:14	49:52
AC	10:34	0:15	55:43
AD	10:59	0:15	58:45
AE	11:57	0:16	64:29
AF	1:03	0:04	5:49
AG	1:15	0:03	7:46
AH	2:10	0:03	13:45
AI	1:07	0:03	6:53
AJ	2:15	0:03	14:23
AK	5:03	0:06	32:56
AL	5:55	0:07	38:09
AM	3:45	0:04	24:53
AN	3:19	0:04	22:05
AO	3:11	0:03	21:13
AP	5:55	0:07	38:26
AQ	3:44	0:04	24:51
AR	2:29	0:03	16:37
AS	1:58	0:03	13:17
AT	3:34	0:04	23:40
AU	2:44	0:03	18:16
AV	1:55	0:03	12:53
AW	1:45	0:03	11:53
AY	3:19	0:04	22:05
AX	3:49	0:04	25:27
AZ	3:24	0:04	22:41
BA	3:44	0:04	24:55

BB	6:33	0:07	44:09
BC	3:57	0:04	26:40
BD	3:57	0:04	26:45
BF	2:43	0:03	17:57
BG	0:59	0:03	6:01
BH	1:46	0:03	11:05
BI	3:26	0:03	23:13
BJ	4:05	0:04	27:46
BL	1:39	0:03	10:20
BM	2:44	0:03	18:11
BN	3:01	0:03	20:08
BO	3:32	0:04	24:25
BP	0:45	0:02	5:36
BQ	7:22	0:11	49:13
BR	5:11	0:06	34:20
BS	6:18	0:06	42:13
BT	5:40	0:04	41:01
BU	2:15	0:03	15:56
BV	4:58	0:06	33:07
BW	4:48	0:06	32:06
BX	6:00	0:07	42:47
BY	6:30	0:08	45:10
BZ	5:49	0:08	40:58
CA	5:04	0:04	36:53
CB	9:30	0:06	50:52
CD	9:31	0:06	50:52
CE	4:18	0:04	31:30
CG	9:17	0:06	49:53
CH	6:37	0:09	44:47
CI	1:36	0:04	12:01
CJ	1:33	0:03	10:16
CK	9:07	0:06	48:44
CL	1:54	0:03	14:04
CM	8:44	0:06	46:59
CN	8:54	0:06	47:33
CO	7:38	0:06	41:47
CP	6:46	0:06	38:15
CQ	6:05	0:06	35:49
CR	6:42	0:06	37:22
CS	1:20	0:03	9:07
CT	8:39	0:06	46:04
CU	5:38	0:07	37:04
CV	6:39	0:06	36:57
CW	6:40	0:06	35:31
CX	4:48	0:05	32:26
CY	1:14	0:03	8:34
CZ	5:59	0:06	34:34

DA	5:33	0:06	32:58
DB	6:12	0:05	33:06
DC	7:03	0:06	38:19
DD	4:22	0:04	31:45
DE	6:36	0:06	36:20
DF	5:48	0:06	33:31
DH	6:12	0:05	33:00
DJ	5:21	0:06	31:43
DK	3:48	0:04	27:54
DL	6:12	0:06	34:34
DM	7:01	0:06	37:59
DN	1:09	0:03	7:51
DO	3:50	0:06	18:46
DQ	3:12	0:06	15:41
DR	3:00	0:04	21:58
DS	5:23	0:06	31:32
DT	6:29	0:06	35:23
DU	5:50	0:06	32:57
DW	5:02	0:06	33:01
DY	1:07	0:03	7:44
DZ	5:23	0:06	31:03
EA	4:53	0:06	32:00
EB	6:31	0:06	35:17
EC	5:49	0:06	32:25
ED	6:04	0:06	33:18
EE	5:48	0:06	32:11
EF	4:33	0:06	23:06
EG	5:53	0:06	32:28
EH	6:04	0:06	33:07
EN	1:37	0:04	7:59
EP	3:27	0:06	16:49
EQ	1:03	0:03	7:26
ES	1:37	0:03	12:16
ET	5:02	0:06	28:24
EU	5:12	0:06	28:49
EV	4:56	0:05	26:10
EW	3:11	0:04	23:22
EX	4:56	0:06	27:37
EY	4:44	0:05	26:55
EZ	3:06	0:04	15:18
FA	5:03	0:05	27:34
FB	4:28	0:05	25:30
FC	5:11	0:05	27:58
FD	4:37	0:06	25:50
FE	0:53	0:02	6:40
FF	2:44	0:03	20:11
FG	3:24	0:05	16:44

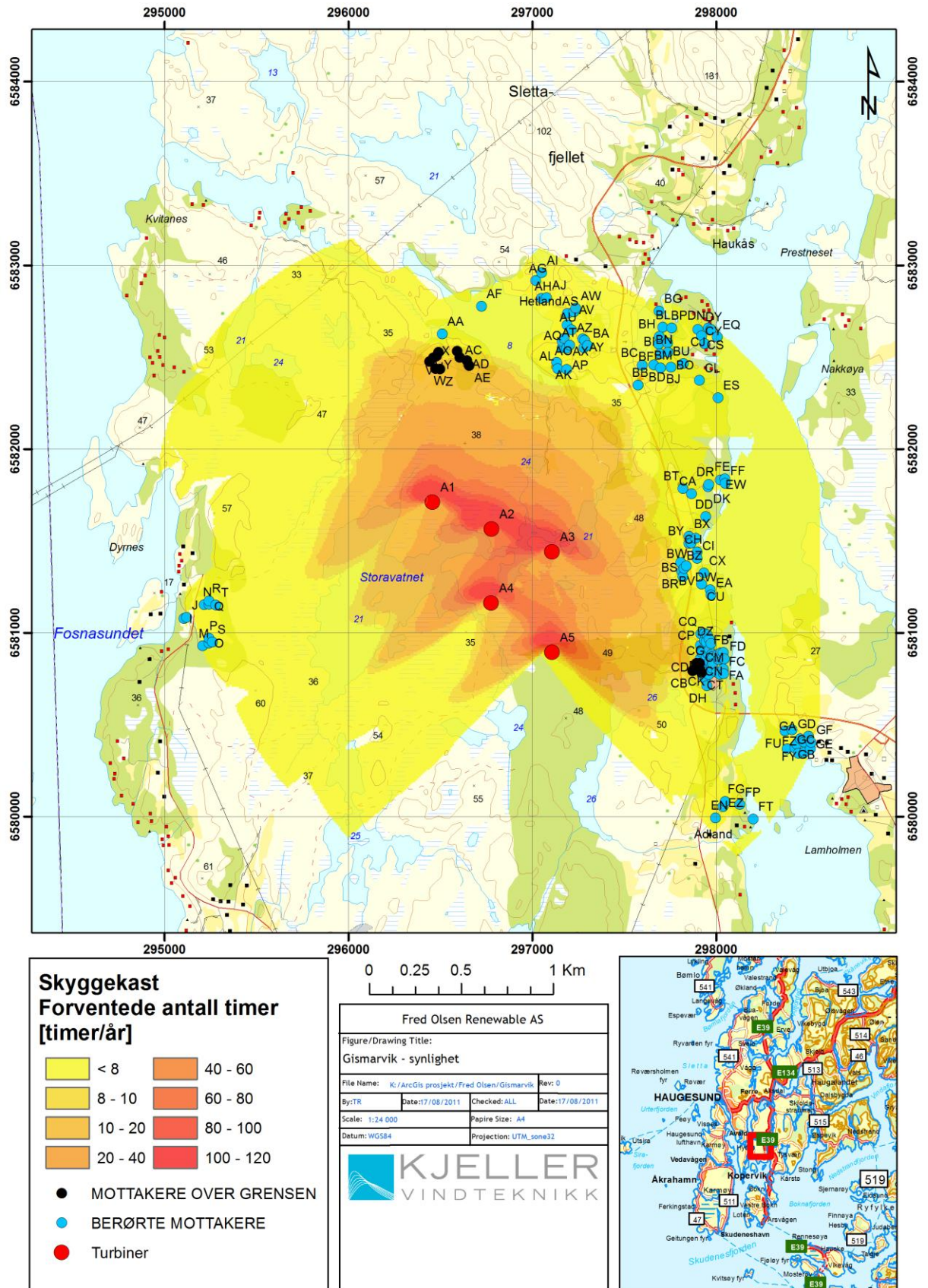
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FP	2:00	0:05	9:44
FT	2:44	0:04	13:25
FU	0:42	0:03	4:12
FV	0:54	0:03	5:12
FW	0:35	0:03	3:34
FX	0:46	0:03	4:29
FY	0:42	0:03	4:11
FZ	0:45	0:03	4:24
GA	0:36	0:03	3:34
GB	0:34	0:03	3:22
GC	0:39	0:03	3:52
GD	0:28	0:03	2:49
GE	0:32	0:03	3:11
GF	0:28	0:03	2:48

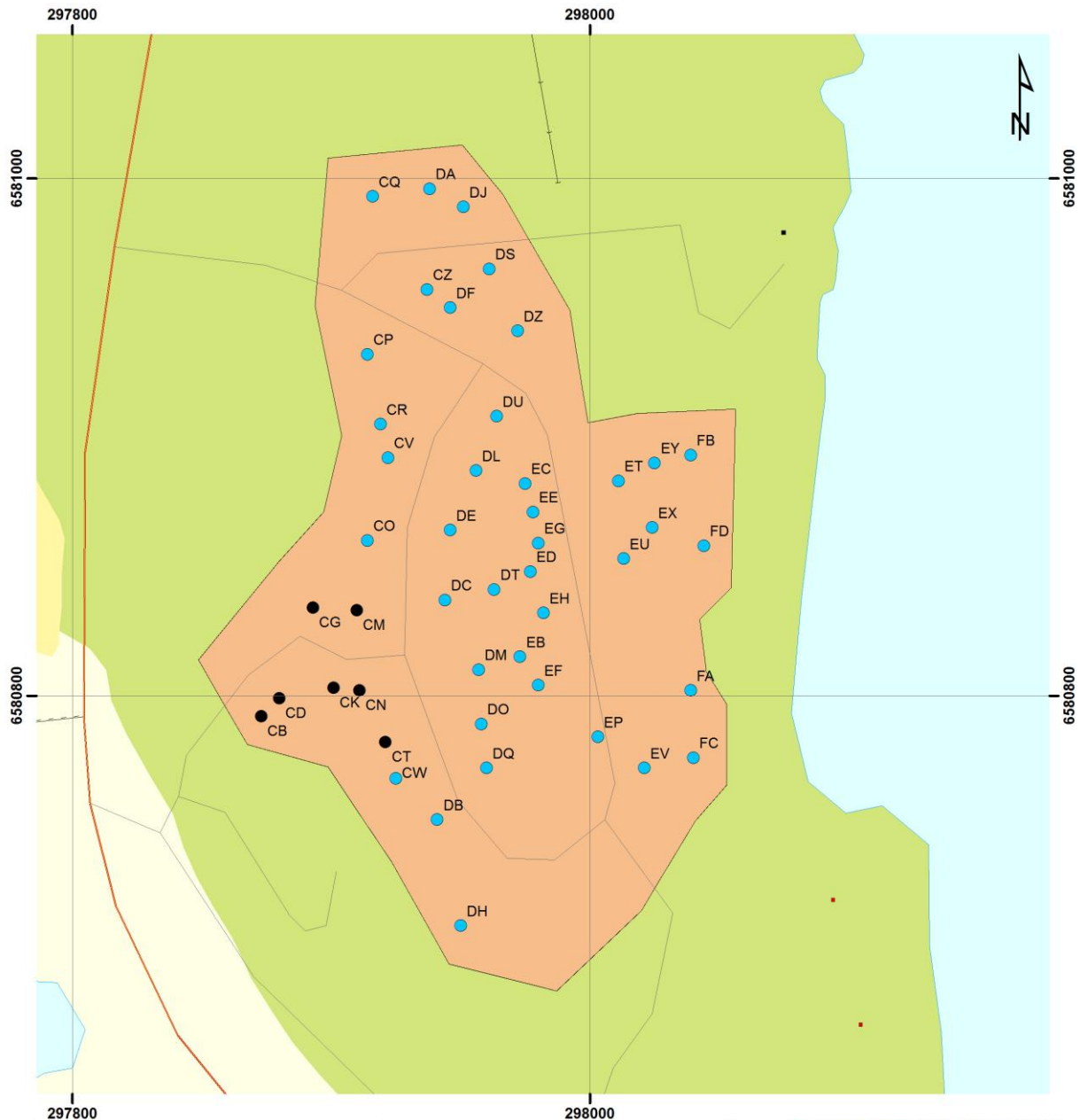
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Fra Tabell 4 ser man at de svenske grenseverdiene på mindre enn 8 timer for forventet skyggekast per år, er oversteget for 17 av skyggemottakerne. For "worst case" beregningen er grenseverdien for maksimal skyggetid per år på 30 timer overskredet for 64 mottakere. Ingen mottakere har skyggekast over grenseverdien på maksimalt 30 minutter per dag. Kart over området med turbiner og skyggemottakere er vist i Figur 3. I Figur 4 og i Figur 5 er det vist detaljkart over mottakere i områdene Mjåsund og Vatnheim.





Figur 3: Kart over Gismarvik med forventet skyggetimer per år, berørte skyggemottakere og turbiner.



**Plassering mottaker Mjåsund**


- MOTTAKERE OVER GRENSEN
- BERØRTE MOTTAKERE

0 25 50 100 m

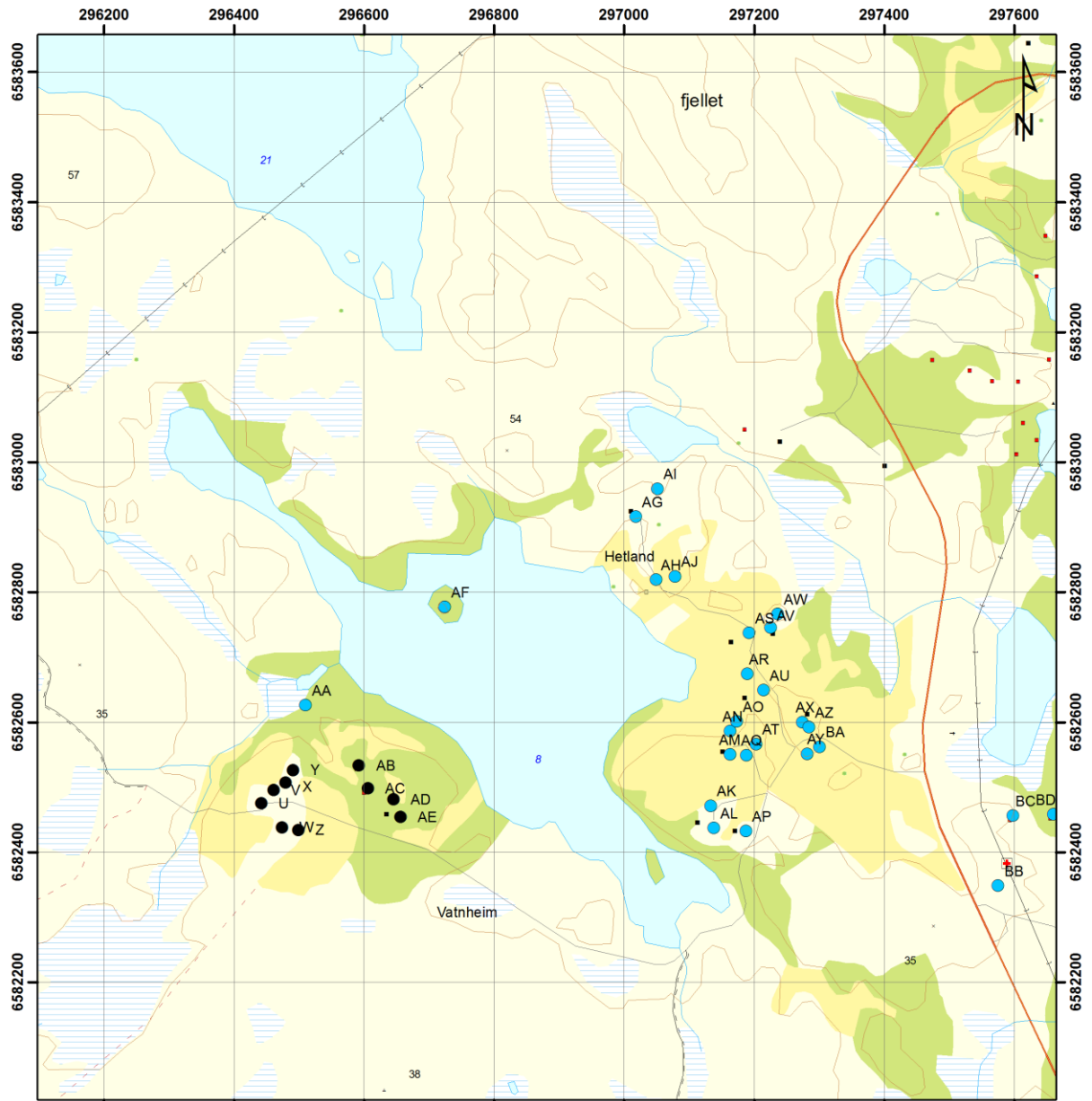
Fred Olsen Renewable AS

Figure/Drawing Title:  
Gismarvik - mottakere, detalj

File Name: K:\ArcGis prosjekt\Fred Olsen\Gismarvik	Rev: 0		
By:TR	Date:17/08/2011	Checked:ALL	Date:17/08/2011
Scale: 1:2 000	Papire Size: A4		
Datum: WGS84	Projection: UTM_sone32		




Figur 4 Mottakere i området Mjåsund



**Plassering mottakere Vatnheim**


- MOTTAKERE OVER GRENSEN
- BERØRTE MOTTAKERE

Fred Olsen Renewable AS

Figure/Drawing Title:  
Gismarvik - mottaker detalj

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By:TR	Date:17/08/2011	Checked:ALL	Date:17/08/2011
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Datum: WGS84		Projection: UTM_sone32	




Figur 5 Mottakere i området Vatnheim



Alle turbinene forårsaker skyggekast, men turbin nummer 4 står for en liten del av skyggekastet. For de mottakerne hvor grenseverdien for faktisk skyggekast overstiges, er turbinene gitt i Tabell 5. Det er også oppgitt i hvilken måned i året skyggekastet finner sted og når på døgnet. Døgnet er delt opp i morgen (før kl 12), ettermiddag (kl 12-16) og kveld (etter kl 16). For de 10 første mottakerne (U - AE) vil skyggekastet finne sted på morgenen og tidlig ettermiddag i januar, november og desember. Belastingen på den tiden av året og døgnet anses som liten, da uteområdene vil være mindre i bruk på vinterstid, samt at de fleste vil være på jobb eller skole på denne tiden av døgnet.

I vedlegg B er det en detaljert tabell over når på døgnet de ulike skyggekastene finner sted. Det er også oppgitt varighet for skyggekastet hver gang et tilfelle finner sted. Den lengste forventede daglige skyggetiden er også oppgitt i Tabell 4.

Tabell 5: Turbiner som forårsaker overskridelser av grenseverdien for faktisk skyggekast hos mottakerne

Skyggemottaker	Turbin	Tidspunkt [mnd]	Tidspunkt på døgnet
U	A1, A2, A3	Jan, Nov, Des	Morgen
V	A1, A2, A3	Jan, Nov, Des	Morgen
W	A1, A2, A3	Jan, Nov, Des	Morgen
X	A1, A2, A3	Jan, Nov, Des	Morgen
Y	A1, A2, A3	Jan, Nov, Des	Morgen
Z	A1, A2, A3	Jan, Nov, Des	Morgen
AB	A1, A3	Jan, Nov, Des	Morgen, ettermiddag
AC	A1, A3	Jan, Nov, Des	Morgen, ettermiddag
AD	A1, A3	Jan, Nov, Des	Morgen, ettermiddag
AE	A1, A3	Jan, Nov, Des	Morgen, ettermiddag
CB	A2, A3, A4, A5	Mar, Apr, Mai, Jun, Jul, Aug,	Kveld
CD	A2, A3, A4, A5	Mar, Apr, Mai, Jun, Jul, Aug,	Kveld
CG	A2, A3, A4, A5	Mar, Apr, Mai, Jun, Jul, Aug,	Kveld
CK	A2, A3, A4, A5	Mar, Apr, Mai, Jun, Jul, Aug,	Kveld
CM	A2, A3, A4, A5	Mar, Apr, Mai, Jun, Jul, Aug,	Kveld
CN	A2, A3, A4, A5	Mar, Apr, Mai, Jun, Jul, Aug,	Kveld
CT	A2, A3, A4, A5	Mar, Apr, Mai, Jun, Jul, Aug,	Kveld

### 3.2 Mulig avbøtende tiltak

Retningslinjene for faktisk skyggekast på mindre enn 8 timer per år, blir overskredet for 17 skyggekastmottakere. Av disse er 10 plassert rett nord for selve parkområdet, i området kalt Vatnheim. I området ved Vatnheim har Reidar Pedersen i Haugaland Kraft AS vært på befaring for å vurdere bebyggelsen i området. Bygningene U-Z ligger på en gård vist i Figur 6. Hovedhuset er den hvite bygningen på bildet. Bildet er tatt mot sør-sørøst og viser at området er eksponert i denne retningen, men de to store trærne like ved huset ligger mot syd og vil begrense effekten av skyggekast fra den retningen.





*Figur 6 Bilde fra området med mottakerne U-Z.*



*Figur 7 Bilde fra veien opp mot Vatnheim. Husene AB-AE ligger til høyre bak skogen på bildet.*

Bildet i Figur 7 er tatt fra veien opp mot Vatnheim. Husene ligger til høyre på bildet, bak skogen. Denne skogen vil antakeligvis skjerme for husene slik at mengde skyggekast blir betydelig redusert.

De 7 andre skyggekastmottakerne ligger i boligområdet som heter Mjåsund. Av de sju mottakerne som får skyggekast over grenseverdiene, så ser mottakerne merket CB, CK og CG i Figur 4 ut til å være garasjer. Bruken av disse er ikke nærmere undersøkt. I dag har området ved Mjåsund et skogsholt liggende mot vest mellom boligene og E39. Dette skogsholtet vil mest sannsynlig skjerme for skyggekastet, men det er uvisst om dette kommer til å være situasjonen videre fremover eller om skogsholtet blir borte. I så fall vil det være aktuelt med avbøtende tiltak i dette området.

Avbøtende tiltak kan være fjerning av turbinene som forårsaker den kritiske skyggekastingen, stopp av turbiner i kritiske perioder og skjerming av vinduer hos skyggemottaker. Beplantning av ekstra vegetasjon kan også være et godt avbøtende tiltak for noen av de berørte mottakerne.

## 4 Synlighet

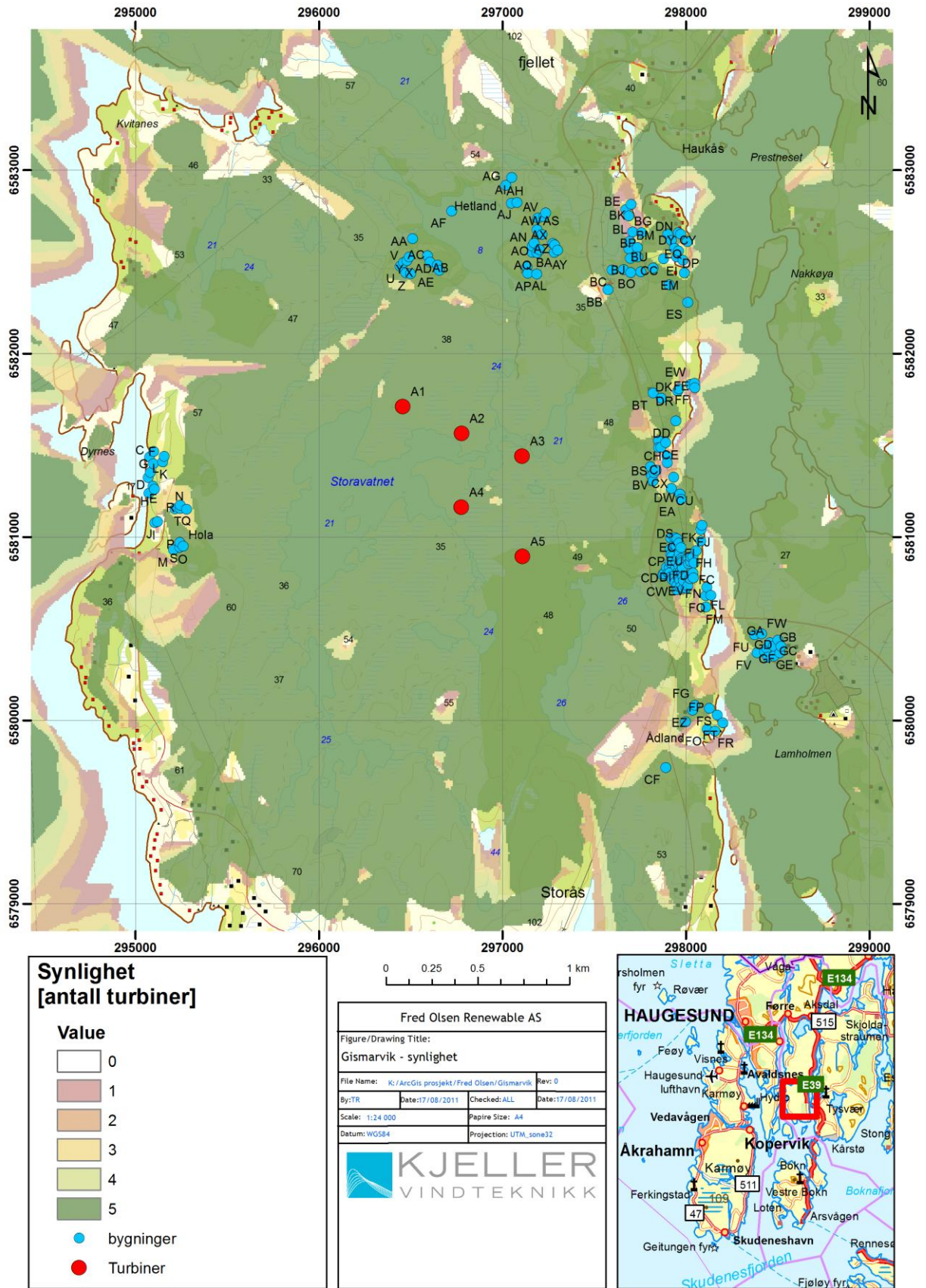
Det er utført synlighetsberegninger i WindPro 2.7 for den spesifiserte layouten. Beregningshøyden som er benyttet for turbinene er satt til navhøyde pluss en halv rotordiameter, det vil si 130.5m. Det er antatt at høyden på den som observerer turbinene er 1.5m. Den horisontale oppløsningen i kartet er 10m, og størrelsen på området strekker seg 20km utenfor parkområdet. I beregningene er det bare tatt hensyn til topografien, ikke til hvilken type terreng det er i området. Det er viktig å tenke på at trær og trehøyde rundt en spesifikk plass påvirker synligheten av vindparken fra akkurat denne plassen.

Det er laget to synlighetskart for området, Figur 9 og Figur 8. Figur 8 viser hvor vindturbinparken vil være synlig fra under gode siktforhold for området med bebyggelsen i nærheten av vindparken, mens Figur 9 er for området som strekker seg 20km utenfor vindparken. Kartet skiller ikke mellom situasjoner hvor hele turbinen eller bare en vingetipp er synlig. Den lokale skjermingseffekten av vegetasjon er heller ikke tatt med i beregningene. I realiteten vil derfor omfanget av synlige turbiner være mindre enn det synlighetskartene viser.

Figur 9 viser at turbinene vil være synlig både i Haugesund og Åkrahamn og Kopervik. Selv om parken vil være synlig over større avstander, er det imidlertid bare i deler av området at vindturbinene vil medføre visuell påvirkning av vesentlig betydning. Vindturbinene vil være små og lite fremtredende i den store landskapsammenheng utenfor den visuelle influenssonen. Visuell influenssone regnes ofte å være inntil 10 km fra vindturbinene. Vindturbinene er på avstand mest iøynefallende i motlys og ellers med lav solbane. Nattestid kan eventuell signallys på turbinene utgjøre et blikkfang. Variasjon i dagslys gjør at man har en kortere del av døgnet der vindturbinene vil være synlige i vinterhalvåret, og tilsvarende mange timer der vindturbinene er synlige midtsommers.

Avstand er den viktigste faktoren når det gjelder hvor visuelt dominerende turbinene vil virke på omgivelsene. Alle bygningene rundt vindparken ligger så langt unna at de ikke vil være i et visuelt territorium. Det betyr at de ikke har turbiner som dekker hele synsfeltet eller hvor man må løfte blikket for å fange inn hele turbinen. Flere bygninger vil imidlertid ligge innen for en visuell dominanssone. Det vil si en sone der turbinene vil dominere synsfeltet og hvor omgivelsene i begrenset grad sette preg på inntrykkbildet på grunn av turbinenes visuelle dominans. Faktorer som kan forsterke dominansgraden er blant annet hvor stor del av de synlige omgivelsene som er belagt med turbiner i forhold til de frie omgivelsene. Det har også betydning om man har naturlig innsynsretning mot vindparken eller og hvor mange turbiner som er synlig i denne retningen. Disse faktorene er ikke nærmere undersøkt i denne analysen.





Figur 8 Synlighetskart for nærområdet rundt Gismarvik vindpark.





Figur 9 Synlighetskart for området ut til 20km fra vindparken på Gismarvik.

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## 5 Bibliografi

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Boverket. *Vindkraftshandboken - Planering och provning av vindkraftverk på land och i kustnära vattenområden*. . [www.boverket.se](http://www.boverket.se).

EMD. (2008). *WindPRO 2.6 User Guide. 1. Edition*. EMD International AS.

NVE. (2009). *Vindkart for Norge*. NVE.

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## 6 Vedlegg

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Utskrift av resultat i WindPRo av skyggekastberegning for Gismarvik.

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## SHADOW - Main Result

Calculation: Skyggekast Gismarvik

### 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

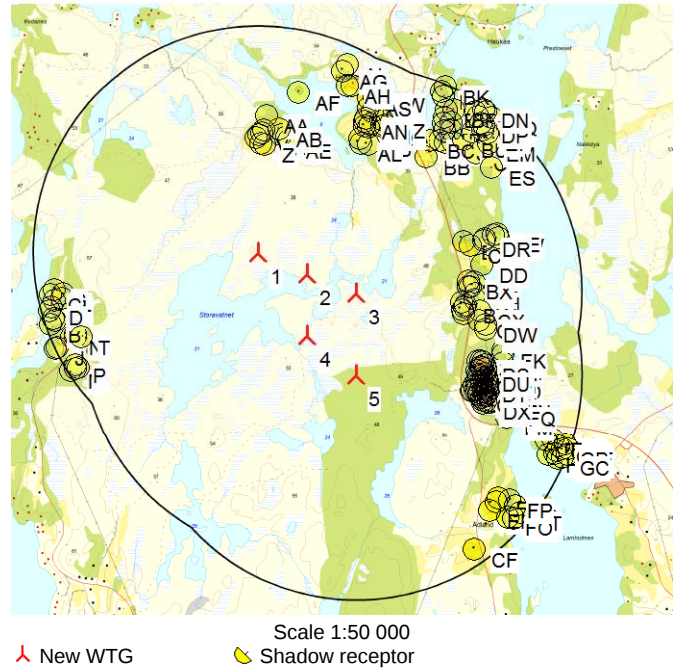
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []  
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational hours are calculated from WTGs in calculation and wind distribution:  
Default Meteo data description

Operational time  
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1281 1143 697 478 515 675 1091 8182  
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: hoyde\_merged.wpo (9)  
Obstacles used in calculation  
Eye height: 1.5 m  
Grid resolution: 10 m



### WTGs

UTM WGS84 Zone: 32			Z	Row data/Description	WTG type			Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
East	North	Valid			Manufact.	Type-generator	Calculation distance [m]				RPM	
UTM WGS84 Zone: 32			[m]									
1	296 457	6 581 711	30.0	Siemens SWT-2.3-10...	Yes	Siemens	SWT-2.3-101-2 300	2 300	101.0	80.0	1 500	16.0
2	296 778	6 581 566	25.0	Siemens SWT-2.3-10...	Yes	Siemens	SWT-2.3-101-2 300	2 300	101.0	80.0	1 500	16.0
3	297 107	6 581 441	25.0	Siemens SWT-2.3-10...	Yes	Siemens	SWT-2.3-101-2 300	2 300	101.0	80.0	1 500	16.0
4	296 777	6 581 162	25.0	Siemens SWT-2.3-10...	Yes	Siemens	SWT-2.3-101-2 300	2 300	101.0	80.0	1 500	16.0
5	297 109	6 580 894	25.0	Siemens SWT-2.3-10...	Yes	Siemens	SWT-2.3-101-2 300	2 300	101.0	80.0	1 500	16.0

### Shadow receptor-Input

UTM WGS84 Zone: 32			Z	Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode
No.	East	North							
A	295 069	6 581 324	0.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
B	295 072	6 581 238	0.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
C	295 076	6 581 436	0.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
D	295 080	6 581 352	4.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
E	295 095	6 581 276	2.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
F	295 097	6 581 398	5.7	2.0	2.0	1.0	180.0	90.0	"Green house mode"
G	295 099	6 581 465	3.1	2.0	2.0	1.0	180.0	90.0	"Green house mode"
H	295 103	6 581 261	7.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
I	295 106	6 581 077	16.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
J	295 120	6 581 083	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
K	295 148	6 581 408	15.4	2.0	2.0	1.0	180.0	90.0	"Green house mode"
L	295 157	6 581 440	13.8	2.0	2.0	1.0	180.0	90.0	"Green house mode"
M	295 207	6 580 928	30.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
N	295 216	6 581 153	24.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
O	295 242	6 580 944	32.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
P	295 242	6 580 970	32.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
Q	295 243	6 581 155	27.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
R	295 243	6 581 173	27.5	2.0	2.0	1.0	180.0	90.0	"Green house mode"

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**SHADOW - Main Result****Calculation:** Skyggekast Gismarvik

...continued from previous page

UTM WGS84 Zone: 32

No.	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
			[m]	[m]	[m]	[m]	[°]	[°]	
S	295 260	6 580 950	33.1	2.0	2.0	1.0	180.0	90.0	"Green house mode"
T	295 278	6 581 151	30.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
U	296 442	6 582 475	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
V	296 461	6 582 495	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
W	296 474	6 582 438	21.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
X	296 479	6 582 507	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
Y	296 491	6 582 526	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
Z	296 499	6 582 434	22.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AA	296 510	6 582 626	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AB	296 592	6 582 533	20.4	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AC	296 606	6 582 498	21.4	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AD	296 645	6 582 481	21.6	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AE	296 656	6 582 454	21.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AF	296 724	6 582 777	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AG	297 018	6 582 916	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AH	297 049	6 582 819	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AI	297 051	6 582 959	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AJ	297 078	6 582 824	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AK	297 133	6 582 471	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AL	297 138	6 582 437	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AM	297 163	6 582 550	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AN	297 163	6 582 586	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AO	297 173	6 582 601	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AP	297 187	6 582 432	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AQ	297 188	6 582 549	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AR	297 189	6 582 674	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AS	297 192	6 582 737	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AT	297 203	6 582 566	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AU	297 214	6 582 649	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AV	297 225	6 582 745	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AW	297 236	6 582 766	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AX	297 274	6 582 600	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AY	297 281	6 582 551	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
AZ	297 284	6 582 592	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BA	297 300	6 582 562	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BB	297 575	6 582 348	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BC	297 598	6 582 456	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BD	297 660	6 582 458	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BE	297 673	6 582 784	5.5	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BF	297 688	6 582 571	16.8	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BG	297 689	6 582 750	5.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BH	297 692	6 582 612	11.8	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BI	297 696	6 582 518	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BJ	297 698	6 582 441	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BK	297 700	6 582 813	0.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BL	297 709	6 582 662	6.4	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BM	297 736	6 582 577	17.6	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BN	297 737	6 582 527	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BO	297 754	6 582 446	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BP	297 758	6 582 659	7.1	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BQ	297 807	6 581 382	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BR	297 813	6 581 333	16.7	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BS	297 820	6 581 305	12.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BT	297 820	6 581 785	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BU	297 821	6 582 465	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BV	297 826	6 581 350	14.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BW	297 837	6 581 363	13.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BX	297 851	6 581 525	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
BY	297 852	6 581 486	16.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"

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**SHADOW - Main Result****Calculation:** Skyggekast Gismarvik

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UTM WGS84 Zone: 32

No.	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
			[m]	[m]	[m]	[m]	[°]	[°]	
BZ	297 864	6 581 487	13.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CA	297 866	6 581 757	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CB	297 873	6 580 792	23.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CC	297 877	6 582 517	6.4	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CD	297 880	6 580 799	22.7	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CE	297 889	6 581 514	13.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CF	297 890	6 579 743	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CG	297 893	6 580 834	21.8	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CH	297 896	6 581 440	2.6	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CI	297 897	6 581 405	0.5	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CJ	297 900	6 582 650	17.7	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CK	297 901	6 580 803	22.1	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CL	297 908	6 582 373	8.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CM	297 910	6 580 833	21.6	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CN	297 911	6 580 802	21.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CO	297 914	6 580 860	22.1	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CP	297 914	6 580 932	20.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CQ	297 916	6 580 993	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CR	297 919	6 580 905	23.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CS	297 920	6 582 615	12.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CT	297 921	6 580 782	22.5	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CU	297 921	6 581 264	4.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CV	297 922	6 580 892	24.1	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CW	297 925	6 580 768	37.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CX	297 932	6 581 325	0.6	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CY	297 937	6 582 574	7.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
CZ	297 937	6 580 957	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DA	297 938	6 580 996	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DB	297 941	6 580 752	37.8	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DC	297 944	6 580 837	20.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DD	297 944	6 581 632	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DE	297 946	6 580 864	21.4	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DF	297 946	6 580 950	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DG	297 948	6 582 526	1.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DH	297 950	6 580 711	37.8	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DI	297 951	6 580 733	35.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DJ	297 951	6 580 989	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DK	297 955	6 581 794	14.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DL	297 956	6 580 887	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DM	297 957	6 580 810	20.6	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DN	297 958	6 582 659	11.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DO	297 958	6 580 789	27.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DP	297 959	6 582 559	2.7	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DQ	297 960	6 580 772	27.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DR	297 960	6 581 807	16.5	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DS	297 961	6 580 965	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DT	297 963	6 580 841	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DU	297 964	6 580 908	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DV	297 966	6 580 763	26.4	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DW	297 967	6 581 234	3.6	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DX	297 968	6 580 726	29.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DY	297 971	6 582 651	9.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
DZ	297 972	6 580 941	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EA	297 972	6 581 205	4.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EB	297 973	6 580 815	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EC	297 975	6 580 882	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
ED	297 977	6 580 848	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EE	297 978	6 580 871	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EF	297 980	6 580 804	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"

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**SHADOW - Main Result****Calculation:** Skyggekast Gismarvik

...continued from previous page

UTM WGS84 Zone: 32

No.	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[°]	[°]	
EG	297 980	6 580 859	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EH	297 982	6 580 832	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EI	297 984	6 582 509	0.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EJ	297 984	6 580 783	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EK	297 987	6 580 720	22.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EL	297 987	6 580 760	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EM	297 991	6 582 439	0.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EN	297 997	6 579 993	19.7	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EO	298 002	6 580 720	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EP	298 003	6 580 784	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EQ	298 007	6 582 609	0.4	2.0	2.0	1.0	180.0	90.0	"Green house mode"
ER	298 009	6 580 731	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
ES	298 010	6 582 279	1.5	2.0	2.0	1.0	180.0	90.0	"Green house mode"
ET	298 011	6 580 883	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EU	298 013	6 580 853	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EV	298 021	6 580 772	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EW	298 023	6 581 831	14.1	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EX	298 024	6 580 865	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EY	298 025	6 580 890	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
EZ	298 036	6 580 054	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FA	298 039	6 580 802	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FB	298 039	6 580 893	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FC	298 040	6 580 776	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FD	298 044	6 580 858	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FE	298 046	6 581 837	7.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FF	298 049	6 581 814	3.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FG	298 049	6 580 082	16.1	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FH	298 057	6 580 924	11.1	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FI	298 081	6 580 978	2.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FJ	298 081	6 581 038	2.1	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FK	298 087	6 581 063	0.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FL	298 107	6 580 679	6.8	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FM	298 110	6 580 618	7.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FN	298 114	6 580 726	2.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FO	298 116	6 579 952	4.1	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FP	298 128	6 580 065	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FQ	298 136	6 580 681	0.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FR	298 157	6 579 942	0.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FS	298 170	6 580 028	0.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FT	298 201	6 579 986	0.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FU	298 374	6 580 465	17.1	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FV	298 387	6 580 367	0.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FW	298 413	6 580 471	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FX	298 428	6 580 373	3.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FY	298 440	6 580 393	7.6	2.0	2.0	1.0	180.0	90.0	"Green house mode"
FZ	298 447	6 580 343	1.5	2.0	2.0	1.0	180.0	90.0	"Green house mode"
GA	298 457	6 580 423	14.4	2.0	2.0	1.0	180.0	90.0	"Green house mode"
GB	298 478	6 580 405	14.2	2.0	2.0	1.0	180.0	90.0	"Green house mode"
GC	298 480	6 580 350	4.9	2.0	2.0	1.0	180.0	90.0	"Green house mode"
GD	298 502	6 580 437	20.0	2.0	2.0	1.0	180.0	90.0	"Green house mode"
GE	298 512	6 580 369	11.7	2.0	2.0	1.0	180.0	90.0	"Green house mode"
GF	298 517	6 580 403	18.3	2.0	2.0	1.0	180.0	90.0	"Green house mode"

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**SHADOW - Main Result**

Calculation: Skyggekast Gismarvik

**Calculation Results**

Shadow receptor

No.	Shadow, worst case		Shadow, expected values	
	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
A	0:00	0	0:00	0:00
B	0:00	0	0:00	0:00
C	0:00	0	0:00	0:00
D	0:00	0	0:00	0:00
E	0:00	0	0:00	0:00
F	0:00	0	0:00	0:00
G	0:00	0	0:00	0:00
H	0:00	0	0:00	0:00
I	4:25	25	0:16	0:38
J	4:15	25	0:16	0:36
K	0:00	0	0:00	0:00
L	0:00	0	0:00	0:00
M	4:52	30	0:16	0:42
N	5:01	27	0:17	0:43
O	5:09	31	0:16	0:44
P	5:08	30	0:16	0:44
Q	5:08	26	0:18	0:44
R	5:11	27	0:18	0:45
S	5:29	33	0:16	0:47
T	7:17	42	0:18	1:04
U	59:28	74	1:01	11:32
V	55:28	70	1:01	10:45
W	65:10	74	1:07	12:33
X	53:02	68	1:02	10:16
Y	49:32	66	1:01	9:36
Z	64:59	72	1:10	12:27
AA	35:11	54	0:55	6:55
AB	49:52	56	1:11	9:33
AC	55:43	58	1:16	10:34
AD	58:45	58	1:20	10:59
AE	64:29	62	1:23	11:57
AF	5:49	24	0:21	1:03
AG	7:46	34	0:17	1:15
AH	13:45	48	0:21	2:10
AI	6:53	32	0:16	1:07
AJ	14:23	48	0:21	2:15
AK	32:56	91	0:36	5:03
AL	38:09	96	0:43	5:55
AM	24:53	84	0:23	3:45
AN	22:05	80	0:23	3:19
AO	21:13	78	0:23	3:11
AP	38:26	96	0:42	5:55
AQ	24:51	86	0:23	3:44
AR	16:37	72	0:21	2:29
AS	13:17	66	0:20	1:58
AT	23:40	82	0:23	3:34
AU	18:16	74	0:21	2:44
AV	12:53	64	0:20	1:55
AW	11:53	60	0:20	1:45
AX	22:05	79	0:22	3:19
AY	25:27	84	0:24	3:49
AZ	22:41	80	0:23	3:24
BA	24:55	84	0:23	3:44
BB	44:09	115	0:42	6:33
BC	26:40	101	0:23	3:57
BD	26:45	101	0:23	3:57
BE	0:00	0	0:00	0:00
BF	17:57	73	0:20	2:43

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**SHADOW - Main Result****Calculation:** Skyggekast Gismarvik

...continued from previous page

No.	Shadow, worst case		Shadow, expected values	
	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
BG	6:01	30	0:15	0:59
BH	11:05	42	0:19	1:46
BI	23:13	96	0:21	3:26
BJ	27:46	104	0:23	4:05
BK	0:00	0	0:00	0:00
BL	10:20	40	0:19	1:39
BM	18:11	72	0:20	2:44
BN	20:08	76	0:21	3:01
BO	24:25	103	0:22	3:32
BP	5:36	30	0:17	0:45
BQ	49:13	113	0:59	7:22
BR	34:20	86	0:34	5:11
BS	42:13	116	0:33	6:18
BT	41:01	135	0:31	5:40
BU	15:56	77	0:21	2:15
BV	33:07	84	0:33	4:58
BW	32:06	84	0:32	4:48
BX	42:47	117	0:45	6:00
BY	45:10	115	0:49	6:30
BZ	40:58	108	0:48	5:49
CA	36:53	127	0:29	5:04
CB	50:52	143	0:31	9:30
CC	0:00	0	0:00	0:00
CD	50:52	144	0:31	9:31
CE	31:30	99	0:31	4:18
CF	0:00	0	0:00	0:00
CG	49:53	150	0:31	9:17
CH	44:47	108	0:56	6:37
CI	12:01	36	0:26	1:36
CJ	10:16	52	0:18	1:33
CK	48:44	144	0:30	9:07
CL	14:04	62	0:21	1:54
CM	46:59	151	0:30	8:44
CN	47:33	146	0:30	8:54
CO	41:47	136	0:30	7:38
CP	38:15	124	0:30	6:46
CQ	35:49	116	0:29	6:05
CR	37:22	124	0:29	6:42
CS	9:07	49	0:18	1:20
CT	46:04	143	0:29	8:39
CU	37:04	102	0:38	5:38
CV	36:57	124	0:29	6:39
CW	35:31	137	0:29	6:40
CX	32:26	98	0:29	4:48
CY	8:34	41	0:18	1:14
CZ	34:34	115	0:29	5:59
DA	32:58	109	0:29	5:33
DB	33:06	135	0:28	6:12
DC	38:19	127	0:29	7:03
DD	31:45	113	0:29	4:22
DE	36:20	122	0:29	6:36
DF	33:31	113	0:28	5:48
DG	0:00	0	0:00	0:00
DH	33:00	129	0:27	6:12
DI	0:00	0	0:00	0:00
DJ	31:43	107	0:28	5:21
DK	27:54	101	0:26	3:48
DL	34:34	117	0:28	6:12
DM	37:59	129	0:28	7:01

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**SHADOW - Main Result****Calculation:** Skyggekast Gismarvik

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No.	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]
DN	7:51	45	0:18	1:09
DO	18:46	73	0:24	3:50
DP	0:00	0	0:00	0:00
DQ	15:41	64	0:23	3:12
DR	21:58	79	0:26	3:00
DS	31:32	110	0:28	5:23
DT	35:23	121	0:28	6:29
DU	32:57	114	0:28	5:50
DV	0:00	0	0:00	0:00
DW	33:01	98	0:35	5:02
DX	0:00	0	0:00	0:00
DY	7:44	42	0:17	1:07
DZ	31:03	110	0:27	5:23
EA	32:00	99	0:32	4:53
EB	35:17	122	0:28	6:31
EC	32:25	114	0:27	5:49
ED	33:18	116	0:28	6:04
EE	32:11	112	0:28	5:48
EF	23:06	90	0:24	4:33
EG	32:28	113	0:28	5:53
EH	33:07	116	0:28	6:04
EI	0:00	0	0:00	0:00
EJ	0:00	0	0:00	0:00
EK	0:00	0	0:00	0:00
EL	0:00	0	0:00	0:00
EM	0:00	0	0:00	0:00
EN	7:59	41	0:17	1:37
EO	0:00	0	0:00	0:00
EP	16:49	64	0:23	3:27
EQ	7:26	36	0:18	1:03
ER	0:00	0	0:00	0:00
ES	12:16	54	0:20	1:37
ET	28:24	106	0:26	5:02
EU	28:49	105	0:27	5:12
EV	26:10	96	0:26	4:56
EW	23:22	93	0:25	3:11
EX	27:37	102	0:26	4:56
EY	26:55	103	0:26	4:44
EZ	15:18	58	0:21	3:06
FA	27:34	103	0:26	5:03
FB	25:30	97	0:26	4:28
FC	27:58	105	0:26	5:11
FD	25:50	100	0:26	4:37
FE	6:40	30	0:19	0:53
FF	20:11	76	0:24	2:44
FG	16:44	64	0:21	3:24
FH	0:00	0	0:00	0:00
FI	0:00	0	0:00	0:00
FJ	0:00	0	0:00	0:00
FK	0:00	0	0:00	0:00
FL	0:00	0	0:00	0:00
FM	0:00	0	0:00	0:00
FN	0:00	0	0:00	0:00
FO	0:00	0	0:00	0:00
FP	9:44	48	0:19	2:00
FQ	0:00	0	0:00	0:00
FR	0:00	0	0:00	0:00
FS	0:00	0	0:00	0:00
FT	13:25	67	0:18	2:44

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## SHADOW - Main Result

Calculation: Skyggekast Gismarvik

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No.	Shadow, worst case		Shadow, expected values	
	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
FU	4:12	22	0:18	0:42
FV	5:12	25	0:18	0:54
FW	3:34	20	0:16	0:35
FX	4:29	23	0:17	0:46
FY	4:11	22	0:17	0:42
FZ	4:24	22	0:17	0:45
GA	3:34	20	0:17	0:36
GB	3:22	21	0:16	0:34
GC	3:52	21	0:16	0:39
GD	2:49	19	0:15	0:28
GE	3:11	19	0:16	0:32
GF	2:48	18	0:15	0:28

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

No.	Name	Worst case [h/year]	Expected [h/year]
1	Siemens SWT-2.3-101 2300 101.0 !O! hub: 80.0 m (6)	192:41	32:35
2	Siemens SWT-2.3-101 2300 101.0 !O! hub: 80.0 m (7)	190:29	32:19
3	Siemens SWT-2.3-101 2300 101.0 !O! hub: 80.0 m (8)	288:24	48:23
4	Siemens SWT-2.3-101 2300 101.0 !O! hub: 80.0 m (9)	73:59	10:58
5	Siemens SWT-2.3-101 2300 101.0 !O! hub: 80.0 m (10)	172:26	26:24

Project:

Gismarvik

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Licensed user:

**Kjeller Vindteknikk AS**  
Gunnar Randres vei 12  
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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: A - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (205)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36	07:51	06:39	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:55	17:05	18:20	19:31	20:39	20:57	20:07	18:43	17:15	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:59	08:09
	14:50	15:57	17:08	18:22	19:34	20:40	20:57	20:05	18:40	17:12	15:46	14:47
3	08:35	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:38	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:04	08:13
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:35	17:06	15:41	14:45
5	08:33	07:42	06:27	04:56	03:32	02:31	02:32	03:31	04:43	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44
6	08:33	07:40	06:24	04:53	03:30	02:30	02:33	03:33	04:45	05:53	07:09	08:16
	14:57	16:07	17:18	18:32	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:36	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:46	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:19	04:47	03:25	02:27	02:36	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:23	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:16	04:44	03:22	02:27	02:37	03:40	04:52	06:00	07:16	08:21
	15:02	16:15	17:25	18:39	19:50	20:50	20:50	19:47	18:20	16:51	15:29	14:41
10	08:29	07:30	06:13	04:42	03:20	02:26	02:39	03:42	04:54	06:03	07:18	08:22
	15:04	16:18	17:27	18:41	19:53	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:39	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:53	20:47	19:42	18:14	16:46	15:24	14:40
12	08:27	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
	15:08	16:23	17:32	18:46	19:57	20:54	20:46	19:39	18:11	16:43	15:22	14:39
13	08:25	07:22	06:04	04:33	03:13	02:24	02:43	03:49	05:01	06:10	07:26	08:27
	15:10	16:25	17:35	18:48	20:00	20:54	20:45	19:37	18:08	16:40	15:20	14:39
14	08:24	07:20	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:51	20:02	20:55	20:43	19:34	18:05	16:37	15:18	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:15	07:31	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:08	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20	07:12	05:52	04:21	03:04	02:22	02:51	03:59	05:10	06:19	07:36	08:31
	15:18	16:35	17:44	18:58	20:09	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:21	16:38	17:47	19:00	20:11	20:58	20:36	19:23	17:53	16:26	15:09	14:38
19	08:17	07:06	05:46	04:16	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:35	19:20	17:50	16:23	15:07	14:38
20	08:15	07:04	05:43	04:13	02:57	02:22	02:56	04:06	05:17	06:27	07:43	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:33	19:18	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:28	16:46	17:54	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:04	14:39
22	08:11	06:58	05:38	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35
	15:30	16:48	17:56	19:10	20:19	20:59	20:29	19:12	17:41	16:15	15:02	14:40
23	08:10	06:55	05:35	04:04	02:51	02:22	03:02	04:13	05:23	06:34	07:50	08:35
	15:32	16:51	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:53	05:32	04:02	02:49	02:23	03:04	04:15	05:26	06:36	07:52	08:36
	15:35	16:53	18:01	19:14	20:24	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:29	03:59	02:47	02:23	03:07	04:17	05:28	06:39	07:54	08:36
	15:37	16:56	18:03	19:17	20:26	20:59	20:23	19:04	17:32	16:06	14:57	14:41
26	08:04	06:47	05:26	03:56	02:46	02:24	03:09	04:20	05:30	06:41	07:56	08:36
	15:40	16:58	18:06	19:19	20:28	20:59	20:21	19:01	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:33	06:44	07:58	08:36
	15:42	17:01	18:08	19:22	20:29	20:59	20:18	18:58	17:26	16:01	14:54	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:01	08:36
	15:45	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:24	15:58	14:52	14:44
29	07:58		05:17	03:48	02:40	02:26	03:15	04:27	05:37	06:49	08:03	08:36
	15:47		18:13	19:26	20:33	20:58	20:14	18:52	17:21	15:56	14:51	14:45
30	07:56		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:50		18:15	19:29	20:35	20:58	20:12	18:49	17:18	15:53	14:49	14:46
31	07:53		05:11		02:37		03:20	04:31		06:54		08:36
	15:52		18:17		20:37		20:09	18:46		15:51		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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Gunnar Randres vei 12

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(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: B - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (206)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36	07:51	06:39	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:55	17:05	18:20	19:31	20:39	20:57	20:07	18:43	17:15	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:59	08:09
	14:50	15:57	17:08	18:22	19:34	20:40	20:57	20:05	18:40	17:12	15:46	14:47
3	08:35	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:38	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:04	08:13
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:35	17:06	15:41	14:45
5	08:33	07:42	06:27	04:56	03:32	02:31	02:32	03:31	04:43	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44
6	08:33	07:40	06:24	04:53	03:30	02:30	02:33	03:33	04:45	05:53	07:09	08:16
	14:57	16:07	17:18	18:32	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:36	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:46	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:19	04:47	03:25	02:27	02:36	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:23	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:16	04:44	03:22	02:27	02:37	03:40	04:52	06:00	07:16	08:21
	15:02	16:15	17:25	18:39	19:50	20:50	20:50	19:47	18:20	16:51	15:29	14:41
10	08:29	07:30	06:13	04:42	03:20	02:26	02:39	03:43	04:54	06:03	07:18	08:22
	15:04	16:18	17:27	18:41	19:53	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:39	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:53	20:47	19:42	18:14	16:46	15:24	14:40
12	08:27	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
	15:08	16:23	17:32	18:46	19:57	20:54	20:46	19:39	18:11	16:43	15:22	14:39
13	08:25	07:22	06:04	04:33	03:13	02:24	02:43	03:49	05:01	06:10	07:26	08:27
	15:10	16:25	17:35	18:48	20:00	20:54	20:44	19:37	18:08	16:40	15:20	14:39
14	08:24	07:20	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:51	20:02	20:55	20:43	19:34	18:05	16:37	15:18	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:15	07:31	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:08	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20	07:12	05:52	04:21	03:04	02:22	02:51	03:59	05:10	06:19	07:36	08:31
	15:18	16:35	17:44	18:58	20:09	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:21	16:38	17:47	19:00	20:11	20:58	20:36	19:23	17:53	16:26	15:09	14:38
19	08:17	07:06	05:46	04:16	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:41	17:49	19:02	20:13	20:58	20:35	19:20	17:50	16:23	15:07	14:38
20	08:15	07:04	05:43	04:13	02:57	02:22	02:56	04:06	05:17	06:27	07:43	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:33	19:18	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:28	16:46	17:54	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:04	14:39
22	08:11	06:58	05:38	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35
	15:30	16:48	17:56	19:10	20:19	20:59	20:29	19:12	17:41	16:15	15:02	14:40
23	08:10	06:55	05:35	04:04	02:51	02:22	03:02	04:13	05:23	06:34	07:50	08:35
	15:32	16:51	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:53	05:32	04:02	02:49	02:23	03:04	04:15	05:26	06:36	07:52	08:36
	15:35	16:53	18:01	19:14	20:24	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:29	03:59	02:47	02:23	03:07	04:17	05:28	06:39	07:54	08:36
	15:37	16:56	18:03	19:17	20:26	20:59	20:23	19:04	17:32	16:06	14:57	14:41
26	08:04	06:47	05:26	03:56	02:46	02:24	03:09	04:20	05:30	06:41	07:56	08:36
	15:40	16:58	18:06	19:19	20:28	20:59	20:21	19:01	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:33	06:44	07:58	08:36
	15:42	17:01	18:08	19:22	20:29	20:59	20:18	18:58	17:26	16:01	14:54	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:01	08:36
	15:45	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:24	15:58	14:52	14:44
29	07:58		05:17	03:48	02:40	02:26	03:15	04:27	05:37	06:49	08:03	08:36
	15:47		18:13	19:26	20:33	20:58	20:14	18:52	17:21	15:56	14:51	14:45
30	07:56		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:50		18:15	19:29	20:35	20:58	20:12	18:49	17:18	15:53	14:49	14:46
31	07:53		05:11		02:37		03:20	04:31		06:54		08:36
	15:52		18:17		20:37		20:09	18:46		15:51		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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Kjeller Vindteknikk AS

Gunnar Randres vei 12

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(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: C - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (207)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36	07:51	06:39	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:55	17:05	18:20	19:31	20:39	20:57	20:07	18:43	17:15	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:59	08:09
	14:50	15:57	17:08	18:22	19:34	20:40	20:57	20:05	18:40	17:12	15:46	14:47
3	08:35	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:38	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:04	08:13
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:35	17:06	15:41	14:45
5	08:33	07:42	06:27	04:56	03:32	02:31	02:32	03:31	04:43	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44
6	08:33	07:40	06:24	04:53	03:30	02:30	02:33	03:33	04:45	05:53	07:09	08:16
	14:57	16:07	17:18	18:32	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:36	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:46	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:19	04:47	03:25	02:27	02:36	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:23	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:16	04:44	03:22	02:27	02:37	03:40	04:52	06:00	07:16	08:21
	15:02	16:15	17:25	18:39	19:50	20:50	20:50	19:47	18:20	16:51	15:29	14:41
10	08:29	07:30	06:13	04:42	03:20	02:26	02:39	03:42	04:54	06:03	07:18	08:23
	15:04	16:18	17:27	18:41	19:53	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:39	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:53	20:47	19:42	18:14	16:46	15:24	14:40
12	08:27	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
	15:08	16:23	17:32	18:46	19:57	20:54	20:46	19:39	18:11	16:43	15:22	14:39
13	08:26	07:22	06:04	04:33	03:13	02:24	02:43	03:49	05:01	06:10	07:26	08:27
	15:10	16:25	17:35	18:48	20:00	20:54	20:45	19:37	18:08	16:40	15:20	14:39
14	08:24	07:20	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:51	20:02	20:55	20:43	19:34	18:05	16:37	15:18	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:15	07:31	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:08	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20	07:12	05:52	04:21	03:04	02:22	02:51	03:59	05:10	06:19	07:36	08:31
	15:18	16:35	17:44	18:58	20:09	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:21	16:38	17:47	19:00	20:11	20:58	20:36	19:23	17:53	16:26	15:09	14:38
19	08:17	07:06	05:46	04:16	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:35	19:20	17:50	16:23	15:07	14:38
20	08:15	07:04	05:43	04:13	02:57	02:22	02:56	04:06	05:17	06:27	07:43	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:33	19:18	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:28	16:46	17:54	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:04	14:39
22	08:11	06:58	05:38	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35
	15:30	16:48	17:56	19:10	20:19	20:59	20:29	19:12	17:41	16:15	15:02	14:40
23	08:10	06:55	05:35	04:04	02:51	02:22	03:02	04:13	05:23	06:34	07:50	08:35
	15:32	16:51	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:53	05:32	04:02	02:49	02:23	03:04	04:15	05:26	06:36	07:52	08:36
	15:35	16:53	18:01	19:14	20:24	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:29	03:59	02:47	02:23	03:07	04:17	05:28	06:39	07:54	08:36
	15:37	16:56	18:03	19:17	20:26	20:59	20:23	19:04	17:32	16:06	14:57	14:41
26	08:04	06:47	05:26	03:56	02:46	02:24	03:09	04:20	05:30	06:41	07:56	08:36
	15:40	16:58	18:06	19:19	20:28	20:59	20:21	19:01	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:33	06:44	07:58	08:36
	15:42	17:01	18:08	19:22	20:29	20:59	20:18	18:58	17:26	16:01	14:54	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:01	08:36
	15:45	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:24	15:58	14:52	14:44
29	07:58		05:17	03:48	02:40	02:26	03:15	04:27	05:37	06:49	08:03	08:36
	15:47		18:13	19:26	20:33	20:58	20:14	18:52	17:21	15:56	14:51	14:45
30	07:56		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:50		18:15	19:29	20:35	20:58	20:12	18:49	17:18	15:53	14:49	14:46
31	07:53		05:11		02:37		03:20	04:31		06:54		08:36
	15:52		18:17		20:37		20:09	18:46		15:51		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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15.08.2011 12:14 / 4

Licensed user:

Kjeller Vindteknikk AS  
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NO-2007 Kjeller  
(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: D - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (208)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36	07:51	06:39	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:55	17:05	18:20	19:31	20:39	20:57	20:07	18:43	17:15	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:59	08:09
	14:50	15:57	17:08	18:22	19:34	20:40	20:57	20:05	18:40	17:12	15:46	14:47
3	08:35	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:38	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:04	08:13
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:35	17:06	15:41	14:45
5	08:33	07:42	06:27	04:56	03:32	02:31	02:32	03:31	04:43	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44
6	08:33	07:40	06:24	04:53	03:30	02:30	02:33	03:33	04:45	05:53	07:09	08:16
	14:57	16:07	17:18	18:32	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:36	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:46	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:19	04:47	03:25	02:27	02:36	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:23	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:16	04:44	03:22	02:27	02:37	03:40	04:52	06:00	07:16	08:21
	15:02	16:15	17:25	18:39	19:50	20:50	20:50	19:47	18:20	16:51	15:29	14:41
10	08:29	07:30	06:13	04:42	03:20	02:26	02:39	03:42	04:54	06:03	07:18	08:22
	15:04	16:18	17:27	18:41	19:53	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:39	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:53	20:47	19:42	18:14	16:46	15:24	14:40
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13	08:25	07:22	06:04	04:33	03:13	02:24	02:43	03:49	05:01	06:10	07:26	08:27
	15:10	16:25	17:35	18:48	20:00	20:54	20:45	19:37	18:08	16:40	15:20	14:39
14	08:24	07:20	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:51	20:02	20:55	20:43	19:34	18:05	16:37	15:18	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:15	07:31	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:08	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20	07:12	05:52	04:21	03:04	02:22	02:51	03:59	05:10	06:19	07:36	08:31
	15:18	16:35	17:44	18:58	20:09	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:21	16:38	17:47	19:00	20:11	20:58	20:36	19:23	17:53	16:26	15:09	14:38
19	08:17	07:06	05:46	04:16	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:35	19:20	17:50	16:23	15:07	14:38
20	08:15	07:04	05:43	04:13	02:57	02:22	02:56	04:06	05:17	06:27	07:43	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:33	19:18	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:28	16:46	17:54	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:04	14:39
22	08:11	06:58	05:38	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35
	15:30	16:48	17:56	19:10	20:19	20:59	20:29	19:12	17:41	16:15	15:02	14:40
23	08:10	06:55	05:35	04:04	02:51	02:22	03:02	04:13	05:23	06:34	07:50	08:35
	15:32	16:51	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:53	05:32	04:02	02:49	02:23	03:04	04:15	05:26	06:36	07:52	08:36
	15:35	16:53	18:01	19:14	20:24	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:29	03:59	02:47	02:23	03:07	04:17	05:28	06:39	07:54	08:36
	15:37	16:56	18:03	19:17	20:26	20:59	20:23	19:04	17:32	16:06	14:57	14:41
26	08:04	06:47	05:26	03:56	02:46	02:24	03:09	04:20	05:30	06:41	07:56	08:36
	15:40	16:58	18:06	19:19	20:28	20:59	20:21	19:01	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:33	06:44	07:58	08:36
	15:42	17:01	18:08	19:22	20:29	20:59	20:18	18:58	17:26	16:01	14:54	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:01	08:36
	15:45	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:24	15:58	14:52	14:44
29	07:58		05:17	03:48	02:40	02:26	03:15	04:27	05:37	06:49	08:03	08:36
	15:47		18:13	19:26	20:33	20:58	20:14	18:52	17:21	15:56	14:51	14:45
30	07:56		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:50		18:15	19:29	20:35	20:58	20:12	18:49	17:18	15:53	14:49	14:46
31	07:53		05:11		02:37		03:20	04:31		06:54		08:36
	15:52		18:17		20:37		20:09	18:46		15:51		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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15.08.2011 12:14 / 5

Licensed user:

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(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: E - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (209)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36	07:51	06:39	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:55	17:05	18:20	19:31	20:39	20:57	20:07	18:43	17:15	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:59	08:09
	14:50	15:57	17:08	18:22	19:34	20:40	20:57	20:05	18:40	17:12	15:46	14:47
3	08:35	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:38	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:04	08:13
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:35	17:06	15:41	14:45
5	08:33	07:42	06:27	04:56	03:32	02:31	02:32	03:31	04:43	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44
6	08:33	07:40	06:24	04:53	03:30	02:30	02:33	03:33	04:45	05:53	07:09	08:16
	14:57	16:07	17:18	18:32	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:36	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:46	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:19	04:47	03:25	02:27	02:36	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:23	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:16	04:44	03:22	02:27	02:37	03:40	04:52	06:00	07:16	08:21
	15:02	16:15	17:25	18:39	19:50	20:50	20:50	19:47	18:20	16:51	15:29	14:41
10	08:29	07:30	06:13	04:42	03:20	02:26	02:39	03:42	04:54	06:03	07:18	08:22
	15:04	16:18	17:27	18:41	19:53	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:39	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:53	20:47	19:42	18:14	16:46	15:24	14:40
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	15:08	16:23	17:32	18:46	19:57	20:54	20:46	19:39	18:11	16:43	15:22	14:39
13	08:25	07:22	06:04	04:33	03:13	02:24	02:43	03:49	05:01	06:10	07:26	08:27
	15:10	16:25	17:35	18:48	20:00	20:54	20:44	19:37	18:08	16:40	15:20	14:39
14	08:24	07:20	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:51	20:02	20:55	20:43	19:34	18:05	16:37	15:18	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:15	07:31	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:08	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20	07:12	05:52	04:21	03:04	02:22	02:51	03:59	05:10	06:19	07:36	08:31
	15:18	16:35	17:44	18:58	20:09	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:21	16:38	17:47	19:00	20:11	20:58	20:36	19:23	17:53	16:26	15:09	14:38
19	08:17	07:06	05:46	04:16	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:35	19:20	17:50	16:23	15:07	14:38
20	08:15	07:04	05:43	04:13	02:57	02:22	02:56	04:06	05:17	06:27	07:43	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:33	19:18	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:28	16:46	17:54	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:04	14:39
22	08:11	06:58	05:38	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35
	15:30	16:48	17:56	19:10	20:19	20:59	20:29	19:12	17:41	16:15	15:02	14:40
23	08:10	06:55	05:35	04:04	02:51	02:22	03:02	04:13	05:23	06:34	07:50	08:35
	15:32	16:51	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:53	05:32	04:02	02:49	02:23	03:04	04:15	05:26	06:36	07:52	08:36
	15:35	16:53	18:01	19:14	20:24	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:29	03:59	02:47	02:23	03:07	04:17	05:28	06:39	07:54	08:36
	15:37	16:56	18:03	19:17	20:26	20:59	20:23	19:04	17:32	16:06	14:57	14:41
26	08:04	06:47	05:26	03:56	02:46	02:24	03:09	04:20	05:30	06:41	07:56	08:36
	15:40	16:58	18:06	19:19	20:28	20:59	20:21	19:01	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:33	06:44	07:58	08:36
	15:42	17:01	18:08	19:22	20:29	20:59	20:18	18:58	17:26	16:01	14:54	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:01	08:36
	15:45	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:24	15:58	14:52	14:44
29	07:58		05:17	03:48	02:40	02:26	03:15	04:27	05:37	06:49	08:03	08:36
	15:47		18:13	19:26	20:33	20:58	20:14	18:52	17:21	15:56	14:51	14:45
30	07:56		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:50		18:15	19:29	20:35	20:58	20:12	18:49	17:18	15:53	14:49	14:46
31	07:53		05:11		02:37		03:20	04:31		06:54		08:36
	15:52		18:17		20:37		20:09	18:46		15:51		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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15.08.2011 12:14 / 6

Licensed user:

Kjeller Vindteknikk AS  
Gunnar Randres vei 12  
NO-2007 Kjeller  
(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: F - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (210)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36	07:51	06:39	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:55	17:05	18:20	19:31	20:39	20:57	20:07	18:43	17:15	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:59	08:09
	14:50	15:57	17:08	18:22	19:34	20:40	20:57	20:05	18:40	17:12	15:46	14:47
3	08:35	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:38	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:04	08:13
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:35	17:06	15:41	14:45
5	08:33	07:42	06:27	04:56	03:32	02:31	02:32	03:31	04:43	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44
6	08:33	07:40	06:24	04:53	03:30	02:30	02:33	03:33	04:45	05:53	07:09	08:16
	14:57	16:07	17:18	18:32	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:36	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:46	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:19	04:47	03:25	02:27	02:36	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:23	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:16	04:44	03:22	02:27	02:37	03:40	04:52	06:00	07:16	08:21
	15:02	16:15	17:25	18:39	19:50	20:50	20:50	19:47	18:20	16:51	15:29	14:41
10	08:29	07:30	06:13	04:42	03:20	02:26	02:39	03:42	04:54	06:03	07:18	08:22
	15:04	16:18	17:27	18:41	19:53	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:39	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:53	20:47	19:42	18:14	16:46	15:24	14:40
12	08:27	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
	15:08	16:23	17:32	18:46	19:57	20:54	20:46	19:39	18:11	16:43	15:22	14:39
13	08:25	07:22	06:04	04:33	03:13	02:24	02:43	03:49	05:01	06:10	07:26	08:27
	15:10	16:25	17:35	18:48	20:00	20:54	20:45	19:37	18:08	16:40	15:20	14:39
14	08:24	07:20	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:51	20:02	20:55	20:43	19:34	18:05	16:37	15:18	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:15	07:31	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:08	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20	07:12	05:52	04:21	03:04	02:22	02:51	03:59	05:10	06:19	07:36	08:31
	15:18	16:35	17:44	18:58	20:09	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:21	16:38	17:47	19:00	20:11	20:58	20:36	19:23	17:53	16:26	15:09	14:38
19	08:17	07:06	05:46	04:16	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:35	19:20	17:50	16:23	15:07	14:38
20	08:15	07:04	05:43	04:13	02:57	02:22	02:56	04:06	05:17	06:27	07:43	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:33	19:18	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:28	16:46	17:54	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:04	14:39
22	08:11	06:58	05:38	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35
	15:30	16:48	17:56	19:10	20:19	20:59	20:29	19:12	17:41	16:15	15:02	14:40
23	08:10	06:55	05:35	04:04	02:51	02:22	03:02	04:13	05:23	06:34	07:50	08:35
	15:32	16:51	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:53	05:32	04:02	02:49	02:23	03:04	04:15	05:26	06:36	07:52	08:36
	15:35	16:53	18:01	19:14	20:24	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:29	03:59	02:47	02:23	03:07	04:17	05:28	06:39	07:54	08:36
	15:37	16:56	18:03	19:17	20:26	20:59	20:23	19:04	17:32	16:06	14:57	14:41
26	08:04	06:47	05:26	03:56	02:46	02:24	03:09	04:20	05:30	06:41	07:56	08:36
	15:40	16:58	18:06	19:19	20:28	20:59	20:21	19:01	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:33	06:44	07:58	08:36
	15:42	17:01	18:08	19:22	20:29	20:59	20:18	18:58	17:26	16:01	14:54	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:01	08:36
	15:45	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:24	15:58	14:52	14:44
29	07:58		05:17	03:48	02:40	02:26	03:15	04:27	05:37	06:49	08:03	08:36
	15:47		18:13	19:26	20:33	20:58	20:14	18:52	17:21	15:56	14:51	14:45
30	07:56		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:50		18:15	19:29	20:35	20:58	20:12	18:49	17:18	15:53	14:49	14:46
31	07:53		05:11		02:37		03:20	04:31		06:54		08:36
	15:52		18:17		20:37		20:09	18:46		15:51		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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15.08.2011 12:14 / 7

Licensed user:

Kjeller Vindteknikk AS

Gunnar Randres vei 12

NO-2007 Kjeller

(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: G - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (211)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36	07:51	06:39	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:55	17:05	18:20	19:31	20:39	20:57	20:07	18:43	17:15	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:59	08:09
	14:50	15:57	17:08	18:22	19:34	20:40	20:57	20:05	18:40	17:12	15:46	14:47
3	08:35	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:38	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:04	08:13
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:35	17:06	15:41	14:45
5	08:33	07:42	06:27	04:56	03:32	02:31	02:32	03:31	04:43	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44
6	08:33	07:40	06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:09	08:16
	14:57	16:07	17:18	18:32	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:36	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:46	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:19	04:47	03:25	02:27	02:36	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:23	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:16	04:44	03:22	02:27	02:37	03:40	04:52	06:00	07:16	08:21
	15:02	16:15	17:25	18:39	19:50	20:50	20:50	19:47	18:20	16:51	15:29	14:41
10	08:29	07:30	06:13	04:42	03:20	02:26	02:39	03:42	04:54	06:03	07:18	08:23
	15:04	16:18	17:27	18:41	19:53	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:39	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
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14	08:24	07:20	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:51	20:02	20:55	20:43	19:34	18:05	16:37	15:18	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:15	07:31	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:08	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20	07:12	05:52	04:21	03:04	02:22	02:51	03:59	05:10	06:19	07:36	08:31
	15:18	16:35	17:44	18:58	20:09	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:21	16:38	17:47	19:00	20:11	20:58	20:36	19:23	17:53	16:26	15:09	14:38
19	08:17	07:06	05:46	04:16	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:35	19:20	17:50	16:23	15:07	14:38
20	08:15	07:04	05:43	04:13	02:57	02:22	02:56	04:06	05:17	06:27	07:43	08:34
	15:25	16:43	17:51	19:05	20:15	20:59	20:33	19:18	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:28	16:46	17:54	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:04	14:39
22	08:11	06:58	05:38	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35
	15:30	16:48	17:56	19:10	20:19	20:59	20:29	19:12	17:41	16:15	15:02	14:40
23	08:10	06:55	05:35	04:04	02:51	02:22	03:02	04:13	05:23	06:34	07:50	08:35
	15:32	16:51	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:53	05:32	04:02	02:49	02:23	03:04	04:15	05:26	06:36	07:52	08:36
	15:35	16:53	18:01	19:14	20:24	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:29	03:59	02:47	02:23	03:07	04:17	05:28	06:39	07:54	08:36
	15:37	16:56	18:03	19:17	20:26	20:59	20:23	19:04	17:32	16:06	14:57	14:41
26	08:04	06:47	05:26	03:56	02:46	02:24	03:09	04:20	05:30	06:41	07:56	08:36
	15:40	16:58	18:06	19:19	20:28	20:59	20:21	19:01	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:33	06:44	07:58	08:36
	15:42	17:01	18:08	19:22	20:29	20:59	20:18	18:58	17:26	16:01	14:54	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:01	08:36
	15:45	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:24	15:58	14:52	14:44
29	07:58		05:17	03:48	02:40	02:26	03:15	04:27	05:37	06:49	08:03	08:36
	15:47		18:13	19:26	20:33	20:58	20:14	18:52	17:21	15:56	14:51	14:45
30	07:56		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:50		18:15	19:29	20:35	20:58	20:12	18:49	17:18	15:53	14:49	14:46
31	07:53		05:11		02:37		03:20	04:31		06:54		08:36
	15:52		18:17		20:37		20:09	18:46		15:51		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:  
**Gismarvik**

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15.08.2011 12:14 / 8

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Tove Risberg / tove.risberg@vindteknikk.no  
Calculated:  
15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

Calculation: Skyggekast Gismarvik Shadow receptor: H - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (212)

**Assumptions for shadow calculations**

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36	07:51	06:39	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:55	17:05	18:20	19:31	20:39	20:57	20:07	18:43	17:15	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:59	08:09
	14:50	15:57	17:08	18:22	19:34	20:40	20:57	20:05	18:40	17:12	15:46	14:47
3	08:35	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:38	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:04	08:13
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:35	17:06	15:41	14:45
5	08:33	07:42	06:27	04:56	03:32	02:31	02:32	03:31	04:43	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44
6	08:33	07:40	06:24	04:53	03:30	02:30	02:33	03:33	04:45	05:53	07:09	08:16
	14:57	16:07	17:18	18:32	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:36	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:46	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:19	04:47	03:25	02:27	02:36	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:23	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:16	04:44	03:22	02:27	02:37	03:40	04:52	06:00	07:16	08:21
	15:02	16:15	17:25	18:39	19:50	20:50	20:50	19:47	18:20	16:51	15:29	14:41
10	08:29	07:30	06:13	04:42	03:20	02:26	02:39	03:42	04:54	06:03	07:18	08:22
	15:04	16:18	17:27	18:41	19:53	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:39	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:53	20:47	19:42	18:14	16:46	15:24	14:40
12	08:27	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
	15:08	16:23	17:32	18:46	19:57	20:54	20:46	19:39	18:11	16:43	15:22	14:39
13	08:25	07:22	06:04	04:33	03:13	02:24	02:43	03:49	05:01	06:10	07:26	08:27
	15:10	16:25	17:35	18:48	20:00	20:54	20:44	19:37	18:08	16:40	15:20	14:39
14	08:24	07:20	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:51	20:02	20:55	20:43	19:34	18:05	16:37	15:18	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:15	07:31	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:08	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20	07:12	05:52	04:21	03:04	02:22	02:51	03:59	05:10	06:19	07:36	08:31
	15:18	16:35	17:44	18:58	20:09	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:21	16:38	17:47	19:00	20:11	20:58	20:36	19:23	17:53	16:26	15:09	14:38
19	08:17	07:06	05:46	04:16	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:35	19:20	17:50	16:23	15:07	14:38
20	08:15	07:04	05:43	04:13	02:57	02:22	02:56	04:06	05:17	06:27	07:43	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:33	19:18	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:28	16:46	17:54	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:04	14:39
22	08:11	06:58	05:38	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35
	15:30	16:48	17:56	19:10	20:19	20:59	20:29	19:12	17:41	16:15	15:02	14:40
23	08:10	06:55	05:35	04:04	02:51	02:22	03:02	04:13	05:23	06:34	07:50	08:35
	15:32	16:51	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:53	05:32	04:02	02:49	02:23	03:04	04:15	05:26	06:36	07:52	08:36
	15:35	16:53	18:01	19:14	20:24	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:29	03:59	02:47	02:23	03:07	04:17	05:28	06:39	07:54	08:36
	15:37	16:56	18:03	19:17	20:26	20:59	20:23	19:04	17:32	16:06	14:57	14:41
26	08:04	06:47	05:26	03:56	02:46	02:24	03:09	04:20	05:30	06:41	07:56	08:36
	15:40	16:58	18:06	19:19	20:28	20:59	20:21	19:01	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:33	06:44	07:58	08:36
	15:42	17:01	18:08	19:22	20:29	20:59	20:18	18:58	17:26	16:01	14:54	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:01	08:36
	15:45	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:24	15:58	14:52	14:44
29	07:58		05:17	03:48	02:40	02:26	03:15	04:27	05:37	06:49	08:03	08:36
	15:47		18:13	19:26	20:33	20:58	20:14	18:52	17:21	15:56	14:51	14:45
30	07:56		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:50		18:15	19:29	20:35	20:58	20:12	18:49	17:18	15:53	14:49	14:46
31	07:53		05:11		02:37		03:20	04:31		06:54		08:36
	15:52		18:17		20:37		20:09	18:46		15:51		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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15.08.2011 12:14 / 9

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: I - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (213)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:36 14:49	07:51 15:55	06:39 17:05	05:08 18:20	03:43 19:31		02:36 20:39	02:27 20:57		04:05 (1) 18:43	04:33 17:15	05:42 15:48	08:07 14:48
2	08:35 14:51	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:34		02:34 20:40	02:28 20:57		04:04 (1) 18:40	04:36 17:12	05:44 15:46	08:09 14:47
3	08:35 14:52	07:47 16:00	06:33 17:10	05:02 18:24	03:37 19:36		02:33 20:42	02:29 20:56		04:04 (1) 18:38	04:38 17:09	05:46 15:43	08:11 14:46
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	04:06 (1) 04:09 (1)	02:32 20:43	02:31 20:55		04:06 (1) 18:35	04:40 17:06	05:49 15:41	08:12 14:45
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:41	04:02 (1) 04:09 (1)	02:31 20:45	02:32 20:54		04:08 (1) 18:32	04:43 17:03	05:51 15:38	08:14 14:44
6	08:33 14:57	07:40 16:07	06:24 17:18	04:53 18:32	03:30 19:43	04:02 (1) 04:10 (1)	02:30 20:46	02:33 20:53		04:10 (1) 18:29	04:45 17:00	05:53 15:36	08:16 14:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:46	03:59 (1) 04:10 (1)	02:28 20:48	02:34 20:52		04:12 (1) 18:26	04:47 16:57	05:56 15:33	08:18 14:42
8	08:31 15:00	07:35 16:12	06:19 17:23	04:47 18:36	03:25 19:48	03:57 (1) 04:10 (1)	02:27 20:49	02:36 20:51		04:14 (1) 18:23	04:49 16:54	05:58 15:31	08:19 14:41
9	08:30 15:02	07:32 16:15	06:16 17:25	04:44 18:39	03:22 19:50	03:55 (1) 04:10 (1)	02:27 20:50	02:37 20:50		04:16 (1) 18:20	04:52 16:51	06:00 15:29	08:21 14:41
10	08:29 15:04	07:30 16:18	06:13 17:27	04:42 18:41	03:20 19:53	03:54 (1) 04:10 (1)	02:26 20:51	02:39 20:49		04:18 (1) 18:17	04:54 16:48	06:03 15:26	08:22 14:40
11	08:28 15:06	07:27 16:20	06:10 17:30	04:39 18:43	03:17 19:55	03:54 (1) 04:10 (1)	02:25 20:52	02:40 20:47		04:18 (1) 18:14	04:56 16:46	06:05 15:24	08:24 14:40
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	03:15 19:57	03:55 (1) 04:09 (1)	02:24 20:54	02:42 20:46		04:19 (1) 18:11	04:58 16:43	06:07 15:22	08:25 14:39
13	08:25 15:10	07:22 16:25	06:04 17:35	04:33 18:48	03:13 20:00	03:56 (1) 04:08 (1)	02:24 20:54	02:43 20:44		04:19 (1) 18:08	04:59 16:40	06:10 15:20	08:27 14:39
14	08:24 15:12	07:20 16:28	06:01 17:37	04:30 18:51	03:10 20:02	03:57 (1) 04:07 (1)	02:23 20:55	02:45 20:43		04:19 (1) 18:05	05:03 16:37	06:12 15:18	08:28 14:38
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	03:58 (1) 04:06 (1)	02:23 20:56	02:47 20:41		04:19 (1) 18:02	05:05 16:34	06:15 15:15	08:29 14:38
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	04:06 (1) 04:10 (1)	02:22 20:57	02:49 20:40		04:19 (1) 17:59	05:08 16:31	06:17 15:13	08:30 14:38
17	08:20 15:18	07:12 16:35	05:52 17:44	04:21 18:58	03:04 20:09	04:09 (1) 04:10 (1)	02:22 20:57	02:51 20:38		04:19 (1) 17:56	05:10 16:28	06:19 15:11	08:31 14:38
18	08:18 15:21	07:09 16:38	05:49 17:47	04:18 19:00	03:01 20:11	04:08 (1) 04:10 (1)	02:22 20:58	02:52 20:36		04:19 (1) 17:53	05:12 16:26	06:22 15:09	08:32 14:38
19	08:17 15:23	07:06 16:41	05:46 17:49	04:16 19:02	02:59 20:13	04:07 (1) 03:58 (1)	02:22 20:58	02:54 20:35		04:19 (1) 17:50	05:14 16:23	06:24 15:07	08:33 14:39
20	08:15 15:25	07:04 16:43	05:43 17:51	04:13 19:05	02:57 20:15	04:06 (1) 04:10 (1)	02:22 20:59	02:56 20:33		04:19 (1) 17:47	05:17 16:20	06:27 15:05	08:33 14:39
21	08:13 15:28	07:01 16:46	05:40 17:54	04:10 19:07	02:55 20:17	04:08 (1) 04:10 (1)	02:22 20:59	02:58 20:31		04:19 (1) 17:44	05:19 16:17	06:29 15:04	08:34 14:39
22	08:11 15:30	06:58 16:48	05:38 17:56	04:07 19:10	02:53 20:19	04:09 (1) 04:10 (1)	02:22 20:59	03:00 20:29		04:19 (1) 17:41	05:21 16:15	06:31 15:02	08:35 14:40
23	08:10 15:32	06:55 16:51	05:35 17:58	04:04 19:12	02:51 20:21	04:08 (1) 04:10 (1)	02:22 20:59	03:02 20:27		04:19 (1) 17:38	05:23 16:12	06:34 15:00	08:35 14:40
24	08:08 15:35	06:53 16:53	05:32 18:01	04:02 19:14	02:49 20:23	04:07 (1) 04:10 (1)	02:23 20:59	03:04 20:25		04:15 17:35	05:26 16:09	06:36 14:58	08:36 14:41
25	08:06 15:37	06:50 16:56	05:29 18:03	03:59 19:17	02:47 20:26	04:08 (1) 04:10 (1)	02:23 20:59	03:07 20:23		04:17 17:32	05:28 16:06	06:39 14:57	08:36 14:41
26	08:04 15:40	06:47 16:58	05:26 18:06	03:56 19:19	02:46 20:27	04:08 (1) 04:10 (1)	02:24 20:59	03:09 20:21		04:20 17:29	05:30 16:04	06:41 14:55	08:36 14:42
27	08:02 15:42	06:44 17:01	05:23 18:08	03:53 19:22	02:44 20:29	04:08 (1) 04:10 (1)	02:24 20:59	03:11 20:18		04:22 18:58	05:33 17:26	06:44 16:01	08:36 14:54
28	08:00 15:45	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	04:18 (1) 04:14 (1)	02:25 18:55	03:13 20:16	04:14 (1)	04:24 18:52	05:35 17:24	06:46 15:58	08:01 14:52
29	07:58 15:47		05:17 18:13	03:48 19:26	02:40 20:33	04:08 (1) 04:17 (1)	02:26 18:52	03:15 20:14	04:08 (1)	04:27 18:52	05:37 17:21	06:49 15:56	08:03 14:51
30	07:56 15:50		05:14 18:15	03:45 19:29	02:39 20:35	04:07 (1) 04:18 (1)	02:26 20:58	03:17 20:12	04:07 (1)	04:29 18:49	05:39 17:18	06:51 15:53	08:05 14:49
31	07:53 15:52		05:11 18:17	03:43 20:37	02:37 20:37	04:06 (1) 04:19 (1)	02:37 20:09	03:20 13	04:16 (1)	04:31 18:46	06:54 15:51	08:36 232	08:36 194
Potential sun hours	216	257	365	434	526	554	551	481		387	318	232	194
Total, worst case					131			37		97			
Sun reduction					0.35			0.26		0.24			
Oper. time red.					0.93			0.93		0.93			
Wind dir. red.					0.52			0.52		0.52			
Total reduction					0.17			0.13		0.12			
Total, real					22			5		11			

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:

Gismarvik

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15.08.2011 12:14 / 10

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: J - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (214)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December					
1	08:36	07:51	06:39	05:08	03:43		02:36	02:27		04:05 (1)	04:33	05:42	06:56	08:07			
	14:49	15:55	17:05	18:20	19:31		20:39	20:57	14	04:19 (1)	18:43	17:15	15:48	14:48			
2	08:35	07:49	06:36	05:05	03:40		02:34	02:28		04:04 (1)	04:36	05:44	06:59	08:09			
	14:51	15:57	17:08	18:22	19:34		20:40	20:57	16	04:20 (1)	18:40	17:12	15:46	14:47			
3	08:35	07:47	06:33	05:02	03:37		02:33	02:29		04:04 (1)	04:38	05:46	07:01	08:11			
	14:52	16:00	17:10	18:24	19:36		20:42	20:56	16	04:20 (1)	18:38	17:09	15:43	14:46			
4	08:34	07:44	06:30	04:59	03:35	04:06 (1)	02:32	02:31		04:06 (1)	04:40	05:49	07:04	08:12			
	14:53	16:02	17:13	18:27	19:38	3	04:09 (1)	20:43		04:20 (1)	18:35	17:06	15:41	14:45			
5	08:33	07:42	06:27	04:56	03:32	04:04 (1)	02:31	02:32		04:08 (1)	04:43	05:51	07:06	08:14			
	14:55	16:05	17:15	18:29	19:41	5	04:09 (1)	20:45		04:20 (1)	18:32	17:03	15:38	14:44			
6	08:33	07:40	06:24	04:53	03:30	04:02 (1)	02:30	02:33		04:10 (1)	04:45	05:53	07:08	08:16			
	14:57	16:07	17:18	18:32	19:43	8	04:10 (1)	20:46		04:20 (1)	18:29	17:00	15:36	14:43			
7	08:32	07:37	06:21	04:50	03:27	03:59 (1)	02:28	02:34		04:12 (1)	04:47	05:56	07:11	08:18			
	14:58	16:10	17:20	18:34	19:45	10	04:09 (1)	20:48		04:19 (1)	18:26	16:57	15:33	14:42			
8	08:31	07:35	06:19	04:47	03:25	03:57 (1)	02:27	02:36		04:14 (1)	04:49	05:58	07:13	08:19			
	15:00	16:12	17:23	18:36	19:48	13	04:10 (1)	20:49		04:19 (1)	18:23	16:54	15:31	14:41			
9	08:30	07:32	06:16	04:44	03:22	03:55 (1)	02:27	02:37		04:16 (1)	04:52	06:00	07:16	08:21			
	15:02	16:15	17:25	18:39	19:50	15	04:10 (1)	20:50		04:18 (1)	18:20	16:51	15:29	14:41			
10	08:29	07:30	06:13	04:42	03:20	03:54 (1)	02:26	02:39			04:54	06:03	07:18	08:22			
	15:04	16:18	17:27	18:41	19:53	16	04:10 (1)	20:51			18:17	16:48	15:26	14:40			
11	08:28	07:27	06:10	04:39	03:17	03:54 (1)	02:25	02:40			04:56	06:05	07:21	08:24			
	15:06	16:20	17:30	18:43	19:55	15	04:09 (1)	20:52			18:14	16:46	15:24	14:40			
12	08:27	07:25	06:07	04:36	03:15	03:55 (1)	02:24	02:42			04:58	06:07	07:23	08:25			
	15:08	16:23	17:32	18:46	19:57	14	04:09 (1)	20:54			18:11	16:43	15:22	14:39			
13	08:25	07:22	06:04	04:33	03:13	03:56 (1)	02:24	02:43			05:01	06:10	07:26	08:27			
	15:10	16:25	17:35	18:48	20:00	12	04:08 (1)	20:54			18:08	16:40	15:20	14:39			
14	08:24	07:20	06:01	04:30	03:10	03:57 (1)	02:23	02:45			05:03	06:12	07:28	08:28			
	15:12	16:28	17:37	18:51	20:02	10	04:07 (1)	20:55			18:05	16:37	15:18	14:38			
15	08:23	07:17	05:58	04:27	03:08	03:59 (1)	02:23	02:47			05:05	06:15	07:31	08:29			
	15:14	16:30	17:39	18:53	20:04	6	04:05 (1)	20:56			18:02	16:34	15:15	14:38			
16	08:21	07:14	05:55	04:24	03:06		02:22	02:49			03:56	05:08	06:17	07:33	08:30		
	15:16	16:33	17:42	18:55	20:06		02:57	20:40			19:29	17:59	16:31	15:13	14:38		
17	08:20	07:12	05:52	04:21	03:04		02:22	02:51			03:59	05:10	06:19	07:36	08:31		
	15:18	16:35	17:44	18:58	20:09		02:57	20:38			19:26	17:56	16:28	15:11	14:38		
18	08:18	07:09	05:49	04:18	03:01		02:22	02:52			04:01	05:12	06:22	07:38	08:32		
	15:21	16:38	17:47	19:00	20:11		02:58	20:36			19:23	17:53	16:26	15:09	14:38		
19	08:17	07:06	05:46	04:16	02:59		02:22	02:54			04:03	05:14	06:24	07:40	08:33		
	15:23	16:41	17:49	19:02	20:13		02:58	20:35			19:20	17:50	16:23	15:07	14:39		
20	08:15	07:04	05:43	04:13	02:57		02:22	02:56			04:06	05:17	06:27	07:43	08:33		
	15:25	16:43	17:51	19:05	20:15		02:59	20:33			19:18	17:47	16:20	15:05	14:39		
21	08:13	07:01	05:40	04:10	02:55		02:22	02:58			04:08	05:19	06:29	07:45	08:34		
	15:28	16:46	17:54	19:07	20:17		02:59	20:31			19:15	17:44	16:17	15:04	14:39		
22	08:11	06:58	05:38	04:07	02:53		02:22	03:00			04:10	05:21	06:31	07:47	08:35		
	15:30	16:48	17:56	19:10	20:19		02:59	20:29			19:12	17:41	16:15	15:02	14:40		
23	08:10	06:55	05:35	04:04	02:51		02:22	03:02			04:13	05:23	06:34	07:50	08:35		
	15:32	16:51	17:58	19:12	20:21		02:59	20:27			19:09	17:38	16:12	15:00	14:40		
24	08:08	06:53	05:32	04:02	02:49		02:23	03:04			04:15	05:26	06:36	07:52	08:36		
	15:35	16:53	18:01	19:14	20:23		02:59	20:25			19:06	17:35	16:09	14:58	14:41		
25	08:06	06:50	05:29	03:59	02:47		02:23	03:07			04:17	05:28	06:39	07:54	08:36		
	15:37	16:56	18:03	19:17	20:26		02:59	20:23			19:04	17:32	16:06	14:57	14:41		
26	08:04	06:47	05:26	03:56	02:46		02:24	03:09			04:20	05:30	06:41	07:56	08:36		
	15:40	16:58	18:06	19:19	20:27		02:59	20:21			19:01	17:29	16:04	14:55	14:42		
27	08:02	06:44	05:23	03:53	02:44		02:24	03:11			04:22	05:33	06:44	07:58	08:36		
	15:42	17:01	18:08	19:22	20:29		02:59	20:18			18:58	17:26	16:01	14:54	14:43		
28	08:00	06:41	05:20	03:51	02:42		02:25	03:13			04:11 (1)	04:24	05:35	06:46	08:01	08:36	
	15:45	17:03	18:10	19:24	20:31		02:59	20:16			2	04:12 (1)	18:55	17:24	15:58	14:52	14:44
29	07:58		05:17	03:48	02:40		02:26	03:15			04:08 (1)	04:27	05:37	06:49	08:03	08:36	
	15:47		18:13	19:26	20:33		02:58	20:14			8	04:16 (1)	18:52	17:21	15:56	14:51	14:45
30	07:56		05:14	03:45	02:39		02:26	03:17			04:07 (1)	04:29	05:39	06:51	08:05	08:36	
	15:50		18:15	19:29	20:35		20:58	20:12			10	04:17 (1)	18:49	17:18	15:53	14:49	14:46
31	07:53		05:11		02:37			03:20				04:06 (1)	04:31		06:54		08:36
	15:52		18:17		20:37			20:09			12	04:18 (1)	18:46		15:51		14:47
Potential sun hours	216	257	365	434	526		554	551			387	318	232	194			
Total, worst case																	
Sun reduction																	
Oper. time red.																	
Wind dir. red.																	
Total reduction																	
Total, real																	

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:

Gismarvik

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15.08.2011 12:14 / 11

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Calculated:

15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

Calculation: Skyggekast Gismarvik Shadow receptor: K - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (215)

**Assumptions for shadow calculations**

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36	07:51	06:39	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:55	17:05	18:20	19:31	20:39	20:57	20:07	18:43	17:15	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:59	08:09
	14:50	15:57	17:08	18:22	19:34	20:40	20:57	20:05	18:40	17:12	15:46	14:47
3	08:35	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:38	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:04	08:13
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:35	17:06	15:41	14:45
5	08:33	07:42	06:27	04:56	03:32	02:31	02:32	03:31	04:43	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44
6	08:33	07:40	06:24	04:53	03:30	02:30	02:33	03:33	04:45	05:53	07:09	08:16
	14:57	16:07	17:18	18:32	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:36	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:46	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:19	04:47	03:25	02:27	02:36	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:23	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:16	04:44	03:22	02:27	02:37	03:40	04:52	06:00	07:16	08:21
	15:02	16:15	17:25	18:39	19:50	20:50	20:50	19:47	18:20	16:51	15:29	14:41
10	08:29	07:30	06:13	04:42	03:20	02:26	02:39	03:42	04:54	06:03	07:18	08:22
	15:04	16:18	17:27	18:41	19:53	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:39	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:53	20:47	19:42	18:14	16:46	15:24	14:39
12	08:27	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
	15:08	16:23	17:32	18:46	19:57	20:54	20:46	19:39	18:11	16:43	15:22	14:39
13	08:25	07:22	06:04	04:33	03:13	02:24	02:43	03:49	05:01	06:10	07:26	08:27
	15:10	16:25	17:35	18:48	20:00	20:54	20:45	19:37	18:08	16:40	15:20	14:39
14	08:24	07:20	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:51	20:02	20:55	20:43	19:34	18:05	16:37	15:18	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:15	07:31	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:08	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20	07:12	05:52	04:21	03:04	02:22	02:51	03:59	05:10	06:19	07:36	08:31
	15:18	16:35	17:44	18:58	20:09	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:21	16:38	17:47	19:00	20:11	20:58	20:36	19:23	17:53	16:26	15:09	14:38
19	08:17	07:06	05:46	04:16	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:35	19:20	17:50	16:23	15:07	14:38
20	08:15	07:04	05:43	04:13	02:57	02:22	02:56	04:06	05:17	06:27	07:43	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:33	19:18	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:28	16:46	17:54	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:04	14:39
22	08:11	06:58	05:38	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35
	15:30	16:48	17:56	19:10	20:19	20:59	20:29	19:12	17:41	16:15	15:02	14:40
23	08:10	06:55	05:35	04:04	02:51	02:22	03:02	04:13	05:23	06:34	07:50	08:35
	15:32	16:51	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:53	05:32	04:02	02:49	02:23	03:04	04:15	05:26	06:36	07:52	08:36
	15:35	16:53	18:01	19:14	20:24	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:29	03:59	02:47	02:23	03:07	04:17	05:28	06:39	07:54	08:36
	15:37	16:56	18:03	19:17	20:26	20:59	20:23	19:04	17:32	16:06	14:57	14:41
26	08:04	06:47	05:26	03:56	02:46	02:24	03:09	04:20	05:30	06:41	07:56	08:36
	15:40	16:58	18:06	19:19	20:28	20:59	20:21	19:01	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:33	06:44	07:58	08:36
	15:42	17:01	18:08	19:22	20:29	20:59	20:18	18:58	17:26	16:01	14:54	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:01	08:36
	15:45	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:24	15:58	14:52	14:44
29	07:58		05:17	03:48	02:40	02:26	03:15	04:26	05:37	06:49	08:03	08:36
	15:47		18:13	19:26	20:33	20:58	20:14	18:52	17:21	15:56	14:51	14:45
30	07:56		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:50		18:15	19:29	20:35	20:58	20:12	18:49	17:18	15:53	14:49	14:46
31	07:53		05:11		02:37		03:20	04:31		06:54		08:36
	15:52		18:17		20:37		20:09	18:46		15:51		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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Licensed user:

**Kjeller Vindteknikk AS**  
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(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: L - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (216)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36	07:51	06:39	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:55	17:05	18:20	19:31	20:39	20:57	20:07	18:43	17:15	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:59	08:09
	14:50	15:57	17:08	18:22	19:34	20:40	20:57	20:05	18:40	17:12	15:46	14:47
3	08:35	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:38	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:04	08:13
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:35	17:06	15:41	14:45
5	08:33	07:42	06:27	04:56	03:32	02:31	02:32	03:31	04:43	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44
6	08:33	07:40	06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:09	08:16
	14:57	16:07	17:18	18:32	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:36	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:46	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:19	04:47	03:25	02:27	02:36	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:23	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:16	04:44	03:22	02:27	02:37	03:40	04:52	06:00	07:16	08:21
	15:02	16:15	17:25	18:39	19:50	20:50	20:50	19:47	18:20	16:51	15:29	14:41
10	08:29	07:30	06:13	04:42	03:20	02:26	02:39	03:42	04:54	06:03	07:18	08:22
	15:04	16:18	17:27	18:41	19:53	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:39	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:53	20:47	19:42	18:14	16:46	15:24	14:39
12	08:27	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
	15:08	16:23	17:32	18:46	19:57	20:54	20:46	19:39	18:11	16:43	15:22	14:39
13	08:25	07:22	06:04	04:33	03:13	02:24	02:43	03:49	05:01	06:10	07:26	08:27
	15:10	16:25	17:35	18:48	20:00	20:54	20:45	19:37	18:08	16:40	15:20	14:39
14	08:24	07:20	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:51	20:02	20:55	20:43	19:34	18:05	16:37	15:18	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:15	07:31	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:08	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20	07:12	05:52	04:21	03:04	02:22	02:51	03:59	05:10	06:19	07:36	08:31
	15:18	16:35	17:44	18:58	20:09	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:21	16:38	17:47	19:00	20:11	20:58	20:36	19:23	17:53	16:26	15:09	14:38
19	08:17	07:06	05:46	04:16	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:35	19:20	17:50	16:23	15:07	14:38
20	08:15	07:04	05:43	04:13	02:57	02:22	02:56	04:06	05:17	06:27	07:43	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:33	19:18	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:28	16:46	17:54	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:04	14:39
22	08:11	06:58	05:38	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35
	15:30	16:48	17:56	19:10	20:19	20:59	20:29	19:12	17:41	16:15	15:02	14:40
23	08:10	06:55	05:35	04:04	02:51	02:22	03:02	04:13	05:23	06:34	07:50	08:35
	15:32	16:51	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:53	05:32	04:02	02:49	02:23	03:04	04:15	05:26	06:36	07:52	08:36
	15:35	16:53	18:01	19:14	20:24	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:29	03:59	02:47	02:23	03:07	04:17	05:28	06:39	07:54	08:36
	15:37	16:56	18:03	19:17	20:26	20:59	20:23	19:04	17:32	16:06	14:57	14:41
26	08:04	06:47	05:26	03:56	02:46	02:24	03:09	04:20	05:30	06:41	07:56	08:36
	15:40	16:58	18:06	19:19	20:28	20:59	20:21	19:01	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:33	06:44	07:58	08:36
	15:42	17:00	18:08	19:22	20:29	20:59	20:18	18:58	17:26	16:01	14:54	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:01	08:36
	15:45	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:24	15:58	14:52	14:44
29	07:58		05:17	03:48	02:40	02:26	03:15	04:26	05:37	06:49	08:03	08:36
	15:47		18:13	19:26	20:33	20:58	20:14	18:52	17:21	15:56	14:51	14:45
30	07:56		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:50		18:15	19:29	20:35	20:58	20:12	18:49	17:18	15:53	14:49	14:46
31	07:53		05:11		02:37		03:20	04:31		06:54		08:36
	15:52		18:17		20:37		20:09	18:46		15:51		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: M - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (217)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36	07:51	06:39	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:55	17:05	18:20	19:31	20:38	20:57	20:07	18:43	17:15	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:59	08:09
	14:51	15:57	17:08	18:22	19:34	20:40	20:57	20:05	18:40	17:12	15:46	14:47
3	08:35	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:38	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:31	03:29	04:40	05:49	07:04	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:35	17:06	15:41	14:45
5	08:33	07:42	06:27	04:56	03:32	02:31	02:32	03:31	04:43	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44
6	08:33	07:40	06:24	04:53	03:30	02:30	02:33	03:33	04:45	05:53	07:08	08:16
	14:57	16:07	17:18	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:36	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:45	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:19	04:47	03:25	02:27	02:36	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:23	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:16	04:44	03:22	02:27	02:37	03:40	04:52	06:00	07:16	08:21
	15:02	16:15	17:25	18:39	19:50	20:50	20:50	19:47	18:20	16:51	15:29	14:41
10	08:29	07:30	06:13	04:42	03:20	02:26	02:39	03:43	04:54	06:03	07:18	08:22
	15:04	16:18	17:27	18:41	19:53	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:39	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:46	15:24	14:40
12	08:27	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
	15:08	16:23	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:43	15:22	14:39
13	08:25	07:22	06:04	04:33	03:13	02:24	02:43	03:49	05:01	06:10	07:26	08:27
	15:10	16:25	17:35	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:20	14:39
14	08:24	07:20	06:01	04:30	03:10	02:23	02:45	03:41 (1)	03:52	05:03	06:12	07:28
	15:12	16:28	17:37	18:51	20:02	20:55	20:43	6 03:47 (1)	19:34	18:05	16:37	15:18
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:40 (1)	03:54	05:05	06:15	07:31
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	9 03:49 (1)	19:31	18:02	16:34	15:15
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:39 (1)	03:56	05:08	06:17	07:33
	15:16	16:33	17:42	18:55	20:06	2 03:43 (1)	20:57	10 03:49 (1)	19:29	17:59	16:31	15:13
17	08:20	07:12	05:52	04:21	03:04	03:39 (1)	02:22	02:51	03:38 (1)	03:59	05:10	06:26
	15:18	16:35	17:44	18:58	20:09	4 03:43 (1)	20:57	13 03:51 (1)	19:26	17:56	16:28	15:11
18	08:18	07:09	05:49	04:18	03:01	03:37 (1)	02:22	02:52	03:38 (1)	04:01	05:12	06:22
	15:21	16:38	17:47	19:00	20:11	6 03:43 (1)	20:58	14 03:52 (1)	19:23	17:53	16:26	15:09
19	08:17	07:06	05:46	04:16	02:59	03:35 (1)	02:22	02:54	03:37 (1)	04:03	05:14	06:24
	15:23	16:40	17:49	19:02	20:13	8 03:43 (1)	20:58	15 03:52 (1)	19:20	17:50	16:23	15:07
20	08:15	07:04	05:43	04:13	02:57	03:33 (1)	02:22	02:56	03:37 (1)	04:06	05:17	06:27
	15:25	16:43	17:51	19:05	20:15	10 03:43 (1)	20:59	16 03:53 (1)	19:18	17:47	16:20	15:05
21	08:13	07:01	05:40	04:10	02:55	03:31 (1)	02:22	02:58	03:39 (1)	04:08	05:19	06:29
	15:28	16:46	17:54	19:07	20:17	12 03:43 (1)	20:59	14 03:53 (1)	19:15	17:44	16:17	15:04
22	08:11	06:58	05:38	04:07	02:53	03:30 (1)	02:22	03:00	03:41 (1)	04:10	05:21	06:31
	15:30	16:48	17:56	19:10	20:19	13 03:43 (1)	20:59	13 03:54 (1)	19:12	17:41	16:15	15:02
23	08:10	06:55	05:35	04:04	02:51	03:28 (1)	02:22	03:02	03:42 (1)	04:13	05:23	06:34
	15:32	16:51	17:58	19:12	20:21	15 03:43 (1)	20:59	11 03:53 (1)	19:09	17:38	16:12	15:00
24	08:08	06:53	05:32	04:02	02:49	03:28 (1)	02:23	03:04	03:44 (1)	04:15	05:26	06:36
	15:35	16:53	18:01	19:14	20:23	15 03:43 (1)	20:59	9 03:53 (1)	19:06	17:35	16:09	14:58
25	08:06	06:50	05:29	03:59	02:47	03:28 (1)	02:23	03:07	03:46 (1)	04:17	05:28	06:39
	15:37	16:56	18:03	19:17	20:25	14 03:42 (1)	20:59	8 03:54 (1)	19:04	17:32	16:06	14:57
26	08:04	06:47	05:26	03:56	02:46	03:29 (1)	02:24	03:09	03:48 (1)	04:20	05:30	06:41
	15:40	16:58	18:05	19:19	20:27	13 03:42 (1)	20:59	6 03:54 (1)	19:01	17:29	16:04	14:55
27	08:02	06:44	05:23	03:53	02:44	03:30 (1)	02:24	03:11	03:50 (1)	04:22	05:33	06:44
	15:42	17:01	18:08	19:22	20:29	11 03:41 (1)	20:59	3 03:53 (1)	18:58	17:26	16:01	14:54
28	08:00	06:41	05:20	03:51	02:42	03:31 (1)	02:25	03:13	03:52 (1)	04:24	05:35	06:46
	15:45	17:03	18:10	19:24	20:31	10 03:41 (1)	20:59	2 03:53 (1)	18:55	17:24	15:58	14:52
29	07:58		05:17	03:48	02:40	03:32 (1)	02:26	03:15		04:27	05:37	06:49
	15:47		18:13	19:26	20:33	7 03:39 (1)	20:58	18:52	17:21	15:56	14:51	14:45
30	07:56		05:14	03:45	02:39	03:34 (1)	02:26	03:17	04:29	05:39	06:51	08:05
	15:50		18:15	19:29	20:35	3 03:37 (1)	20:58	20:12	18:49	17:18	15:53	14:49
31	07:53		05:11		02:37			03:20	04:31		06:54	08:36
	15:52		18:17		20:37			20:09	18:46		15:51	14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case					143							
Sun reduction					0.35							
Oper. time red.					0.93							
Wind dir. red.					0.51							
Total reduction					0.17							
Total, real					24							

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: N - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (218)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December			
1	08:36	07:51	06:39	05:08	03:43		02:36	02:27	03:22	04:09 (1)	04:33	05:42	06:56	08:07	
	14:49	15:55	17:05	18:20	19:31		20:39	20:57	20:07	14	04:23 (1)	18:43	17:15	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	04:11 (1)	02:34	02:28	03:24	04:08 (1)	04:36	05:44	06:59	08:09	
	14:50	15:57	17:08	18:22	19:34	2	04:13 (1)	20:40	20:05	15	04:23 (1)	18:40	17:12	15:46	14:47
3	08:35	07:47	06:33	05:02	03:37	04:09 (1)	02:33	02:29	03:26	04:07 (1)	04:38	05:46	07:01	08:11	
	14:52	16:00	17:10	18:24	19:36	5	04:14 (1)	20:42	20:02	17	04:24 (1)	18:38	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	04:06 (1)	02:32	02:30	03:29	04:07 (1)	04:40	05:49	07:04	08:12	
	14:53	16:02	17:13	18:27	19:38	8	04:14 (1)	20:43	20:00	17	04:24 (1)	18:35	17:06	15:41	14:45
5	08:33	07:42	06:27	04:56	03:32	04:04 (1)	02:31	02:32	03:31	04:08 (1)	04:43	05:51	07:06	08:14	
	14:55	16:05	17:15	18:29	19:41	10	04:14 (1)	20:45	19:57	16	04:24 (1)	18:32	17:03	15:38	14:44
6	08:33	07:40	06:24	04:53	03:30	04:02 (1)	02:30	02:33	03:33	04:10 (1)	04:45	05:53	07:08	08:16	
	14:57	16:07	17:18	18:32	19:43	13	04:15 (1)	20:46	19:55	14	04:24 (1)	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	03:59 (1)	02:28	02:34	03:36	04:12 (1)	04:47	05:56	07:11	08:18	
	14:58	16:10	17:20	18:34	19:45	15	04:14 (1)	20:48	19:52	12	04:24 (1)	18:26	16:57	15:33	14:42
8	08:31	07:35	06:19	04:47	03:25	03:57 (1)	02:27	02:36	03:38	04:14 (1)	04:49	05:58	07:13	08:19	
	15:00	16:12	17:23	18:36	19:48	17	04:14 (1)	20:49	19:50	10	04:24 (1)	18:23	16:54	15:31	14:41
9	08:30	07:32	06:16	04:44	03:22	03:57 (1)	02:27	02:37	03:40	04:16 (1)	04:52	06:00	07:16	08:21	
	15:02	16:15	17:25	18:39	19:50	17	04:14 (1)	20:50	19:47	7	04:23 (1)	18:20	16:51	15:29	14:41
10	08:29	07:30	06:13	04:42	03:20	03:57 (1)	02:26	02:39	03:42	04:18 (1)	04:54	06:03	07:18	08:22	
	15:04	16:18	17:27	18:41	19:53	16	04:13 (1)	20:51	19:45	4	04:22 (1)	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:39	03:17	03:58 (1)	02:25	02:40	03:45	04:20 (1)	04:56	06:05	07:21	08:24	
	15:06	16:20	17:30	18:43	19:55	15	04:13 (1)	20:52	19:42	2	04:21 (1)	18:14	16:46	15:24	14:40
12	08:27	07:25	06:07	04:36	03:15	03:59 (1)	02:24	02:42	03:47		04:58	06:07	07:23	08:25	
	15:08	16:23	17:32	18:46	19:57	13	04:12 (1)	20:54	19:39		18:11	16:43	15:22	14:39	
13	08:25	07:22	06:04	04:33	03:13	04:00 (1)	02:24	02:43	03:49		05:01	06:10	07:26	08:27	
	15:10	16:25	17:35	18:48	19:59	11	04:11 (1)	20:54	19:37		18:08	16:40	15:20	14:39	
14	08:24	07:20	06:01	04:30	03:10	04:01 (1)	02:23	02:45	03:52		05:03	06:12	07:28	08:28	
	15:12	16:28	17:37	18:51	20:02	7	04:08 (1)	20:55	19:34		18:05	16:37	15:18	14:38	
15	08:23	07:17	05:58	04:27	03:08		02:23	02:47	03:54		05:05	06:15	07:31	08:29	
	15:14	16:30	17:39	18:53	20:04		20:56	20:41	19:31		18:02	16:34	15:15	14:38	
16	08:21	07:14	05:55	04:24	03:06		02:22	02:49	03:56		05:08	06:17	07:33	08:30	
	15:16	16:33	17:42	18:55	20:06		20:57	20:40	19:29		17:59	16:31	15:13	14:38	
17	08:20	07:12	05:52	04:21	03:04		02:22	02:51	03:59		05:10	06:19	07:36	08:31	
	15:18	16:35	17:44	18:58	20:09		20:57	20:38	19:26		17:56	16:28	15:11	14:38	
18	08:18	07:09	05:49	04:18	03:01		02:22	02:52	04:01		05:12	06:22	07:38	08:32	
	15:21	16:38	17:47	19:00	20:11		20:58	20:36	19:23		17:53	16:26	15:09	14:38	
19	08:17	07:06	05:46	04:16	02:59		02:22	02:54	04:03		05:14	06:24	07:40	08:33	
	15:23	16:40	17:49	19:02	20:13		20:58	20:35	19:20		17:50	16:23	15:07	14:38	
20	08:15	07:04	05:43	04:13	02:57		02:22	02:56	04:06		05:17	06:27	07:43	08:33	
	15:25	16:43	17:51	19:05	20:15		20:59	20:33	19:18		17:47	16:20	15:05	14:39	
21	08:13	07:01	05:40	04:10	02:55		02:22	02:58	04:08		05:19	06:29	07:45	08:34	
	15:28	16:46	17:54	19:07	20:17		20:59	20:31	19:15		17:44	16:17	15:04	14:39	
22	08:11	06:58	05:38	04:07	02:53		02:22	03:00	04:10		05:21	06:31	07:47	08:35	
	15:30	16:48	17:56	19:10	20:19		20:59	20:29	19:12		17:41	16:15	15:02	14:40	
23	08:10	06:55	05:35	04:04	02:51		02:22	03:02	04:13		05:23	06:34	07:50	08:35	
	15:32	16:51	17:58	19:12	20:21		20:59	20:27	19:09		17:38	16:12	15:00	14:40	
24	08:08	06:53	05:32	04:02	02:49		02:23	03:04	04:15		05:26	06:36	07:52	08:36	
	15:35	16:53	18:01	19:14	20:23		20:59	20:25	19:06		17:35	16:09	14:58	14:41	
25	08:06	06:50	05:29	03:59	02:47		02:23	03:07	04:17		05:28	06:39	07:54	08:36	
	15:37	16:56	18:03	19:17	20:26		20:59	20:23	19:04		17:32	16:06	14:57	14:41	
26	08:04	06:47	05:26	03:56	02:46		02:24	03:09	04:20		05:30	06:41	07:56	08:36	
	15:40	16:58	18:05	19:19	20:27		20:59	20:21	19:01		17:29	16:04	14:55	14:42	
27	08:02	06:44	05:23	03:53	02:44		02:24	03:11	04:22		05:33	06:44	07:58	08:36	
	15:42	17:00	18:08	19:22	20:29		20:59	20:18	18:58		17:26	16:01	14:54	14:43	
28	08:00	06:41	05:20	03:51	02:42		02:25	03:13	04:24		05:35	06:46	08:01	08:36	
	15:45	17:03	18:10	19:24	20:31		20:59	20:16	18:55		17:23	15:58	14:52	14:44	
29	07:58		05:17	03:48	02:40		02:26	03:15			05:37	06:49	08:03	08:36	
	15:47		18:13	19:26	20:33		20:58	20:14			17:21	15:56	14:51	14:45	
30	07:56		05:14	03:45	02:39		02:26	03:17			05:39	06:51	08:05	08:36	
	15:50		18:15	19:29	20:35		20:58	20:12			17:18	15:53	14:49	14:46	
31	07:53		05:11		02:37		03:20	04:10 (1)	04:31			06:54		08:36	
	15:52		18:17		20:37		20:09	12	04:22 (1)			15:51		14:47	
Potential sun hours	216	257	365	434	526	554	551	481		387	318	232	194		
Total, worst case					149			24		128					
Sun reduction					0.35			0.26		0.24					
Oper. time red.					0.93			0.93		0.93					
Wind dir. red.					0.52			0.52		0.52					
Total reduction					0.17			0.13		0.12					
Total, real					25			3		15					

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:

Gismarvik

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15.08.2011 12:14 / 15

Licensed user:

**Kjeller Vindteknikk AS**  
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NO-2007 Kjeller  
(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: O - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (219)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36	07:51	06:39	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:55	17:05	18:20	19:31	20:38	20:57	20:07	18:43	17:15	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:59	08:09
	14:51	15:57	17:08	18:22	19:34	20:40	20:57	20:05	18:40	17:12	15:46	14:47
3	08:35	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:38	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:31	03:29	04:40	05:49	07:04	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:35	17:06	15:41	14:45
5	08:33	07:42	06:27	04:56	03:32	02:31	02:32	03:31	04:43	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44
6	08:33	07:40	06:24	04:53	03:30	02:30	02:33	03:33	04:45	05:53	07:08	08:16
	14:57	16:07	17:18	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:36	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:45	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:19	04:47	03:25	02:27	02:36	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:23	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:16	04:44	03:22	02:27	02:37	03:40	04:52	06:00	07:16	08:21
	15:02	16:15	17:25	18:39	19:50	20:50	20:50	19:47	18:20	16:51	15:29	14:41
10	08:29	07:30	06:13	04:42	03:20	02:26	02:39	03:43	04:54	06:03	07:18	08:22
	15:04	16:18	17:27	18:41	19:53	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:39	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:46	15:24	14:40
12	08:27	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
	15:08	16:23	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:43	15:22	14:39
13	08:25	07:22	06:04	04:33	03:13	02:24	02:43	03:49 (1)	03:49	05:01	06:10	07:26
	15:10	16:25	17:35	18:48	19:59	20:54	20:44	5 03:46 (1)	19:37	18:08	16:40	15:20
14	08:24	07:20	06:01	04:30	03:10	02:23	02:45	03:39 (1)	03:52	05:03	06:12	07:28
	15:12	16:28	17:37	18:51	20:02	20:55	20:43	8 03:47 (1)	19:34	18:05	16:37	15:18
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:39 (1)	03:54	05:05	06:15	07:31
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	10 03:49 (1)	19:31	18:02	16:34	15:15
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:37 (1)	03:56	05:08	06:17	07:33
	15:16	16:33	17:42	18:55	20:06	2 03:42 (1)	20:57	12 03:49 (1)	19:29	17:59	16:31	15:13
17	08:20	07:12	05:52	04:21	03:04	03:39 (1)	02:52	03:37 (1)	03:59	05:10	06:19	07:35
	15:18	16:35	17:44	18:58	20:09	4 03:43 (1)	20:57	13 03:50 (1)	19:26	17:56	16:28	15:11
18	08:18	07:09	05:49	04:18	03:01	03:37 (1)	02:22	02:52	03:37 (1)	04:01	05:12	06:22
	15:21	16:38	17:47	19:00	20:11	6 03:43 (1)	20:58	14 03:51 (1)	19:23	17:53	16:26	15:09
19	08:17	07:06	05:46	04:16	02:59	03:35 (1)	02:22	02:54	03:36 (1)	04:03	05:14	06:24
	15:23	16:40	17:49	19:02	20:13	8 03:43 (1)	20:58	15 03:51 (1)	19:20	17:50	16:23	15:07
20	08:15	07:04	05:43	04:13	02:57	03:33 (1)	02:22	02:56	03:37 (1)	04:06	05:17	06:27
	15:25	16:43	17:51	19:05	20:15	10 03:43 (1)	20:59	15 03:52 (1)	19:18	17:47	16:20	15:05
21	08:13	07:01	05:40	04:10	02:55	03:31 (1)	02:22	02:58	03:39 (1)	04:08	05:19	06:29
	15:28	16:46	17:54	19:07	20:17	11 03:42 (1)	20:59	14 03:53 (1)	19:15	17:44	16:17	15:04
22	08:11	06:58	05:38	04:07	02:53	03:30 (1)	02:22	03:00	03:41 (1)	04:10	05:21	06:31
	15:30	16:48	17:56	19:10	20:19	13 03:43 (1)	20:59	12 03:53 (1)	19:12	17:41	16:15	15:02
23	08:10	06:55	05:35	04:04	02:51	03:28 (1)	02:22	03:02	03:42 (1)	04:13	05:23	06:34
	15:32	16:51	17:58	19:12	20:21	14 03:42 (1)	20:59	11 03:53 (1)	19:09	17:38	16:12	15:00
24	08:08	06:53	05:32	04:02	02:49	03:27 (1)	02:23	03:04	03:44 (1)	04:15	05:26	06:36
	15:35	16:53	18:01	19:14	20:23	16 03:43 (1)	20:59	9 03:53 (1)	19:06	17:35	16:09	14:58
25	08:06	06:50	05:29	03:59	02:47	03:27 (1)	02:23	03:07	03:46 (1)	04:17	05:28	06:39
	15:37	16:56	18:03	19:17	20:25	15 03:42 (1)	20:59	7 03:53 (1)	19:04	17:32	16:06	14:57
26	08:04	06:47	05:26	03:56	02:46	03:28 (1)	02:24	03:09	03:48 (1)	04:20	05:30	06:41
	15:40	16:58	18:05	19:19	20:27	14 03:42 (1)	20:59	5 03:53 (1)	19:01	17:29	16:04	14:55
27	08:02	06:44	05:23	03:53	02:44	03:28 (1)	02:24	03:11	03:50 (1)	04:22	05:33	06:44
	15:42	17:01	18:08	19:22	20:29	13 03:41 (1)	20:59	3 03:53 (1)	18:58	17:26	16:01	14:54
28	08:00	06:41	05:20	03:51	02:42	03:29 (1)	02:25	03:13		04:24	05:35	06:46
	15:45	17:03	18:10	19:24	20:31	12 03:41 (1)	20:59	20:16		18:55	17:23	15:58
29	07:58		05:17	03:48	02:40	03:30 (1)	02:26	03:15		04:27	05:37	06:49
	15:47		18:13	19:26	20:33	9 03:39 (1)	20:58	20:14		18:52	17:21	15:56
30	07:56		05:14	03:45	02:39	03:31 (1)	02:26	03:17		04:29	05:39	06:51
	15:50		18:15	19:29	20:35	7 03:38 (1)	20:58	20:12		18:49	17:18	15:53
31	07:53		05:11		02:37	03:34 (1)		03:20		04:31		06:54
	15:52		18:17		20:37	2 03:36 (1)		20:09		18:46		15:51
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case					156							
Sun reduction					0.35							
Oper. time red.					0.93							
Wind dir. red.					0.51							
Total reduction					0.17							
Total, real					26							

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:

Gismarvik

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15.08.2011 12:14 / 16

Licensed user:

Kjeller Vindteknikk AS

Gunnar Randres vei 12

NO-2007 Kjeller

(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: P - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (220)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:36	07:51	06:39	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07	
	14:49	15:55	17:05	18:20	19:31	20:38	20:57	20:07	18:43	17:15	15:48	14:48	
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:59	08:09	
	14:51	15:57	17:08	18:22	19:34	20:40	20:57	20:05	18:40	17:12	15:46	14:47	
3	08:35	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:38	17:09	15:43	14:46	
4	08:34	07:44	06:30	04:59	03:35	02:32	02:31	03:29	04:40	05:49	07:04	08:12	
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:35	17:06	15:41	14:45	
5	08:33	07:42	06:27	04:56	03:32	02:31	02:32	03:31	04:43	05:51	07:06	08:14	
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44	
6	08:33	07:40	06:24	04:53	03:30	02:30	02:33	03:33	04:45	05:53	07:08	08:16	
	14:57	16:07	17:18	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43	
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:36	04:47	05:56	07:11	08:18	
	14:58	16:10	17:20	18:34	19:45	20:48	20:52	19:52	18:26	16:57	15:33	14:42	
8	08:31	07:35	06:19	04:47	03:25	02:27	02:36	03:38	04:49	05:58	07:13	08:19	
	15:00	16:12	17:23	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41	
9	08:30	07:32	06:16	04:44	03:22	02:27	02:37	03:40	04:52	06:00	07:16	08:21	
	15:02	16:15	17:25	18:39	19:50	20:50	20:50	19:47	18:20	16:51	15:29	14:41	
10	08:29	07:30	06:13	04:42	03:20	02:26	02:39	03:42	04:54	06:03	07:18	08:22	
	15:04	16:18	17:27	18:41	19:53	20:51	20:49	19:45	18:17	16:48	15:26	14:40	
11	08:28	07:27	06:10	04:39	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24	
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:46	15:24	14:40	
12	08:27	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25	
	15:08	16:23	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:43	15:22	14:39	
13	08:25	07:22	06:04	04:33	03:13	02:24	02:43	03:49	05:01	06:10	07:26	08:27	
	15:10	16:25	17:35	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:20	14:39	
14	08:24	07:20	06:01	04:30	03:10	03:45 (1)	02:23	03:52	05:03	06:12	07:28	08:28	
	15:12	16:28	17:37	18:51	20:02	2 03:46 (1)	20:55	19:34	18:05	16:37	15:18	14:38	
15	08:23	07:17	05:58	04:27	03:08	03:43 (1)	02:23	03:54	05:05	06:15	07:31	08:29	
	15:14	16:30	17:39	18:53	20:04	3 03:46 (1)	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	03:41 (1)	02:22	03:43 (1)	03:56	05:08	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	5 03:46 (1)	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20	07:12	05:52	04:21	03:04	03:39 (1)	02:22	03:42 (1)	03:59	05:10	06:19	07:35	08:31
	15:18	16:35	17:44	18:58	20:09	8 03:47 (1)	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	03:37 (1)	02:22	03:42 (1)	04:01	05:12	06:22	07:38	08:32
	15:21	16:38	17:47	19:00	20:11	10 03:47 (1)	20:58	20:36	19:23	17:53	16:26	15:09	14:38
19	08:17	07:06	05:46	04:16	02:59	03:35 (1)	02:22	03:40 (1)	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	11 03:46 (1)	20:58	20:34	19:20	17:50	16:23	15:07	14:39
20	08:15	07:04	05:43	04:13	02:57	03:33 (1)	02:22	03:40 (1)	04:06	05:17	06:27	07:43	08:33
	15:25	16:43	17:51	19:05	20:15	13 03:46 (1)	20:59	20:33	19:18	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	03:31 (1)	02:22	03:40 (1)	04:08	05:19	06:29	07:45	08:34
	15:28	16:46	17:54	19:07	20:17	15 03:46 (1)	20:59	20:31	19:15	17:44	16:17	15:04	14:39
22	08:11	06:58	05:38	04:07	02:53	03:30 (1)	02:22	03:41 (1)	04:10	05:21	06:31	07:47	08:35
	15:30	16:48	17:56	19:10	20:19	16 03:46 (1)	20:59	20:29	19:12	17:41	16:15	15:02	14:40
23	08:10	06:55	05:35	04:04	02:51	03:30 (1)	02:22	03:42 (1)	04:13	05:23	06:34	07:50	08:35
	15:32	16:51	17:58	19:12	20:21	15 03:45 (1)	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:53	05:32	04:02	02:49	03:31 (1)	02:23	03:44 (1)	04:15	05:26	06:36	07:52	08:36
	15:35	16:53	18:01	19:14	20:23	14 03:45 (1)	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:29	03:59	02:47	03:31 (1)	02:23	03:46 (1)	04:17	05:28	06:39	07:54	08:36
	15:37	16:56	18:03	19:17	20:25	13 03:44 (1)	20:59	20:23	19:04	17:32	16:06	14:57	14:41
26	08:04	06:47	05:26	03:56	02:46	03:33 (1)	02:24	03:48 (1)	04:20	05:30	06:41	07:56	08:36
	15:40	16:58	18:05	19:19	20:27	11 03:44 (1)	20:59	20:21	19:01	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	03:33 (1)	02:24	03:50 (1)	04:22	05:33	06:44	07:58	08:36
	15:42	17:01	18:08	19:22	20:29	10 03:43 (1)	20:59	20:18	19:01	17:26	16:01	14:54	14:43
28	08:00	06:41	05:20	03:51	02:42	03:35 (1)	02:25	03:52 (1)	04:24	05:35	06:46	08:01	08:36
	15:45	17:03	18:10	19:24	20:31	7 03:42 (1)	20:59	20:16	19:01	17:23	15:58	14:52	14:44
29	07:58		05:17	03:48	02:40		02:26	03:54 (1)	04:27	05:37	06:49	08:03	08:36
	15:47		18:13	19:26	20:33		20:58	20:14	19:01	17:21	15:56	14:51	14:45
30	07:56		05:14	03:45	02:39		02:26	03:57 (1)	04:29	05:39	06:51	08:05	08:36
	15:50		18:15	19:29	20:35		20:58	20:12	19:01	17:18	15:53	14:49	14:46
31	07:53		05:11		02:37			04:31			06:54		08:36
	15:52		18:17		20:37			18:46			15:51		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194	
Total, worst case					153								
Sun reduction					0.35								
Oper. time red.					0.93								
Wind dir. red.					0.51								
Total reduction					0.17								
Total, real					25								

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:  
**Gismarvik**

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15.08.2011 12:14 / 17

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Calculated:  
15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

Calculation: Skyggekast Gismarvik Shadow receptor: Q - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (221)

**Assumptions for shadow calculations**

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes  
 Sunshine probability S/S0 (Sun hours/Possible sun hours) []  
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30  
 Operational time  
 N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December		
1	08:36 14:49	07:51 15:55	06:39 17:05	05:08 18:20	03:43 19:31		02:36 20:39	03:22 20:07		04:06 (1) 18:43	05:42 17:15	06:56 15:48	08:07 14:48	
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:34		02:34 20:40	03:24 20:05	16	04:06 (1) 18:40	05:44 17:12	06:59 15:46	08:09 14:47	
3	08:35 14:52	07:47 16:00	06:33 17:10	05:02 18:24	03:37 19:36	04:09 (1) 04:12 (1)	02:33 20:42	03:26 20:02	16	04:05 (1) 18:38	05:46 17:09	07:01 15:43	08:11 14:46	
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	04:06 (1) 04:12 (1)	02:32 20:43	03:29 20:00	18	04:06 (1) 18:35	05:49 17:06	07:04 15:41	08:12 14:45	
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:41	04:04 (1) 04:13 (1)	02:31 20:45	03:31 19:57	17	04:08 (1) 18:32	05:51 17:03	07:06 15:38	08:14 14:44	
6	08:33 14:57	07:40 16:07	06:24 17:18	04:53 18:32	03:30 19:43	04:02 (1) 04:13 (1)	02:30 20:46	03:33 19:55	15	04:10 (1) 18:29	05:53 17:00	07:08 15:36	08:16 14:43	
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	03:59 (1) 04:13 (1)	02:28 20:48	03:36 19:52	13	04:12 (1) 18:26	05:56 16:57	07:11 15:33	08:18 14:42	
8	08:31 15:00	07:35 16:12	06:19 17:23	04:47 18:36	03:25 19:48	03:57 (1) 04:13 (1)	02:27 20:49	03:38 19:50	11	04:14 (1) 18:23	05:58 16:54	07:13 15:31	08:19 14:41	
9	08:30 15:02	07:32 16:15	06:16 17:25	04:44 18:39	03:22 19:50	03:55 (1) 04:13 (1)	02:27 20:50	03:40 19:47	8	04:16 (1) 18:20	06:00 16:51	07:16 15:29	08:21 14:41	
10	08:29 15:04	07:30 16:18	06:13 17:27	04:42 18:41	03:20 19:53	03:55 (1) 04:12 (1)	02:26 20:51	03:42 19:45	5	04:18 (1) 18:17	06:03 16:48	07:18 15:26	08:22 14:40	
11	08:28 15:06	07:27 16:20	06:10 17:30	04:39 18:43	03:17 19:55	03:56 (1) 04:12 (1)	02:25 20:52	03:45 19:42	2	04:20 (1) 18:14	06:05 16:46	07:21 15:24	08:24 14:40	
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	03:15 19:57	03:57 (1) 04:11 (1)	02:24 20:54	03:47 19:39		04:58 18:11	06:07 16:43	07:23 15:22	08:25 14:39	
13	08:25 15:10	07:22 16:25	06:04 17:35	04:33 18:48	03:13 19:59	03:57 (1) 04:10 (1)	02:24 20:54	03:49 19:37		05:01 18:08	06:10 16:40	07:26 15:20	08:27 14:39	
14	08:24 15:12	07:20 16:28	06:01 17:37	04:30 18:51	03:10 20:02	03:58 (1) 04:08 (1)	02:23 20:55	03:52 19:34	13	05:03 18:05	06:12 16:37	07:28 15:18	08:28 14:38	
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	04:01 (1) 04:07 (1)	02:23 20:56	03:54 19:31	10	05:05 18:02	06:15 16:34	07:31 15:15	08:29 14:38	
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	04:07 (1) 04:12 (1)	02:22 20:57	03:56 19:29	6	05:08 17:59	06:17 16:31	07:33 15:13	08:30 14:38	
17	08:20 15:18	07:12 16:35	05:52 17:44	04:21 18:58	03:04 20:09	04:11 (1) 04:16 (1)	02:22 20:57	03:59 19:26		05:10 17:56	06:19 16:28	07:35 15:11	08:31 14:38	
18	08:18 15:21	07:09 16:38	05:49 17:47	04:18 19:00	03:01 20:11	04:10 (1) 04:15 (1)	02:22 20:58	04:01 19:23		05:12 17:53	06:22 16:26	07:38 15:09	08:32 14:38	
19	08:17 15:23	07:06 16:40	05:46 17:49	04:16 19:02	02:59 20:13	04:12 (1) 04:17 (1)	02:22 20:58	04:03 19:20		05:14 17:50	06:24 16:23	07:40 15:07	08:33 14:38	
20	08:15 15:25	07:04 16:43	05:43 17:51	04:13 19:05	02:57 20:15	04:13 (1) 04:18 (1)	02:22 20:59	04:06 19:18		05:17 17:47	06:27 16:20	07:43 15:05	08:33 14:39	
21	08:13 15:28	07:01 16:46	05:40 17:54	04:10 19:07	02:55 20:17	04:14 (1) 04:19 (1)	02:22 20:59	04:08 19:15		05:19 17:44	06:29 16:17	07:45 15:04	08:34 14:39	
22	08:11 15:30	06:58 16:48	05:38 17:56	04:07 19:10	02:53 20:19	04:15 (1) 04:20 (1)	02:22 20:59	04:10 19:12		05:21 17:41	06:31 16:15	07:47 15:02	08:35 14:40	
23	08:10 15:32	06:55 16:51	05:35 17:58	04:04 19:12	02:51 20:21	04:16 (1) 04:21 (1)	02:22 20:59	04:13 19:09		05:23 17:38	06:34 16:12	07:50 15:00	08:35 14:40	
24	08:08 15:35	06:53 16:53	05:32 18:01	04:02 19:14	02:49 20:23	04:17 (1) 04:22 (1)	02:23 20:59	04:15 19:06		05:26 17:35	06:36 16:09	07:52 14:58	08:36 14:41	
25	08:06 15:37	06:50 16:56	05:29 18:03	03:59 19:17	02:47 20:26	04:18 (1) 04:23 (1)	02:23 20:59	04:17 19:04		05:28 17:32	06:39 16:06	07:54 14:57	08:36 14:41	
26	08:04 15:40	06:47 16:58	05:26 18:05	03:56 19:19	02:46 20:27	04:19 (1) 04:24 (1)	02:24 20:59	04:20 19:01		05:30 17:29	06:41 16:04	07:56 14:55	08:36 14:42	
27	08:02 15:42	06:44 17:00	05:23 18:08	03:53 19:22	02:44 20:29	04:20 (1) 04:25 (1)	02:24 20:59	04:22 18:58		05:33 17:26	06:44 16:01	07:58 14:54	08:36 14:43	
28	08:00 15:45	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	04:21 (1) 04:26 (1)	02:25 20:59	04:24 18:55		05:35 17:23	06:46 15:58	08:01 14:52	08:36 14:44	
29	07:58 15:47		05:17 18:13	03:48 19:26	02:40 20:33	04:22 (1) 04:27 (1)	02:26 20:58	03:15 20:14	8	04:10 (1) 18:52	05:37 17:21	06:49 15:56	08:03 14:51	08:36 14:45
30	07:56 15:50		05:14 18:15	03:45 19:29	02:39 20:35	04:18 (1) 04:23 (1)	02:26 20:58	03:17 20:12		04:08 (1) 18:49	05:39 17:18	06:51 15:53	08:05 14:49	08:36 14:46
31	07:53 15:52		05:11 18:17	02:37 20:37		04:07 (1) 04:21 (1)	02:37 20:09	04:31 18:46	12	04:07 (1) 18:46	06:54 15:51	08:06 14:51	08:36 14:47	
Potential sun hours	216	257	365	434	526	554	551	481		387	318	232	194	
Total, worst case					153			34		121				
Sun reduction					0.35			0.26		0.24				
Oper. time red.					0.93			0.93		0.93				
Wind dir. red.					0.52			0.52		0.52				
Total reduction					0.17			0.13		0.12				
Total, real					26			4		14				

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:

Gismarvik

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15.08.2011 12:14 / 19

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Gunnar Randres vei 12  
NO-2007 Kjeller  
(+47) 480 50 480

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: S - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (223)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36	07:51	06:39	05:08	03:43	02:36						
	14:49	15:55	17:05	18:20	19:31	20:38	03:34 (1)	02:27	03:22	04:33	05:42	06:56
							03:36 (1)	20:57	20:07	18:43	17:15	15:48
2	08:35	07:49	06:36	05:05	03:40	02:34						
	14:51	15:57	17:08	18:22	19:34	20:40						
3	08:35	07:47	06:33	05:02	03:37	02:33						
	14:52	16:00	17:10	18:24	19:36	20:42						
4	08:34	07:44	06:30	04:59	03:35	02:32						
	14:53	16:02	17:13	18:27	19:38	20:43						
5	08:33	07:42	06:27	04:56	03:32	02:31						
	14:55	16:05	17:15	18:29	19:41	20:45						
6	08:33	07:40	06:24	04:53	03:30	02:30						
	14:57	16:07	17:18	18:31	19:43	20:46						
7	08:32	07:37	06:21	04:50	03:27	02:28						
	14:58	16:10	17:20	18:34	19:45	20:48						
8	08:31	07:35	06:19	04:47	03:25	02:27						
	15:00	16:12	17:23	18:36	19:48	20:49						
9	08:30	07:32	06:16	04:44	03:22	02:27						
	15:02	16:15	17:25	18:39	19:50	20:50						
10	08:29	07:30	06:13	04:42	03:20	02:26						
	15:04	16:18	17:27	18:41	19:53	20:51						
11	08:28	07:27	06:10	04:39	03:17	02:25						
	15:06	16:20	17:30	18:43	19:55	20:52						
12	08:27	07:25	06:07	04:36	03:15	02:24						
	15:08	16:23	17:32	18:46	19:57	20:53						
13	08:25	07:22	06:04	04:33	03:13	02:24						
	15:10	16:25	17:35	18:48	19:59	20:54						
14	08:24	07:20	06:01	04:30	03:10	02:23						
	15:12	16:28	17:37	18:51	20:02	20:55						
15	08:23	07:17	05:58	04:27	03:08	02:23						
	15:14	16:30	17:39	18:53	20:04	20:56						
16	08:21	07:14	05:55	04:24	03:06	02:22						
	15:16	16:33	17:42	18:55	20:06	20:57						
17	08:20	07:12	05:52	04:21	03:04	02:22						
	15:18	16:35	17:44	18:58	20:09	20:57						
18	08:18	07:09	05:49	04:18	03:01	02:22						
	15:21	16:38	17:47	19:00	20:11	20:58						
19	08:17	07:06	05:46	04:16	02:59	02:22						
	15:23	16:40	17:49	19:02	20:13	20:58						
20	08:15	07:04	05:43	04:13	02:57	02:22						
	15:25	16:43	17:51	19:05	20:15	20:59						
21	08:13	07:01	05:40	04:10	02:55	02:22						
	15:28	16:46	17:54	19:07	20:17	20:59						
22	08:11	06:58	05:38	04:07	02:53	02:22						
	15:30	16:48	17:56	19:10	20:19	20:59						
23	08:10	06:55	05:35	04:04	02:51	02:22						
	15:32	16:51	17:58	19:12	20:21	20:59						
24	08:08	06:53	05:32	04:02	02:49	02:23						
	15:35	16:53	18:01	19:14	20:23	20:59						
25	08:06	06:50	05:29	03:59	02:47	02:23						
	15:37	16:56	18:03	19:17	20:25	20:59						
26	08:04	06:47	05:26	03:56	02:46	02:24						
	15:40	16:58	18:05	19:19	20:27	20:59						
27	08:02	06:44	05:23	03:53	02:44	02:24						
	15:42	17:00	18:08	19:22	20:29	20:59						
28	08:00	06:41	05:20	03:51	02:42	02:25						
	15:45	17:03	18:10	19:24	20:31	20:59						
29	07:58		05:17	03:48	02:40	02:26						
	15:47		18:13	19:26	20:33	20:58						
30	07:56		05:14	03:45	02:39	02:26						
	15:50		18:15	19:29	20:35	20:58						
31	07:53		05:11	03:41	02:37	02:26						
	15:52		18:17	19:31	20:37	20:58						
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case					163	2	164					
Sun reduction					0.35	0.30	0.26					
Oper. time red.					0.93	0.93	0.93					
Wind dir. red.					0.51	0.51	0.51					
Total reduction					0.17	0.14	0.12					
Total, real					27	0	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)

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15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: T - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (224)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:36 14:49	07:51 15:55	06:39 17:05	05:08 18:20	05:35 (4) 18:20	03:43 19:31
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	05:32 (4) 18:22	03:40 19:34
3	08:35 14:52	07:47 16:00	06:33 17:10	05:02 18:24	05:29 (4) 18:24	03:37 19:36
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	05:30 (4) 18:27	03:35 19:38
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	05:32 (4) 18:29	03:32 19:41
6	08:33 14:57	07:40 16:07	06:24 17:18	04:53 18:31	03:30 19:43	03:30 19:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	03:27 19:45
8	08:31 15:00	07:35 16:12	06:19 17:23	04:47 18:36	03:25 19:48	03:25 19:48
9	08:30 15:02	07:32 16:15	06:16 17:25	04:44 18:39	03:22 19:50	03:22 19:50
10	08:29 15:04	07:30 16:18	06:13 17:27	04:42 18:41	03:20 19:53	03:20 19:53
11	08:28 15:06	07:27 16:20	06:10 17:30	04:39 18:43	03:17 19:55	03:17 19:55
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	03:15 19:57	03:15 19:57
13	08:25 15:10	07:22 16:25	06:04 17:35	04:33 18:48	03:13 19:59	03:13 19:59
14	08:24 15:12	07:20 16:28	06:01 17:37	04:30 18:51	03:10 20:02	03:10 20:02
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	03:08 20:04
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	03:06 20:06
17	08:20 15:18	07:12 16:35	05:52 17:44	04:21 18:58	03:04 20:09	03:04 20:09
18	08:18 15:21	07:09 16:38	05:49 17:47	04:18 19:00	03:01 20:11	03:01 20:11
19	08:17 15:23	07:06 16:40	05:46 17:49	04:16 19:02	02:59 20:13	02:59 20:13
20	08:15 15:25	07:04 16:43	05:43 17:51	04:13 19:05	02:57 20:15	02:57 20:15
21	08:13 15:28	07:01 16:46	05:40 17:54	04:10 19:07	02:55 20:17	02:55 20:17
22	08:11 15:30	06:58 16:48	05:38 17:56	04:07 19:10	02:53 20:19	02:53 20:19
23	08:10 15:32	06:55 16:51	05:35 17:58	04:04 19:12	02:51 20:21	02:51 20:21
24	08:08 15:35	06:53 16:53	05:32 18:01	04:02 19:14	02:49 20:23	02:49 20:23
25	08:06 15:37	06:50 16:56	05:29 18:03	03:59 19:17	02:47 20:26	02:47 20:26
26	08:04 15:40	06:47 16:58	05:26 18:05	03:56 19:19	02:46 20:27	02:46 20:27
27	08:02 15:42	06:44 17:00	05:23 18:08	03:53 19:22	02:44 20:29	02:44 20:29
28	08:00 15:45	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	02:42 20:31
29	07:58 15:47		05:17 18:13	03:48 19:26	02:40 20:33	02:40 20:33
30	07:56 15:50		05:14 18:15	03:45 19:29	02:39 20:35	02:39 20:35
31	07:53 15:52		05:11 18:17	03:42 19:31	02:37 20:37	02:37 20:37
Potential sun hours	216	257	365	434	526	554
Total, worst case			9	46	163	
Sun reduction			0.28	0.30	0.35	
Oper. time red.			0.93	0.93	0.93	
Wind dir. red.			0.59	0.59	0.52	
Total reduction			0.15	0.17	0.17	
Total, real			1	8	28	

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)

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15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: T - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (224)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.27	0.29	0.28	0.30	0.35	0.30	0.26	0.24	0.26	0.28	0.28	0.30

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
813	231	221	428	610	1281	1143	697	478	515	675	1091	8182

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

	July	August	September	October	November	December
1	02:27	03:22	04:02 (1) 04:33	05:42	06:56	08:07
	20:57	20:07	18 04:20 (1) 18:43	17:15	15:48	14:48
2	02:28	03:24	04:02 (1) 04:36	05:44	06:59	08:09
	20:57	20:05	18 04:20 (1) 18:40	17:12	15:46	14:47
3	02:29	03:26	04:04 (1) 04:38	05:46	07:01	08:11
	20:56	20:02	16 04:20 (1) 18:38	17:09	15:43	14:46
4	02:30	03:29	04:06 (1) 04:40	05:49	07:04	08:12
	20:55	20:00	14 04:20 (1) 18:35	17:06	15:41	14:45
5	02:32	03:31	04:08 (1) 04:43	05:51	07:06	08:14
	20:54	19:57	12 04:20 (1) 18:32	17:03	15:38	14:44
6	02:33	03:33	04:10 (1) 04:45	05:53	07:08	08:16
	20:53	19:55	10 04:20 (1) 18:29	17:00	15:36	14:43
7	02:34	03:36	04:12 (1) 04:47	05:56	07:11	08:18
	20:52	19:52	7 04:19 (1) 18:26	4 05:28 (4) 05:56	07:11	08:18
8	02:36	03:38	04:14 (1) 04:49	05:25 (4) 05:58	07:13	08:19
	20:51	19:50	5 04:19 (1) 18:23	10 05:35 (4) 16:54	15:31	14:41
9	02:37	03:40	04:16 (1) 04:52	05:23 (4) 06:00	07:16	08:21
	20:50	19:47	2 04:18 (1) 18:20	12 05:35 (4) 16:51	15:29	14:41
10	02:39	03:42	04:54	05:25 (4) 06:03	07:18	08:22
	20:49	19:45	11 05:36 (4) 16:48	11 05:36 (4) 16:48	15:26	14:40
11	02:40	03:45	04:56	05:27 (4) 06:05	07:21	08:24
	20:47	19:42	9 05:36 (4) 16:46	9 05:36 (4) 16:46	15:24	14:40
12	02:42	03:47	04:58	05:30 (4) 06:07	07:23	08:25
	20:46	19:39	6 05:36 (4) 16:43	6 05:36 (4) 16:43	15:22	14:39
13	02:43	03:49	05:01	05:32 (4) 06:10	07:26	08:27
	20:44	19:37	4 05:36 (4) 16:40	4 05:36 (4) 16:40	15:20	14:39
14	02:45	03:52	05:03	06:12	07:28	08:28
	20:43	19:34	18:05	16:37	15:18	14:38
15	02:47	03:54	05:05	06:15	07:31	08:29
	20:41	19:31	18:02	16:34	15:15	14:38
16	02:49	03:56	05:08	06:17	07:33	08:30
	20:40	19:29	17:59	16:31	15:13	14:38
17	02:51	03:59	05:10	06:19	07:35	08:31
	20:38	19:26	17:56	16:28	15:11	14:38
18	02:52	04:01	05:12	06:22	07:38	08:32
	20:36	19:23	17:53	16:26	15:09	14:38
19	02:54	04:03	05:14	06:24	07:40	08:33
	20:35	19:20	17:50	16:23	15:07	14:38
20	02:56	04:06	05:17	06:27	07:43	08:33
	20:33	19:18	17:47	16:20	15:05	14:39
21	02:58	04:08	05:19	06:29	07:45	08:34
	20:31	19:15	17:44	16:17	15:04	14:39
22	03:00	04:10	05:21	06:31	07:47	08:35
	20:29	19:12	17:41	16:15	15:02	14:40
23	03:02	04:13	05:23	06:34	07:50	08:35
	20:27	19:09	17:38	16:12	15:00	14:40
24	03:04	04:15	05:26	06:36	07:52	08:36
	20:25	19:06	17:35	16:09	14:58	14:41
25	03:07	04:17	05:28	06:39	07:54	08:36
	20:23	19:04	17:32	16:06	14:57	14:41
26	03:09	04:20	05:30	06:41	07:56	08:36
	20:21	19:01	17:29	16:04	14:55	14:42
27	03:11	04:07 (1) 04:22	05:33	06:44	07:58	08:36
	20:18	7 04:14 (1) 18:58	17:26	16:01	14:54	14:43
28	03:13	04:06 (1) 04:24	05:35	06:46	08:01	08:36
	20:16	10 04:16 (1) 18:55	17:23	15:58	14:52	14:44
29	03:15	04:05 (1) 04:26	05:37	06:49	08:03	08:36
	20:14	13 04:18 (1) 18:52	17:21	15:56	14:51	14:45
30	03:17	04:04 (1) 04:29	05:39	06:51	08:05	08:36
	20:12	15 04:19 (1) 18:49	17:18	15:53	14:49	14:46
31	03:20	04:03 (1) 04:31		06:54		08:36
	20:09	16 04:19 (1) 18:46		15:51		14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	61	102	56			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.52	0.52	0.59			
Total reduction	0.13	0.12	0.14			
Total, real	8	12	8			

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)



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SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: U - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (225)

Assumptions for shadow calculations

Maximum distance for influence 1 500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1281 1143 697 478 515 675 1091 8182
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for each day (1-31) showing sunrise, sunset, and shadow times. Includes a summary table at the bottom for 'Potential sun hours' and 'Total, real'.

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

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

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SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: V - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (226)

Assumptions for shadow calculations

Maximum distance for influence 1 500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30
Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January-December) and rows for time intervals (e.g., 08:36-08:37) and summary statistics (Potential sun hours, Total, worst case, Sun reduction, etc.).

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

Matrix with 4 columns: Day in month, Sun rise (hh:mm), Sun set (hh:mm), Minutes with flicker, First time (hh:mm) with flicker, Last time (hh:mm) with flicker, (WTG causing flicker first time), (WTG causing flicker last time)

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SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: W - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (227)

Assumptions for shadow calculations

Maximum distance for influence: 1 500 m
Minimum sun height over horizon for influence: 3 °
Day step for calculation: 1 days
Time step for calculation: 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30
Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182
Idle start wind speed: Cut in wind speed from power curve

Table with 12 columns for months (January-December) and rows for each day of the month. Columns contain sun rise and set times. Summary rows at the bottom show total sun hours, reduction percentages, and real sun hours.

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

Matrix with 4 columns: Day in month, Sun rise (hh:mm), Sun set (hh:mm), Minutes with flicker, First time (hh:mm) with flicker, Last time (hh:mm) with flicker, (WTG causing flicker first time), (WTG causing flicker last time)

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SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: X - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (228)

Assumptions for shadow calculations

Maximum distance for influence 1 500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30
Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1281 1143 697 478 515 675 1091 8182
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January-December) and rows for time slots (08:36-15:52) and summary statistics (Potential sun hours, Total, worst case, Sun reduction, etc.).

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

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

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SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: Y - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (229)

Assumptions for shadow calculations

Maximum distance for influence: 1 500 m
Minimum sun height over horizon for influence: 3 °
Day step for calculation: 1 days
Time step for calculation: 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for daily sun rise and set times. Includes summary rows for Potential sun hours, Total, worst case, Sun reduction, Oper. time red., Wind dir. red., Total reduction, and Total, real.

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

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



Project: **Gismarvik**

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Calculated:  
15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

**Calculation:** Skyggecast Gismarvik **Shadow receptor:** Z - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (230)

**Assumptions for shadow calculations**

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []  
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30  
Operational time  
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December		
1	08:36 14:49	09:56 (2) 11:59 (1)	07:51 15:54	06:39 17:05	05:08 18:20	03:43 19:31	02:36 20:39	02:27 20:07	03:22 18:43	05:42 17:15	06:56 15:48	08:07 14:48	08:54 (3) 11:43 (1)	
2	08:35 14:50	09:56 (2) 11:59 (1)	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:34	02:34 20:40	02:28 20:57	03:24 20:05	05:44 17:12	06:59 15:45	08:09 14:47	08:56 (3) 11:44 (1)	
3	08:35 14:52	09:56 (2) 11:59 (1)	07:47 16:00	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	05:46 17:09	07:01 15:43	08:11 14:46	08:58 (3) 11:44 (1)	
4	08:34 14:53	09:57 (2) 12:00 (1)	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:29 20:00	05:49 17:06	07:03 15:40	08:13 14:45	09:01 (3) 11:46 (1)	
5	08:33 14:55	09:20 (3) 12:00 (1)	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:41	02:30 20:45	02:31 20:54	03:31 19:57	05:42 17:03	07:06 15:38	08:14 14:44	09:03 (3) 11:46 (1)	
6	08:33 14:57	09:19 (3) 12:00 (1)	07:40 16:07	06:24 17:18	04:53 18:31	03:30 19:43	02:29 20:46	02:33 20:53	03:33 19:55	05:53 18:29	07:08 15:36	08:16 14:43	09:05 (3) 11:47 (1)	
7	08:32 14:58	09:18 (3) 12:01 (1)	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:48	02:34 20:52	03:35 19:52	05:47 18:26	07:11 15:57	08:18 14:42	09:07 (3) 11:47 (1)	
8	08:31 15:00	09:16 (3) 12:00 (1)	07:35 16:12	06:19 17:22	04:47 18:36	03:25 19:48	02:27 20:49	02:35 20:51	03:38 19:50	05:58 18:23	07:13 15:31	08:19 14:41	09:45 (2) 11:48 (1)	
9	08:30 15:02	09:15 (3) 12:01 (1)	07:32 16:15	06:16 17:25	04:44 18:39	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	06:00 18:20	07:16 16:51	08:21 15:29	09:45 (2) 11:49 (1)	
10	08:29 15:04	09:14 (3) 12:02 (1)	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:53	02:26 20:51	02:38 20:49	03:42 19:45	06:03 18:17	07:18 15:26	08:22 14:40	09:46 (2) 11:49 (1)	
11	08:28 15:06	09:12 (3) 12:01 (1)	07:27 16:20	06:10 17:30	04:39 18:43	03:17 19:55	02:25 20:53	02:40 20:47	03:45 19:42	06:05 18:14	07:21 15:24	08:24 14:39	09:46 (2) 11:49 (1)	
12	08:27 15:08	09:10 (3) 12:01 (1)	07:25 16:23	06:07 17:32	04:36 18:46	03:15 19:57	02:24 20:54	02:42 20:46	03:47 19:39	06:07 18:11	07:23 15:22	08:25 14:39	09:46 (2) 11:50 (1)	
13	08:25 15:10	09:09 (3) 12:01 (1)	07:22 16:25	06:04 17:35	04:33 18:48	03:12 19:59	02:23 20:54	02:43 20:45	03:49 19:37	06:01 18:08	07:26 16:40	08:27 15:20	09:46 (2) 11:50 (1)	
14	08:24 15:12	09:07 (3) 12:01 (1)	07:20 16:28	06:01 17:37	04:30 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 19:34	06:03 18:05	07:28 16:37	08:28 15:17	09:47 (2) 11:51 (1)	
15	08:23 15:14	09:06 (3) 12:00 (1)	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:23 20:56	02:47 20:41	03:54 19:31	06:15 18:02	07:31 16:34	08:29 15:15	09:48 (2) 11:51 (1)	
16	08:21 15:16	09:07 (3) 12:00 (1)	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	02:22 20:57	02:49 20:40	03:56 19:29	06:17 15:31	07:33 15:13	8 08:49 (3) 08:57 (3)	08:30 14:38	09:48 (2) 11:52 (1)
17	08:20 15:18	09:07 (3) 11:59 (1)	07:12 16:35	05:52 17:44	04:21 18:58	03:03 20:09	02:22 20:57	02:50 20:38	03:59 19:26	05:10 17:56	06:19 16:28	12 09:00 (3) 09:38 (3)	08:31 14:38	09:48 (2) 11:52 (1)
18	08:18 15:21	09:08 (3) 11:58 (1)	07:09 16:38	05:49 17:46	04:18 19:00	03:01 20:11	02:22 20:58	02:52 20:36	04:01 19:23	05:12 17:53	06:22 16:26	15 09:02 (3) 08:47 (3)	08:32 14:38	09:49 (2) 11:53 (1)
19	08:17 15:23	09:08 (3) 11:57 (1)	07:06 16:40	05:46 17:49	04:16 19:02	02:59 20:13	02:22 20:58	02:54 20:35	04:03 19:20	05:14 17:50	06:24 16:23	17 09:03 (3) 08:46 (3)	08:33 14:38	09:49 (2) 11:53 (1)
20	08:15 15:25	09:09 (3) 11:55 (1)	07:04 16:43	05:43 17:51	04:13 19:05	02:57 20:15	02:22 20:59	02:56 20:33	04:06 19:18	05:17 17:47	06:27 16:20	19 09:03 (3) 08:45 (3)	08:33 14:39	09:50 (2) 11:54 (1)
21	08:13 15:27	09:10 (3) 09:29 (3)	07:01 16:45	05:40 17:54	04:10 19:07	02:55 20:17	02:22 20:59	02:58 20:31	04:08 19:15	05:19 17:44	06:29 16:17	20 09:04 (3) 08:45 (3)	08:34 14:39	09:50 (2) 11:54 (1)
22	08:11 15:30	09:10 (3) 09:28 (3)	06:58 16:48	05:37 17:56	04:07 19:10	02:53 20:19	02:22 20:59	03:00 20:29	04:10 19:12	05:21 17:41	06:31 16:14	21 11:31 (1) 15:02 (3)	08:35 14:39	09:51 (2) 11:55 (1)
23	08:10 15:32	09:11 (3) 09:28 (3)	06:55 16:50	05:34 17:58	04:04 19:12	02:51 20:21	02:22 20:59	03:02 20:27	04:13 19:09	05:23 17:38	06:34 16:12	22 08:44 (3) 11:33 (1)	08:35 14:40	09:51 (2) 11:55 (1)
24	08:08 15:35	09:13 (3) 09:28 (3)	06:53 16:53	05:31 18:01	04:02 19:14	02:49 20:24	02:22 20:59	03:04 20:25	04:15 19:06	05:26 17:35	06:36 16:09	23 08:45 (3) 11:35 (1)	08:36 14:41	09:51 (2) 11:55 (1)
25	08:06 15:37	09:14 (3) 09:26 (3)	06:50 16:55	05:29 18:03	03:59 19:17	02:47 20:26	02:23 20:59	03:06 20:23	04:17 19:03	05:28 17:32	06:39 16:06	24 08:45 (3) 11:37 (1)	08:36 14:41	09:53 (2) 11:56 (1)
26	08:04 15:39	09:16 (3) 09:24 (3)	06:47 16:58	05:26 18:05	03:56 19:19	02:45 20:28	02:23 20:59	03:09 20:21	04:19 19:01	05:30 17:29	06:41 16:04	25 08:45 (3) 11:38 (1)	08:36 14:42	09:53 (2) 11:57 (1)
27	08:02 15:42	09:16 (3) 17:00	06:44 18:08	05:23 19:22	03:53 20:29	02:44 20:59	02:24 20:18	03:11 18:58	04:22 17:26	05:33 16:01	06:44 14:53	26 08:45 (3) 11:40 (1)	08:36 14:43	09:53 (2) 11:56 (1)
28	08:00 15:44	09:11 (3) 17:03	06:41 18:10	05:20 19:24	03:51 20:31	02:42 20:59	02:25 20:16	03:13 18:55	04:24 17:23	05:35 15:58	06:46 14:52	27 08:47 (3) 11:41 (1)	08:36 14:44	09:53 (2) 11:57 (1)
29	07:58 15:47	09:08 (3) 18:13	06:38 18:13	05:17 19:26	03:48 20:33	02:40 20:58	02:25 20:14	03:15 18:52	04:26 17:20	05:37 15:56	06:49 14:51	28 08:49 (3) 11:42 (1)	08:36 14:45	09:54 (2) 11:58 (1)
30	07:56 15:49	09:06 (3) 18:15	06:36 18:15	05:14 19:29	03:45 20:35	02:39 20:58	02:26 20:12	03:17 18:49	04:29 17:18	05:39 15:53	06:51 14:49	29 08:51 (3) 11:42 (1)	08:36 14:46	09:54 (2) 11:58 (1)
31	07:53 15:52	09:04 (3) 18:17	06:34 18:08	05:11 19:22	03:43 20:37	02:37 20:59	02:27 20:09	03:20 18:46	04:31 17:18	05:41 15:51	06:54 14:47	30 08:52 (3) 11:42 (1)	08:36 14:47	09:55 (2) 11:59 (1)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194		
Total, worst case	1317										608		1974	
Sun reduction	0.27										0.28		0.30	
Oper. time red.	0.93										0.93		0.93	
Wind dir. red.	0.72										0.73		0.71	
Total reduction	0.18										0.19		0.20	
Total, real	239										116		393	

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:

Gismarvik

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Calculated:
15.08.2011 09:56/2.7.486



SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: AB - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (232)

Assumptions for shadow calculations

Maximum distance for influence 1 500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for each day (1-31) showing sun rise/set times, potential sun hours, and various reduction factors. Summary row at the bottom shows totals for each month and overall averages.

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

Matrix layout for daily data: Day in month | Sun rise (hh:mm) | Sun set (hh:mm) | Minutes with flicker | First time (hh:mm) with flicker | Last time (hh:mm) with flicker | (WTG causing flicker first time) | (WTG causing flicker last time)

Project:

Gismarvik

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Calculated:
15.08.2011 09:56/2.7.486



SHADOW - Calendar

Calculation: Skyggekast GismarvikShadow receptor: AC - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (233)

Assumptions for shadow calculations

Maximum distance for influence 1 500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for each day of the month. Columns include start and end times for shadows. Summary rows at the bottom show total sun hours, reduction factors, and real sun hours.

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

Matrix for table layout with columns: Day in month, Sun rise (hh:mm), Sun set (hh:mm), Minutes with flicker, First time (hh:mm) with flicker, Last time (hh:mm) with flicker, (WTG causing flicker first time), (WTG causing flicker last time)

Project:  
**Gismarvik**

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15.08.2011 12:14 / 31

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Calculated:  
15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: AD - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (234)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June	July	August	September	October	November	December			
1	08:36 14:49	09:31 (3) 12:43 (1)	07:51 15:54	06:39 17:05	05:08 18:20	03:43 19:31	02:36 20:39	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:15	06:56 15:48	08:07 14:48	09:19 (3) 12:27 (1)	
2	08:35 14:50	09:32 (3) 12:43 (1)	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:34	02:34 20:40	02:28 20:57	03:24 20:05	04:36 18:40	05:44 17:12	06:58 15:45	08:09 14:47	09:19 (3) 12:27 (1)	
3	08:35 14:52	09:32 (3) 12:43 (1)	07:47 16:00	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	08:11 14:46	09:19 (3) 12:28 (1)	
4	08:34 14:53	09:32 (3) 12:43 (1)	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:29 20:00	04:40 18:35	05:49 17:06	07:03 15:40	08:12 14:45	09:20 (3) 12:29 (1)	
5	08:33 14:55	09:33 (3) 12:44 (1)	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:41	02:30 20:45	02:31 20:54	03:31 19:57	04:42 18:32	05:51 17:03	07:06 15:38	08:14 14:44	09:20 (3) 12:30 (1)	
6	08:33 14:56	09:34 (3) 12:44 (1)	07:40 16:07	06:24 17:18	04:53 18:31	03:30 19:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36	08:16 14:43	09:20 (3) 12:30 (1)	
7	08:32 14:58	09:35 (3) 12:45 (1)	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:48	02:34 20:52	03:35 19:52	04:47 18:26	05:56 16:57	07:11 15:33	08:18 14:42	09:20 (3) 12:31 (1)	
8	08:31 15:00	09:35 (3) 12:44 (1)	07:35 16:12	06:19 17:22	04:47 18:36	03:25 19:48	02:27 20:49	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 15:31	08:19 14:41	09:21 (3) 12:31 (1)	
9	08:30 15:02	09:36 (3) 12:45 (1)	07:32 16:15	06:16 17:25	04:44 18:39	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:52 18:20	06:00 16:51	07:16 15:29	08:21 14:40	09:21 (3) 12:32 (1)	
10	08:29 15:04	09:37 (3) 12:45 (1)	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:53	02:25 20:51	02:38 20:49	03:42 19:45	04:54 18:17	06:03 16:48	07:18 15:26	08:22 14:40	09:22 (3) 12:33 (1)	
11	08:28 15:06	09:37 (3) 12:45 (1)	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:53	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24	08:24 14:39	09:21 (3) 12:33 (1)	
12	08:27 15:08	09:38 (3) 12:44 (1)	07:25 16:23	06:07 17:32	04:36 18:46	03:15 19:57	02:24 20:54	02:42 20:46	03:47 19:39	04:58 18:11	06:07 16:43	07:23 15:22	08:25 14:39	09:22 (3) 12:34 (1)	
13	08:25 15:10	09:39 (3) 12:45 (1)	07:22 16:25	06:04 17:35	04:33 18:48	03:12 19:59	02:23 20:54	02:43 20:44	03:49 19:37	05:01 18:08	06:10 16:40	07:26 15:20	08:27 14:39	09:22 (3) 12:34 (1)	
14	08:24 15:12	09:40 (3) 12:44 (1)	07:20 16:28	06:01 17:37	04:30 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:17	08:28 14:38	09:23 (3) 12:35 (1)	
15	08:23 15:14	09:41 (3) 12:44 (1)	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:23 20:56	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	07:31 15:15	08:29 14:38	09:23 (1) 12:35 (1)	
16	08:21 15:16	09:42 (3) 12:43 (1)	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	02:22 20:57	02:49 20:40	03:56 19:29	05:07 17:59	06:17 16:31	07:33 15:13	08:30 14:38	09:24 (3) 12:35 (1)	
17	08:20 15:18	09:44 (3) 12:42 (1)	07:12 16:35	05:52 17:44	04:21 18:58	03:03 20:09	02:22 20:57	02:50 20:38	03:59 19:26	05:10 17:56	06:19 16:28	07:35 15:11	08:31 14:38	09:24 (3) 12:36 (1)	
18	08:18 15:21	09:47 (3) 12:41 (1)	07:09 16:38	05:49 17:46	04:18 19:00	03:01 20:11	02:22 20:58	02:52 20:36	04:01 19:23	05:12 17:53	06:22 16:26	07:38 15:09	08:32 14:38	09:25 (3) 12:36 (1)	
19	08:17 15:23	09:47 (3) 12:38 (1)	07:06 16:40	05:46 17:49	04:16 19:02	02:59 20:13	02:22 20:58	02:54 20:35	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:07	08:33 14:38	09:25 (3) 12:37 (1)	
20	08:15 15:25	09:48 (3) 12:43 (1)	07:04 16:43	05:43 17:51	04:13 19:05	02:57 20:15	02:22 20:59	02:56 20:33	04:06 19:18	05:17 17:47	06:27 16:20	07:43 15:05	08:33 14:39	09:26 (3) 12:38 (1)	
21	08:13 15:27	09:49 (3) 12:44 (1)	07:01 16:45	05:40 17:54	04:10 19:07	02:55 20:17	02:22 20:59	02:58 20:31	04:08 19:15	05:19 17:44	06:29 16:17	07:45 15:03	08:34 14:39	09:26 (3) 12:38 (1)	
22	08:11 15:30	09:50 (3) 12:45 (1)	06:58 16:48	05:37 17:56	04:07 19:10	02:53 20:19	02:22 20:59	03:00 20:29	04:10 19:12	05:21 17:41	06:31 16:14	07:47 15:02	08:35 14:39	09:27 (3) 12:39 (1)	
23	08:10 15:32	09:51 (3) 12:46 (1)	06:55 16:50	05:34 17:58	04:04 19:12	02:51 20:21	02:22 20:59	03:02 20:27	04:13 19:09	05:23 17:38	06:34 16:12	07:50 15:00	7 12:07 (1) 14:40	08:35 14:40	09:27 (3) 12:39 (1)
24	08:08 15:35	09:52 (3) 12:47 (1)	06:53 16:53	05:31 18:01	04:02 19:14	02:49 20:24	02:22 20:59	03:04 20:25	04:15 19:06	05:26 17:35	06:36 16:09	07:52 14:58	19 12:18 (1) 14:41	08:36 14:41	09:27 (3) 12:39 (1)
25	08:06 15:37	09:53 (3) 12:48 (1)	06:50 16:55	05:29 18:03	03:59 19:17	02:47 20:26	02:23 20:59	03:06 20:23	04:17 19:03	05:28 17:32	06:39 16:06	07:54 14:57	19 12:20 (1) 14:41	08:36 14:41	09:28 (3) 12:40 (1)
26	08:04 15:39	09:54 (3) 12:49 (1)	06:47 16:58	05:26 18:05	03:56 19:19	02:45 20:28	02:23 20:59	03:09 20:21	04:19 19:01	05:30 17:29	06:41 16:04	07:56 14:55	32 12:21 (1) 14:42	08:36 14:42	09:29 (3) 12:41 (1)
27	08:02 15:42	09:55 (3) 12:50 (1)	06:44 17:00	05:23 18:08	03:53 19:22	02:44 20:29	02:24 20:59	03:11 20:18	04:22 18:58	05:32 17:26	06:44 16:01	07:58 14:53	37 12:23 (1) 14:43	08:36 14:43	09:28 (3) 12:40 (1)
28	08:00 15:44	09:56 (3) 12:51 (1)	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	02:25 20:59	03:13 20:16	04:24 18:55	05:35 17:23	06:46 14:52	08:01 12:24 (1)	40 12:24 (1) 14:44	08:36 14:44	09:29 (3) 12:41 (1)
29	07:58 15:47	09:57 (3) 12:52 (1)	06:38 17:05	05:17 18:12	03:48 19:26	02:40 20:33	02:25 20:58	03:15 20:14	04:26 18:52	05:37 17:20	06:49 15:56	08:03 14:51	43 12:25 (1) 14:45	08:36 14:45	09:30 (3) 12:41 (1)
30	07:56 15:49	09:58 (3) 12:53 (1)	06:35 17:08	05:14 18:15	03:45 19:29	02:39 20:35	02:26 20:58	03:17 20:12	04:29 18:49	05:39 17:17	06:51 15:53	08:05 14:49	44 12:25 (1) 14:46	08:36 14:46	09:30 (3) 12:41 (1)
31	07:53 15:52	09:59 (3) 12:54 (1)	06:32 17:07	05:11 18:17	03:42 19:30	02:37 20:37	02:27 20:59	03:19 18:46	04:31 17:11	06:54 15:51	08:06 14:48	08:06 14:47	14:47	08:36 14:47	09:31 (3) 12:42 (1)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194			
Total, worst case	978										249		2298		
Sun reduction	0.27										0.28		0.30		
Oper. time red.	0.93										0.93		0.93		
Wind dir. red.	0.69										0.68		0.69		
Total reduction	0.17										0.18		0.19		
Total, real	170										44		445		

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

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

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Calculated:  
15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: AE - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (235)

### Assumptions for shadow calculations

Maximum distance for influence	1 500 m	Sunshine probability S/S0 (Sun hours/Possible sun hours) []
Minimum sun height over horizon for influence	3 °	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Day step for calculation	1 days	0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30
Time step for calculation	1 minutes	Operational time
		N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
		813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182
		Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December		
1	08:36 14:49	09:31 (3) 12:49 (1)	07:51 15:54	06:39 17:05	05:08 18:20	03:43 19:31	02:36 20:39	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:15	06:56 15:48	08:07 14:48	09:19 (3) 12:34 (1)
2	08:35 14:50	09:31 (3) 12:49 (1)	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:34	02:34 20:40	02:28 20:57	03:24 20:05	04:36 18:40	05:44 17:12	06:58 15:45	08:09 14:47	09:18 (3) 12:34 (1)
3	08:35 14:52	09:31 (3) 12:49 (1)	07:47 16:00	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	08:11 14:46	09:18 (3) 12:34 (1)
4	08:34 14:53	09:32 (3) 12:50 (1)	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:29 20:00	04:40 18:35	05:49 17:06	07:03 15:40	08:12 14:45	09:19 (3) 12:36 (1)
5	08:33 14:55	09:33 (3) 12:50 (1)	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:41	02:30 20:45	02:30 20:54	03:31 19:57	04:42 18:32	05:51 17:03	07:06 15:38	08:14 14:44	09:19 (3) 12:36 (1)
6	08:33 14:56	09:33 (3) 12:50 (1)	07:40 16:07	06:24 17:18	04:53 18:31	03:30 19:43	02:29 20:46	02:29 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36	08:16 14:43	09:19 (3) 12:37 (1)
7	08:32 14:58	09:34 (3) 12:51 (1)	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:48	02:34 20:52	03:35 19:52	04:47 18:26	05:56 16:57	07:11 15:33	08:18 14:42	09:20 (3) 12:37 (1)
8	08:31 15:00	09:34 (3) 12:51 (1)	07:35 16:12	06:19 17:22	04:47 18:36	03:25 19:48	02:27 20:49	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 15:31	08:19 14:41	09:20 (3) 12:38 (1)
9	08:30 15:02	09:35 (3) 12:51 (1)	07:32 16:15	06:16 17:25	04:44 18:39	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:52 18:20	06:00 16:51	07:16 15:29	08:21 14:40	09:21 (3) 12:38 (1)
10	08:29 15:04	09:36 (3) 12:52 (1)	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:53	02:25 20:51	02:38 20:49	03:42 19:45	04:54 18:17	06:03 16:48	07:18 15:26	08:22 14:40	09:21 (3) 12:39 (1)
11	08:28 15:06	09:36 (3) 12:51 (1)	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:53	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24	08:24 14:39	09:21 (3) 12:39 (1)
12	08:27 15:08	09:37 (3) 12:51 (1)	07:25 16:23	06:07 17:32	04:36 18:46	03:15 19:57	02:24 20:54	02:42 20:46	03:47 19:39	04:58 18:11	06:07 16:43	07:23 15:22	08:25 14:39	09:22 (3) 12:40 (1)
13	08:25 15:10	09:38 (3) 12:52 (1)	07:22 16:25	06:04 17:35	04:33 18:48	03:12 19:59	02:23 20:54	02:43 20:44	03:49 19:37	05:01 18:08	06:10 16:40	07:26 15:20	08:27 14:39	09:22 (3) 12:40 (1)
14	08:24 15:12	09:39 (3) 12:51 (1)	07:20 16:28	06:01 17:37	04:30 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:17	08:28 14:38	09:23 (3) 12:41 (1)
15	08:23 15:14	09:40 (3) 12:51 (1)	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:23 20:56	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	07:31 15:15	08:29 14:38	09:23 (3) 12:41 (1)
16	08:21 15:16	09:41 (3) 12:51 (1)	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	02:22 20:57	02:49 20:40	03:56 19:29	05:07 17:59	06:17 16:31	07:33 15:13	08:30 14:38	09:23 (3) 12:41 (1)
17	08:20 15:18	09:43 (3) 12:50 (1)	07:12 16:35	05:52 17:44	04:21 18:58	03:03 20:09	02:22 20:57	02:50 20:38	03:59 19:26	05:10 17:56	06:19 16:28	07:35 15:11	08:31 14:38	09:24 (3) 12:42 (1)
18	08:18 15:21	09:45 (3) 12:49 (1)	07:09 16:38	05:49 17:46	04:18 19:00	03:01 20:11	02:22 20:58	02:52 20:36	04:01 19:23	05:12 17:53	06:22 16:26	07:38 15:09	08:32 14:38	09:24 (3) 12:42 (1)
19	08:17 15:23	09:48 (3) 12:48 (1)	07:06 16:40	05:46 17:49	04:16 19:02	02:59 20:13	02:22 20:58	02:54 20:35	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:07	08:33 14:38	09:25 (3) 12:43 (1)
20	08:15 15:25	09:48 (3) 12:34 (1)	07:04 16:43	05:43 17:51	04:13 19:05	02:57 20:15	02:22 20:59	02:56 20:33	04:06 19:18	05:17 17:47	06:27 16:20	07:43 15:03	08:33 14:39	09:26 (3) 12:44 (1)
21	08:13 15:27	09:48 (3) 12:37 (1)	07:01 16:45	05:40 17:54	04:10 19:07	02:55 20:17	02:22 20:59	02:58 20:31	04:08 19:15	05:19 17:44	06:29 16:17	07:45 15:03	08:34 12:13 (1)	09:26 (3) 12:44 (1)
22	08:11 15:30	09:49 (3) 12:34 (1)	07:00 16:48	05:37 17:56	04:07 19:10	02:53 20:19	02:22 20:59	03:00 20:29	04:10 19:12	05:21 17:41	06:31 16:14	07:47 15:02	08:35 12:23 (1)	09:27 (3) 12:45 (1)
23	08:10 15:32	09:51 (3) 12:32 (1)	07:00 16:55	05:34 17:58	04:04 19:12	02:51 20:21	02:22 20:59	03:02 20:27	04:13 19:09	05:23 17:38	06:34 16:12	07:50 15:00	08:36 12:24 (1)	09:27 (3) 12:45 (1)
24	08:08 15:35	09:53 (3) 12:30 (1)	06:58 16:53	05:31 18:01	04:02 19:14	02:49 20:23	02:22 20:59	03:04 20:25	04:15 19:06	05:26 17:35	06:36 16:09	07:52 14:58	08:36 12:26 (1)	09:27 (3) 12:45 (1)
25	08:06 15:37	09:55 (3) 12:28 (1)	06:56 16:55	05:29 18:03	03:59 19:17	02:47 20:26	02:23 20:59	03:06 20:23	04:17 19:03	05:28 17:32	06:39 16:06	07:54 14:57	08:36 12:28 (1)	09:28 (3) 12:46 (1)
26	08:04 15:39	09:57 (3) 12:26 (1)	06:54 16:58	05:26 18:05	03:56 19:19	02:45 20:28	02:23 20:59	03:09 20:21	04:19 19:01	05:30 17:29	06:41 16:04	07:56 14:55	08:36 12:29 (1)	09:29 (3) 12:47 (1)
27	08:02 15:42	09:59 (3) 12:24 (1)	06:52 17:00	05:23 18:08	03:53 19:22	02:44 20:29	02:24 20:59	03:11 20:18	04:22 18:58	05:32 17:26	06:44 16:01	07:58 14:53	08:36 12:30 (1)	09:28 (3) 12:46 (1)
28	08:00 15:44	10:01 (3) 12:22 (1)	06:49 17:03	05:20 18:10	03:51 19:24	02:42 20:31	02:25 20:59	03:13 20:16	04:24 18:55	05:35 17:23	06:46 15:58	08:01 14:52	08:36 12:30 (1)	09:29 (3) 12:47 (1)
29	07:58 15:47	10:03 (3) 12:20 (1)	06:47 17:05	05:17 18:12	03:48 19:26	02:40 20:33	02:25 20:58	03:15 20:14	04:26 18:52	05:37 17:20	06:49 15:56	08:03 14:51	08:36 12:32 (1)	09:30 (3) 12:48 (1)
30	07:56 15:49	10:05 (3) 12:18 (1)	06:45 17:03	05:15 18:10	03:45 19:24	02:39 20:35	02:26 20:58	03:17 20:12	04:29 18:49	05:39 17:17	06:51 15:53	08:05 14:49	08:36 12:32 (1)	09:30 (3) 12:47 (1)
31	07:53 15:52	10:07 (3) 12:16 (1)	06:43 17:01	05:13 18:08	03:43 19:22	02:37 20:37	02:27 20:58	03:19 20:09	04:31 18:46	05:41 15:51	06:54 15:51	08:06 14:47	08:36 12:47 (1)	09:30 (3) 12:48 (1)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194		
Total, worst case	1119										321		2429	
Sun reduction	0.27										0.28		0.30	
Oper. time red.	0.93										0.93		0.93	
Wind dir. red.	0.68										0.67		0.69	
Total reduction	0.17										0.18		0.19	
Total, real	193										56		468	

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: AF - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (236)

Assumptions for shadow calculations

Maximum distance for influence 1 500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30
Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182
Idle start wind speed: Cut in wind speed from power curve

Table with 12 columns for months (January to December) and multiple rows for sun rise and set times, including potential sun hours and reduction factors.

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

Matrix for table layout with columns: Day in month, Sun rise (hh:mm), Sun set (hh:mm), Minutes with flicker, First time (hh:mm) with flicker, Last time (hh:mm) with flicker, (WTG causing flicker first time), (WTG causing flicker last time)

Project:  
Gismarvik

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Calculated:  
15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: AG - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (237)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []  
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30  
Operational time  
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:36	13:10 (1)	07:51	06:39	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	14	13:24 (1)	15:54	17:05	18:20	19:31	20:39	20:57	18:43	17:15	15:48	14:48
2	08:35	13:11 (1)	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:58	08:09
	14:50	13	13:24 (1)	15:57	17:08	18:22	19:34	20:40	20:57	18:40	17:12	15:45	14:47
3	08:35	13:12 (1)	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	12	13:24 (1)	15:59	17:10	18:24	19:36	20:42	20:56	18:37	17:09	15:43	14:46
4	08:34	13:13 (1)	07:44	06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:13
	14:53	11	13:24 (1)	16:02	17:13	18:27	19:38	20:43	20:55	18:35	17:06	15:40	14:45
5	08:33	13:14 (1)	07:42	06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14
	14:55	10	13:24 (1)	16:05	17:15	18:29	19:41	20:45	20:54	18:32	17:03	15:38	14:44
6	08:33	13:16 (1)	07:40	06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:56	7	13:23 (1)	16:07	17:18	18:31	19:43	20:46	20:53	18:29	17:00	15:36	14:43
7	08:32	13:18 (1)	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
	14:58	4	13:22 (1)	16:10	17:20	18:34	19:45	20:48	20:52	18:26	16:57	15:33	14:42
8	08:31		07:35	06:18	04:47	03:25	02:27	02:35	03:38	04:49	05:58	07:13	08:19
	15:00		16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30		07:32	06:16	04:44	03:22	02:26	02:37	03:40	04:52	06:00	07:16	08:21
	15:02		16:15	17:25	18:39	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29		07:30	06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	08:22
	15:04		16:17	17:27	18:41	19:53	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28		07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06		16:20	17:30	18:43	19:55	20:53	20:47	19:42	18:14	16:45	15:24	14:39
12	08:27		07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
	15:08		16:23	17:32	18:46	19:57	20:54	20:46	19:39	18:11	16:42	15:22	14:39
13	08:25		07:22	06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	08:27
	15:10		16:25	17:34	18:48	19:59	20:55	20:45	19:37	18:08	16:40	15:19	14:38
14	08:24		07:20	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12		16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23		07:17	05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	08:29
	15:14		16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21		07:14	05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	08:30
	15:16		16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20		07:12	05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31
	15:18		16:35	17:44	18:58	20:09	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18		07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:20		16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:17		07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23		16:40	17:49	19:02	20:13	20:58	20:35	19:20	17:50	16:23	15:07	14:38
20	08:15		07:04	05:43	04:13	02:57	02:22	02:56	04:06	05:16	06:26	07:43	08:33
	15:25		16:43	17:51	19:05	20:15	20:59	20:33	19:18	17:47	16:20	15:05	14:38
21	08:13		07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27		16:45	17:54	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
22	08:11		06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35
	15:30		16:48	17:56	19:10	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
23	08:10		06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:50	08:35
	15:32		16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08		06:53	05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	08:36
	15:35		16:53	18:01	19:14	20:24	21:00	20:25	19:06	17:35	16:09	14:58	14:40
25	08:06		06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
	15:37		16:55	18:03	19:17	20:26	20:59	20:23	19:03	17:32	16:06	14:57	14:41
26	08:04		06:47	05:26	03:56	02:45	02:23	03:08	04:19	05:30	06:41	07:56	08:36
	15:39		16:58	18:05	19:19	20:28	20:59	20:21	19:01	17:29	16:04	14:55	14:42
27	08:02		06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:44	07:58	08:36
	15:42		17:00	18:08	19:22	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00		06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:01	08:36
	15:44		17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:23	15:58	14:52	14:44
29	07:58			05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:49	08:03	08:36
	15:47			18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45
30	07:56			05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:49			18:15	19:29	20:35	20:58	20:12	18:49	17:17	15:53	14:49	14:46
31	07:53			05:11	03:42	02:37		03:19	04:31		06:54		08:36
	15:52			18:17		20:37		20:09	18:46		15:50		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	193	
Total, worst case		71											395
Sun reduction		0.27											0.30
Oper. time red.		0.93											0.93
Wind dir. red.		0.59											0.59
Total reduction		0.15											0.17
Total, real		11											65

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:

Gismarvik

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Licensed user:

Kjeller Vindteknikk AS  
Gunnar Randres vei 12  
NO-2007 Kjeller  
(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

Calculation: Skyggekast Gismarvik Shadow receptor: AH - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (238)

**Assumptions for shadow calculations**

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December		
1	08:36	13:20 (1)	07:51	06:39	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07	13:11 (1)
2	08:35	13:21 (1)	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:58	08:09	13:10 (1)
3	08:35	13:21 (1)	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:09 (1)
4	08:34	13:22 (1)	07:44	06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12	13:10 (1)
5	08:33	13:23 (1)	07:42	06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14	13:10 (1)
6	08:33	13:24 (1)	07:40	06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16	13:10 (1)
7	08:32	13:25 (1)	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18	13:10 (1)
8	08:31	13:25 (1)	07:35	06:18	04:47	03:25	02:27	02:35	03:38	04:49	05:58	07:13	08:19	13:10 (1)
9	08:30	13:26 (1)	07:32	06:16	04:44	03:22	02:26	02:37	03:40	04:52	06:00	07:16	08:21	13:10 (1)
10	08:29	13:28 (1)	07:30	06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	08:22	13:11 (1)
11	08:28	13:28 (1)	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24	13:11 (1)
12	08:27	13:29 (1)	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25	13:11 (1)
13	08:25	13:32 (1)	07:22	06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	08:27	13:11 (1)
14	08:24	13:35 (1)	07:20	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28	13:12 (1)
15	08:23	13:38 (1)	07:17	05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	08:29	13:12 (1)
16	08:21	13:42 (1)	07:14	05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	08:30	13:13 (1)
17	08:20	13:45 (1)	07:12	05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31	13:13 (1)
18	08:18	13:48 (1)	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32	13:13 (1)
19	08:17	13:51 (1)	07:07	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33	13:14 (1)
20	08:15	13:54 (1)	07:04	05:43	04:13	02:57	02:22	02:56	04:06	05:16	06:26	07:43	08:33	13:15 (1)
21	08:13	13:57 (1)	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34	13:15 (1)
22	08:11	14:00 (1)	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35	13:16 (1)
23	08:10	14:03 (1)	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:50	08:35	13:16 (1)
24	08:08	14:06 (1)	06:53	05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	08:36	13:16 (1)
25	08:06	14:09 (1)	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36	13:17 (1)
26	08:04	14:12 (1)	06:47	05:25	03:56	02:45	02:23	03:08	04:19	05:30	06:41	07:56	08:36	13:18 (1)
27	08:02	14:15 (1)	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:44	07:58	08:36	13:17 (1)
28	08:00	14:18 (1)	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:01	08:36	13:18 (1)
29	07:58	14:21 (1)	06:38	05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:49	08:03	08:36	13:19 (1)
30	07:55	14:24 (1)	06:35	05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36	13:19 (1)
31	07:53	14:27 (1)	06:32	05:11	03:42	02:37	02:26	03:19	04:31	05:41	06:54	08:09	08:36	13:20 (1)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	193	593	193
Total, worst case	212												20	593
Sun reduction	0.27												0.28	0.30
Oper. time red.	0.93												0.93	0.93
Wind dir. red.	0.58												0.58	0.58
Total reduction	0.15												0.15	0.16
Total, real	31												3	97

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	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)
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Project:

Gismarvik

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Licensed user:

Kjeller Vindteknikk AS

Gunnar Randres vei 12

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(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: AI - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (239)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:36	13:13 (1)	07:51	06:39	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	13:26 (1)	15:54	17:05	18:20	19:31	20:39	20:57	20:07	18:43	17:15	15:48	14:48
2	08:35	13:14 (1)	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:58	08:09
	14:50	13:26 (1)	15:57	17:08	18:22	19:34	20:40	20:57	20:05	18:40	17:12	15:45	14:47
3	08:35	13:15 (1)	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	13:25 (1)	15:59	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
4	08:34	13:16 (1)	07:44	06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:13
	14:53	13:25 (1)	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:35	17:06	15:40	14:45
5	08:33	13:17 (1)	07:42	06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14
	14:55	13:25 (1)	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44
6	08:33	13:20 (1)	07:40	06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:56	13:24 (1)	16:07	17:18	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32		07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
	14:58		16:10	17:20	18:34	19:45	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31		07:35	06:18	04:47	03:24	02:27	02:35	03:38	04:49	05:58	07:13	08:19
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9	08:30		07:32	06:16	04:44	03:22	02:26	02:37	03:40	04:52	06:00	07:16	08:21
	15:02		16:15	17:25	18:39	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29		07:30	06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	08:22
	15:04		16:17	17:27	18:41	19:53	20:51	20:49	19:45	18:17	16:48	15:26	14:40
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	15:06		16:20	17:30	18:43	19:55	20:53	20:47	19:42	18:14	16:45	15:24	14:39
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	15:10		16:25	17:34	18:48	19:59	20:55	20:45	19:37	18:08	16:40	15:19	14:38
14	08:24		07:20	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12		16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23		07:17	05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	08:29
	15:14		16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21		07:14	05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	08:30
	15:16		16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20		07:12	05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31
	15:18		16:35	17:44	18:58	20:09	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18		07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:20		16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:17		07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23		16:40	17:49	19:02	20:13	20:58	20:35	19:20	17:50	16:23	15:07	14:38
20	08:15		07:04	05:43	04:13	02:57	02:22	02:56	04:06	05:16	06:26	07:43	08:33
	15:25		16:43	17:51	19:05	20:15	20:59	20:33	19:18	17:47	16:20	15:05	14:38
21	08:13		07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27		16:45	17:54	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
22	08:11		06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35
	15:30		16:48	17:56	19:10	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
23	08:10		06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:50	08:35
	15:32		16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08		06:53	05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	08:36
	15:35		16:53	18:01	19:14	20:24	21:00	20:25	19:06	17:35	16:09	14:58	14:40
25	08:06		06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
	15:37		16:55	18:03	19:17	20:26	20:59	20:23	19:03	17:32	16:06	14:57	14:41
26	08:04		06:47	05:26	03:56	02:45	02:23	03:08	04:19	05:30	06:41	07:56	08:36
	15:39		16:58	18:05	19:19	20:28	20:59	20:21	19:01	17:29	16:04	14:55	14:42
27	08:02		06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:44	07:58	08:36
	15:42		17:00	18:08	19:22	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00		06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:01	08:36
	15:44		17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:23	15:58	14:52	14:44
29	07:58			05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:49	08:03	08:36
	15:47			18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45
30	07:56			05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:49			18:15	19:29	20:35	20:58	20:12	18:49	17:17	15:53	14:49	14:46
31	07:53			05:11	03:42	02:37		03:19	04:31		06:54		08:36
	15:52			18:17	19:31	20:37		20:09	18:46		15:50		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	193	
Total, worst case		56											357
Sun reduction		0.27											0.30
Oper. time red.		0.93											0.93
Wind dir. red.		0.59											0.59
Total reduction		0.15											0.16
Total, real		8											59

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

Calculation: Skyggekast Gismarvik Shadow receptor: AJ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (240)

**Assumptions for shadow calculations**

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December		
1	08:36 14:49	13:25 (1) 13:45 (1)	07:51 15:54	06:39 17:05	05:08 18:20	03:42 19:31	02:36 20:39	02:27 20:57	03:22 20:27	04:33 18:43	05:42 17:15	06:56 15:48	08:07 14:48	13:14 (1) 15:29 (1)
2	08:35 14:50	13:25 (1) 13:45 (1)	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:34	02:34 20:40	02:28 20:57	03:24 20:05	04:36 18:40	05:44 17:12	06:58 15:45	08:09 14:47	13:14 (1) 15:29 (1)
3	08:35 14:52	13:26 (1) 13:45 (1)	07:47 15:59	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	08:11 14:46	13:13 (1) 15:30 (1)
4	08:34 14:53	13:26 (1) 13:45 (1)	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:28 20:00	04:40 18:35	05:49 17:06	07:03 15:40	08:12 14:45	13:14 (1) 15:31 (1)
5	08:33 14:55	13:27 (1) 13:46 (1)	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:41	02:30 20:45	02:31 20:54	03:31 19:57	04:42 18:32	05:51 17:03	07:06 15:38	08:14 14:44	13:14 (1) 15:32 (1)
6	08:33 14:56	13:28 (1) 13:46 (1)	07:40 16:07	06:24 17:18	04:53 18:31	03:30 19:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36	08:16 14:43	13:14 (1) 15:32 (1)
7	08:32 14:58	13:29 (1) 13:47 (1)	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:48	02:34 20:52	03:35 19:52	04:47 18:26	05:56 16:57	07:11 15:33	08:18 14:42	13:14 (1) 15:33 (1)
8	08:31 15:00	13:29 (1) 13:46 (1)	07:35 16:12	06:18 17:22	04:47 18:36	03:25 19:48	02:27 20:49	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 15:31	08:19 14:41	13:14 (1) 15:34 (1)
9	08:30 15:02	13:30 (1) 13:47 (1)	07:32 16:15	06:16 17:25	04:44 18:39	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:52 18:20	06:00 16:51	07:16 15:28	08:21 14:40	13:15 (1) 15:34 (1)
10	08:29 15:04	13:31 (1) 13:47 (1)	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:53	02:25 20:51	02:38 20:49	03:42 19:45	04:54 18:17	06:03 16:48	07:18 15:26	08:22 14:40	13:15 (1) 15:35 (1)
11	08:28 15:06	13:32 (1) 13:46 (1)	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:53	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24	08:24 14:39	13:15 (1) 15:35 (1)
12	08:27 15:08	13:33 (1) 13:46 (1)	07:25 16:23	06:07 17:32	04:36 18:46	03:15 19:57	02:24 20:54	02:42 20:46	03:47 19:39	04:58 18:11	06:07 16:42	07:23 15:22	08:25 14:39	13:16 (1) 15:36 (1)
13	08:25 15:10	13:35 (1) 13:46 (1)	07:22 16:25	06:04 17:34	04:33 18:48	03:12 19:59	02:23 20:54	02:43 20:44	03:49 19:37	05:01 18:08	06:10 16:40	07:26 15:19	08:27 14:38	13:16 (1) 15:36 (1)
14	08:24 15:12	13:37 (1) 13:45 (1)	07:20 16:28	06:01 17:37	04:30 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:17	08:28 14:38	13:17 (1) 15:37 (1)
15	08:23 15:14	13:45 (1)	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:22 20:56	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	07:31 15:15	08:29 14:38	13:17 (1) 15:37 (1)
16	08:21 15:16	13:45 (1)	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	02:22 20:57	02:48 20:40	03:56 19:29	05:07 17:59	06:17 16:31	07:33 15:13	08:30 14:38	13:17 (1) 15:37 (1)
17	08:20 15:18	13:45 (1)	07:12 16:35	05:52 17:44	04:21 18:58	03:03 20:09	02:22 20:57	02:50 20:38	03:59 19:26	05:10 17:56	06:19 16:28	07:35 15:11	08:31 14:38	13:18 (1) 15:38 (1)
18	08:18 15:20	13:45 (1)	07:09 16:38	05:49 17:46	04:18 19:00	03:01 20:11	02:22 20:58	02:52 20:36	04:01 19:23	05:12 17:53	06:22 16:25	07:38 15:09	08:32 14:38	13:18 (1) 15:38 (1)
19	08:17 15:23	13:45 (1)	07:06 16:40	05:46 17:49	04:15 19:02	02:59 20:13	02:22 20:58	02:54 20:35	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:07	08:33 14:38	13:19 (1) 15:39 (1)
20	08:15 15:25	13:45 (1)	07:04 16:43	05:43 17:51	04:13 19:05	02:57 20:15	02:22 20:59	02:56 20:33	04:06 19:18	05:16 17:47	06:26 16:20	07:43 15:05	08:33 14:38	13:19 (1) 15:40 (1)
21	08:13 15:27	13:45 (1)	07:01 16:45	05:40 17:54	04:10 19:07	02:55 20:17	02:22 20:59	02:58 20:31	04:08 19:15	05:19 17:44	06:29 16:17	07:45 15:03	08:34 14:39	13:19 (1) 15:40 (1)
22	08:11 15:30	13:45 (1)	06:58 16:48	05:37 17:56	04:07 19:10	02:53 20:19	02:22 20:59	03:00 20:29	04:10 19:12	05:21 17:41	06:31 16:14	07:47 15:02	08:35 14:39	13:20 (1) 15:40 (1)
23	08:10 15:32	13:45 (1)	06:55 16:50	05:34 17:58	04:04 19:12	02:51 20:21	02:22 20:59	03:02 20:27	04:12 19:09	05:23 17:38	06:34 16:12	07:50 15:00	08:35 14:40	13:20 (1) 15:41 (1)
24	08:08 15:35	13:45 (1)	06:53 16:53	05:31 18:01	04:01 19:14	02:49 20:23	02:22 20:59	03:04 20:25	04:15 19:06	05:26 17:35	06:36 16:09	07:52 14:58	08:36 14:40	13:21 (1) 15:41 (1)
25	08:06 15:37	13:45 (1)	06:50 16:55	05:28 18:03	03:59 19:17	02:47 20:26	02:23 20:59	03:06 20:23	04:17 19:03	05:28 17:32	06:39 16:06	07:54 14:57	08:36 14:41	13:22 (1) 15:42 (1)
26	08:04 15:39	13:45 (1)	06:47 16:58	05:26 18:05	03:56 19:19	02:45 20:28	02:23 20:59	03:08 20:21	04:19 19:01	05:30 17:29	06:41 16:04	07:56 14:55	08:36 14:42	13:22 (1) 15:43 (1)
27	08:02 15:42	13:45 (1)	06:44 17:00	05:23 18:08	03:53 19:22	02:44 20:29	02:24 20:59	03:11 20:18	04:22 18:58	05:32 17:26	06:44 16:01	07:58 14:53	08:36 14:43	13:22 (1) 15:44 (1)
28	08:00 15:44	13:45 (1)	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	02:25 20:59	03:13 20:16	04:24 18:55	05:35 17:23	06:46 15:58	08:01 14:52	08:36 14:44	13:23 (1) 15:45 (1)
29	07:58 15:47	13:45 (1)	06:38 17:06	05:17 18:12	03:48 19:26	02:40 20:33	02:25 20:58	03:15 20:14	04:26 18:52	05:37 17:20	06:49 15:56	08:03 14:51	08:36 14:45	13:23 (1) 15:46 (1)
30	07:55 15:49	13:45 (1)	06:35 17:09	05:14 18:15	03:45 19:29	02:39 20:35	02:26 20:58	03:17 20:12	04:29 18:49	05:39 17:17	06:51 15:53	08:05 14:49	08:36 14:46	13:23 (1) 15:47 (1)
31	07:53 15:52	13:45 (1)	06:32 17:12	05:11 18:17	03:42 19:29	02:37 20:37	02:27 20:59	03:19 20:09	04:31 18:46	05:41 17:17	06:54 15:50	08:06 14:49	08:36 14:47	13:24 (1) 15:48 (1)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	193	602	193
Total, worst case	229											32	602	602
Sun reduction	0.27											0.28	0.30	0.30
Oper. time red.	0.93											0.93	0.93	0.93
Wind dir. red.	0.58											0.58	0.58	0.58
Total reduction	0.15											0.15	0.16	0.16
Total, real	33											5	98	98

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: AK - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (241)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum

813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:36	12:49 (2)   07:51	14:25 (1)   06:39	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07	12:39 (2)
2	08:35	12:49 (2)   07:49	14:26 (1)   06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:58	08:09	12:39 (2)
3	08:35	12:50 (2)   07:47	14:28 (1)   06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	12:38 (2)
4	08:34	12:50 (2)   07:44	14:30 (1)   06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12	12:39 (2)
5	08:33	12:51 (2)   07:42	14:31 (1)   06:27	04:56	03:32	02:30	02:28	03:26	04:41	05:50	07:04	08:13	12:38 (2)
6	08:33	12:52 (2)   07:39	14:32 (1)   06:24	04:53	03:30	02:29	02:27	03:24	04:42	05:51	07:05	08:14	12:38 (2)
7	08:32	12:53 (2)   07:37	14:33 (1)   06:21	04:50	03:27	02:28	02:26	03:22	04:43	05:52	07:06	08:15	12:38 (2)
8	08:31	12:53 (2)   07:35	14:34 (1)   06:18	04:47	03:25	02:27	02:25	03:20	04:44	05:53	07:07	08:16	12:38 (2)
9	08:30	12:55 (2)   07:32	14:35 (1)   06:16	04:44	03:22	02:26	02:24	03:18	04:45	05:54	07:08	08:17	12:38 (2)
10	08:29	12:55 (2)   07:30	14:36 (1)   06:13	04:41	03:20	02:25	02:23	03:14	04:46	05:55	07:09	08:18	12:39 (2)
11	08:28	12:57 (2)   07:27	14:37 (1)   06:10	04:38	03:17	02:25	02:23	03:10	04:47	05:56	07:10	08:19	12:39 (2)
12	08:27	12:58 (2)   07:25	14:38 (1)   06:07	04:36	03:15	02:24	02:22	03:06	04:48	05:57	07:11	08:20	12:39 (2)
13	08:25	13:00 (2)   07:22	14:39 (1)   06:04	04:33	03:12	02:23	02:21	03:02	04:49	05:58	07:12	08:21	12:39 (2)
14	08:24	13:02 (2)   07:19	14:40 (1)   06:01	04:30	03:10	02:23	02:21	02:58	04:50	05:59	07:13	08:22	12:40 (2)
15	08:23	13:03 (2)   07:17	14:41 (1)   05:58	04:27	03:08	02:22	02:20	02:56	04:51	06:00	07:14	08:23	12:40 (2)
16	08:21	13:05 (2)   07:14	14:42 (1)   05:55	04:24	03:06	02:22	02:20	02:54	04:52	06:01	07:15	08:24	12:40 (2)
17	08:20	13:07 (2)   07:12	14:43 (1)   05:52	04:21	03:03	02:22	02:20	02:52	04:53	06:02	07:16	08:25	12:40 (2)
18	08:18	13:09 (2)   07:09	14:44 (1)   05:49	04:18	03:01	02:22	02:20	02:50	04:54	06:03	07:17	08:26	12:40 (2)
19	08:17	13:11 (2)   07:06	14:45 (1)   05:46	04:15	02:59	02:22	02:20	02:48	04:55	06:04	07:18	08:27	12:40 (2)
20	08:15	13:13 (2)   07:04	14:46 (1)   05:43	04:13	02:57	02:22	02:20	02:46	04:56	06:05	07:19	08:28	12:40 (2)
21	08:13	13:15 (2)   07:01	14:47 (1)   05:40	04:10	02:55	02:22	02:20	02:44	04:57	06:06	07:20	08:29	12:40 (2)
22	08:11	13:17 (2)   06:58	14:48 (1)   05:37	04:07	02:53	02:22	02:20	02:42	04:58	06:07	07:21	08:30	12:40 (2)
23	08:10	13:19 (2)   06:55	14:49 (1)   05:34	04:04	02:51	02:22	02:20	02:40	04:59	06:08	07:22	08:31	12:40 (2)
24	08:08	13:21 (2)   06:53	14:50 (1)   05:31	04:01	02:49	02:22	02:20	02:38	05:00	06:09	07:23	08:32	12:40 (2)
25	08:06	13:23 (2)   06:50	14:51 (1)   05:28	03:59	02:47	02:23	02:20	02:36	05:01	06:10	07:24	08:33	12:40 (2)
26	08:04	13:25 (2)   06:47	14:52 (1)   05:25	03:56	02:45	02:23	02:20	02:34	05:02	06:11	07:25	08:34	12:40 (2)
27	08:02	13:27 (2)   06:44	14:53 (1)   05:22	03:53	02:44	02:24	02:20	02:32	05:03	06:12	07:26	08:35	12:40 (2)
28	08:00	13:29 (2)   06:41	14:54 (1)   05:19	03:51	02:42	02:25	02:20	02:30	05:04	06:13	07:27	08:36	12:40 (2)
29	07:58	13:31 (2)   06:38	14:55 (1)   05:16	03:48	02:40	02:26	02:20	02:28	05:05	06:14	07:28	08:37	12:40 (2)
30	07:55	13:33 (2)   06:35	14:56 (1)   05:13	03:45	02:39	02:26	02:20	02:26	05:06	06:15	07:29	08:38	12:40 (2)
31	07:53	13:35 (2)   06:32	14:57 (1)   05:10	03:42	02:37	02:27	02:20	02:24	05:07	06:16	07:30	08:39	12:40 (2)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194	868
Total, worst case	609	63									436		868
Sun reduction	0.27	0.29									0.28		0.30
Oper. time red.	0.93	0.93									0.93		0.93
Wind dir. red.	0.56	0.53									0.53		0.61
Total reduction	0.14	0.14									0.14		0.17
Total, real	86	9									61		148

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: AL - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (242)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December		
1	08:36	11:33 (3)   07:51	14:29 (1)   06:39	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07		12:42 (2)
2	08:35	13:19 (2)   07:49	14:52 (1)   06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:58	08:09	20	13:02 (2)
3	08:35	13:19 (2)   07:47	14:51 (1)   06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	22	13:03 (2)
4	08:34	13:19 (2)   07:44	14:52 (1)   06:30	05:00	03:34	02:32	02:28	03:23	04:40	05:49	07:03	08:12	24	13:05 (2)
5	08:33	13:20 (2)   07:42	14:50 (1)   06:27	04:58	03:32	02:31	02:27	03:21	04:42	05:51	07:06	08:14	24	13:05 (2)
6	08:33	13:20 (2)   07:40	14:50 (1)   06:25	04:56	03:31	02:30	02:26	03:20	04:44	05:53	07:08	08:16	25	13:06 (2)
7	08:32	13:21 (2)   07:38	14:49 (1)   06:23	04:54	03:30	02:29	02:25	03:19	04:46	05:55	07:10	08:18	26	13:07 (2)
8	08:31	13:22 (2)   07:36	14:48 (1)   06:21	04:52	03:29	02:28	02:24	03:18	04:48	05:57	07:12	08:20	26	13:08 (2)
9	08:30	13:23 (2)   07:34	14:47 (1)   06:19	04:50	03:28	02:27	02:23	03:17	04:50	05:59	07:14	08:22	26	13:09 (2)
10	08:29	13:24 (2)   07:32	14:46 (1)   06:17	04:48	03:27	02:26	02:22	03:16	04:52	06:00	07:16	08:24	26	13:10 (2)
11	08:28	13:25 (2)   07:30	14:45 (1)   06:15	04:46	03:26	02:25	02:21	03:15	04:54	06:01	07:17	08:26	26	13:11 (2)
12	08:27	13:26 (2)   07:28	14:44 (1)   06:13	04:44	03:25	02:24	02:20	03:14	04:56	06:02	07:18	08:28	26	13:12 (2)
13	08:25	13:27 (2)   07:26	14:43 (1)   06:11	04:42	03:24	02:23	02:19	03:13	04:58	06:03	07:19	08:30	26	13:13 (2)
14	08:24	13:28 (2)   07:24	14:42 (1)   06:09	04:40	03:23	02:22	02:18	03:12	05:00	06:04	07:20	08:32	26	13:14 (2)
15	08:23	13:29 (2)   07:22	14:41 (1)   06:07	04:38	03:22	02:21	02:17	03:11	05:02	06:05	07:21	08:34	26	13:15 (2)
16	08:21	13:30 (2)   07:20	14:40 (1)   06:05	04:36	03:21	02:20	02:16	03:10	05:04	06:06	07:22	08:36	26	13:16 (2)
17	08:20	13:31 (2)   07:18	14:39 (1)   06:03	04:34	03:20	02:23	02:15	03:09	05:06	06:07	07:23	08:38	26	13:17 (2)
18	08:18	13:32 (2)   07:16	14:38 (1)   06:01	04:32	03:19	02:26	02:14	03:08	05:08	06:08	07:24	08:40	26	13:18 (2)
19	08:17	13:33 (2)   07:14	14:37 (1)   05:59	04:30	03:18	02:29	02:13	03:07	05:10	06:09	07:25	08:42	26	13:19 (2)
20	08:15	13:34 (2)   07:12	14:36 (1)   05:57	04:28	03:17	02:32	02:12	03:06	05:12	06:10	07:26	08:44	26	13:20 (2)
21	08:13	13:35 (2)   07:10	14:35 (1)   05:55	04:26	03:16	02:35	02:11	03:05	05:14	06:11	07:27	08:46	26	13:21 (2)
22	08:11	13:36 (2)   07:08	14:34 (1)   05:53	04:24	03:15	02:38	02:10	03:04	05:16	06:12	07:28	08:48	26	13:22 (2)
23	08:10	13:37 (2)   07:06	14:33 (1)   05:51	04:22	03:14	02:41	02:09	03:03	05:18	06:13	07:29	08:50	26	13:23 (2)
24	08:08	13:38 (2)   07:04	14:32 (1)   05:49	04:20	03:13	02:44	02:08	03:02	05:20	06:14	07:30	08:52	26	13:24 (2)
25	08:06	13:39 (2)   07:02	14:31 (1)   05:47	04:18	03:12	02:47	02:07	03:01	05:22	06:15	07:31	08:54	26	13:25 (2)
26	08:04	13:40 (2)   07:00	14:30 (1)   05:45	04:16	03:11	02:50	02:06	03:00	05:24	06:16	07:32	08:56	26	13:26 (2)
27	08:02	13:41 (2)   06:58	14:29 (1)   05:43	04:14	03:10	02:53	02:05	02:59	05:26	06:17	07:33	08:58	26	13:27 (2)
28	08:00	13:42 (2)   06:56	14:28 (1)   05:41	04:12	03:09	02:56	02:04	02:58	05:28	06:18	07:34	09:00	26	13:28 (2)
29	07:58	13:43 (2)   06:54	14:27 (1)   05:39	04:10	03:08	02:59	02:03	02:57	05:30	06:19	07:35	09:02	26	13:29 (2)
30	07:55	13:44 (2)   06:52	14:26 (1)   05:37	04:08	03:07	03:02	02:02	02:56	05:32	06:20	07:36	09:04	26	13:30 (2)
31	07:53	13:45 (2)   06:50	14:25 (1)   05:35	04:06	03:06	03:05	02:01	02:55	05:34	06:21	07:37	09:06	26	13:31 (2)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194		
Total, worst case	637	114									479		1059	
Sun reduction	0.27	0.29									0.28		0.30	
Oper. time red.	0.93	0.93									0.93		0.93	
Wind dir. red.	0.56	0.52									0.53		0.62	
Total reduction	0.14	0.14									0.14		0.17	
Total, real	90	16									67		182	

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

Calculation: Skyggekast Gismarvik Shadow receptor: AM - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (243)

**Assumptions for shadow calculations**

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36	12:51 (2)   07:51	14:27 (1)   06:39	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07
2	08:35	12:51 (2)   07:49	14:32 (1)   06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:58	08:09
3	08:35	13:11 (2)   07:47	14:32 (1)   06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
4	08:34	13:11 (2)   07:44	14:32 (1)   06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12
5	08:33	13:12 (2)   07:42	14:32 (1)   06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14
6	08:33	13:12 (2)   07:40	14:32 (1)   06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16
7	08:32	13:12 (2)   07:37	14:32 (1)   06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
8	08:31	13:12 (2)   07:35	14:32 (1)   06:18	04:47	03:25	02:27	02:35	03:38	04:49	05:58	07:13	08:19
9	08:30	13:11 (2)   07:32	14:32 (1)   06:16	04:44	03:22	02:26	02:37	03:40	04:52	06:00	07:16	08:21
10	08:29	13:11 (2)   07:30	14:32 (1)   06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	08:22
11	08:28	13:09 (2)   07:27	14:32 (1)   06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
12	08:27	14:18 (1)   07:25	14:32 (1)   06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
13	08:25	14:20 (1)   07:22	14:32 (1)   06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	08:27
14	08:24	14:23 (1)   07:19	14:32 (1)   06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
15	08:23	14:25 (1)   07:17	14:32 (1)   05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	08:29
16	08:21	14:28 (1)   07:14	14:32 (1)   05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	08:30
17	08:20	14:30 (1)   07:12	14:32 (1)   05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31
18	08:18	14:33 (1)   07:09	14:32 (1)   05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
19	08:17	14:36 (1)   07:06	14:32 (1)   05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
20	08:15	14:39 (1)   07:04	14:32 (1)   05:43	04:13	02:57	02:22	02:56	04:06	05:16	06:26	07:43	08:34
21	08:13	14:42 (1)   07:01	14:32 (1)   05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:35
22	08:11	14:45 (1)   06:58	14:32 (1)   05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:36
23	08:10	14:48 (1)   06:55	14:32 (1)   05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:50	08:37
24	08:08	14:51 (1)   06:53	14:32 (1)   05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	08:38
25	08:06	14:54 (1)   06:50	14:32 (1)   05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:39
26	08:04	14:57 (1)   06:47	14:32 (1)   05:25	03:56	02:45	02:23	03:08	04:19	05:30	06:41	07:56	08:40
27	08:02	14:59 (1)   06:44	14:32 (1)   05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:44	07:58	08:41
28	08:00	15:02 (1)   06:41	14:32 (1)   05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:01	08:42
29	07:58	15:05 (1)   06:38	14:32 (1)   05:18	03:49	02:41	02:26	03:15	04:26	05:36	06:47	08:02	08:43
30	07:55	15:08 (1)   06:35	14:32 (1)   05:16	03:47	02:39	02:27	03:17	04:29	05:38	06:49	08:03	08:44
31	07:53	15:11 (1)   06:32	14:32 (1)   05:14	03:45	02:37	02:28	03:19	04:31	05:40	06:51	08:04	08:45
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194
Total, worst case	520										359	609
Sun reduction	0.27	0.29									0.28	0.30
Oper. time red.	0.93	0.93									0.93	0.93
Wind dir. red.	0.56	0.54									0.54	0.60
Total reduction	0.14	0.15									0.14	0.17
Total, real	73	1									50	101

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)

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Calculated:

15.08.2011 09:56/2.7.486



SHADOW - Calendar

Calculation: Skyggekast GismarvikShadow receptor: AN - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (244)

Assumptions for shadow calculations

Maximum distance for influence 1 500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for each day of the month. Each cell contains a time range (e.g., 08:36-14:49) and a number. Summary rows at the bottom show potential sun hours, reduction factors, and real sun hours for each month.

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

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



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SHADOW - Calendar

Calculation: Skyggecast Gismarvik Shadow receptor: AO - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (245)

Assumptions for shadow calculations

Maximum distance for influence 1 500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes
Sunshine probability S/S0 (Sun hours/Possible sun hours) []
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30
Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1281 1143 697 478 515 675 1091 8182
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for shadow calculations, including sun rise/set times, potential sun hours, and various reduction factors.

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

Matrix with columns for Day in month, Sun rise (hh:mm), Sun set (hh:mm), Minutes with flicker, First time (hh:mm) with flicker, Last time (hh:mm) with flicker, and WTG causing flicker (first/last time).

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Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: AP - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (246)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:36	11:45 (3)   07:51	14:38 (1)   06:39	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07	12:52 (2)
2	08:35	13:04 (2)   07:49	14:38 (1)   06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:58	08:09	12:52 (2)
3	08:35	13:05 (2)   07:47	14:39 (1)   06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	14:15 (1)   08:11	12:52 (2)
4	08:34	13:05 (2)   07:44	14:39 (1)   06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	14:12 (1)   08:12	12:53 (2)
5	08:33	13:06 (2)   07:42	14:41 (1)   06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	14:11 (1)   08:14	12:53 (2)
6	08:33	13:07 (2)   07:39	14:42 (1)   06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	14:10 (1)   08:16	12:53 (2)
7	08:32	13:08 (2)   07:37	14:43 (1)   06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	14:10 (1)   08:18	12:53 (2)
8	08:31	13:08 (2)   07:35	14:45 (1)   06:18	04:47	03:25	02:27	02:35	03:38	04:49	05:58	07:13	14:10 (1)   08:19	12:54 (2)
9	08:30	13:09 (2)   07:32	14:45 (1)   06:16	04:44	03:22	02:26	02:37	03:40	04:52	06:00	07:16	14:08 (1)   08:21	12:54 (2)
10	08:29	13:09 (2)   07:30	14:45 (1)   06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	14:08 (1)   08:22	12:54 (2)
11	08:28	13:10 (2)   07:27	14:45 (1)   06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	14:09 (1)   08:24	11:35 (3)
12	08:27	13:11 (2)   07:25	14:45 (1)   06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	14:09 (1)   08:25	11:34 (3)
13	08:25	13:11 (2)   07:22	14:45 (1)   06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	14:09 (1)   08:27	11:34 (3)
14	08:24	13:12 (2)   07:19	14:45 (1)   06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	14:10 (1)   08:28	11:34 (3)
15	08:23	13:13 (2)   07:17	14:45 (1)   05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	14:10 (1)   08:29	11:34 (3)
16	08:21	13:13 (2)   07:14	14:45 (1)   05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	14:10 (1)   08:30	11:33 (3)
17	08:20	13:14 (2)   07:12	14:45 (1)   05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	14:11 (1)   08:31	11:33 (3)
18	08:18	13:14 (2)   07:09	14:45 (1)   05:49	04:18	03:01	02:22	02:52	03:58	05:11	06:20	07:36	14:11 (1)   08:32	11:33 (3)
19	08:17	13:15 (2)   07:06	14:45 (1)   05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	14:12 (1)   08:33	11:33 (3)
20	08:15	13:16 (2)   07:04	14:45 (1)   05:43	04:13	02:57	02:22	02:56	04:06	05:16	06:26	07:43	14:12 (1)   08:33	11:32 (3)
21	08:13	14:40 (1)   07:01	14:45 (1)   05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	14:15 (1)   08:34	11:35 (3)
22	08:11	14:41 (1)   06:58	14:45 (1)   05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	14:15 (1)   08:35	11:36 (3)
23	08:10	14:42 (1)   06:55	14:45 (1)   05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:50	12:59 (2)   08:35	11:36 (3)
24	08:08	14:43 (1)   06:53	14:45 (1)   05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	12:56 (2)   08:36	11:36 (3)
25	08:06	14:44 (1)   06:50	14:45 (1)   05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	12:55 (2)   08:36	11:38 (3)
26	08:04	14:45 (1)   06:47	14:45 (1)   05:25	03:56	02:45	02:23	03:08	04:19	05:30	06:41	07:56	12:54 (2)   08:36	11:38 (3)
27	08:02	14:46 (1)   06:44	14:45 (1)   05:22	03:53	02:44	02:24	03:11	04:22	05:32	06:44	07:58	12:53 (2)   08:36	11:38 (3)
28	08:00	14:47 (1)   06:41	14:45 (1)   05:19	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:01	12:52 (2)   08:36	11:39 (3)
29	07:58	14:48 (1)   06:38	14:45 (1)   05:16	03:48	02:40	02:26	03:15	04:26	05:37	06:49	08:03	12:53 (2)   08:36	11:40 (3)
30	07:55	14:49 (1)   06:35	14:45 (1)   05:13	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	12:52 (2)   08:36	11:41 (3)
31	07:53	14:50 (1)   06:32	14:45 (1)   05:10	03:42	02:37	02:27	03:19	04:31	05:41	06:53	08:06	12:51 (2)   08:36	11:41 (3)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194	1070
Total, worst case	609	151									476		0.30
Sun reduction	0.27	0.29									0.28		0.93
Oper. time red.	0.93	0.93									0.93		0.61
Wind dir. red.	0.56	0.51									0.53		0.17
Total reduction	0.14	0.14									0.14		182
Total, real	86	21									66		

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: Gismarvik

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Licensed user: Kjeller Vindteknikk AS, Gunnar Randres vei 12, NO-2007 Kjeller, (+47) 480 50 480, Tove Risberg / tove.risberg@vindteknikk.no



SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: AR - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (248)

Assumptions for shadow calculations

Maximum distance for influence: 1 500 m
Minimum sun height over horizon for influence: 3 °
Day step for calculation: 1 days
Time step for calculation: 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for days (1 to 31) showing sun rise/set times and shadow calculations. Includes summary rows for Potential sun hours, Total, worst case, Sun reduction, Oper. time red., Wind dir. red., Total reduction, and Total, real.

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) Minutes with flicker Last time (hh:mm) with flicker (WTG causing flicker last time)

Project:  
**Gismarvik**

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Licensed user:  
**Kjeller Vindteknikk AS**  
Gunnar Randres vei 12  
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(+47) 480 50 480  
Tove Risberg / tove.risberg@vindteknikk.no  
Calculated:  
15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

**Calculation:** Skyggekast Gismarvik Shadow receptor: AS - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (249)

**Assumptions for shadow calculations**

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []  
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30  
Operational time  
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December		
1	08:36 14:49	13:53 (1) 13:57 (1)	07:51 15:54	06:39 17:05	05:08 18:20	03:42 19:31	02:36 20:39	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:15	06:56 15:48	08:07 14:48	13:38 (1) 20 13:58 (1)
2	08:35 14:50	13:53 (1) 13:58 (1)	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:34	02:34 20:40	02:28 20:57	03:24 20:05	04:36 18:40	05:44 17:12	06:58 15:45	08:09 14:47	13:38 (1) 20 13:58 (1)
3	08:35 14:52	13:53 (1) 14:00 (1)	07:47 15:59	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	08:11 14:46	13:38 (1) 18 13:56 (1)
4	08:34 14:53	13:54 (1) 14:02 (1)	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:28 20:00	04:40 18:35	05:49 17:06	07:03 15:40	08:12 14:45	13:40 (1) 15 13:55 (1)
5	08:33 14:55	13:54 (1) 14:04 (1)	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:41	02:30 20:45	02:31 20:54	03:31 19:57	04:42 18:32	05:51 17:03	07:06 15:38	08:14 14:44	13:40 (1) 14 13:54 (1)
6	08:33 14:56	13:54 (1) 14:06 (1)	07:40 16:07	06:24 17:18	04:53 18:31	03:30 19:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36	08:16 14:43	13:41 (1) 11 13:52 (1)
7	08:32 14:58	13:55 (1) 14:08 (1)	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:48	02:34 20:52	03:35 19:52	04:47 18:26	05:56 16:57	07:11 15:33	08:18 14:42	13:41 (1) 10 13:51 (1)
8	08:31 15:00	13:55 (1) 14:10 (1)	07:35 16:12	06:18 17:22	04:47 18:36	03:24 19:48	02:27 20:49	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 15:31	08:19 14:41	13:42 (1) 8 13:50 (1)
9	08:30 15:02	13:55 (1) 14:13 (1)	07:32 16:15	06:16 17:25	04:44 18:39	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:52 18:20	06:00 16:51	07:16 15:28	08:21 14:40	13:43 (1) 6 13:49 (1)
10	08:29 15:04	13:56 (1) 14:15 (1)	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:53	02:25 20:51	02:38 20:49	03:42 19:45	04:54 18:17	06:03 16:48	07:18 15:26	08:22 14:40	13:44 (1) 4 13:48 (1)
11	08:28 15:06	13:56 (1) 14:16 (1)	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:53	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24	08:24 14:39	13:43 (1) 4 13:47 (1)
12	08:27 15:08	13:56 (1) 14:16 (1)	07:25 16:23	06:07 17:32	04:36 18:46	03:15 19:57	02:24 20:54	02:42 20:46	03:47 19:39	04:58 18:11	06:07 16:42	07:23 15:22	08:25 14:39	13:45 (1) 2 13:47 (1)
13	08:25 15:10	13:57 (1) 14:17 (1)	07:22 16:25	06:04 17:34	04:33 18:48	03:12 19:59	02:23 20:54	02:43 20:44	03:49 19:37	05:01 18:08	06:10 16:40	07:26 15:19	08:27 14:38	13:45 (1) 2 13:46 (1)
14	08:24 15:12	13:57 (1) 14:17 (1)	07:19 16:28	06:01 17:37	04:30 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:17	08:28 14:38	12:43 (2) 5 12:48 (2)
15	08:23 15:14	13:58 (1) 14:17 (1)	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:22 20:56	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	07:31 15:15	08:29 14:38	12:42 (2) 7 12:49 (2)
16	08:21 15:16	13:58 (1) 14:17 (1)	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	02:22 20:57	02:48 20:40	03:56 19:29	05:07 17:59	06:17 16:31	07:33 15:13	08:30 14:38	12:42 (2) 8 12:50 (2)
17	08:20 15:18	13:59 (1) 14:17 (1)	07:12 16:35	05:52 17:44	04:21 18:58	03:03 20:09	02:22 20:57	02:50 20:38	03:59 19:26	05:10 17:56	06:19 16:28	07:35 15:11	08:31 14:38	12:42 (2) 9 12:51 (2)
18	08:18 15:20	14:00 (1) 14:17 (1)	07:09 16:38	05:49 17:46	04:18 19:00	03:01 20:11	02:22 20:58	02:52 20:36	04:01 19:23	05:12 17:53	06:22 16:25	07:38 15:09	08:32 14:38	12:42 (2) 9 12:51 (2)
19	08:17 15:23	14:01 (1) 14:17 (1)	07:06 16:40	05:46 17:49	04:15 19:02	02:59 20:13	02:22 20:58	02:54 20:35	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:07	08:33 14:38	12:43 (2) 9 12:52 (2)
20	08:15 15:25	14:02 (1) 14:17 (1)	07:04 16:43	05:43 17:51	04:13 19:05	02:57 20:15	02:22 20:59	02:56 20:33	04:05 19:18	05:16 17:47	06:26 16:20	07:43 15:05	08:33 14:38	12:43 (2) 10 12:53 (2)
21	08:13 15:27	14:03 (1) 14:17 (1)	07:01 16:45	05:40 17:54	04:10 19:07	02:55 20:17	02:22 20:59	02:58 20:31	04:08 19:15	05:19 17:44	06:29 16:17	07:45 15:03	08:34 14:39	12:43 (2) 10 12:53 (2)
22	08:11 15:30	14:04 (1) 14:15 (1)	06:58 16:48	05:37 17:56	04:07 19:10	02:53 20:19	02:22 20:59	03:00 20:29	04:10 19:12	05:21 17:41	06:31 16:14	07:47 15:02	08:35 14:39	12:44 (2) 10 12:54 (2)
23	08:10 15:32	14:07 (1) 14:13 (1)	06:55 16:50	05:34 17:58	04:04 19:12	02:51 20:21	02:22 20:59	03:02 20:27	04:12 19:09	05:23 17:38	06:34 16:12	07:50 15:00	08:35 14:40	12:44 (2) 10 12:54 (2)
24	08:08 15:35	14:08 (1) 14:13 (1)	06:53 16:53	05:31 18:01	04:01 19:14	02:49 20:23	02:22 20:59	03:04 20:25	04:15 19:06	05:26 17:35	06:36 16:09	07:52 14:58	08:36 14:40	12:44 (2) 10 12:54 (2)
25	08:06 15:37	14:09 (1) 14:14 (1)	06:50 16:55	05:28 18:03	03:59 19:17	02:47 20:26	02:23 20:59	03:06 20:23	04:17 19:03	05:28 17:32	06:39 16:06	07:54 14:57	08:36 14:41	12:45 (2) 9 12:55 (2)
26	08:04 15:39	14:09 (1) 14:14 (1)	06:47 16:58	05:26 18:05	03:56 19:19	02:45 20:27	02:23 20:59	03:08 20:21	04:19 19:01	05:30 17:29	06:41 16:04	07:56 14:55	08:36 14:42	12:47 (2) 8 12:55 (2)
27	08:02 15:42	14:10 (1) 14:15 (1)	06:44 16:59	05:23 18:08	03:53 19:22	02:44 20:29	02:24 20:59	03:11 20:18	04:22 18:58	05:32 17:26	06:44 16:01	07:58 14:53	08:36 14:43	12:47 (2) 8 12:55 (2)
28	08:00 15:44	14:11 (1) 14:16 (1)	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	02:25 20:59	03:13 20:16	04:24 18:55	05:35 17:23	06:46 15:58	08:01 14:52	08:36 14:44	12:48 (2) 7 12:55 (2)
29	07:58 15:47	14:12 (1) 14:17 (1)	06:38 17:08	05:17 18:18	03:48 19:26	02:40 20:33	02:25 20:58	03:15 20:14	04:26 18:52	05:37 17:20	06:49 15:56	08:03 14:51	08:36 14:45	12:49 (2) 6 12:55 (2)
30	07:55 15:49	14:13 (1) 14:18 (1)	06:35 17:15	05:14 18:25	03:45 19:37	02:39 20:35	02:26 20:58	03:17 20:12	04:29 18:49	05:39 17:17	06:51 15:53	08:05 14:49	08:36 14:46	12:51 (2) 4 13:53 (1)
31	07:53 15:52	14:14 (1) 14:19 (1)	06:32 17:22	05:11 18:35	03:42 19:47	02:37 20:37	02:27 20:59	03:19 20:09	04:31 18:46	06:53 15:50	08:06 14:49	08:36 14:46	08:36 14:46	13:53 (1) 2 13:55 (1)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194	275	275
Total, worst case	326											196	275	275
Sun reduction	0.27											0.28	0.30	0.30
Oper. time red.	0.93											0.93	0.93	0.93
Wind dir. red.	0.56											0.56	0.58	0.58
Total reduction	0.14											0.15	0.16	0.16
Total, real	46											28	45	45

**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:

Gismarvik

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Licensed user:

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Gunnar Randres vei 12

NO-2007 Kjeller

(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: AT - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (250)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December		
1	08:36	12:58 (2)   07:51	14:30 (1)   06:39	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07	12:51 (2)	
2	08:35	12:59 (2)   07:49	14:38 (1)   06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:58	08:09	12:50 (2)	
3	08:35	12:59 (2)   07:47	14:38 (1)   06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	12:49 (2)	
4	08:34	12:59 (2)   07:44	14:38 (1)   06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12	12:49 (2)	
5	08:33	13:01 (2)   07:42	14:38 (1)   06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14	12:48 (2)	
6	08:33	13:02 (2)   07:39	14:38 (1)   06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16	12:48 (2)	
7	08:32	13:03 (2)   07:37	14:38 (1)   06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18	12:48 (2)	
8	08:31	13:04 (2)   07:35	14:38 (1)   06:18	04:47	03:25	02:27	02:35	03:38	04:49	05:58	07:13	08:19	12:48 (2)	
9	08:30	13:05 (2)   07:32	14:38 (1)   06:16	04:44	03:22	02:26	02:37	03:40	04:52	06:00	07:16	08:21	12:47 (2)	
10	08:29	13:06 (2)   07:30	14:38 (1)   06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	14:00 (1)   08:22	12:49 (2)	
11	08:28	13:07 (2)   07:27	14:38 (1)   06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	14:09 (1)   08:24	12:48 (2)	
12	08:27	13:07 (2)   07:25	14:38 (1)   06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	14:11 (1)   08:25	12:49 (2)	
13	08:25	14:22 (1)   07:22	14:38 (1)   06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	14:13 (1)   08:27	12:49 (2)	
14	08:24	14:23 (1)   07:19	14:38 (1)   06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	14:14 (1)   08:28	12:50 (2)	
15	08:23	14:25 (1)   07:17	14:38 (1)   05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	14:15 (1)   08:29	12:50 (2)	
16	08:21	14:28 (1)   07:14	14:38 (1)   05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	14:16 (1)   08:30	12:51 (2)	
17	08:20	14:30 (1)   07:12	14:38 (1)   05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	14:17 (1)   08:31	12:52 (2)	
18	08:18	14:33 (1)   07:09	14:38 (1)   05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	14:18 (1)   08:32	12:51 (2)	
19	08:17	14:36 (1)   07:06	14:38 (1)   05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	14:19 (1)   08:33	12:52 (2)	
20	08:15	14:40 (1)   07:04	14:38 (1)   05:43	04:13	02:57	02:22	02:56	04:06	05:16	06:26	07:43	14:20 (1)   08:34	12:53 (2)	
21	08:13	14:41 (1)   07:01	14:38 (1)   05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	14:21 (1)   08:35	12:54 (2)	
22	08:11	14:42 (1)   06:58	14:38 (1)   05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	14:22 (1)   08:36	12:55 (2)	
23	08:10	14:43 (1)   06:55	14:38 (1)   05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:50	14:23 (1)   08:37	12:56 (2)	
24	08:08	14:44 (1)   06:53	14:38 (1)   05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	14:24 (1)   08:38	12:57 (2)	
25	08:06	14:45 (1)   06:50	14:38 (1)   05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	14:25 (1)   08:39	12:58 (2)	
26	08:04	14:46 (1)   06:47	14:38 (1)   05:25	03:56	02:45	02:23	03:08	04:19	05:30	06:41	07:56	14:26 (1)   08:40	12:59 (2)	
27	08:02	14:47 (1)   06:44	14:38 (1)   05:22	03:53	02:44	02:24	03:11	04:22	05:32	06:44	07:58	14:27 (1)   08:41	13:00 (2)	
28	08:00	14:48 (1)   06:41	14:38 (1)   05:19	03:50	02:42	02:25	03:13	04:24	05:35	06:46	08:01	14:28 (1)   08:42	13:01 (2)	
29	07:58	14:49 (1)   06:38	14:38 (1)   05:16	03:47	02:40	02:26	03:15	04:26	05:37	06:49	08:03	14:29 (1)   08:43	13:02 (2)	
30	07:55	14:50 (1)   06:35	14:38 (1)   05:13	03:44	02:37	02:27	03:17	04:29	05:39	06:51	08:05	14:30 (1)   08:44	13:03 (2)	
31	07:53	14:51 (1)   06:32	14:38 (1)   05:10	03:41	02:34	02:28	03:19	04:31	05:41	06:53	08:07	14:31 (1)   08:45	13:04 (2)	
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194	613	
Total, worst case	483	8											316	613
Sun reduction	0.27	0.29											0.28	0.30
Oper. time red.	0.93	0.93											0.93	0.93
Wind dir. red.	0.55	0.53											0.53	0.59
Total reduction	0.14	0.14											0.14	0.17
Total, real	67	1											44	102

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: Gismarvik

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Calculated: 15.08.2011 09:56/2.7.486



SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: AU - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (251)

Assumptions for shadow calculations

Maximum distance for influence 1 500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for daily sun rise and set times, shadow reduction, and potential sun hours. Includes summary rows at the bottom for total reduction and real sun hours.

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) Minutes with flicker Last time (hh:mm) with flicker (WTG causing flicker last time)

Project:

**Gismarvik**

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

**Calculation:** Skyggekast Gismarvik Shadow receptor: AV - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (252)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36 14:49	07:51 15:54	06:39 17:05	05:08 18:20	03:42 19:31	02:36 20:39	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:15	06:56 15:48	08:07 14:00 (1)
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:34	02:34 20:40	02:28 20:57	03:24 20:05	04:36 18:40	05:44 17:12	06:58 15:45	08:09 14:47 (1)
3	08:35 14:52	13:58 (1) 14:00 (1)	07:47 15:59	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43
4	08:34 14:53	13:59 (1) 14:02 (1)	07:44 16:02	06:30 17:13	05:04 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:28 20:00	04:40 18:35	05:49 17:06	07:03 15:40
5	08:33 14:55	13:59 (1) 14:04 (1)	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:41	02:30 20:45	02:31 20:54	03:31 19:57	04:42 18:32	05:51 17:03	07:06 15:38
6	08:33 14:56	13:59 (1) 14:06 (1)	07:40 16:07	06:24 17:18	04:53 18:31	03:30 19:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36
7	08:32 14:58	14:00 (1) 14:08 (1)	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:48	02:34 20:52	03:35 19:52	04:47 18:26	05:56 16:57	07:11 15:33
8	08:31 15:00	13:59 (1) 14:10 (1)	07:35 16:12	06:18 17:22	04:47 18:36	03:24 19:48	02:27 20:49	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 15:31
9	08:30 15:02	14:00 (1) 14:13 (1)	07:32 16:15	06:16 17:25	04:44 18:39	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:52 18:20	06:00 16:51	07:16 15:28
10	08:29 15:04	14:01 (1) 14:15 (1)	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:53	02:25 20:51	02:38 20:49	03:42 19:45	04:54 18:17	06:03 16:48	07:18 15:26
11	08:28 15:06	14:00 (1) 14:17 (1)	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:53	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24
12	08:27 15:08	14:00 (1) 14:20 (1)	07:25 16:23	06:07 17:32	04:36 18:46	03:15 19:57	02:24 20:54	02:42 20:46	03:47 19:39	04:58 18:11	06:07 16:42	07:23 15:22
13	08:25 15:10	14:01 (1) 14:21 (1)	07:22 16:25	06:04 17:34	04:33 18:48	03:12 19:59	02:23 20:54	02:43 20:44	03:49 19:37	05:01 18:08	06:10 16:40	07:26 15:19
14	08:24 15:12	14:02 (1) 14:21 (1)	07:19 16:28	06:01 17:37	04:30 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:17
15	08:23 15:14	14:02 (1) 14:22 (1)	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:22 20:56	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	07:31 15:15
16	08:21 15:16	14:02 (1) 14:22 (1)	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	02:22 20:57	02:48 20:40	03:56 19:29	05:07 17:59	06:17 16:31	07:33 15:13
17	08:20 15:18	14:03 (1) 14:22 (1)	07:12 16:35	05:52 17:44	04:21 18:58	03:03 20:09	02:22 20:57	02:50 20:38	03:59 19:26	05:10 17:56	06:19 16:28	07:35 15:11
18	08:18 15:20	14:04 (1) 14:22 (1)	07:09 16:38	05:49 17:46	04:18 19:00	03:01 20:11	02:22 20:58	02:52 20:36	04:01 19:23	05:12 17:53	06:22 16:25	07:38 15:09
19	08:17 15:23	14:04 (1) 14:22 (1)	07:06 16:40	05:46 17:49	04:15 19:02	02:59 20:13	02:22 20:58	02:54 20:35	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:07
20	08:15 15:25	14:05 (1) 14:22 (1)	07:04 16:43	05:43 17:51	04:13 19:05	02:57 20:15	02:22 20:59	02:56 20:33	04:05 19:18	05:16 17:47	06:26 16:20	07:43 15:05
21	08:13 15:27	14:07 (1) 14:21 (1)	07:01 16:45	05:40 17:54	04:10 19:07	02:55 20:17	02:22 20:59	02:58 20:31	04:08 19:15	05:19 17:44	06:29 16:17	07:45 15:03
22	08:11 15:30	14:07 (1) 14:20 (1)	06:58 16:48	05:37 17:56	04:07 19:10	02:53 20:19	02:22 20:59	03:00 20:29	04:10 19:12	05:21 17:41	06:31 16:14	07:47 15:02
23	08:10 15:32	14:09 (1) 14:19 (1)	06:55 16:50	05:34 17:58	04:04 19:12	02:51 20:21	02:22 20:59	03:02 20:27	04:12 19:09	05:23 17:38	06:34 16:12	07:50 15:00
24	08:08 15:35	14:13 (1) 14:17 (1)	06:53 16:53	05:31 18:01	04:01 19:14	02:49 20:23	02:22 20:59	03:04 20:25	04:15 19:06	05:26 17:35	06:36 16:09	07:52 14:58
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	02:47 20:26	02:23 20:59	03:06 20:23	04:17 19:03	05:28 17:32	06:39 16:06	07:54 14:57	19 14:00 (1)
26	08:04 15:39	06:47 16:58	05:26 18:05	03:56 19:19	02:45 20:27	02:23 20:59	03:08 20:21	04:19 19:01	05:30 17:29	06:41 16:04	07:56 14:55	20 14:00 (1)
27	08:02 15:42	06:44 17:00	05:23 18:08	03:53 19:22	02:44 20:29	02:24 20:59	03:11 20:18	04:22 18:58	05:32 17:26	06:44 16:01	07:58 14:53	20 14:01 (1)
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	02:25 20:59	03:13 20:16	04:24 18:55	05:35 17:23	06:46 15:58	08:01 14:52	19 14:00 (1)
29	07:58 15:47	06:41 18:12	05:17 19:26	03:48 20:33	02:40 20:58	02:25 20:58	03:15 20:14	04:26 18:52	05:37 17:20	06:49 15:56	08:03 14:51	19 14:01 (1)
30	07:55 15:49	06:41 18:15	05:14 19:29	03:45 20:35	02:39 20:58	02:26 20:58	03:17 20:12	04:29 18:49	05:39 17:17	06:51 15:53	08:05 14:49	19 14:01 (1)
31	07:53 15:52	06:41 18:17	05:11 19:43	03:45 20:53	02:37 20:37	02:26 20:58	03:19 20:09	04:31 18:46	05:41 15:50	06:53 14:49	08:06 14:46	19 14:01 (1)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194
Total, worst case	292										208	273
Sun reduction	0.27										0.28	0.30
Oper. time red.	0.93										0.93	0.93
Wind dir. red.	0.55										0.55	0.58
Total reduction	0.14										0.14	0.16
Total, real	41										30	45

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: AW - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (253)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

Table with 12 columns for months (January to December) and rows for each day of the month, showing sun rise and set times, and potential sun hours. Summary rows at the bottom show total reduction and real sun hours.

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

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

Project:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: AX - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (254)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:36	13:09 (2)   07:51	14:35 (1)   06:39	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07	13:01 (2)
2	08:35	13:30 (2)   07:49	14:45 (1)   06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:58	08:09	13:00 (2)
3	08:35	13:30 (2)   07:47	14:45 (1)   06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:13 (2)
4	08:34	13:31 (2)   07:44	14:45 (1)   06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12	13:14 (2)
5	08:33	13:12 (2)   07:42	14:45 (1)   06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14	13:15 (2)
6	08:33	13:13 (2)   07:39	14:45 (1)   06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16	13:16 (2)
7	08:32	13:14 (2)   07:37	14:45 (1)   06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18	13:17 (2)
8	08:31	13:14 (2)   07:35	14:45 (1)   06:18	04:47	03:24	02:27	02:35	03:38	04:49	05:58	07:13	08:19	13:18 (2)
9	08:30	13:16 (2)   07:32	14:45 (1)   06:16	04:44	03:22	02:26	02:37	03:40	04:52	06:00	07:16	14:09 (1)   08:21	13:19 (2)
10	08:29	13:17 (2)   07:30	14:45 (1)   06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	14:06 (1)   08:22	13:20 (2)
11	08:28	13:19 (2)   07:27	14:45 (1)   06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	14:04 (1)   08:24	13:21 (2)
12	08:27	13:20 (2)   07:25	14:45 (1)   06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	14:03 (1)   08:25	13:22 (2)
13	08:25	13:28 (2)   07:22	14:45 (1)   06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	14:03 (1)   08:27	13:23 (2)
14	08:24	13:30 (2)   07:19	14:45 (1)   06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	14:02 (1)   08:28	13:24 (2)
15	08:23	13:32 (2)   07:17	14:45 (1)   05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	14:01 (1)   08:29	13:25 (2)
16	08:21	14:28 (1)   07:14	14:45 (1)   05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	14:01 (1)   08:30	13:26 (2)
17	08:20	14:30 (1)   07:12	14:45 (1)   05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	14:02 (1)   08:31	13:27 (2)
18	08:18	14:33 (1)   07:09	14:45 (1)   05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	14:02 (1)   08:32	13:28 (2)
19	08:17	14:36 (1)   07:06	14:45 (1)   05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	14:01 (1)   08:33	13:29 (2)
20	08:15	14:38 (1)   07:04	14:45 (1)   05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:43	14:02 (1)   08:33	13:30 (2)
21	08:13	14:41 (1)   07:01	14:45 (1)   05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	14:03 (1)   08:34	13:31 (2)
22	08:11	14:44 (1)   06:58	14:45 (1)   05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	14:04 (1)   08:35	13:32 (2)
23	08:10	14:47 (1)   06:55	14:45 (1)   05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:50	14:04 (1)   08:35	13:33 (2)
24	08:08	14:48 (1)   06:53	14:45 (1)   05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	14:05 (1)   08:36	13:34 (2)
25	08:06	14:49 (1)   06:50	14:45 (1)   05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	14:06 (1)   08:36	13:35 (2)
26	08:04	14:51 (1)   06:47	14:45 (1)   05:25	03:56	02:45	02:23	03:08	04:19	05:30	06:41	07:56	14:06 (1)   08:36	13:36 (2)
27	08:02	14:52 (1)   06:44	14:45 (1)   05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:44	07:58	14:07 (1)   08:36	13:37 (2)
28	08:00	14:53 (1)   06:41	14:45 (1)   05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:01	14:08 (1)   08:36	13:38 (2)
29	07:58	14:54 (1)   06:38	14:45 (1)   05:17	03:48	02:40	02:26	03:15	04:26	05:37	06:49	08:03	14:09 (1)   08:36	13:39 (2)
30	07:55	14:55 (1)   06:35	14:45 (1)   05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	13:02 (2)   14:46	13:40 (2)
31	07:53	14:56 (1)   06:32	14:45 (1)   05:11	03:42	02:37	02:27	03:19	04:31	05:41	06:53	08:07	13:09 (2)   14:47	13:41 (2)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194	617
Total, worst case	436	10									262		617
Sun reduction	0.27	0.29									0.28		0.30
Oper. time red.	0.93	0.93									0.93		0.93
Wind dir. red.	0.55	0.52									0.53		0.59
Total reduction	0.14	0.14									0.14		0.16
Total, real	61	1									36		101

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:

Gismarvik

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Kjeller Vindteknikk AS  
Gunnar Randres vei 12  
NO-2007 Kjeller  
(+47) 480 50 480

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: AY - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (255)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:36	13:14 (2)   07:51	14:38 (1)   06:39	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07	13:04 (2)
2	08:35	13:15 (2)   07:49	14:39 (1)   06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:58	08:09	13:03 (2)
3	08:35	13:15 (2)   07:47	14:41 (1)   06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:03 (2)
4	08:34	13:16 (2)   07:44	14:54 (1)   06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12	13:03 (2)
5	08:33	13:16 (2)   07:42	14:54 (1)   06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12	13:03 (2)
6	08:33	13:17 (2)   07:39	14:55 (1)   06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14	13:03 (2)
7	08:32	13:18 (2)   07:37	14:56 (1)   06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16	13:03 (2)
8	08:31	13:18 (2)   07:35	14:56 (1)   06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16	13:03 (2)
9	08:30	13:19 (2)   07:32	14:57 (1)   06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18	13:04 (2)
10	08:29	13:20 (2)   07:30	14:58 (1)   06:18	04:47	03:25	02:27	02:35	03:38	04:49	05:58	07:13	08:20	13:04 (2)
11	08:28	13:21 (2)   07:27	14:58 (1)   06:18	04:47	03:25	02:27	02:35	03:38	04:49	05:58	07:13	08:20	13:04 (2)
12	08:27	13:22 (2)   07:25	14:59 (1)   06:15	04:44	03:22	02:26	02:37	03:40	04:52	06:00	07:16	08:24	13:04 (2)
13	08:25	13:23 (2)   07:22	15:00 (1)   06:12	04:41	03:19	02:25	02:38	03:42	04:54	06:03	07:18	08:26	13:05 (2)
14	08:24	13:24 (2)   07:19	15:01 (1)   06:09	04:38	03:16	02:24	02:40	03:45	04:56	06:05	07:21	08:28	13:05 (2)
15	08:23	13:25 (2)   07:17	15:02 (1)   06:06	04:35	03:13	02:23	02:41	03:48	04:58	06:07	07:23	08:30	13:05 (2)
16	08:21	13:26 (2)   07:14	15:03 (1)   06:03	04:32	03:10	02:22	02:42	03:51	04:59	06:08	07:24	08:31	13:05 (2)
17	08:20	13:27 (2)   07:12	15:04 (1)   06:00	04:29	03:07	02:21	02:43	03:54	05:01	06:10	07:26	08:32	13:05 (2)
18	08:18	13:28 (2)   07:09	15:05 (1)   05:57	04:26	03:04	02:20	02:44	03:57	05:02	06:11	07:27	08:33	13:05 (2)
19	08:17	14:37 (1)   07:06	15:06 (1)   05:54	04:23	03:01	02:19	02:45	03:58	05:03	06:12	07:28	08:34	13:05 (2)
20	08:15	14:38 (1)   07:04	15:07 (1)   05:51	04:20	02:58	02:18	02:46	03:59	05:04	06:13	07:29	08:35	13:05 (2)
21	08:13	14:39 (1)   07:01	15:08 (1)   05:48	04:17	02:55	02:17	02:47	04:00	05:05	06:14	07:30	08:36	13:05 (2)
22	08:11	14:40 (1)   06:58	15:09 (1)   05:45	04:14	02:52	02:16	02:48	04:01	05:06	06:15	07:31	08:37	13:05 (2)
23	08:10	14:41 (1)   06:55	15:10 (1)   05:42	04:11	02:49	02:15	02:49	04:02	05:07	06:16	07:32	08:38	13:05 (2)
24	08:08	14:42 (1)   06:53	15:11 (1)   05:39	04:08	02:46	02:14	02:50	04:03	05:08	06:17	07:33	08:39	13:05 (2)
25	08:06	14:43 (1)   06:50	15:12 (1)   05:36	04:05	02:43	02:13	02:51	04:04	05:09	06:18	07:34	08:40	13:05 (2)
26	08:04	14:44 (1)   06:47	15:13 (1)   05:33	04:02	02:40	02:12	02:52	04:05	05:10	06:19	07:35	08:41	13:05 (2)
27	08:02	14:45 (1)   06:44	15:14 (1)   05:30	03:59	02:37	02:11	02:53	04:06	05:11	06:20	07:36	08:42	13:05 (2)
28	08:00	14:46 (1)   06:41	15:15 (1)   05:27	03:56	02:34	02:10	02:54	04:07	05:12	06:21	07:37	08:43	13:05 (2)
29	07:58	14:47 (1)   06:38	15:16 (1)   05:24	03:53	02:31	02:09	02:55	04:08	05:13	06:22	07:38	08:44	13:05 (2)
30	07:55	14:48 (1)   06:35	15:17 (1)   05:21	03:50	02:28	02:08	02:56	04:09	05:14	06:23	07:39	08:45	13:05 (2)
31	07:53	14:49 (1)   06:32	15:18 (1)   05:18	03:47	02:25	02:07	02:57	04:10	05:15	06:24	07:40	08:46	13:05 (2)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194	688
Total, worst case	478	56									305		688
Sun reduction	0.27	0.29									0.28		0.30
Oper. time red.	0.93	0.93									0.93		0.93
Wind dir. red.	0.56	0.51									0.53		0.58
Total reduction	0.14	0.14									0.14		0.16
Total, real	67	8									42		112

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: AZ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (256)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum

813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:36	13:12 (2)   07:51	14:36 (1)   06:39	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07	13:03 (2)
2	08:35	13:12 (2)   07:49	14:38 (1)   06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:58	08:09	13:02 (2)
3	08:35	13:13 (2)   07:47	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
4	08:34	13:13 (2)   07:44	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
5	08:33	13:14 (2)   07:42	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
6	08:33	13:15 (2)   07:39	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
7	08:32	13:16 (2)   07:37	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
8	08:31	13:16 (2)   07:35	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
9	08:30	13:18 (2)   07:32	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
10	08:29	13:18 (2)   07:30	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
11	08:28	13:20 (2)   07:27	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
12	08:27	13:22 (2)   07:25	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
13	08:25	13:23 (2)   07:22	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
14	08:24	13:23 (2)   07:20	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
15	08:23	13:24 (2)   07:17	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
16	08:21	13:24 (2)   07:14	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
17	08:20	14:31 (1)   07:12	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
18	08:18	14:31 (1)   07:09	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
19	08:17	14:31 (1)   07:06	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
20	08:15	14:30 (1)   07:04	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
21	08:13	14:30 (1)   07:01	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
22	08:11	14:30 (1)   06:58	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
23	08:10	14:30 (1)   06:55	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
24	08:08	14:30 (1)   06:53	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
25	08:06	14:30 (1)   06:50	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
26	08:04	14:31 (1)   06:47	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
27	08:02	14:32 (1)   06:44	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
28	08:00	14:32 (1)   06:41	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
29	07:58	14:33 (1)   06:38	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
30	07:55	14:33 (1)   06:35	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
31	07:53	14:35 (1)   06:32	14:46 (1)   07:08	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:01 (2)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194	634
Total, worst case	445	20									262		0.30
Sun reduction	0.27	0.29									0.28		0.93
Oper. time red.	0.93	0.93									0.93		0.59
Wind dir. red.	0.55	0.52									0.53		0.16
Total reduction	0.14	0.14									0.14		104
Total, real	62	3									36		

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BA - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (257)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:36	13:17 (2)   07:51	14:40 (1)   06:39	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07	13:06 (2)
2	08:35	13:17 (2)   07:49	14:40 (1)   06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:58	08:09	13:06 (2)
3	08:35	13:18 (2)   07:47	14:43 (1)   06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:05 (2)
4	08:34	13:18 (2)   07:44	14:45 (1)   06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12	13:06 (2)
5	08:33	13:19 (2)   07:42	14:45 (1)   06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14	13:06 (2)
6	08:33	13:20 (2)   07:39	14:45 (1)   06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16	13:06 (2)
7	08:32	13:21 (2)   07:37	14:45 (1)   06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18	13:06 (2)
8	08:31	13:21 (2)   07:35	14:45 (1)   06:18	04:47	03:24	02:27	02:35	03:38	04:49	05:58	07:13	08:20	13:07 (2)
9	08:30	13:22 (2)   07:32	14:45 (1)   06:16	04:44	03:22	02:26	02:37	03:40	04:52	06:00	07:16	08:21	13:07 (2)
10	08:29	13:22 (2)   07:30	14:45 (1)   06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	08:22	13:07 (2)
11	08:28	13:23 (2)   07:27	14:45 (1)   06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24	13:07 (2)
12	08:27	13:23 (2)   07:25	14:45 (1)   06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25	13:08 (2)
13	08:25	13:24 (2)   07:22	14:45 (1)   06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	08:27	13:08 (2)
14	08:24	13:24 (2)   07:19	14:45 (1)   06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28	13:09 (2)
15	08:23	13:25 (2)   07:17	14:45 (1)   05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	08:29	13:09 (2)
16	08:21	13:26 (2)   07:14	14:45 (1)   05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	08:30	13:09 (2)
17	08:20	13:26 (2)   07:12	14:45 (1)   05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31	13:10 (2)
18	08:18	13:27 (2)   07:09	14:45 (1)   05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32	13:10 (2)
19	08:17	13:27 (2)   07:06	14:45 (1)   05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33	13:11 (2)
20	08:15	13:28 (2)   07:04	14:45 (1)   05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:43	08:34	13:11 (2)
21	08:13	13:29 (2)   07:01	14:45 (1)   05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:35	13:11 (2)
22	08:11	13:30 (2)   06:58	14:45 (1)   05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:36	13:12 (2)
23	08:10	13:31 (2)   06:55	14:45 (1)   05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:50	08:37	13:12 (2)
24	08:08	13:32 (2)   06:53	14:45 (1)   05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	08:38	13:13 (2)
25	08:06	13:33 (2)   06:50	14:45 (1)   05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:39	13:14 (2)
26	08:04	13:34 (2)   06:47	14:45 (1)   05:25	03:56	02:45	02:23	03:08	04:19	05:30	06:41	07:56	08:40	13:14 (2)
27	08:02	13:35 (2)   06:44	14:45 (1)   05:22	03:53	02:43	02:23	03:10	04:21	05:32	06:43	07:58	08:41	13:15 (2)
28	08:00	13:36 (2)   06:41	14:45 (1)   05:19	03:50	02:41	02:23	03:12	04:23	05:34	06:45	07:59	08:42	13:15 (2)
29	07:58	13:37 (2)   06:38	14:45 (1)   05:16	03:47	02:39	02:23	03:14	04:25	05:36	06:47	08:00	08:43	13:16 (2)
30	07:55	13:38 (2)   06:35	14:45 (1)   05:13	03:44	02:37	02:23	03:16	04:27	05:38	06:49	08:01	08:44	13:16 (2)
31	07:53	13:39 (2)   06:32	14:45 (1)   05:10	03:41	02:35	02:23	03:18	04:29	05:40	06:51	08:02	08:45	13:17 (2)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194	684
Total, worst case	466	53									292		0.30
Sun reduction	0.27	0.29									0.28		0.93
Oper. time red.	0.93	0.93									0.93		0.58
Wind dir. red.	0.56	0.51									0.53		0.16
Total reduction	0.14	0.14									0.14		112
Total, real	65	7									40		

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:

Gismarvik

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15.08.2011 12:14 / 55

Licensed user:

**Kjeller Vindteknikk AS**  
Gunnar Randres vei 12  
NO-2007 Kjeller  
(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BB - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (258)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.27	0.29	0.28	0.30	0.35	0.30	0.26	0.24	0.26	0.28	0.28	0.30

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
813	231	221	428	610	1281	1143	697	478	515	675	1091	8182

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

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:36 14:49	13:14 (3)   07:51 13:57 (4)   15:54	14:41 (2)   06:39 15:02 (2)   17:05	05:08 18:20	03:42 20:38	02:36 20:57	02:27 20:07	03:22 20:07	04:33 18:43	05:42 17:14	06:56 15:48	08:07 14:48	13:02 (3) 38   13:50 (4)
2	08:35 14:50	13:14 (3)   07:49 13:58 (4)   15:57	14:42 (2)   06:36 15:01 (2)   17:08	05:05 18:22	03:40 20:40	02:34 20:57	02:28 20:05	03:24 20:05	04:35 18:40	05:44 17:12	06:58 15:45	08:09 14:47	13:02 (3) 38   13:50 (4)
3	08:35 14:52	13:14 (3)   07:47 13:15 (3)   07:44	14:43 (2)   06:33 14:44 (2)   06:30	05:02 04:59	03:37 20:49	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	08:11 14:46	13:01 (3) 41   13:51 (4)
4	08:34 14:53	13:15 (3)   07:44 14:02 (3)   16:02	14:43 (2)   06:30 14:47 (2)   06:27	04:59 04:56	03:35 20:43	02:32 20:55	02:30 20:00	03:28 18:34	04:40 17:06	05:49 15:40	07:03 15:40	08:12 14:45	13:02 (3) 41   13:52 (4)
5	08:33 14:55	13:16 (3)   07:42 14:04 (4)   16:05	14:42 (2)   06:24 14:49 (2)   06:24	04:52 04:53	03:32 20:41	02:30 20:45	02:31 20:54	03:31 19:57	04:42 18:32	05:51 17:03	07:06 15:38	14:18 (2)   14:44 14:26 (2)   14:44	13:02 (3) 41   13:52 (4)
6	08:33 14:56	13:16 (3)   07:39 14:06 (4)   16:07	14:42 (2)   06:24 14:56 (2)   17:18	04:52 18:31	03:30 19:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36	14:16 (2)   14:43 14:28 (2)   14:43	13:02 (3) 42   13:52 (4)
7	08:32 14:58	13:17 (3)   07:37 14:07 (4)   16:10	14:42 (2)   06:21 17:20 06:18	04:50 18:34 19:45	03:27 20:48 04:47	02:28 20:52 02:27	02:34 20:52 02:35	03:35 19:52 03:38	04:47 18:26 04:49	05:56 16:57 05:58	07:11 15:33	14:15 (2)   14:42 14:30 (2)   14:42	13:03 (3) 40   13:51 (4)
8	08:31 15:00	13:17 (3)   07:35 14:07 (4)   16:12	14:42 (2)   06:16 17:25	04:44 18:38	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	07:16 15:28	14:31 (2)   14:41 14:32 (2)   14:40	13:04 (3) 39   13:50 (4)
9	08:30 15:02	13:18 (3)   07:32 14:08 (4)   16:15	14:42 (2)   06:13 17:27	04:41 18:41	03:20 19:52	02:25 20:51	02:38 20:49	03:42 19:45	04:54 18:17	06:03 16:48	07:18 15:26	14:32 (2)   14:40 14:32 (2)   14:40	13:03 (3) 37   13:48 (4)
10	08:29 15:04	13:18 (3)   07:30 14:07 (4)   16:17	14:42 (2)   06:10 15:42 (1)   17:30	04:38 18:43	03:17 19:55	02:25 20:52	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24	14:32 (2)   14:40 14:33 (2)   14:39	13:04 (3) 35   13:47 (4)
11	08:28 15:06	13:20 (3)   07:25 14:08 (4)   16:23	14:41 (1)   06:07 15:47 (1)   17:32	04:36 18:46	03:15 19:57	02:24 20:53	02:42 20:46	03:47 19:39	04:58 18:11	06:07 16:42	07:23 15:22	14:32 (2)   14:39 14:34 (2)   14:39	13:05 (3) 34   13:47 (4)
12	08:27 15:08	13:20 (3)   07:25 14:08 (4)   16:23	14:41 (1)   06:07 15:47 (1)   17:32	04:36 18:48	03:15 19:59	02:24 20:54	02:42 20:44	03:47 19:37	04:58 18:08	06:07 16:40	07:23 15:19	14:32 (2)   14:38 14:34 (2)   14:38	13:05 (3) 33   13:46 (4)
13	08:25 15:10	13:21 (3)   07:22 14:07 (4)   16:30	14:41 (1)   06:04 15:50 (1)   17:34	04:33 18:48	03:12 19:59	02:23 20:54	02:43 20:44	03:49 19:37	05:01 18:08	06:10 16:40	07:26 15:19	14:32 (2)   14:38 14:34 (2)   14:38	13:06 (3) 33   13:46 (4)
14	08:24 15:12	13:23 (3)   07:19 14:08 (4)   16:28	14:41 (1)   06:01 15:53 (1)   17:37	04:30 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:17	14:31 (2)   14:38 14:34 (2)   14:38	13:06 (3) 32   13:46 (4)
15	08:23 15:14	13:24 (3)   07:17 14:07 (4)   16:30	14:41 (1)   05:58 15:56 (1)   17:39	04:27 18:53	03:08 20:04	02:22 20:56	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	07:31 15:15	14:31 (2)   14:38 14:32 (2)   14:38	13:06 (3) 31   13:45 (4)
16	08:21 15:16	13:25 (3)   07:14 14:06 (4)   16:33	14:41 (1)   05:55 15:58 (1)   17:42	04:24 18:55	03:06 20:06	02:22 20:57	02:49 20:49	03:56 19:29	05:07 17:59	06:17 16:31	07:33 15:13	14:31 (2)   14:38 14:33 (2)   14:38	13:06 (3) 31   13:45 (4)
17	08:20 15:18	13:26 (3)   07:12 14:04 (4)   16:35	14:41 (1)   05:52 15:58 (1)   17:44	04:21 18:58	03:03 20:08	02:22 20:57	02:50 20:38	03:59 19:26	05:10 17:56	06:19 16:28	07:35 15:11	14:32 (2)   14:38 14:34 (2)   14:38	13:07 (3) 29   13:44 (4)
18	08:18 15:20	13:28 (3)   07:09 13:38 (3)   16:38	14:41 (1)   05:49 15:57 (1)   17:46	04:18 19:00	03:01 20:11	02:22 20:58	02:52 20:36	04:01 19:23	05:12 17:53	06:22 16:25	07:38 15:09	14:32 (2)   14:38 14:34 (2)   14:38	13:07 (3) 29   13:44 (4)
19	08:17 15:23	13:33 (3)   07:06 13:35 (3)   16:40	14:41 (1)   05:46 15:57 (1)   17:49	04:15 19:02	02:59 20:13	02:22 20:58	02:54 20:34	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:07	14:34 (2)   14:38 14:35 (2)   14:38	13:08 (3) 29   13:45 (4)
20	08:15 15:25	13:35 (3)   07:04 14:43 (2)   16:45	14:41 (1)   05:43 15:56 (1)   17:51	04:13 19:05	02:57 20:15	02:22 20:59	02:56 20:33	04:05 19:18	05:16 17:47	06:26 16:20	07:43 15:05	14:35 (2)   14:38 14:36 (2)   14:38	13:08 (3) 29   13:45 (4)
21	08:13 15:27	14:40 (2)   07:01 14:43 (2)   16:45	14:41 (1)   05:40 15:54 (1)   17:54	04:10 19:07	02:55 20:17	02:22 20:59	02:58 20:31	04:08 19:15	05:19 17:44	06:29 16:17	07:45 15:03	14:36 (2)   14:39 14:37 (2)   14:39	13:08 (3) 28   13:45 (4)
22	08:11 15:30	14:40 (2)   06:58 14:46 (2)   16:48	14:40 (2)   06:58 15:54 (1)   17:54	04:07 19:07	02:53 20:19	02:22 20:59	03:00 20:29	04:10 19:12	05:21 17:41	06:31 16:14	07:47 15:02	14:37 (2)   14:40 14:38 (2)   14:40	13:09 (3) 28   13:46 (4)
23	08:10 15:32	14:40 (2)   06:55 14:49 (2)   16:50	14:40 (2)   06:55 15:54 (1)   17:54	04:04 19:12	02:51 20:21	02:22 20:59	03:02 20:27	04:12 19:09	05:23 17:38	06:34 16:12	07:49 15:00	14:39 (3)   14:42 14:39 (3)   14:42	13:09 (3) 29   13:46 (4)
24	08:08 15:35	14:40 (2)   06:53 14:49 (2)   16:53	14:40 (2)   06:53 15:54 (1)   17:54	04:01 19:14	02:49 20:23	02:22 20:59	03:04 20:25	04:15 19:06	05:26 17:35	06:36 16:09	07:52 14:58	14:39 (3)   14:40 14:36 (3)   14:40	13:10 (3) 28   13:46 (4)
25	08:06 15:37	14:39 (2)   06:50 14:55 (2)   16:55	14:39 (2)   06:50 15:53 (1)   17:53	03:59 19:17	02:47 20:25	02:23 20:59	03:06 20:23	04:17 19:03	05:28 17:32	06:39 16:06	07:54 14:57	14:38 (3)   14:41 14:34 (3)   14:41	13:10 (3) 29   13:47 (4)
26	08:04 15:39	14:39 (2)   06:47 14:58 (2)   16:58	14:39 (2)   06:47 15:52 (1)   17:52	03:56 19:19	02:45 20:27	02:23 20:59	03:08 20:20	04:19 19:01	05:30 17:29	06:41 16:04	07:56 14:55	14:37 (3)   14:40 14:34 (3)   14:40	13:11 (3) 30   13:49 (4)
27	08:02 15:42	14:40 (2)   06:44 15:01 (2)   17:00	14:40 (2)   06:44 15:51 (2)   17:00	03:53 19:22	02:44 20:29	02:24 20:59	03:11 20:18	04:22 18:58	05:32 17:26	06:44 16:01	07:58 14:53	14:41 (3)   14:43 14:37 (3)   14:43	13:11 (3) 30   13:49 (4)
28	08:00 15:44	14:39 (2)   06:41 15:02 (2)   17:03	14:39 (2)   06:41 15:50 (2)   17:03	03:51 19:24	02:42 20:31	02:25 20:59	03:13 20:16	04:24 18:55	05:35 17:23	06:46 16:58	07:59 14:52	14:40 (3)   14:44 14:36 (3)   14:44	13:12 (3) 31   13:51 (4)
29	07:58 15:47	14:40 (2)     15:02 (2)	14:40 (2)     15:12   19:26	03:48 20:33	02:40 20:58	02:25 20:14	03:15 20:14	04:26 18:52	05:37 17:20	06:48 15:56	07:58 14:51	14:41 (3)   14:45 14:37 (3)   14:45	13:12 (3) 32   13:52 (4)
30	07:55 15:49	14:40 (2)     15:02 (2)	14:40 (2)     15:14   19:29	03:45 20:35	02:39 20:58	02:26 20:12	03:17 20:12	04:29 18:49	05:39 17:17	06:51 15:53	07:58 14:49	14:40 (3)   14:44 14:36 (3)   14:44	13:12 (3) 33   13:53 (4)
31	07:53 15:52	14:41 (2)     15:02 (2)	14:41 (2)     15:11   19:29	03:43 20:37	02:37 20:56	02:27 20:09	03:19 20:09	04:31 18:46	05:43 15:50	06:53 15:13 (1)	07:59 14:47	14:41 (3)   14:45 14:37 (3)   14:45	13:13 (3) 34   13:55 (4)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194	
Total, worst case	785	232									146	1039	
Sun reduction	0.27	0.29									0.28	0.30	
Oper. time red.	0.93	0.93									0.93	0.93	
Wind dir. red.	0.56	0.51									0.51	0.58	
Total reduction	0.14	0.14									0.13	0.16	
Total, real	111	32									20	168	

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:

Gismarvik

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Licensed user:

Kjeller Vindteknikk AS

Gunnar Randres vei 12

NO-2007 Kjeller

(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BC - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (259)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36 14:49	13:10 (3) 07:51	14:38 (2) 06:39	05:08 18:20	03:42 20:38	02:36 20:57	02:27 20:07	03:22 20:07	04:33 18:43	05:42 17:14	06:56 15:48	14:57 (1) 14:48
2	08:35 14:50	13:10 (3) 07:49	14:43 (2) 06:36	05:05 18:22	03:40 20:33	02:34 20:40	02:28 20:57	03:24 20:05	04:35 18:40	05:44 17:12	06:58 15:45	14:58 (1) 14:47
3	08:35 14:52	13:11 (3) 07:47	14:43 (2) 06:30	05:02 18:24	03:37 20:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	14:57 (1) 14:46
4	08:34 14:53	13:11 (3) 07:44	14:43 (2) 06:27	05:00 18:27	03:35 20:38	02:32 20:43	02:30 20:55	03:28 20:00	04:40 18:34	05:49 17:06	07:03 15:40	14:58 (1) 14:45
5	08:33 14:55	13:12 (3) 07:42	14:43 (2) 06:24	05:00 18:29	03:32 20:30	02:30 20:45	02:31 20:54	03:31 20:07	04:42 18:32	05:51 17:03	07:06 15:38	15:02 (1) 14:44
6	08:33 14:56	13:13 (3) 07:39	14:43 (2) 06:24	05:00 18:31	03:30 20:30	02:29 20:46	02:33 20:53	03:33 20:05	04:45 18:29	05:53 17:00	07:08 15:36	14:44 14:43
7	08:32 14:58	13:14 (3) 07:37	15:28 (1) 06:21	05:00 18:34	03:27 20:48	02:28 20:52	02:34 20:52	03:35 20:05	04:47 18:26	05:56 16:57	07:11 15:33	14:43 14:42
8	08:31 15:00	13:14 (3) 07:35	15:28 (1) 06:18	05:00 18:36	03:24 20:48	02:27 20:51	02:35 20:50	03:38 20:05	04:49 18:23	05:58 16:54	07:13 15:31	14:05 (2) 14:41
9	08:30 15:02	13:16 (3) 07:32	15:28 (1) 06:16	05:00 18:38	03:22 20:50	02:26 20:50	02:37 20:50	03:40 20:05	04:51 18:20	06:00 16:51	07:16 15:28	14:05 (2) 14:40
10	08:29 15:04	13:16 (3) 07:30	15:28 (1) 06:13	05:00 18:41	03:20 20:52	02:25 20:51	02:38 20:49	03:42 20:05	04:54 18:17	06:03 16:48	07:18 15:26	14:09 (2) 14:40
11	08:28 15:06	13:18 (3) 07:27	15:27 (1) 06:10	05:00 18:43	03:17 20:55	02:25 20:52	02:40 20:47	03:45 20:05	04:56 18:14	06:05 16:45	07:21 15:24	14:06 (2) 14:39
12	08:27 15:08	13:20 (3) 07:25	15:27 (1) 06:07	05:00 18:46	03:15 20:57	02:24 20:53	02:41 20:46	03:47 20:05	04:58 18:11	06:07 16:42	07:23 15:22	14:05 (2) 14:39
13	08:25 15:10	13:21 (3) 07:22	15:29 (1) 06:04	05:00 18:48	03:12 20:59	02:23 20:54	02:43 20:44	03:49 20:08	05:01 18:08	06:10 16:40	07:26 15:19	14:19 (2) 14:38
14	08:24 15:12	13:23 (3) 07:19	15:29 (1) 06:01	05:00 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 20:05	05:03 18:05	06:12 16:37	07:28 15:17	14:20 (2) 14:38
15	08:23 15:14	13:23 (3) 07:17	15:30 (1) 05:58	05:00 18:53	03:08 20:04	02:22 20:56	02:47 20:41	03:54 20:05	05:05 18:02	06:14 16:34	07:31 15:15	14:02 (2) 14:38
16	08:21 15:16	14:28 (2) 07:14	15:32 (1) 05:55	05:00 18:55	03:06 20:06	02:22 20:57	02:49 20:48	03:56 20:05	05:07 18:31	06:17 16:31	07:33 15:13	14:02 (2) 14:38
17	08:20 15:18	14:28 (2) 07:12	15:41 (1) 05:52	05:00 18:58	03:03 20:08	02:22 20:57	02:50 20:38	03:59 20:05	05:10 18:28	06:19 16:28	07:35 15:11	14:02 (2) 14:38
18	08:18 15:20	14:28 (2) 07:09	15:41 (1) 05:52	05:00 19:00	03:01 20:11	02:22 20:58	02:52 20:36	04:01 20:05	05:12 18:25	06:22 16:25	07:38 15:09	14:03 (2) 14:38
19	08:17 15:23	14:28 (2) 07:06	15:41 (1) 05:52	05:00 19:02	03:01 20:13	02:22 20:58	02:54 20:34	04:03 20:05	05:14 18:23	06:24 16:23	07:40 15:07	14:02 (2) 14:38
20	08:15 15:25	14:28 (2) 07:04	15:41 (1) 05:52	05:00 19:05	03:01 20:15	02:22 20:59	02:56 20:33	04:05 20:05	05:16 18:20	06:26 16:20	07:43 15:05	14:03 (2) 14:38
21	08:13 15:27	14:27 (2) 07:01	15:41 (1) 05:52	05:00 19:07	03:01 20:17	02:22 20:59	02:58 20:31	04:08 20:05	05:19 18:17	06:29 16:17	07:45 15:03	14:03 (2) 14:39
22	08:11 15:30	14:28 (2) 06:58	15:41 (1) 05:52	05:00 19:10	03:01 20:19	02:22 20:59	03:00 20:46	04:10 20:12	05:21 18:14	06:31 16:14	07:47 15:02	14:04 (2) 14:39
23	08:10 15:32	14:28 (2) 06:55	15:41 (1) 05:52	05:00 19:12	03:01 20:21	02:22 20:59	03:02 20:42	04:12 20:05	05:23 18:34	06:34 16:12	07:49 15:00	14:04 (2) 14:40
24	08:08 15:35	14:29 (2) 06:53	15:41 (1) 05:52	05:00 19:14	03:01 20:23	02:22 20:59	03:04 20:25	04:15 20:06	05:26 18:35	06:36 16:09	07:52 14:58	14:05 (2) 14:40
25	08:06 15:37	14:29 (2) 06:50	15:41 (1) 05:52	05:00 19:17	03:01 20:25	02:22 20:59	03:06 20:23	04:17 20:03	05:28 18:32	06:39 16:06	07:54 14:56	14:06 (2) 14:41
26	08:04 15:39	14:29 (2) 06:47	15:41 (1) 05:52	05:00 19:19	03:01 20:27	02:22 20:59	03:08 20:20	04:19 20:01	05:30 18:29	06:41 16:04	07:54 14:55	14:06 (2) 14:42
27	08:02 15:42	14:31 (2) 06:44	15:41 (1) 05:52	05:00 19:22	03:01 20:29	02:22 20:59	03:11 20:18	04:22 20:05	05:32 18:26	06:44 16:01	07:58 14:53	14:08 (2) 14:43
28	08:00 15:44	14:31 (2) 06:41	15:41 (1) 05:52	05:00 19:24	03:01 20:31	02:22 20:59	03:13 20:16	04:24 20:05	05:35 18:23	06:46 16:58	07:58 14:52	14:08 (2) 14:44
29	07:58 15:47	14:32 (2) 06:38	15:41 (1) 05:52	05:00 19:26	03:01 20:33	02:22 20:58	03:15 20:14	04:26 20:05	05:37 18:20	06:48 16:56	07:58 14:51	13:03 (3) 14:45
30	07:55 15:49	14:33 (2) 06:35	15:41 (1) 05:52	05:00 19:29	03:01 20:35	02:22 20:58	03:17 20:12	04:29 20:05	05:39 18:17	06:51 16:53	07:58 14:51	13:01 (3) 14:46
31	07:53 15:52	14:35 (2) 06:32	15:41 (1) 05:52	05:00 19:31	03:01 20:37	02:22 20:58	03:19 20:09	04:31 20:05	05:43 18:50	06:53 16:50	07:58 14:51	13:01 (3) 14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194
Total, worst case	449	129								94	287	641
Sun reduction	0.27	0.29								0.28	0.28	0.30
Oper. time red.	0.93	0.93								0.93	0.93	0.93
Wind dir. red.	0.56	0.50								0.50	0.53	0.59
Total reduction	0.14	0.14								0.13	0.14	0.16
Total, real	63	18								12	39	105

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)



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Calculated:

15.08.2011 09:56/2.7.486



SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BD - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (260)

Assumptions for shadow calculations

Maximum distance for influence 1 500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for specific times of day, showing sun position and shadow data.

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

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

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BE - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (261)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36	07:51	06:39	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:54	17:05	18:20	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:09
	14:50	15:57	17:08	18:22	19:34	20:40	20:57	20:05	18:40	17:12	15:45	14:47
3	08:35	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	15:59	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:44
5	08:33	07:42	06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44
6	08:33	07:39	06:24	04:53	03:29	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:56	16:07	17:18	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:45	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:18	04:47	03:24	02:27	02:35	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:16	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29	07:30	06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	08:22
	15:04	16:17	17:27	18:41	19:52	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:27	07:25	06:07	04:36	03:15	02:24	02:41	03:47	04:58	06:07	07:23	08:25
	15:08	16:22	17:32	18:46	19:57	20:54	20:46	19:39	18:11	16:42	15:22	14:39
13	08:25	07:22	06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	08:27
	15:10	16:25	17:34	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:19	14:38
14	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	07:17	05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20	07:12	05:52	04:21	03:03	02:22	02:50	03:58	05:10	06:19	07:35	08:31
	15:18	16:35	17:44	18:58	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:20	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:17	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
20	08:15	07:04	05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:43	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:33	19:18	17:47	16:20	15:05	14:38
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27	16:45	17:54	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
22	08:11	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35
	15:30	16:48	17:56	19:10	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
23	08:10	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:50	08:35
	15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:53	05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	08:36
	15:34	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	14:40
25	08:06	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
	15:37	16:55	18:03	19:17	20:25	20:59	20:23	19:03	17:32	16:06	14:56	14:41
26	08:04	06:47	05:25	03:56	02:45	02:23	03:08	04:19	05:30	06:41	07:56	08:36
	15:39	16:58	18:05	19:19	20:27	20:59	20:21	19:01	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:44	07:58	08:36
	15:42	17:00	18:08	19:22	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00	06:41	05:20	03:50	02:42	02:25	03:13	04:24	05:35	06:46	08:01	08:36
	15:44	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:23	15:58	14:52	14:44
29	07:58		05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:49	08:03	08:36
	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45
30	07:55		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:49		18:15	19:29	20:35	20:58	20:12	18:49	17:17	15:53	14:49	14:46
31	07:53		05:11		02:37		03:19	04:31		06:53		08:36
	15:52		18:17		20:37		20:09	18:46		15:50		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	193
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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)

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BF - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (262)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for each day of the month, showing sun rise/set times and shadow calculations. Includes a summary table at the bottom for potential sun hours and reductions.

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

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

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Calculated:  
15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BG - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (263)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June	July	August	September	October	November	December			
1	08:36	13:07 (3)	07:51	06:39	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07		
	14:49	11	13:18 (3)	15:54	17:05	18:20	19:31	20:38	20:57	18:43	17:14	15:48	14:48		
2	08:35	13:08 (3)	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:09		
	14:50	10	13:18 (3)	15:57	17:08	18:22	19:34	20:40	20:57	18:40	17:12	15:45	14:47		
3	08:35	13:09 (3)	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11		
	14:52	9	13:18 (3)	15:59	17:10	18:24	19:36	20:42	20:56	18:37	17:09	15:43	14:46		
4	08:34	13:10 (3)	07:44	06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12		
	14:53	7	13:17 (3)	16:02	17:13	18:27	19:38	20:43	20:55	18:34	17:06	15:40	14:44		
5	08:33	13:13 (3)	07:42	06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14		
	14:55	3	13:16 (3)	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44	
6	08:33		07:39	06:24	04:53	03:29	02:29	02:33	03:33	04:45	05:53	07:08	08:16		
	14:56		16:07	17:18	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43		
7	08:32		07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18		
	14:58		16:10	17:20	18:34	19:45	20:48	20:52	19:52	18:26	16:57	15:33	14:42	3	13:00 (3)
8	08:31		07:35	06:18	04:47	03:24	02:27	02:35	03:38	04:49	05:58	07:13	08:19		12:59 (3)
	15:00		16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41	6	13:05 (3)
9	08:30		07:32	06:16	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21		12:58 (3)
	15:02		16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40	9	13:07 (3)
10	08:29		07:30	06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	08:22		12:57 (3)
	15:04		16:17	17:27	18:41	19:52	20:51	20:49	19:45	18:17	16:48	15:26	14:40	10	13:07 (3)
11	08:28		07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24		12:57 (3)
	15:06		16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39	12	13:09 (3)
12	08:27		07:25	06:07	04:36	03:15	02:24	02:41	03:47	04:58	06:07	07:23	08:25		12:58 (3)
	15:08		16:22	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39	12	13:10 (3)
13	08:25		07:22	06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	08:27		12:57 (3)
	15:10		16:25	17:34	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:19	14:38	13	13:10 (3)
14	08:24		07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28		12:58 (3)
	15:12		16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38	13	13:11 (3)
15	08:23		07:17	05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	08:29		12:58 (3)
	15:14		16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38	14	13:12 (3)
16	08:21		07:14	05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	08:30		12:58 (3)
	15:16		16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38	14	13:12 (3)
17	08:20		07:12	05:52	04:21	03:03	02:22	02:50	03:58	05:10	06:19	07:35	08:31		12:58 (3)
	15:18		16:35	17:44	18:58	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38	15	13:13 (3)
18	08:18		07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32		12:59 (3)
	15:20		16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38	14	13:13 (3)
19	08:17		07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33		12:59 (3)
	15:23		16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38	15	13:14 (3)
20	08:15		07:04	05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:43	08:33		13:00 (3)
	15:25		16:43	17:51	19:05	20:15	20:59	20:33	19:18	17:47	16:20	15:05	14:38	15	13:15 (3)
21	08:13		07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34		13:00 (3)
	15:27		16:45	17:54	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39	15	13:15 (3)
22	08:11		06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35		13:01 (3)
	15:30		16:48	17:56	19:10	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39	15	13:16 (3)
23	08:10		06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:50	08:35		13:01 (3)
	15:32		16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40	15	13:16 (3)
24	08:08		06:53	05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	08:36		13:01 (3)
	15:34		16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	14:40	15	13:16 (3)
25	08:06		06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36		13:03 (3)
	15:37		16:55	18:03	19:17	20:25	20:59	20:23	19:03	17:32	16:06	14:56	14:41	14	13:17 (3)
26	08:04		06:47	05:25	03:56	02:45	02:23	03:08	04:19	05:30	06:41	07:56	08:36		13:03 (3)
	15:39		16:58	18:05	19:19	20:27	20:59	20:21	19:01	17:29	16:04	14:55	14:42	15	13:18 (3)
27	08:02		06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:44	07:58	08:36		13:03 (3)
	15:42		17:00	18:08	19:22	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43	14	13:17 (3)
28	08:00		06:41	05:20	03:50	02:42	02:25	03:13	04:24	05:35	06:46	08:01	08:36		13:04 (3)
	15:44		17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:23	15:58	14:52	14:44	14	13:18 (3)
29	07:58			05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:49	08:03	08:36		13:05 (3)
	15:47			18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45	13	13:18 (3)
30	07:55			05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36		13:05 (3)
	15:49			18:15	19:29	20:35	20:58	20:12	18:49	17:17	15:53	14:49	14:46	13	13:18 (3)
31	07:53			05:11		02:37		03:19	04:31		06:53		08:36		13:06 (3)
	15:52			18:17		20:37		20:09	18:46		15:50		14:47	13	13:19 (3)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	193			321
Total, worst case		40													0.30
Sun reduction		0.27													0.93
Oper. time red.		0.93													0.59
Wind dir. red.		0.59													0.17
Total reduction		0.15													0.17
Total, real		6													53

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:  
**Gismarvik**

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Calculated:  
15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

Calculation: Skyggekast Gismarvik Shadow receptor: BH - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (264)

**Assumptions for shadow calculations**

Maximum distance for influence	1 500 m	Sunshine probability S/S0 (Sun hours/Possible sun hours) []
Minimum sun height over horizon for influence	3 °	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Day step for calculation	1 days	0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30
Time step for calculation	1 minutes	Operational time
		N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
		813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182
		Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December		
1	08:36	13:15 (3)	07:51	06:39	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07	13:09 (3)
2	08:35	13:15 (3)	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:09	13:06 (3)
3	08:35	13:16 (3)	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:05 (3)
4	08:34	13:17 (3)	07:44	06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12	13:06 (3)
5	08:33	13:18 (3)	07:42	06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14	13:05 (3)
6	08:33	13:19 (3)	07:39	06:24	04:53	03:29	02:29	02:33	03:33	04:45	05:53	07:08	08:16	13:05 (3)
7	08:32	13:20 (3)	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18	13:05 (3)
8	08:31	13:20 (3)	07:35	06:18	04:47	03:24	02:27	02:35	03:38	04:49	05:58	07:13	08:19	13:05 (3)
9	08:30	13:22 (3)	07:32	06:16	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21	13:05 (3)
10	08:29	13:23 (3)	07:30	06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	08:22	13:05 (3)
11	08:28	13:26 (3)	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24	13:05 (3)
12	08:27	13:30 (3)	07:25	06:07	04:36	03:15	02:24	02:41	03:47	04:58	06:07	07:23	08:25	13:06 (3)
13	08:25	13:33 (3)	07:22	06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	08:27	13:06 (3)
14	08:24	13:36 (3)	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28	13:07 (3)
15	08:23	13:39 (3)	07:17	05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	08:29	13:07 (3)
16	08:21	13:42 (3)	07:14	05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	08:30	13:07 (3)
17	08:20	13:45 (3)	07:12	05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31	13:07 (3)
18	08:18	13:48 (3)	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32	13:08 (3)
19	08:17	13:51 (3)	07:07	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33	13:08 (3)
20	08:15	13:54 (3)	07:04	05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:43	08:33	13:09 (3)
21	08:13	13:57 (3)	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34	13:09 (3)
22	08:11	14:00 (3)	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35	13:10 (3)
23	08:10	14:03 (3)	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	08:35	13:10 (3)
24	08:08	14:06 (3)	06:53	05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	08:36	13:10 (3)
25	08:06	14:09 (3)	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36	13:11 (3)
26	08:04	14:12 (3)	06:47	05:25	03:56	02:45	02:23	03:08	04:19	05:30	06:41	07:56	08:36	13:12 (3)
27	08:02	14:15 (3)	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:44	07:58	08:36	13:12 (3)
28	08:00	14:18 (3)	06:41	05:20	03:50	02:42	02:25	03:13	04:24	05:35	06:46	08:01	08:36	13:12 (3)
29	07:58	14:21 (3)	06:38	05:17	03:47	02:40	02:26	03:16	04:27	05:38	06:49	08:02	08:36	13:13 (3)
30	07:55	14:24 (3)	06:35	05:14	03:44	02:39	02:27	03:17	04:29	05:39	06:51	08:05	08:36	13:13 (3)
31	07:53	14:27 (3)	06:32	05:11	03:41	02:37	02:28	03:19	04:31	05:41	06:53	08:06	08:36	13:14 (3)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194		518
Total, worst case		147												518
Sun reduction		0.27												0.30
Oper. time red.		0.93												0.93
Wind dir. red.		0.59												0.59
Total reduction		0.15												0.16
Total, real		22												85

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BI - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (265)

Assumptions for shadow calculations

Maximum distance for influence 1 500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for time slots (08:36 to 15:52). Includes summary rows for Potential sun hours, Total, worst case, Sun reduction, Oper. time red., Wind dir. red., Total reduction, and Total, real.

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

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

Project:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BJ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (266)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:36 14:49	13:30 (3) 15:54	07:51 17:05	14:47 (2) 17:05	06:39 18:20	05:08 20:38	03:42 20:38	02:27 20:07	03:22 18:43	05:42 17:14	06:56 15:48	15:09 (1) 15:10 (1)	08:07 14:48
2	08:35 14:50	13:30 (3) 15:57	07:49 15:57	14:48 (2) 17:08	06:36 18:22	05:05 20:33	03:40 20:40	02:28 20:57	03:24 18:40	04:35 17:12	05:44 15:45	06:58 15:45	08:09 14:47
3	08:35 14:52	13:30 (3) 15:59	07:47 15:59	14:50 (2) 17:10	06:33 18:24	05:02 20:36	03:37 20:42	02:29 20:56	03:26 18:37	04:38 17:09	05:46 15:43	07:01 15:43	08:11 14:46
4	08:34 14:53	13:31 (3) 16:02	07:44 16:02	14:52 (2) 17:13	06:30 18:27	04:59 20:38	03:35 20:43	02:32 20:55	03:28 18:34	04:40 17:06	05:49 15:40	07:03 15:40	08:12 14:45
5	08:33 14:55	13:31 (3) 16:05	07:42 16:05	15:01 (2) 17:13	06:27 18:29	04:56 20:41	03:32 20:45	02:30 20:54	03:31 18:32	04:42 17:03	05:51 15:38	07:06 15:38	08:14 14:44
6	08:33 14:56	13:32 (3) 16:07	07:39 16:07	15:03 (2) 17:18	06:24 18:31	04:53 20:43	03:29 20:46	02:29 20:53	03:33 18:29	04:45 17:00	05:53 15:36	07:08 15:36	08:16 14:43
7	08:32 14:58	13:33 (3) 16:10	07:37 16:10	15:04 (2) 17:20	06:21 18:34	04:50 20:45	03:27 20:48	02:28 20:52	03:35 18:26	04:47 16:57	05:56 15:33	07:11 15:33	14:22 (2) 14:31 (2)
8	08:31 15:00	13:33 (3) 16:12	07:35 16:12	15:03 (2) 17:22	06:18 18:36	04:47 20:48	03:24 20:49	02:27 20:51	03:38 18:23	04:49 16:54	05:58 15:31	07:13 15:31	14:20 (2) 14:33 (2)
9	08:30 15:02	13:34 (3) 16:15	07:32 16:15	15:04 (1) 17:25	06:16 18:38	04:44 20:50	03:22 20:50	02:26 20:50	03:40 18:20	04:51 16:51	06:00 15:28	07:16 15:28	14:18 (2) 14:34 (2)
10	08:29 15:04	13:34 (3) 16:17	07:30 16:17	15:40 (1) 17:27	06:13 18:41	04:41 20:51	03:20 20:51	02:25 20:49	03:42 18:17	04:54 16:48	06:03 15:26	07:18 15:26	14:18 (2) 14:40 (2)
11	08:28 15:06	13:35 (3) 16:20	07:27 16:20	15:39 (1) 17:30	06:10 18:43	04:38 20:52	03:17 20:52	02:25 20:47	03:45 18:14	04:56 16:45	06:05 15:24	07:21 15:24	14:18 (2) 14:36 (2)
12	08:27 15:08	13:36 (3) 16:22	07:25 16:22	15:44 (1) 17:32	06:07 18:46	04:36 20:53	03:15 20:53	02:24 20:46	03:47 18:11	04:58 16:42	06:07 15:22	07:23 15:22	14:18 (2) 14:36 (2)
13	08:25 15:10	13:36 (3) 16:25	07:22 16:25	15:39 (1) 17:34	06:04 18:48	04:33 20:54	03:12 20:54	02:23 20:44	03:49 18:08	05:01 16:40	06:10 15:19	07:26 15:19	14:18 (2) 14:37 (2)
14	08:24 15:12	13:38 (3) 16:28	07:19 16:28	15:50 (1) 17:37	06:01 18:50	04:30 20:02	03:10 20:55	02:23 20:43	03:52 18:05	05:03 16:37	06:12 15:17	07:28 15:17	14:17 (2) 14:35 (2)
15	08:23 15:14	13:39 (3) 16:30	07:17 16:30	15:53 (1) 17:39	05:58 18:53	04:27 20:04	03:08 20:56	02:22 20:41	03:54 18:02	05:05 16:34	06:14 15:15	07:31 15:15	14:17 (2) 14:33 (2)
16	08:21 15:16	13:40 (3) 16:33	07:14 16:33	15:39 (1) 17:42	05:55 18:55	04:24 20:06	03:06 20:57	02:22 20:49	03:56 17:59	05:07 16:31	06:17 15:13	07:33 15:13	14:18 (2) 14:31 (2)
17	08:20 15:18	13:42 (3) 16:35	07:12 16:35	15:40 (1) 17:44	05:52 18:58	04:21 20:08	03:03 20:57	02:22 20:38	03:59 18:26	05:10 16:28	06:19 15:11	07:35 15:11	14:18 (2) 14:29 (2)
18	08:18 15:20	13:44 (3) 16:38	07:09 16:38	15:41 (1) 17:46	05:49 19:00	04:18 20:11	03:01 20:58	02:22 20:36	04:01 18:23	05:12 16:25	06:22 15:09	07:38 15:09	14:19 (2) 14:26 (2)
19	08:17 15:23	13:51 (3) 16:40	07:06 16:40	15:45 (1) 17:49	05:46 19:02	04:15 20:13	02:59 20:58	02:22 20:34	04:03 18:20	05:14 16:23	06:24 15:07	07:40 15:07	14:19 (2) 14:23 (2)
20	08:15 15:25	14:45 (2) 16:43	07:04 16:43	15:50 (1) 19:05	05:43 20:15	04:13 20:52	02:57 20:59	02:22 20:33	04:05 18:18	05:16 17:47	06:26 15:05	07:43 15:05	14:20 (2) 14:21 (2)
21	08:13 15:27	14:45 (2) 16:45	07:01 16:45	15:54 (1) 19:07	05:40 20:17	04:10 20:52	02:55 20:59	02:22 20:31	04:08 18:15	05:19 17:44	06:29 16:17	07:45 15:03	14:18 (2) 14:39 (2)
22	08:11 15:30	14:45 (2) 16:48	06:58 16:48	15:53 (1) 19:10	05:37 20:19	04:07 20:59	02:53 20:59	02:22 20:29	04:10 18:12	05:21 17:41	06:31 16:14	07:47 15:02	14:19 (2) 14:36 (2)
23	08:10 15:32	14:45 (2) 16:50	06:55 16:50	15:52 (1) 19:12	05:34 20:21	04:04 20:59	02:51 20:59	02:22 20:27	04:12 18:09	05:23 17:38	06:34 16:12	07:49 15:00	14:18 (2) 14:40 (2)
24	08:08 15:35	14:45 (2) 16:53	06:53 16:53	15:51 (1) 19:14	05:31 20:23	04:01 20:59	02:49 20:59	02:22 20:34	04:15 18:06	05:26 17:35	06:36 16:09	07:49 15:11 (1)	13:22 (3) 14:28 (3)
25	08:06 15:37	14:44 (2) 16:55	06:50 16:55	15:50 (1) 19:17	05:28 20:25	03:59 20:59	02:47 20:59	02:23 20:33	04:17 18:03	05:28 17:32	06:39 16:06	07:49 14:56	14:18 (2) 14:41 (2)
26	08:04 15:39	14:45 (2) 16:58	06:47 16:58	15:49 (1) 19:19	05:25 20:27	03:56 20:59	02:45 20:59	02:23 20:20	04:19 18:01	05:30 17:29	06:41 16:04	07:49 15:09 (1)	14:18 (2) 14:55 (2)
27	08:02 15:42	14:45 (2) 17:00	06:44 17:00	15:48 (1) 19:21	05:22 20:29	03:53 20:59	02:44 20:59	02:24 20:18	04:22 18:58	05:32 17:26	06:44 16:01	07:49 15:08 (1)	14:18 (2) 14:43 (2)
28	08:00 15:44	14:45 (2) 17:03	06:41 17:03	15:47 (1) 19:24	05:20 20:31	03:50 20:59	02:42 20:59	02:25 20:16	03:13 18:55	05:35 17:23	06:46 15:58	07:49 15:08 (1)	14:18 (2) 14:44 (2)
29	07:58 15:47	14:46 (2) 17:05	06:38 17:05	15:46 (1) 19:26	05:17 20:33	03:48 20:58	02:40 20:58	02:25 20:14	03:15 18:52	04:26 17:20	05:37 15:56	07:49 15:08 (1)	14:18 (2) 14:51 (2)
30	07:55 15:49	14:46 (2) 17:07	06:35 17:07	15:45 (1) 19:29	05:14 20:35	03:45 20:58	02:39 20:58	02:26 20:12	03:17 18:49	04:29 17:17	05:39 15:53	06:51 15:08 (1)	14:18 (2) 14:49 (2)
31	07:53 15:52	14:47 (2) 17:09	06:32 17:09	15:44 (1) 19:31	05:11 20:37	03:42 20:58	02:37 20:58	02:26 20:09	03:19 18:46	04:31 17:15	05:53 15:50	06:58 15:13 (1)	14:18 (2) 14:47 (2)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194	
Total, worst case	464	155									101	283	663
Sun reduction	0.27	0.29									0.28	0.28	0.30
Oper. time red.	0.93	0.93									0.93	0.93	0.93
Wind dir. red.	0.55	0.51									0.51	0.53	0.57
Total reduction	0.14	0.14									0.13	0.14	0.16
Total, real	65	21									13	39	107

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:

Gismarvik

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Licensed user:

Kjeller Vindteknikk AS

Gunnar Randres vei 12

NO-2007 Kjeller

(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BK - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (267)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36	07:51	06:39	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:54	17:05	18:20	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:09
	14:50	15:57	17:08	18:22	19:34	20:40	20:57	20:05	18:40	17:12	15:45	14:47
3	08:35	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	15:59	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:44
5	08:33	07:42	06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44
6	08:33	07:39	06:24	04:53	03:29	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:56	16:07	17:18	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:45	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:18	04:47	03:24	02:27	02:35	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:16	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29	07:30	06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	08:22
	15:04	16:17	17:27	18:41	19:52	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:27	07:25	06:07	04:36	03:15	02:24	02:41	03:47	04:58	06:07	07:23	08:25
	15:08	16:22	17:32	18:46	19:57	20:54	20:46	19:39	18:11	16:42	15:22	14:39
13	08:25	07:22	06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	08:27
	15:10	16:25	17:34	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:19	14:38
14	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	07:17	05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20	07:12	05:52	04:21	03:03	02:22	02:50	03:58	05:10	06:19	07:35	08:31
	15:18	16:35	17:44	18:58	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:20	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:17	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
20	08:15	07:04	05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:43	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:33	19:18	17:47	16:20	15:05	14:38
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27	16:45	17:54	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
22	08:11	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35
	15:30	16:48	17:56	19:10	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
23	08:10	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:50	08:35
	15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:53	05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	08:36
	15:34	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	14:40
25	08:06	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
	15:37	16:55	18:03	19:17	20:25	20:59	20:23	19:03	17:32	16:06	14:56	14:41
26	08:04	06:47	05:25	03:56	02:45	02:23	03:08	04:19	05:30	06:41	07:56	08:36
	15:39	16:58	18:05	19:19	20:27	20:59	20:21	19:01	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:44	07:58	08:36
	15:42	17:00	18:08	19:22	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00	06:41	05:20	03:50	02:42	02:25	03:13	04:24	05:35	06:46	08:01	08:36
	15:44	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:23	15:58	14:52	14:44
29	07:58		05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:49	08:03	08:36
	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:50	14:45
30	07:55		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:49		18:15	19:29	20:35	20:58	20:12	18:49	17:17	15:53	14:49	14:46
31	07:53		05:11		02:37		03:19	04:31		06:53		08:36
	15:52		18:17		20:37		20:09	18:46		15:50		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	193
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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Licensed user:

Kjeller Vindteknikk AS

Gunnar Randres vei 12

NO-2007 Kjeller

(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BL - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (268)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:36	13:14 (3)	07:51	06:39	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	17	13:31 (3)	15:54	17:05	18:20	19:31	20:38	20:57	18:43	17:14	15:48	14:48
2	08:35	13:14 (3)	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:09
	14:50	17	13:31 (3)	15:57	17:08	18:22	19:34	20:40	20:57	18:40	17:12	15:45	14:47
3	08:35	13:15 (3)	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	16	13:31 (3)	15:59	17:10	18:24	19:36	20:42	20:56	18:37	17:09	15:43	14:46
4	08:34	13:16 (3)	07:44	06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12
	14:53	15	13:31 (3)	16:02	17:13	18:27	19:38	20:43	20:55	18:34	17:06	15:40	14:45
5	08:33	13:17 (3)	07:42	06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14
	14:55	14	13:31 (3)	16:05	17:15	18:29	19:41	20:45	20:54	18:32	17:03	15:38	14:44
6	08:33	13:18 (3)	07:39	06:24	04:53	03:29	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:56	13	13:31 (3)	16:07	17:18	18:31	19:43	20:46	20:53	18:29	17:00	15:36	14:43
7	08:32	13:19 (3)	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
	14:58	13	13:32 (3)	16:10	17:20	18:34	19:45	20:48	20:52	18:26	16:57	15:33	14:42
8	08:31	13:20 (3)	07:35	06:18	04:47	03:24	02:27	02:35	03:38	04:49	05:58	07:13	08:19
	15:00	11	13:31 (3)	16:12	17:22	18:36	19:48	20:49	20:51	18:23	16:54	15:31	14:41
9	08:30	13:21 (3)	07:32	06:16	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
	15:02	10	13:31 (3)	16:15	17:25	18:38	19:50	20:50	20:50	18:20	16:51	15:28	14:40
10	08:29	13:23 (3)	07:30	06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	08:22
	15:04	6	13:29 (3)	16:17	17:27	18:41	19:52	20:51	20:49	18:17	16:48	15:26	14:40
11	08:28	13:23 (3)	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06		16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:27	13:23 (3)	07:25	06:07	04:36	03:15	02:24	02:41	03:47	04:58	06:07	07:23	08:25
	15:08		16:22	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39
13	08:25	13:23 (3)	07:22	06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	08:27
	15:10		16:25	17:34	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:19	14:38
14	08:24	13:23 (3)	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12		16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	13:23 (3)	07:17	05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	08:29
	15:14		16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	13:23 (3)	07:14	05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	08:30
	15:16		16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20	13:23 (3)	07:12	05:52	04:21	03:03	02:22	02:50	03:58	05:10	06:19	07:35	08:31
	15:18		16:35	17:44	18:58	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	13:23 (3)	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:20		16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:17	13:23 (3)	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23		16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
20	08:15	13:23 (3)	07:04	05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:43	08:33
	15:25		16:43	17:51	19:05	20:15	20:59	20:33	19:18	17:47	16:20	15:05	14:38
21	08:13	13:23 (3)	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27		16:45	17:54	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
22	08:11	13:23 (3)	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35
	15:30		16:48	17:56	19:10	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
23	08:10	13:23 (3)	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:50	08:35
	15:32		16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	13:23 (3)	06:53	05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	08:36
	15:34		16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	14:40
25	08:06	13:23 (3)	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
	15:37		16:55	18:03	19:17	20:25	20:59	20:23	19:03	17:32	16:06	14:56	14:41
26	08:04	13:23 (3)	06:47	05:25	03:56	02:45	02:23	03:08	04:19	05:30	06:41	07:56	08:36
	15:39		16:58	18:05	19:19	20:27	20:59	20:21	19:01	17:29	16:04	14:55	14:42
27	08:02	13:23 (3)	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:44	07:58	08:36
	15:42		17:00	18:08	19:22	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00	13:23 (3)	06:41	05:20	03:50	02:42	02:25	03:13	04:24	05:35	06:46	08:01	08:36
	15:44		17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:23	15:58	14:52	14:44
29	07:58	13:23 (3)	06:37	05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	08:03	08:36
	15:47		17:02	18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45
30	07:55	13:23 (3)	06:35	05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:49		17:05	18:15	19:29	20:35	20:58	20:12	18:49	17:17	15:53	14:49	14:46
31	07:53	13:23 (3)	06:33	05:11	03:43	02:37	02:26	03:19	04:31	05:41	06:53	08:06	08:36
	15:52		17:07	18:17	19:31	20:37	20:58	20:09	18:46	17:14	15:50	14:47	14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194	488
Total, worst case		132											0.30
Sun reduction		0.27											0.93
Oper. time red.		0.93											0.59
Wind dir. red.		0.59											0.16
Total reduction		0.15											80
Total, real		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:  
**Gismarvik**

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Calculated:  
15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

Calculation: Skyggekast Gismarvik Shadow receptor: BM - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (269)

**Assumptions for shadow calculations**

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December			
1	08:36 14:49	13:25 (3) 13:44 (3)	07:51 15:54	06:39 17:05	05:08 18:20	03:42 19:31	02:36 20:38	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	06:56 15:48	08:07 14:48	13:15 (3) 12 13:27 (3)	
2	08:35 14:50	13:25 (3) 13:44 (3)	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:33	02:34 20:40	02:28 20:57	03:24 20:05	04:35 18:40	05:44 17:12	06:58 15:45	08:09 14:47	13:14 (3) 13 13:27 (3)	
3	08:35 14:52	13:26 (3) 13:44 (3)	07:47 15:59	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	08:11 14:46	13:14 (3) 14 13:28 (3)	
4	08:34 14:53	13:26 (3) 13:44 (3)	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:28 20:00	04:40 18:34	05:49 17:06	07:03 15:40	08:12 14:45	13:14 (3) 15 13:30 (3)	
5	08:33 14:55	13:27 (3) 13:45 (3)	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:41	02:30 20:45	02:31 20:54	03:31 19:57	04:42 18:32	05:51 17:03	07:06 15:38	08:14 14:44	13:14 (3) 16 13:30 (3)	
6	08:33 14:56	13:28 (3) 13:45 (3)	07:39 16:07	06:24 17:18	04:53 18:31	03:29 19:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36	08:16 14:43	13:14 (3) 17 13:31 (3)	
7	08:32 14:58	13:29 (3) 13:45 (3)	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:48	02:34 20:52	03:35 19:52	04:47 18:26	05:56 16:57	07:11 15:33	08:18 14:42	13:14 (3) 18 13:32 (3)	
8	08:31 15:00	13:29 (3) 13:45 (3)	07:35 16:12	06:18 17:22	04:47 18:36	03:24 19:48	02:27 20:49	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 15:31	08:19 14:41	13:14 (3) 18 13:32 (3)	
9	08:30 15:02	13:31 (3) 13:45 (3)	07:32 16:15	06:16 17:25	04:44 18:38	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	07:16 15:28	08:21 14:40	13:15 (3) 18 13:33 (3)	
10	08:29 15:04	13:31 (3) 13:44 (3)	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:52	02:25 20:51	02:38 20:49	03:42 19:45	04:54 18:17	06:03 16:48	07:18 15:26	08:22 14:40	13:14 (3) 19 13:33 (3)	
11	08:28 15:06	13:33 (3) 13:44 (3)	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:52	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24	08:24 14:39	13:15 (3) 19 13:34 (3)	
12	08:27 15:08	13:34 (3) 13:43 (3)	07:25 16:22	06:07 17:32	04:36 18:46	03:15 19:57	02:24 20:53	02:41 20:46	03:47 19:39	04:58 18:11	06:07 16:42	07:23 15:22	8 14:12 (2) 14:20 (2)	08:25 14:39	13:16 (3) 19 13:35 (3)
13	08:25 15:10	13:36 (3) 13:42 (3)	07:22 16:25	06:04 17:34	04:33 18:48	03:12 19:59	02:23 20:54	02:43 20:44	03:49 19:37	05:01 18:08	06:10 16:40	07:26 15:19	12 14:22 (2) 14:08 (2)	08:27 14:38	13:16 (3) 19 13:35 (3)
14	08:24 15:12	13:42 (3) 13:43 (3)	07:19 16:28	06:01 17:37	04:30 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:17	14 14:22 (2) 14:08 (2)	08:28 14:38	13:17 (3) 19 13:36 (3)
15	08:23 15:14	13:44 (3) 13:43 (3)	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:22 20:56	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	07:31 15:15	15 14:22 (2) 14:08 (2)	08:29 14:38	13:17 (3) 19 13:36 (3)
16	08:21 15:16	13:42 (3) 13:43 (3)	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	02:22 20:57	02:48 20:40	03:56 19:29	05:07 17:59	06:17 16:31	07:33 15:13	16 14:24 (2) 14:08 (2)	08:30 14:38	13:17 (3) 20 13:37 (3)
17	08:20 15:18	13:43 (3) 13:43 (3)	07:12 16:35	05:52 17:44	04:21 18:58	03:03 20:08	02:22 20:57	02:50 20:38	03:58 19:26	05:10 17:56	06:19 16:28	07:35 15:11	17 14:25 (2) 14:08 (2)	08:31 14:38	13:17 (3) 20 13:37 (3)
18	08:18 15:20	14:33 (2) 14:36 (2)	07:09 16:38	05:49 17:46	04:18 19:00	03:01 20:11	02:22 20:58	02:52 20:36	04:01 19:23	05:12 17:53	06:22 16:25	07:38 15:09	18 14:26 (2) 14:07 (2)	08:32 14:38	13:18 (3) 19 13:37 (3)
19	08:17 15:23	14:33 (2) 14:38 (2)	07:06 16:40	05:46 17:49	04:15 19:02	02:59 20:13	02:22 20:58	02:54 20:34	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:07	16 14:23 (2) 14:07 (2)	08:33 14:38	13:18 (3) 20 13:38 (3)
20	08:15 15:25	14:33 (2) 14:41 (2)	07:04 16:43	05:43 17:51	04:13 19:05	02:57 20:15	02:22 20:59	02:56 20:33	04:05 19:18	05:16 17:47	06:26 16:20	07:43 15:05	13 14:21 (2) 14:08 (2)	08:33 14:38	13:19 (3) 20 13:39 (3)
21	08:13 15:27	14:32 (2) 14:43 (2)	07:01 16:45	05:40 17:54	04:10 19:07	02:55 20:17	02:22 20:59	02:58 20:31	04:08 19:15	05:19 17:44	06:29 16:17	07:45 15:03	11 14:19 (2) 14:09 (2)	08:34 14:39	13:19 (3) 20 13:39 (3)
22	08:11 15:30	14:33 (2) 14:46 (2)	06:58 16:48	05:37 17:56	04:07 19:10	02:53 20:19	02:22 20:59	03:00 20:29	04:10 19:12	05:21 17:41	06:31 16:14	07:47 15:02	8 14:17 (2) 14:09 (2)	08:35 14:39	13:20 (3) 20 13:40 (3)
23	08:10 15:32	14:33 (2) 14:49 (2)	06:55 16:50	05:34 17:58	04:04 19:12	02:51 20:21	02:22 20:59	03:02 20:27	04:12 19:09	05:23 17:38	06:34 16:12	07:49 15:00	5 14:14 (2) 14:10 (2)	08:35 14:40	13:20 (3) 20 13:40 (3)
24	08:08 15:34	14:34 (2) 14:52 (2)	06:53 16:53	05:31 18:01	04:01 19:14	02:49 20:23	02:22 20:59	03:04 20:25	04:15 19:06	05:26 17:35	06:36 16:09	07:52 14:58	3 14:13 (2) 14:08 (2)	08:36 14:40	13:20 (3) 20 13:40 (3)
25	08:06 15:37	14:34 (2) 14:51 (2)	06:50 16:55	05:28 18:03	03:59 19:17	02:47 20:25	02:23 20:59	03:06 20:23	04:17 19:03	05:28 17:32	06:39 16:06	07:54 14:56	08:36 14:41	13:22 (3) 19 13:41 (3)	
26	08:04 15:39	14:35 (2) 14:51 (2)	06:47 16:58	05:25 18:05	03:56 19:19	02:45 20:27	02:23 20:59	03:08 20:20	04:19 19:01	05:30 17:29	06:41 16:04	07:56 14:55	08:36 14:42	13:22 (3) 20 13:42 (3)	
27	08:02 15:42	14:36 (2) 14:51 (2)	06:44 17:00	05:23 18:08	03:53 19:22	02:44 20:29	02:24 20:59	03:11 20:18	04:22 18:58	05:32 17:26	06:44 16:01	07:58 14:53	08:36 14:43	13:22 (3) 19 13:41 (3)	
28	08:00 15:44	14:37 (2) 14:50 (2)	06:41 17:03	05:20 18:10	03:50 19:24	02:42 20:31	02:25 20:59	03:13 20:16	04:24 18:55	05:35 17:23	06:46 15:58	08:01 14:52	08:36 14:44	13:22 (3) 20 13:42 (3)	
29	07:58 15:47	14:38 (2) 14:50 (2)	06:42 17:04	05:17 18:12	03:48 19:26	02:40 20:33	02:25 20:58	03:15 20:14	04:26 18:52	05:37 17:20	06:48 15:56	08:03 14:51	5 13:23 (3) 13:15 (3)	08:36 14:45	13:23 (3) 20 13:43 (3)
30	07:55 15:49	14:40 (2) 14:48 (2)	06:43 17:05	05:14 18:15	03:45 19:29	02:39 20:35	02:26 20:58	03:17 20:12	04:29 18:49	05:39 17:17	06:51 15:53	08:05 14:49	9 13:24 (3) 13:16 (3)	08:36 14:46	13:23 (3) 20 13:43 (3)
31	07:53 15:52	14:48 (2) 14:52 (2)	06:44 17:06	05:11 18:17	03:46 19:30	02:37 20:37	02:27 20:59	03:19 20:09	04:31 18:46	05:41 15:50	06:53 15:50	08:06 14:49	8 13:24 (3) 13:16 (3)	08:36 14:47	13:24 (3) 19 13:43 (3)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	170	194	572	
Total, worst case	349											170		572	
Sun reduction	0.27											0.28		0.30	
Oper. time red.	0.93											0.93		0.93	
Wind dir. red.	0.55											0.53		0.58	
Total reduction	0.14											0.14		0.16	
Total, real	49											23		93	

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

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



Project:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BN - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (270)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36	13:29 (3)   07:51	14:46 (2)   06:39	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07
2	08:35	13:29 (3)   07:49	14:54 (2)   06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:09
3	08:35	13:30 (3)   07:47	14:54 (2)   06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
4	08:34	13:30 (3)   07:44	14:54 (2)   06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12
5	08:33	13:31 (3)   07:42	14:54 (2)   06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14
6	08:33	13:32 (3)   07:39	14:54 (2)   06:24	04:53	03:29	02:29	02:33	03:33	04:45	05:53	07:08	08:16
7	08:32	13:33 (3)   07:37	14:54 (2)   06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
8	08:31	13:33 (3)   07:35	14:54 (2)   06:18	04:47	03:24	02:27	02:35	03:38	04:49	05:58	07:13	08:19
9	08:30	13:34 (3)   07:32	14:54 (2)   06:16	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
10	08:29	13:34 (3)   07:30	14:54 (2)   06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	08:22
11	08:28	13:35 (3)   07:27	14:54 (2)   06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
12	08:27	13:37 (3)   07:25	14:54 (2)   06:07	04:36	03:15	02:24	02:41	03:47	04:58	06:07	07:23	08:25
13	08:25	13:38 (3)   07:22	14:54 (2)   06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	08:27
14	08:24	13:40 (3)   07:19	14:54 (2)   06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
15	08:23	13:42 (3)   07:17	14:54 (2)   05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	08:29
16	08:21	13:48 (3)   07:14	14:54 (2)   05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	08:30
17	08:20	13:51 (3)   07:12	14:54 (2)   05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31
18	08:18	13:53 (3)   07:09	14:54 (2)   05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
19	08:17	13:56 (3)   07:06	14:54 (2)   05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
20	08:15	14:00 (2)   07:04	14:54 (2)   05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:43	08:34
21	08:13	14:02 (2)   07:01	14:54 (2)   05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:35
22	08:11	14:04 (2)   06:58	14:54 (2)   05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:36
23	08:10	14:06 (2)   06:55	14:54 (2)   05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	08:37
24	08:08	14:08 (2)   06:53	14:54 (2)   05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	08:38
25	08:06	14:10 (2)   06:50	14:54 (2)   05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:39
26	08:04	14:12 (2)   06:47	14:54 (2)   05:25	03:56	02:45	02:23	03:08	04:19	05:30	06:41	07:56	08:40
27	08:02	14:14 (2)   06:44	14:54 (2)   05:22	03:53	02:44	02:24	03:11	04:22	05:32	06:44	07:58	08:41
28	08:00	14:16 (2)   06:41	14:54 (2)   05:19	03:50	02:42	02:24	03:13	04:24	05:35	06:46	08:01	08:42
29	07:58	14:18 (2)   06:38	14:54 (2)   05:16	03:47	02:40	02:25	03:15	04:26	05:37	06:48	08:03	08:43
30	07:55	14:20 (2)   06:35	14:54 (2)   05:13	03:44	02:38	02:26	03:17	04:29	05:39	06:51	08:05	08:44
31	07:53	14:22 (2)   06:32	14:54 (2)   05:10	03:41	02:36	02:27	03:19	04:31	05:41	06:53	08:07	08:45
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194
Total, worst case	389	8									196	615
Sun reduction	0.27	0.29									0.28	0.30
Oper. time red.	0.93	0.93									0.93	0.93
Wind dir. red.	0.55	0.51									0.53	0.58
Total reduction	0.14	0.14									0.14	0.16
Total, real	54	1									27	99

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BO - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (271)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35 14:49	13:40 (3) 07:51	14:53 (2) 06:39	05:08 18:20	03:42 20:38	02:36 20:57	02:27 20:07	03:22 20:07	04:33 18:43	05:42 17:14	06:56 15:48	08:07 14:48
2	08:35 14:50	13:40 (3) 07:49	14:53 (2) 06:36	05:05 18:22	03:40 20:33	02:34 20:40	02:28 20:57	03:24 20:05	04:35 18:40	05:44 17:12	06:58 15:45	08:09 14:47
3	08:35 14:52	13:40 (3) 07:44	14:55 (2) 06:33	05:02 18:24	03:37 20:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	08:11 14:46
4	08:34 14:53	13:40 (3) 07:44	14:56 (2) 06:30	04:59 18:27	03:35 20:38	02:32 20:43	02:30 20:55	03:28 20:00	04:40 18:34	05:49 17:06	07:03 15:40	08:12 14:45
5	08:33 14:55	13:41 (3) 07:42	14:58 (2) 06:27	04:56 18:29	03:32 20:41	02:30 20:54	02:31 20:54	03:31 19:57	04:42 18:32	05:51 17:03	07:06 15:38	14:30 (2) 14:44
6	08:33 14:56	13:41 (3) 07:39	15:01 (2) 06:24	04:53 18:31	03:29 20:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36	14:25 (2) 14:43
7	08:32 14:58	13:42 (3) 07:37	15:04 (2) 06:17	04:50 18:34	03:27 20:48	02:28 20:52	02:34 20:52	03:35 19:52	04:47 18:26	05:56 16:57	07:11 15:33	14:26 (2) 14:42
8	08:31 15:00	13:42 (3) 07:35	15:01 (2) 06:14	04:47 18:36	03:24 20:49	02:27 20:51	02:35 19:50	03:38 18:23	04:49 16:54	05:58 15:31	07:13 15:16	14:25 (2) 14:41
9	08:30 15:02	13:43 (3) 07:32	15:02 (2) 06:11	04:44 18:38	03:22 20:50	02:26 20:50	02:37 19:47	03:40 18:20	04:51 16:51	06:00 15:28	07:16 15:18	14:24 (2) 14:40
10	08:29 15:04	13:43 (3) 07:30	15:03 (2) 06:10	04:41 18:41	03:20 20:51	02:25 20:49	02:38 19:45	03:42 18:17	04:54 16:48	06:03 15:26	07:18 15:17	14:24 (2) 14:40
11	08:28 15:06	13:44 (3) 07:27	15:04 (2) 06:09	04:38 18:43	03:17 20:52	02:25 20:47	02:40 19:42	03:45 18:14	04:56 16:45	06:05 15:24	07:21 15:18	14:24 (2) 14:39
12	08:27 15:08	13:44 (3) 07:25	15:05 (1) 06:07	04:36 18:46	03:15 20:53	02:24 20:46	02:41 19:39	03:47 18:11	04:58 16:42	06:07 15:22	07:23 15:17	14:24 (2) 14:39
13	08:25 15:10	13:45 (3) 07:22	15:06 (1) 06:04	04:33 18:48	03:12 20:54	02:23 20:44	02:43 19:37	03:49 18:08	05:01 16:40	06:10 15:19	07:26 15:15	14:24 (2) 14:38
14	08:24 15:12	13:46 (3) 07:19	15:07 (1) 06:01	04:30 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:17	14:23 (2) 14:38
15	08:23 15:14	13:47 (3) 07:17	15:08 (1) 05:58	04:27 18:53	03:08 20:04	02:22 20:56	02:47 20:41	03:54 18:02	05:05 16:34	06:14 15:15	07:31 15:15	14:24 (2) 14:38
16	08:21 15:16	13:48 (3) 07:14	15:09 (1) 05:55	04:24 18:55	03:06 20:06	02:22 20:57	02:48 20:40	03:56 17:59	05:07 16:31	06:17 15:13	07:33 15:13	14:25 (2) 14:38
17	08:20 15:18	13:49 (3) 07:12	15:10 (1) 05:52	04:21 18:58	03:03 20:08	02:22 20:57	02:50 20:38	03:59 19:26	05:10 17:56	06:19 16:28	07:35 15:11	14:26 (2) 14:38
18	08:18 15:20	13:50 (3) 07:09	15:11 (1) 05:49	04:18 19:00	03:01 20:11	02:22 20:58	02:52 20:36	04:01 19:23	05:12 17:53	06:22 16:25	07:38 15:09	14:27 (2) 14:38
19	08:17 15:23	13:52 (3) 07:06	15:12 (1) 05:46	04:15 19:02	02:59 20:13	02:22 20:58	02:54 20:34	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:07	14:28 (2) 14:33
20	08:15 15:25	13:53 (3) 07:04	15:13 (1) 05:43	04:13 19:05	02:57 20:15	02:22 20:59	02:56 20:33	04:05 19:17	05:16 17:47	06:26 16:20	07:43 15:05	14:29 (2) 14:33
21	08:13 15:27	14:01 (3) 06:43	15:14 (1) 05:40	04:10 19:07	02:55 20:17	02:22 20:59	02:58 20:31	04:08 19:15	05:19 17:44	06:29 16:17	07:45 15:03	14:30 (2) 14:39
22	08:11 15:30	14:02 (3) 06:40	15:15 (1) 05:37	04:07 19:09	02:53 20:19	02:22 20:59	03:00 20:29	04:10 19:12	05:21 17:41	06:31 16:14	07:47 15:02	14:31 (3) 14:39
23	08:10 15:32	14:03 (3) 06:37	15:16 (1) 05:34	04:04 19:12	02:52 20:21	02:22 20:59	03:02 20:27	04:12 19:09	05:23 17:38	06:34 16:12	07:49 15:10	14:32 (3) 14:40
24	08:08 15:34	14:04 (3) 06:34	15:17 (1) 05:31	04:01 19:14	02:49 20:23	02:22 20:59	03:04 20:25	04:15 19:06	05:26 17:35	06:36 16:09	07:52 15:14	14:33 (3) 14:40
25	08:06 15:37	14:05 (2) 06:30	15:18 (1) 05:28	03:59 19:17	02:47 20:25	02:23 20:59	03:06 20:23	04:17 19:03	05:28 17:32	06:39 16:06	07:54 15:13	14:34 (3) 14:41
26	08:04 15:39	14:06 (2) 06:27	15:19 (1) 05:25	03:56 19:19	02:45 20:27	02:23 20:59	03:08 20:20	04:19 19:01	05:30 17:29	06:41 16:04	07:56 15:12	14:35 (3) 14:42
27	08:02 15:42	14:07 (2) 06:24	15:20 (1) 05:23	03:53 19:21	02:44 20:29	02:24 20:59	03:11 20:18	04:22 18:58	05:32 17:26	06:44 16:01	07:58 15:12	14:36 (3) 14:43
28	08:00 15:44	14:08 (2) 06:21	15:21 (1) 05:20	03:50 19:24	02:42 20:31	02:25 20:59	03:13 20:16	04:24 18:55	05:35 17:23	06:46 16:08	07:59 15:12	14:37 (3) 14:44
29	07:58 15:47	14:09 (2) 06:18	15:22 (1) 05:17	03:48 19:26	02:40 20:33	02:25 20:58	03:15 20:14	04:26 18:52	05:37 17:20	06:48 16:56	07:58 15:19	14:38 (3) 14:45
30	07:55 15:49	14:10 (2) 06:15	15:23 (1) 05:14	03:45 19:29	02:39 20:33	02:26 20:58	03:17 20:12	04:29 18:49	05:39 17:17	06:51 16:53	07:59 15:15	14:39 (3) 14:46
31	07:53 15:52	14:11 (2) 06:12	15:24 (1) 05:11	03:42 19:29	02:37 20:37	02:27 20:58	03:19 20:09	04:31 18:46	05:41 17:50	06:53 16:50	07:59 15:12	14:40 (3) 14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194
Total, worst case	445	161								90	299	470
Sun reduction	0.27	0.29								0.28	0.28	0.30
Oper. time red.	0.93	0.93								0.93	0.93	0.93
Wind dir. red.	0.55	0.50								0.51	0.53	0.57
Total reduction	0.14	0.14								0.13	0.14	0.16
Total, real	62	22								12	41	75

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:

Gismarvik

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Licensed user:

**Kjeller Vindteknikk AS**  
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NO-2007 Kjeller  
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Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BP - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (272)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36	07:51	06:39	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:54	17:05	18:20	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:09
	14:50	15:57	17:08	18:22	19:33	20:40	20:57	20:05	18:40	17:12	15:45	14:47
3	08:35	07:47	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	15:59	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:45
5	08:33	07:42	06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44
6	08:33	07:39	06:24	04:53	03:29	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:56	16:07	17:18	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:45	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:18	04:47	03:24	02:27	02:35	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:16	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29	07:30	06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	08:22
	15:04	16:17	17:27	18:41	19:52	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:27	07:25	06:07	04:36	03:15	02:24	02:41	03:47	04:58	06:07	07:23	08:25
	15:08	16:22	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39
13	08:25	07:22	06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	14:08 (2)
	15:10	16:25	17:34	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:19	3 14:11 (2)
14	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	14:04 (2)
	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	9 14:13 (2)
15	08:23	14:26 (2)	07:17	05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	14:03 (2)
	15:14	2 14:28 (2)	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	12 14:15 (2)
16	08:21	14:26 (2)	07:14	05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	14:02 (2)
	15:16	4 14:30 (2)	16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	14 14:16 (2)
17	08:20	14:26 (2)	07:12	05:52	04:21	03:03	02:22	02:50	03:58	05:10	06:19	14:02 (2)
	15:18	7 14:33 (2)	16:35	17:44	18:58	20:08	20:57	20:38	19:26	17:56	16:28	15 14:17 (2)
18	08:18	14:26 (2)	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	14:02 (2)
	15:20	9 14:35 (2)	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	16 14:18 (2)
19	08:17	14:26 (2)	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	14:01 (2)
	15:23	12 14:38 (2)	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	17 14:18 (2)
20	08:15	14:27 (2)	07:04	05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	14:02 (2)
	15:25	14 14:41 (2)	16:43	17:51	19:05	20:15	20:59	20:33	19:18	17:47	16:20	17 14:19 (2)
21	08:13	14:26 (2)	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	14:02 (2)
	15:27	17 14:43 (2)	16:45	17:54	19:07	20:17	20:59	20:31	19:15	17:44	16:17	17 14:19 (2)
22	08:11	14:27 (2)	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	14:03 (2)
	15:30	17 14:44 (2)	16:48	17:56	19:10	20:19	20:59	20:29	19:12	17:41	16:14	14 14:17 (2)
23	08:10	14:27 (2)	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	14:02 (2)
	15:32	17 14:44 (2)	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	12 14:14 (2)
24	08:08	14:28 (2)	06:53	05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	14:03 (2)
	15:34	16 14:44 (2)	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	10 14:13 (2)
25	08:06	14:28 (2)	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	14:04 (2)
	15:37	15 14:43 (2)	16:55	18:03	19:17	20:25	20:59	20:23	19:03	17:32	16:06	7 14:11 (2)
26	08:04	14:30 (2)	06:47	05:25	03:56	02:45	02:23	03:08	04:19	05:30	06:41	14:04 (2)
	15:39	13 14:43 (2)	16:58	18:05	19:19	20:27	20:59	20:20	19:01	17:29	16:04	4 14:08 (2)
27	08:02	14:31 (2)	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:44	14:06 (2)
	15:42	12 14:43 (2)	17:00	18:08	19:22	20:29	20:59	20:18	18:58	17:26	16:01	2 14:07 (2)
28	08:00	14:32 (2)	06:41	05:20	03:50	02:42	02:25	03:13	04:24	05:35	06:46	08:01
	15:44	9 14:41 (2)	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:23	15:58	14:52
29	07:58	14:36 (2)		05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	08:03
	15:47	3 14:39 (2)		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51
30	07:55			05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05
	15:49			18:15	19:29	20:35	20:58	20:12	18:49	17:17	15:53	14:49
31	07:53			05:11	03:42	02:37		03:19	04:31		06:53	08:36
	15:52			18:17	19:31	20:37		20:09	18:46		15:50	14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194
Total, worst case	167										169	
Sun reduction	0.27										0.28	
Oper. time red.	0.93										0.93	
Wind dir. red.	0.53										0.53	
Total reduction	0.13										0.14	
Total, real	22										23	

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:

Gismarvik

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15.08.2011 12:14 / 70

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BQ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (273)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June			
1	08:35	07:51	06:38	05:08	17:20 (3)	03:42	02:36		
	14:49	15:54	17:05	18:19	17:49 (3)	19:31	20:38		
2	08:35	07:49	06:36	05:05	17:19 (3)	03:40	02:34		
	14:50	15:57	17:08	18:22	17:49 (3)	19:33	20:40		
3	08:35	07:46	06:33	05:02	17:18 (3)	03:37	02:33		
	14:52	15:59	17:10	18:24	17:53 (2)	19:36	20:42		
4	08:34	07:44	15:18 (5)	06:30	04:59	17:17 (3)	03:35	02:32	
	14:53	16:02	6 15:24 (5)	17:13	18:27	17:55 (2)	19:38	20:43	
5	08:33	07:42	15:16 (5)	06:27	16:42 (4)	04:56	17:16 (3)	03:32	02:30
	14:55	16:05	10 15:26 (5)	17:15	2 16:43 (4)	18:29	41 17:57 (2)	19:41	20:45
6	08:33	07:39	15:16 (5)	06:24	16:40 (4)	04:53	17:16 (3)	03:30	02:29
	14:56	16:07	14 15:30 (5)	17:18	6 16:46 (4)	18:31	44 18:00 (2)	19:43	20:46
7	08:32	07:37	15:15 (5)	06:21	16:38 (4)	04:50	17:16 (3)	03:27	02:28
	14:58	16:10	18 15:33 (5)	17:20	10 16:48 (4)	18:34	47 18:03 (2)	19:45	20:48
8	08:31	07:35	15:14 (5)	06:18	16:37 (4)	04:47	17:16 (3)	03:25	02:27
	15:00	16:12	21 15:35 (5)	17:22	14 16:51 (4)	18:36	49 18:05 (1)	19:48	20:49
9	08:30	07:32	15:14 (5)	06:16	16:37 (4)	04:44	17:15 (3)	03:22	02:26
	15:02	16:15	25 15:39 (5)	17:25	17 16:54 (4)	18:38	52 18:07 (1)	19:50	20:50
10	08:29	07:30	15:13 (5)	06:13	16:37 (4)	04:41	17:15 (3)	03:20	02:26
	15:04	16:17	27 15:40 (5)	17:27	20 16:57 (4)	18:41	54 18:09 (1)	19:52	20:51
11	08:28	07:27	15:13 (5)	06:10	16:36 (4)	04:38	17:15 (3)	03:17	02:25
	15:06	16:20	27 15:40 (5)	17:30	23 16:59 (4)	18:43	56 18:11 (1)	19:55	20:52
12	08:27	07:25	15:12 (5)	06:07	16:36 (4)	04:36	17:17 (3)	03:15	02:24
	15:08	16:23	28 15:40 (5)	17:32	22 16:58 (4)	18:46	57 18:14 (1)	19:57	20:53
13	08:25	07:22	15:13 (5)	06:04	16:36 (4)	04:33	17:17 (3)	03:12	02:23
	15:10	16:25	28 15:41 (5)	17:34	22 16:58 (4)	18:48	59 18:16 (1)	19:59	20:54
14	08:24	07:19	15:13 (5)	06:01	16:37 (4)	04:30	17:18 (3)	03:10	02:23
	15:12	16:28	28 15:41 (5)	17:37	20 16:57 (4)	18:50	55 18:15 (1)	20:02	20:55
15	08:23	07:17	15:13 (5)	05:58	16:37 (4)	04:27	17:19 (3)	03:08	02:23
	15:14	16:30	28 15:41 (5)	17:39	19 16:56 (4)	18:53	51 18:14 (1)	20:04	20:56
16	08:21	07:14	15:13 (5)	05:55	16:38 (4)	04:24	17:20 (3)	03:06	02:22
	15:16	16:33	27 15:40 (5)	17:42	16 16:54 (4)	18:55	39 18:12 (1)	20:06	20:57
17	08:20	07:12	15:13 (5)	05:52	16:40 (4)	04:21	17:23 (3)	03:03	02:22
	15:18	16:35	27 15:40 (5)	17:44	12 16:52 (4)	18:57	21 18:11 (1)	20:08	20:57
18	08:18	07:09	15:14 (5)	05:49	16:44 (4)	04:18	17:28 (3)	03:01	02:22
	15:20	16:38	25 15:39 (5)	17:46	3 16:47 (4)	19:00	4 17:32 (3)	20:11	20:58
19	08:16	07:06	15:15 (5)	05:46	04:15	02:59	02:22		
	15:23	16:40	24 15:39 (5)	17:49	19:02	20:13	20:58		
20	08:15	07:03	15:16 (5)	05:43	04:13	02:57	02:22		
	15:25	16:43	21 15:37 (5)	17:51	19:05	20:15	20:59		
21	08:13	07:01	15:18 (5)	05:40	04:10	02:55	02:22		
	15:27	16:45	18 15:36 (5)	17:53	19:07	20:17	20:59		
22	08:11	06:58	15:20 (5)	05:37	04:07	02:53	02:22		
	15:30	16:48	13 15:33 (5)	17:56	19:09	20:19	20:59		
23	08:09	06:55	15:25 (5)	05:34	04:04	02:51	02:22		
	15:32	16:50	3 15:28 (5)	17:58	19:12	20:21	20:59		
24	08:08	06:52	05:31	02:49	04:01	02:49	02:22		
	15:35	16:53	18:01	19:14	20:23	20:59			
25	08:06	06:50	05:28	02:47	03:59	02:47	02:23		
	15:37	16:55	18:03	19:17	20:25	20:59			
26	08:04	06:47	05:25	02:45	03:56	02:45	02:23		
	15:39	16:58	18:05	19:19	20:27	20:59			
27	08:02	06:44	05:23	17:32 (3)	03:53	02:44	02:24		
	15:42	17:00	18:08	5 17:37 (3)	19:21	20:29	20:59		
28	08:00	06:41	05:20	17:28 (3)	03:51	02:42	02:25		
	15:44	17:03	18:10	12 17:40 (3)	19:24	20:31	20:59		
29	07:58		05:17	17:25 (3)	03:48	02:40	02:25		
	15:47		18:12	17 17:42 (3)	19:26	20:33	20:58		
30	07:55		05:14	17:23 (3)	03:45	02:39	02:26		
	15:49		18:15	21 17:44 (3)	19:29	20:35	20:58		
31	07:53		05:11	17:21 (3)		02:37			
	15:52		18:17	25 17:46 (3)		20:37			
Potential sun hours	216	257	365	434	526	554			
Total, worst case		418	286	761					
Sun reduction		0.29	0.28	0.30					
Oper. time red.		0.93	0.93	0.93					
Wind dir. red.		0.50	0.55	0.63					
Total reduction		0.14	0.14	0.18					
Total, real		57	41	134					

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:

Gismarvik

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Licensed user:

Kjeller Vindteknikk AS

Gunnar Randres vei 12

NO-2007 Kjeller

(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BQ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (273)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	July	August	September	October	November	December
1	02:27   03:22	03:22	04:33	17:14 (3)   05:42	16:15 (4)   06:56	14:43 (5)   08:07
	20:57   20:07	20:07	18:43	18:10 (1)   17:14	16:37 (4)   15:48	15:10 (5)   14:48
2	02:28   03:24	03:24	04:35	17:14 (3)   05:44	16:15 (4)   06:58	14:43 (5)   08:09
	20:56   20:04	20:04	18:40	18:08 (1)   17:12	16:37 (4)   15:45	15:08 (5)   14:47
3	02:29   03:26	03:26	04:38	17:13 (3)   05:46	16:14 (4)   07:01	14:43 (5)   08:10
	20:56   20:02	20:02	18:37	18:05 (1)   17:09	16:35 (4)   15:43	15:04 (5)   14:46
4	02:30   03:28	03:28	04:40	17:13 (3)   05:49	16:14 (4)   07:03	14:44 (5)   08:12
	20:55   20:00	20:00	18:34	18:02 (1)   17:06	16:33 (4)   15:40	15:02 (5)   14:45
5	02:31   03:31	03:31	04:42	17:12 (3)   05:51	16:14 (4)   07:06	14:46 (5)   08:14
	20:54   19:57	19:57	18:32	17:59 (2)   17:03	16:29 (4)   15:38	14:59 (5)   14:44
6	02:33   03:33	03:33	04:45	17:11 (3)   05:53	16:14 (4)   07:08	14:47 (5)   08:16
	20:53   19:55	19:55	18:29	17:56 (2)   17:00	16:26 (4)   15:36	14:57 (5)   14:43
7	02:34   03:35	03:35	04:47	17:12 (3)   05:56	16:15 (4)   07:11	14:49 (5)   08:18
	20:52   19:52	19:52	18:26	17:54 (2)   16:57	16:24 (4)   15:33	14:54 (5)   14:42
8	02:35   03:38	03:38	04:49	17:12 (3)   05:58	16:16 (4)   07:13	14:49 (5)   08:19
	20:51   19:50	19:50	18:23	17:51 (2)   16:54	16:20 (4)   15:31	14:51 (5)   14:41
9	02:37   03:40	03:40	04:51	17:12 (3)   06:00	16:16 (4)   07:16	14:49 (5)   08:21
	20:50   19:47	19:47	18:20	17:47 (2)   16:51	16:16 (4)   15:28	14:50 (5)   14:40
10	02:38   03:42	03:42	04:54	17:12 (3)   06:03	16:16 (4)   07:18	14:49 (5)   08:22
	20:48   19:44	19:44	18:17	17:43 (3)   16:48	16:16 (4)   15:26	14:50 (5)   14:40
11	02:40   03:45	03:45	04:56	17:12 (3)   06:05	16:16 (4)   07:21	14:49 (5)   08:24
	20:47   19:42	19:42	18:14	17:41 (3)   16:45	16:16 (4)   15:24	14:50 (5)   14:39
12	02:42   03:47	03:47	04:58	17:13 (3)   06:07	16:16 (4)   07:23	14:49 (5)   08:25
	20:46   19:39	19:39	18:11	17:39 (3)   16:42	16:16 (4)   15:22	14:50 (5)   14:39
13	02:43   03:49	03:49	05:01	17:14 (3)   06:10	16:16 (4)   07:26	14:49 (5)   08:26
	20:44   19:37	19:37	18:08	17:36 (3)   16:40	16:16 (4)   15:19	14:50 (5)   14:39
14	02:45   03:52	03:52	05:03	17:15 (3)   06:12	16:16 (4)   07:28	14:49 (5)   08:28
	20:43   19:34	19:34	18:05	17:33 (3)   16:37	16:16 (4)   15:17	14:50 (5)   14:38
15	02:47   03:54	03:54	05:05	17:17 (3)   06:14	16:16 (4)   07:31	14:49 (5)   08:29
	20:41   19:31	19:31	18:02	17:30 (3)   16:34	16:16 (4)   15:15	14:50 (5)   14:38
16	02:49   03:56	03:56	05:07	17:20 (3)   06:17	16:16 (4)   07:33	14:49 (5)   08:30
	20:40   19:28	19:28	17:59	17:26 (3)   16:31	16:16 (4)   15:13	14:50 (5)   14:38
17	02:50   03:59	03:59	05:10	17:20 (3)   06:19	16:16 (4)   07:35	14:49 (5)   08:31
	20:38   19:26	19:26	17:56	17:26 (3)   16:28	16:16 (4)   15:11	14:50 (5)   14:38
18	02:52   04:01	04:01	05:12	17:22 (3)   06:22	16:16 (4)   07:38	14:49 (5)   08:32
	20:36   19:23	19:23	17:53	17:22 (3)   16:25	16:16 (4)   15:09	14:50 (5)   14:38
19	02:54   04:03	04:03	05:14	17:23 (3)   06:24	14:54 (5)   07:40	14:49 (5)   08:33
	20:34   19:20	19:20	17:50	17:23 (3)   16:23	15:02 (5)   15:07	14:50 (5)   14:38
20	02:56   04:05	04:05	05:16	17:24 (3)   06:26	14:50 (5)   07:42	14:49 (5)   08:33
	20:33   19:17	19:17	17:47	17:24 (3)   16:20	15:05 (5)   15:05	14:50 (5)   14:39
21	02:58   04:08	04:08	05:19	17:25 (3)   06:29	14:47 (5)   07:45	14:49 (5)   08:34
	20:31   19:15	19:15	17:44	17:25 (3)   16:17	15:06 (5)   15:03	14:50 (5)   14:39
22	03:00   04:10	04:10	05:21	17:26 (3)   06:31	14:46 (5)   07:47	14:49 (5)   08:35
	20:29   19:12	19:12	17:41	17:26 (3)   16:14	15:08 (5)   15:02	14:50 (5)   14:39
23	03:02   04:12	04:12	05:23	17:27 (3)   06:34	14:44 (5)   07:49	14:49 (5)   08:35
	20:27   19:09	19:09	17:38	17:27 (3)   16:12	15:08 (5)   15:00	14:50 (5)   14:40
24	03:04   04:15	04:15	05:26	17:28 (3)   06:36	14:44 (5)   07:52	14:49 (5)   08:35
	20:25   19:06	19:06	17:35	17:28 (3)   16:09	15:09 (5)   14:58	14:50 (5)   14:41
25	03:06   04:17	04:17	17:30 (3)   05:28	17:29 (3)   06:39	14:43 (5)   07:54	14:49 (5)   08:36
	20:23   19:03	19:03	17:36 (3)   17:32	17:29 (3)   16:06	15:10 (5)   14:57	14:50 (5)   14:41
26	03:09   04:19	04:19	17:25 (3)   05:30	17:30 (3)   06:41	14:42 (5)   07:56	14:49 (5)   08:36
	20:20   19:01	19:01	18:13 (1)   17:29	17:30 (3)   16:04	15:10 (5)   14:55	14:50 (5)   14:42
27	03:11   04:22	04:22	17:23 (3)   05:32	17:31 (3)   06:44	14:42 (5)   07:58	14:49 (5)   08:36
	20:18   18:58	18:58	18:15 (1)   17:26	17:31 (3)   16:01	15:10 (5)   14:53	14:50 (5)   14:43
28	03:13   04:24	04:24	17:21 (3)   05:35	17:32 (3)   06:46	14:42 (5)   08:00	14:49 (5)   08:36
	20:16   18:55	18:55	18:16 (1)   17:23	17:32 (3)   15:58	15:10 (5)   14:52	14:50 (5)   14:44
29	03:15   04:26	04:26	17:19 (3)   05:37	17:33 (3)   06:48	14:42 (5)   08:03	14:49 (5)   08:36
	20:14   18:52	18:52	18:16 (1)   17:20	17:33 (3)   15:56	15:11 (5)   14:51	14:50 (5)   14:45
30	03:17   04:29	04:29	17:17 (3)   05:39	17:34 (3)   06:51	14:42 (5)   08:05	14:49 (5)   08:36
	20:12   18:49	18:49	18:16 (1)   17:17	17:34 (3)   15:53	15:10 (5)   14:49	14:50 (5)   14:46
31	03:19   04:31	04:31	17:16 (3)   05:41	17:35 (3)   06:53	14:42 (5)   08:07	14:49 (5)   08:36
	20:09   18:46	18:46	18:13 (1)   17:16	17:35 (3)   15:50	15:10 (5)   14:49	14:50 (5)   14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case		289	647	433	119	
Sun reduction		0.24	0.26	0.28	0.28	
Oper. time red.		0.93	0.93	0.93	0.93	
Wind dir. red.		0.63	0.61	0.51	0.50	
Total reduction		0.14	0.15	0.13	0.13	
Total, real		41	96	57	16	

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:

Gismarvik

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Licensed user:

Kjeller Vindteknikk AS

Gunnar Randres vei 12

NO-2007 Kjeller

(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BR - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (274)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19		03:42 19:31
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	17:41 (3)	03:40 19:33
3	08:35 14:52	07:46 16:00	06:33 17:10	05:02 18:24	10 17:51 (3)	03:37 19:36
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	15 17:53 (3)	03:35 19:38
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	20 17:55 (3)	03:32 19:41
6	08:33 14:56	07:39 16:07	06:24 17:18	04:53 18:31	24 17:57 (3)	03:30 19:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	27 18:00 (3)	03:27 19:45
8	08:31 15:00	07:35 16:12	15:31 (5) 15:35 (5)	06:18 17:22	29 18:00 (3)	03:25 19:48
9	08:30 15:02	07:32 16:15	15:30 (5) 15:39 (5)	06:16 17:25	31 18:01 (3)	03:22 19:50
10	08:29 15:04	07:30 16:17	15:28 (5) 15:41 (5)	06:13 17:27	32 18:01 (3)	03:20 19:52
11	08:28 15:06	07:27 16:20	15:26 (5) 15:44 (5)	06:10 17:30	33 18:01 (3)	03:17 19:55
12	08:27 15:08	07:25 16:23	15:25 (5) 15:47 (5)	06:07 17:32	34 18:01 (3)	03:15 19:57
13	08:25 15:10	07:22 16:25	15:25 (5) 15:50 (5)	06:04 17:34	33 17:27 (3)	03:12 19:59
14	08:24 15:12	07:19 16:28	15:24 (5) 15:51 (5)	06:01 17:37	34 18:01 (3)	03:10 20:02
15	08:23 15:14	07:17 16:30	15:23 (5) 15:51 (5)	05:58 17:39	33 17:27 (3)	03:08 20:04
16	08:21 15:16	07:14 16:33	15:23 (5) 15:51 (5)	05:55 17:42	32 17:59 (3)	03:06 20:06
17	08:20 15:18	07:12 16:35	15:22 (5) 15:51 (5)	05:52 17:44	31 17:58 (3)	03:03 20:08
18	08:18 15:20	07:09 16:38	15:22 (5) 15:51 (5)	05:49 17:46	30 17:58 (3)	03:01 20:11
19	08:16 15:23	07:06 16:40	15:22 (5) 15:51 (5)	05:46 17:49	29 17:57 (3)	02:59 20:13
20	08:15 15:25	07:03 16:43	15:23 (5) 15:51 (5)	05:43 17:51	27 17:56 (3)	02:57 20:15
21	08:13 15:27	07:01 16:45	15:23 (5) 15:51 (5)	05:40 17:53	25 17:55 (3)	02:55 20:17
22	08:11 15:30	06:58 16:48	15:24 (5) 15:50 (5)	05:37 17:56	22 17:53 (3)	02:53 20:19
23	08:09 15:32	06:55 16:50	15:24 (5) 15:49 (5)	05:34 17:58	19 17:51 (3)	02:51 20:21
24	08:08 15:35	06:52 16:53	15:25 (5) 15:48 (5)	05:31 18:01	14 17:49 (3)	02:49 20:23
25	08:06 15:37	06:50 16:55	15:27 (5) 15:46 (5)	05:28 18:03	4 17:44 (3)	02:47 20:25
26	08:04 15:39	06:47 16:58	15:28 (5) 15:44 (5)	05:25 18:05		02:45 20:27
27	08:02 15:42	06:44 17:00	15:31 (5) 15:41 (5)	05:23 18:08		02:44 20:29
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24		02:42 20:31
29	07:58 15:47		05:17 18:12	03:48 19:26		02:40 20:33
30	07:55 15:49		05:14 18:15	03:45 19:29		02:39 20:35
31	07:53 15:52		05:11 18:17	03:42 19:31		02:37 20:37
Potential sun hours	216	257	365	434	588	554
Total, worst case		436			588	
Sun reduction		0.29			0.30	
Oper. time red.		0.93			0.93	
Wind dir. red.		0.51			0.64	
Total reduction		0.14			0.18	
Total, real		60		105		

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BR - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (274)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	July	August	September	October	November	December
1	02:27	03:22	04:33	17:26 (3)	05:42	06:56
	20:57	20:07	18:43	34 18:00 (3)	17:14	15:48
2	02:28	03:24	04:35	17:27 (3)	05:44	06:58
	20:56	20:04	18:40	33 18:00 (3)	17:12	15:45
3	02:29	03:26	04:38	17:27 (3)	05:46	07:01
	20:56	20:02	18:37	32 17:59 (3)	17:09	15:43
4	02:30	03:29	04:40	17:27 (3)	05:49	07:03
	20:55	20:00	18:34	31 17:58 (3)	17:06	15:40
5	02:31	03:31	04:42	17:27 (3)	05:51	07:06
	20:54	19:57	18:32	30 17:57 (3)	17:03	15:38
6	02:33	03:33	04:45	17:28 (3)	05:53	07:08
	20:53	19:55	18:29	27 17:55 (3)	17:00	15:36
7	02:34	03:35	04:47	17:29 (3)	05:56	07:11
	20:52	19:52	18:26	25 17:54 (3)	16:57	15:33
8	02:35	03:38	04:49	17:30 (3)	05:58	07:13
	20:51	19:50	18:23	21 17:51 (3)	16:54	15:31
9	02:37	03:40	04:51	17:32 (3)	06:00	07:16
	20:50	19:47	18:20	15 17:47 (3)	16:51	15:28
10	02:38	03:42	04:54	17:34 (3)	06:03	07:18
	20:48	19:44	18:17	10 17:44 (3)	16:48	15:26
11	02:40	03:45	04:56	06:05	07:21	08:24
	20:47	19:42	18:14	16:45	15:24	14:39
12	02:42	03:47	04:58	06:07	07:23	08:25
	20:46	19:39	18:11	16:42	15:22	14:39
13	02:43	03:49	05:01	06:10	07:26	08:26
	20:44	19:37	18:08	16:40	15:19	14:39
14	02:45	03:52	05:03	06:12	07:28	08:28
	20:43	19:34	18:05	16:37	15:17	14:38
15	02:47	03:54	05:05	06:14	15:03 (5)	07:31
	20:41	19:31	18:02	16:34	12 15:15 (5)	15:15
16	02:49	03:56	05:07	06:17	14:59 (5)	07:33
	20:40	19:28	17:59	16:31	18 15:17 (5)	15:13
17	02:50	03:59	05:10	06:19	14:58 (5)	07:35
	20:38	19:26	17:56	16:28	21 15:19 (5)	15:11
18	02:52	04:01	05:12	06:22	14:56 (5)	07:38
	20:36	19:23	17:53	16:25	23 15:19 (5)	15:09
19	02:54	04:03	17:44 (3)	05:14	06:24	14:55 (5)
	20:34	19:20	7 17:51 (3)	17:50	16:23	25 15:20 (5)
20	02:56	04:06	17:40 (3)	05:16	06:26	14:55 (5)
	20:33	19:17	15 17:55 (3)	17:47	16:20	26 15:21 (5)
21	02:58	04:08	17:38 (3)	05:19	06:29	14:53 (5)
	20:31	19:15	19 17:57 (3)	17:44	16:17	28 15:21 (5)
22	03:00	04:10	17:35 (3)	05:21	06:31	14:53 (5)
	20:29	19:12	23 17:58 (3)	17:41	16:14	29 15:22 (5)
23	03:02	04:12	17:34 (3)	05:23	06:34	14:52 (5)
	20:27	19:09	25 17:59 (3)	17:38	16:12	29 15:21 (5)
24	03:04	04:15	17:32 (3)	05:26	06:36	14:52 (5)
	20:25	19:06	27 17:59 (3)	17:35	16:09	29 15:21 (5)
25	03:06	04:17	17:31 (3)	05:28	06:39	14:53 (5)
	20:23	19:03	29 18:00 (3)	17:32	16:06	29 15:22 (5)
26	03:09	04:19	17:30 (3)	05:30	06:41	14:52 (5)
	20:20	19:01	30 18:00 (3)	17:29	16:04	29 15:21 (5)
27	03:11	04:22	17:30 (3)	05:32	06:44	14:53 (5)
	20:18	18:58	31 18:01 (3)	17:26	16:01	27 15:20 (5)
28	03:13	04:24	17:29 (3)	05:35	06:46	14:54 (5)
	20:16	18:55	32 18:01 (3)	17:23	15:58	26 15:20 (5)
29	03:15	04:26	17:28 (3)	05:37	06:48	14:54 (5)
	20:14	18:52	33 18:01 (3)	17:20	15:56	25 15:19 (5)
30	03:17	04:29	17:27 (3)	05:39	06:51	14:54 (5)
	20:12	18:49	34 18:01 (3)	17:17	15:53	22 15:16 (5)
31	03:19	04:31	17:27 (3)		06:53	14:56 (5)
	20:09	18:46	33 18:00 (3)		15:50	17 15:13 (5)
Potential sun hours	551	481	387	318	232	194
Total, worst case		338	258	415	25	
Sun reduction		0.24	0.26	0.28	0.28	
Oper. time red.		0.93	0.93	0.93	0.93	
Wind dir. red.		0.64	0.64	0.51	0.51	
Total reduction		0.14	0.15	0.13	0.13	
Total, real		48	40	55	3	

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BS - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (275)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum

813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June						
1	08:35	07:51	06:38	15:34 (5)	05:08	03:42	02:36					
	14:49	15:54	17:05	16	15:50 (5)	18:19	19:31	20:38				
2	08:35	07:49	06:36	15:37 (5)	05:05	03:40	02:34					
	14:50	15:57	17:08	10	15:47 (5)	18:22	19:33	20:40				
3	08:35	07:46	06:33	15:40 (5)	05:02	03:37	02:33					
	14:52	16:00	17:10		18:24	19:36	20:42					
4	08:34	07:44	06:30	15:43 (5)	04:59	03:35	02:32					
	14:53	16:02	17:13		18:27	19:38	20:43					
5	08:33	07:42	06:27	15:46 (5)	04:56	17:50 (3)	03:32	02:30				
	14:55	16:05	17:15		18:29	5	17:55 (3)	19:41	20:45			
6	08:33	07:39	06:24	15:49 (5)	04:53	17:46 (3)	03:30	02:29				
	14:56	16:07	17:18		18:31	14	18:00 (3)	19:43	20:46			
7	08:32	07:37	06:21	15:52 (5)	04:50	17:43 (3)	03:27	02:28				
	14:58	16:10	17:20		18:34	19	18:02 (3)	19:45	20:48			
8	08:31	07:35	06:18	15:55 (5)	04:47	17:41 (3)	03:25	02:27				
	15:00	16:12	17:22		18:36	23	18:04 (3)	19:48	20:49			
9	08:30	07:32	06:16	15:58 (5)	04:44	17:39 (3)	03:22	02:26				
	15:02	16:15	17:25		18:38	26	18:05 (3)	19:50	20:50			
10	08:29	07:30	06:13	16:01 (5)	04:41	17:37 (3)	03:20	02:26				
	15:04	16:17	17:27		18:41	28	18:05 (3)	19:52	20:51			
11	08:28	07:27	15:40 (5)	06:10	16:56 (4)	04:38	17:36 (3)	03:17	02:25			
	15:06	16:20	4	15:44 (5)	17:30	3	16:59 (4)	18:43	30	18:06 (3)	19:55	20:52
12	08:27	07:25	15:36 (5)	06:07	16:54 (4)	04:36	17:36 (3)	03:15	02:24			
	15:08	16:23	11	15:47 (5)	17:32	8	17:02 (4)	18:46	31	18:07 (3)	19:57	20:53
13	08:25	07:22	15:35 (5)	06:04	16:52 (4)	04:33	17:35 (3)	03:12	02:23			
	15:10	16:25	15	15:50 (5)	17:34	12	17:04 (4)	18:48	32	18:07 (3)	19:59	20:54
14	08:24	07:19	15:33 (5)	06:01	16:51 (4)	04:30	17:34 (3)	03:10	02:23			
	15:12	16:28	20	15:53 (5)	17:37	16	17:07 (4)	18:50	33	18:07 (3)	20:02	20:55
15	08:23	07:17	15:32 (5)	05:58	16:50 (4)	04:27	17:33 (3)	03:08	02:23			
	15:14	16:30	23	15:55 (5)	17:39	19	17:09 (4)	18:53	33	18:06 (3)	20:04	20:56
16	08:21	07:14	15:31 (5)	05:55	16:49 (4)	04:24	17:33 (3)	03:06	02:22			
	15:16	16:33	25	15:56 (5)	17:42	22	17:11 (4)	18:55	33	18:06 (3)	20:06	20:57
17	08:20	07:12	15:30 (5)	05:52	16:49 (4)	04:21	17:33 (3)	03:03	02:22			
	15:18	16:35	27	15:57 (5)	17:44	22	17:11 (4)	18:57	33	18:06 (3)	20:08	20:57
18	08:18	07:09	15:29 (5)	05:49	16:48 (4)	04:18	17:33 (3)	03:01	02:22			
	15:20	16:38	28	15:57 (5)	17:46	23	17:11 (4)	19:00	33	18:06 (3)	20:11	20:58
19	08:16	07:06	15:29 (5)	05:46	16:48 (4)	04:15	17:33 (3)	02:59	02:22			
	15:23	16:40	28	15:57 (5)	17:49	22	17:10 (4)	19:02	32	18:05 (3)	20:13	20:58
20	08:15	07:03	15:29 (5)	05:43	16:49 (4)	04:13	17:34 (3)	02:57	02:22			
	15:25	16:43	29	15:58 (5)	17:51	20	17:09 (4)	19:05	31	18:05 (3)	20:15	20:59
21	08:13	07:01	15:29 (5)	05:40	16:49 (4)	04:10	17:34 (3)	02:55	02:22			
	15:27	16:45	29	15:58 (5)	17:53	19	17:08 (4)	19:07	29	18:03 (3)	20:17	20:59
22	08:11	06:58	15:29 (5)	05:37	16:50 (4)	04:07	17:34 (3)	02:53	02:22			
	15:30	16:48	29	15:58 (5)	17:56	17	17:07 (4)	19:09	28	18:02 (3)	20:19	20:59
23	08:09	06:55	15:29 (5)	05:34	16:52 (4)	04:04	17:36 (3)	02:51	02:22			
	15:32	16:50	28	15:57 (5)	17:58	12	17:04 (4)	19:12	26	18:02 (3)	20:21	20:59
24	08:08	06:52	15:29 (5)	05:31	16:54 (4)	04:01	17:36 (3)	02:49	02:22			
	15:35	16:53	28	15:57 (5)	18:01	7	17:01 (4)	19:14	24	18:00 (3)	20:23	20:59
25	08:06	06:50	15:29 (5)	05:28	16:59 (4)	03:59	17:37 (3)	02:47	02:23			
	15:37	16:55	27	15:56 (5)	18:03	19	17:08 (4)	19:17	21	17:58 (3)	20:25	20:59
26	08:04	06:47	15:30 (5)	05:25	16:56 (4)	03:56	17:40 (3)	02:45	02:23			
	15:39	16:58	25	15:55 (5)	18:05	19	17:19 (4)	19:21	16	17:56 (3)	20:27	20:59
27	08:02	06:44	15:31 (5)	05:23	16:57 (4)	03:53	17:42 (3)	02:44	02:24			
	15:42	17:00	23	15:54 (5)	18:08	19	17:21 (4)	19:24	11	17:53 (3)	20:29	20:59
28	08:00	06:41	15:32 (5)	05:20	16:58 (4)	03:51	17:43 (3)	02:42	02:25			
	15:44	17:03	20	15:52 (5)	18:10	19	17:24 (4)	19:26	20	18:03 (3)	20:31	20:59
29	07:58		15:33 (5)	05:17	16:59 (4)	03:48	17:44 (3)	02:40	02:25			
	15:47			18:12	19	17:26 (4)	19:28	20	18:04 (3)	20:33	20:58	
30	07:55		15:34 (5)	05:14	16:59 (4)	03:45	17:45 (3)	02:39	02:26			
	15:49			18:15	19	17:28 (4)	19:30	20	18:05 (3)	20:35	20:58	
31	07:53		15:35 (5)	05:11	16:59 (4)	03:42	17:46 (3)	02:37	02:26			
	15:52			18:17	19	17:30 (4)	19:33	20	18:06 (3)	20:37	20:58	
Potential sun hours	216	257	365	434	591	526	554					
Total, worst case		419	248	591								
Sun reduction		0.29	0.28	0.30								
Oper. time red.		0.93	0.93	0.93								
Wind dir. red.		0.51	0.54	0.64								
Total reduction		0.14	0.14	0.18								
Total, real		58	35	107								

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:

Gismarvik

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15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BS - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (275)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum

813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	July	August	September	October	November	December			
1	02:27	03:22	04:33	17:35 (3)	05:42	16:32 (4)	06:56	08:07	
	20:57	20:07	18:43	30 18:05 (3)	17:14	10 16:42 (4)	15:48	14:48	
2	02:28	03:24	04:35	17:36 (3)	05:44	16:33 (4)	06:58	08:09	
	20:56	20:04	18:40	28 18:04 (3)	17:12	6 16:39 (4)	15:45	14:47	
3	02:29	03:26	04:38	17:37 (3)	05:46		07:01	08:10	
	20:56	20:02	18:37	26 18:03 (3)	17:09		15:43	14:46	
4	02:30	03:29	04:40	17:38 (3)	05:49		07:03	08:12	
	20:55	20:00	18:34	23 18:01 (3)	17:06		15:40	14:45	
5	02:31	03:31	04:42	17:39 (3)	05:51		07:06	08:14	
	20:54	19:57	18:32	19 17:58 (3)	17:03		15:38	14:44	
6	02:33	03:33	04:45	17:41 (3)	05:53		07:08	08:16	
	20:53	19:55	18:29	14 17:55 (3)	17:00		15:36	14:43	
7	02:34	03:35	04:47	17:45 (3)	05:56		07:11	08:18	
	20:52	19:52	18:26	7 17:52 (3)	16:57		15:33	14:42	
8	02:35	03:38	04:49		05:58		07:13	08:19	
	20:51	19:50	18:23		16:54		15:31	14:41	
9	02:37	03:40	04:51		06:00		07:16	08:21	
	20:50	19:47	18:20		16:51		15:28	14:40	
10	02:38	03:42	04:54		06:03		07:18	08:22	
	20:48	19:44	18:17		16:48		15:26	14:40	
11	02:40	03:45	04:56		06:05		15:14 (5)	07:21	08:24
	20:47	19:42	18:14		16:45	5	15:19 (5)	15:24	14:39
12	02:42	03:47	04:58		06:07		15:09 (5)	07:23	08:25
	20:46	19:39	18:11		16:42	14	15:23 (5)	15:22	14:39
13	02:43	03:49	05:01		06:10		15:07 (5)	07:26	08:26
	20:44	19:37	18:08		16:40	18	15:25 (5)	15:19	14:39
14	02:45	03:52	05:03		06:12		15:04 (5)	07:28	08:28
	20:43	19:34	18:05		16:37	22	15:26 (5)	15:17	14:38
15	02:47	03:54	17:54 (3)	05:05	06:14		15:03 (5)	07:31	08:29
	20:41	19:31	3 17:57 (3)	18:02	16:34	24	15:27 (5)	15:15	14:38
16	02:49	03:56	17:48 (3)	05:07	06:17		15:02 (5)	07:33	08:30
	20:40	19:28	13 18:01 (3)	17:59	16:31	25	15:27 (5)	15:13	14:38
17	02:50	03:59	17:46 (3)	05:10	06:19		15:01 (5)	07:35	08:31
	20:38	19:26	17 18:03 (3)	17:56	16:28	27	15:28 (5)	15:11	14:38
18	02:52	04:01	17:43 (3)	05:12	06:22		15:00 (5)	07:38	08:32
	20:36	19:23	22 18:05 (3)	17:53	16:25	28	15:28 (5)	15:09	14:38
19	02:54	04:03	17:42 (3)	05:14	06:24		15:00 (5)	07:40	08:33
	20:34	19:20	24 18:06 (3)	17:50	3 16:46 (4)	16:23	29 15:29 (5)	15:07	14:38
20	02:56	04:06	17:41 (3)	05:16	06:26		15:00 (5)	07:42	08:33
	20:32	19:17	26 18:07 (3)	17:47	12 16:50 (4)	16:20	29 15:29 (5)	15:05	14:39
21	02:58	04:08	17:40 (3)	05:19	06:29		14:59 (5)	07:45	08:34
	20:31	19:15	28 18:08 (3)	17:44	16 16:52 (4)	16:17	29 15:28 (5)	15:03	14:39
22	03:00	04:10	17:39 (3)	05:21	06:31		14:59 (5)	07:47	08:35
	20:29	19:12	29 18:08 (3)	17:41	18 16:52 (4)	16:14	29 15:28 (5)	15:02	14:39
23	03:02	04:12	17:37 (3)	05:23	06:34		14:59 (5)	07:49	08:35
	20:27	19:09	31 18:08 (3)	17:38	20 16:53 (4)	16:12	28 15:27 (5)	15:00	14:40
24	03:04	04:15	17:37 (3)	05:26	06:36		15:00 (5)	07:52	08:35
	20:25	19:06	31 18:08 (3)	17:35	22 16:53 (4)	16:09	27 15:27 (5)	14:58	14:41
25	03:06	04:17	17:36 (3)	05:28	06:39		15:00 (5)	07:54	08:36
	20:23	19:03	32 18:08 (3)	17:32	22 16:53 (4)	16:06	27 15:27 (5)	14:57	14:41
26	03:09	04:19	17:35 (3)	05:30	06:41		15:00 (5)	07:56	08:36
	20:20	19:01	33 18:08 (3)	17:29	23 16:53 (4)	16:04	25 15:25 (5)	14:55	14:42
27	03:11	04:22	17:36 (3)	05:32	06:44		15:02 (5)	07:58	08:36
	20:18	18:58	33 18:09 (3)	17:26	22 16:52 (4)	16:01	22 15:24 (5)	14:53	14:43
28	03:13	04:24	17:35 (3)	05:35	06:46		15:03 (5)	08:00	08:36
	20:16	18:55	33 18:08 (3)	17:23	20 16:51 (4)	15:58	19 15:22 (5)	14:52	14:44
29	03:15	04:26	17:35 (3)	05:37	06:48		15:05 (5)	08:03	08:36
	20:14	18:52	32 18:07 (3)	17:20	18 16:48 (4)	15:56	14 15:19 (5)	14:51	14:45
30	03:17	04:29	17:35 (3)	05:39	06:51		15:06 (5)	08:05	08:36
	20:12	18:49	32 18:07 (3)	17:17	13 16:44 (4)	15:53	10 15:16 (5)	14:49	14:46
31	03:19	04:31	17:35 (3)		06:53			15:11 (5)	08:36
	20:09	18:46	31 18:06 (3)		15:50	2	15:13 (5)		14:47
Potential sun hours	551	481	387	318	232	194			
Total, worst case		450	356	469					
Sun reduction		0.24	0.26	0.28					
Oper. time red.		0.93	0.93	0.93					
Wind dir. red.		0.64	0.58	0.51					
Total reduction		0.14	0.14	0.13					
Total, real		65	51	63					

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:

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BT - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (276)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1281 1143 697 478 515 675 1091 8182

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

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	06:38 17:05	15:44 (3) 16:12 (3)	05:08 18:19	03:42 19:31
2	08:35 14:50	07:49 15:57	06:36 17:08	15:44 (3) 16:11 (3)	05:05 18:22	03:40 19:33
3	08:35 14:52	07:46 15:59	06:33 17:10	15:45 (3) 16:10 (3)	05:02 18:24	03:37 19:36
4	08:34 14:53	07:44 16:02	06:30 17:13	15:46 (3) 16:08 (3)	04:59 18:27	03:35 19:38
5	08:33 14:55	07:42 16:05	06:27 17:15	15:48 (3) 16:07 (3)	04:56 18:29	03:32 19:41
6	08:33 14:56	07:39 16:07	06:24 17:18	15:50 (3) 16:46 (2)	04:53 18:31	03:30 19:43
7	08:32 14:58	14:08 (5) 16:10	06:21 17:20	15:54 (3) 16:48 (2)	04:50 18:34	03:27 19:45
8	08:31 15:00	14:08 (5) 16:12	06:18 17:22	16:39 (2) 16:52 (2)	04:47 18:36	03:24 19:48
9	08:30 15:02	14:08 (5) 16:15	15:38 (4) 15:39 (4)	06:16 17:25	16:38 (2) 16:54 (2)	04:44 18:38
10	08:29 15:04	14:08 (5) 16:17	15:36 (4) 15:41 (4)	06:13 17:27	16:38 (2) 16:57 (2)	04:41 18:41
11	08:28 15:06	14:08 (5) 16:20	15:35 (4) 15:44 (4)	06:10 17:30	16:37 (2) 16:59 (2)	04:38 18:43
12	08:27 15:08	14:08 (5) 16:23	15:35 (4) 15:47 (4)	06:07 17:32	16:37 (2) 16:59 (2)	04:36 18:46
13	08:25 15:10	14:08 (5) 16:25	15:35 (4) 15:50 (4)	06:04 17:34	16:37 (2) 16:59 (2)	04:33 18:48
14	08:24 15:12	14:09 (5) 16:28	15:35 (4) 15:53 (4)	06:01 17:37	16:37 (2) 16:58 (2)	04:30 18:50
15	08:23 15:14	14:09 (5) 16:30	15:35 (4) 15:55 (4)	05:58 17:39	16:38 (2) 16:56 (2)	04:27 18:53
16	08:21 15:16	14:28 (5) 16:33	15:55 (4) 15:35 (4)	17:39 17:42	18:53 18:55	20:04 20:06
17	08:20 15:18	14:09 (5) 16:35	15:35 (4) 16:01 (3)	05:52 17:44	16:41 (2) 17:14 (1)	03:03 18:58
18	08:18 15:20	14:09 (5) 16:38	15:36 (4) 16:03 (3)	05:49 17:46	16:44 (2) 17:16 (1)	04:18 19:00
19	08:17 15:23	14:10 (5) 16:40	15:38 (4) 16:07 (3)	05:46 17:49	17:10 (1) 17:19 (1)	04:15 19:02
20	08:15 15:25	14:10 (5) 16:43	15:40 (4) 16:10 (3)	05:43 17:51	17:09 (1) 17:21 (1)	04:13 19:05
21	08:13 15:27	14:10 (5) 16:45	15:46 (3) 16:12 (3)	05:40 17:53	17:09 (1) 17:23 (1)	04:10 19:07
22	08:11 15:30	14:11 (5) 16:48	15:45 (3) 16:14 (3)	05:37 17:56	17:09 (1) 17:25 (1)	04:07 19:09
23	08:09 15:32	14:12 (5) 16:50	15:44 (3) 16:14 (3)	05:34 17:58	17:09 (1) 17:24 (1)	04:04 19:12
24	08:08 15:35	14:13 (5) 16:53	15:44 (3) 16:14 (3)	05:31 18:01	17:10 (1) 17:23 (1)	04:01 19:14
25	08:06 15:37	14:14 (5) 16:55	15:44 (3) 16:14 (3)	05:28 18:03	17:11 (1) 17:21 (1)	03:59 19:17
26	08:04 15:39	14:15 (5) 16:58	15:43 (3) 16:14 (3)	05:25 18:05	17:15 (1) 17:16 (1)	03:56 19:19
27	08:02 15:42	14:17 (5) 17:00	15:43 (3) 16:13 (3)	05:23 18:08	03:53 19:21	02:44 20:29
28	08:00 15:44	14:19 (5) 17:03	15:44 (3) 16:13 (3)	05:20 18:10	03:51 19:24	02:42 20:31
29	07:58 15:47		05:17 18:12		03:48 19:26	02:40 20:33
30	07:55 15:49		05:14 18:15		03:45 19:29	02:39 20:35
31	07:53 15:52		05:11 18:17		03:42 20:37	02:37 20:37
Potential sun hours	216	257	365	434	526	554
Total, worst case		332	451	439		
Sun reduction		0.27	0.29	0.28		
Oper. time red.		0.93	0.93	0.93		
Wind dir. red.		0.54	0.52	0.54		
Total reduction		0.14	0.14	0.14		
Total, real	46	63	62			

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)



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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BT - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (276)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	06:56 16:38 (2)	08:07 15:06 (4)
2	02:28 20:56	03:24 20:05	04:35 18:40	05:44 17:12	06:58 16:38 (2)	08:09 15:07 (4)
3	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 16:35 (2)	08:11 14:46
4	02:30 20:55	03:28 20:00	04:40 18:34	05:49 17:06	07:03 16:33 (2)	08:12 14:45
5	02:31 20:54	03:31 19:57	04:42 18:32	05:51 17:03	07:06 16:29 (2)	08:14 14:44
6	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 16:26 (2)	08:16 14:43
7	02:34 20:52	03:35 19:52	04:47 18:26	05:56 16:57	07:11 16:24 (2)	08:18 14:42
8	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 16:20 (2)	08:19 14:41
9	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	07:16 15:22 (3)	08:21 14:40
10	02:38 20:49	03:42 19:44	04:54 18:17	06:03 16:48	07:18 15:20 (3)	08:22 14:40
11	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:19 (3)	08:24 14:39
12	02:42 20:46	03:47 19:39	04:58 18:11	06:07 16:42	07:23 15:18 (3)	08:25 14:39
13	02:43 20:44	03:49 19:37	05:01 18:08	06:10 16:40	07:26 15:17 (3)	08:26 14:38
14	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:16 (3)	08:28 13:51 (5)
15	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	07:31 15:16 (3)	08:29 14:02 (6)
16	02:48 20:40	03:56 19:28	05:07 17:59	06:17 16:31	07:33 15:15 (3)	08:30 14:03 (6)
17	02:50 20:38	03:59 19:26	05:10 17:56	06:19 16:28	07:35 15:16 (3)	08:31 14:05 (6)
18	02:52 20:36	04:01 19:23	05:12 17:53	06:22 17:08 (1)	07:38 15:15 (3)	08:32 13:47 (5)
19	02:54 20:34	04:03 19:20	05:14 17:50	06:24 17:09 (1)	07:40 15:16 (3)	08:33 14:06 (6)
20	02:56 20:33	04:05 19:17	05:16 17:47	06:26 17:10 (1)	07:42 15:16 (3)	08:33 14:07 (6)
21	02:58 20:31	04:08 19:15	05:19 17:44	06:29 17:11 (1)	07:45 15:12 (4)	08:34 14:08 (6)
22	03:00 20:29	04:10 19:12	05:21 17:41	06:31 17:09 (1)	07:47 15:09 (4)	08:35 14:08 (6)
23	03:02 20:27	04:12 19:09	05:23 17:38	06:34 17:06 (1)	07:49 15:07 (4)	08:35 14:08 (6)
24	03:04 20:25	04:15 19:06	05:26 17:35	06:36 17:02 (1)	07:52 15:06 (4)	08:35 14:09 (6)
25	03:06 20:23	04:17 19:03	05:28 17:32	06:39 17:00 (1)	07:54 15:05 (4)	08:36 14:09 (6)
26	03:08 20:20	04:19 19:01	05:30 17:29	06:41 16:57 (1)	07:56 15:04 (4)	08:36 14:08 (6)
27	03:11 20:18	04:22 18:58	05:32 17:26	06:44 16:35 (2)	07:58 15:04 (4)	08:36 14:07 (6)
28	03:13 20:16	04:24 18:55	05:35 17:23	06:46 16:19 (2)	08:00 15:22 (4)	08:36 14:05 (6)
29	03:15 20:14	04:26 18:52	05:37 17:20	06:48 16:37 (2)	08:03 15:19 (4)	08:36 14:03 (6)
30	03:17 20:12	04:29 18:49	05:39 17:17	06:51 16:37 (2)	08:05 15:16 (4)	08:36 14:01 (6)
31	03:19 20:09	04:31 18:46		06:53 15:50	08:07 15:13 (4)	08:36 14:47
Potential sun hours	551	481	387	317	232	194
Total, worst case			186	717	312	24
Sun reduction			0.26	0.28	0.28	0.30
Oper. time red.			0.93	0.93	0.93	0.93
Wind dir. red.			0.55	0.52	0.54	0.54
Total reduction			0.13	0.14	0.14	0.15
Total, real			25	97	44	4

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)



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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BV - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (278)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.27	0.29	0.28	0.30	0.35	0.30	0.26	0.24	0.26	0.28	0.28	0.30

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
813	231	221	428	610	1281	1143	697	478	515	675	1091	8182

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

	January	February	March	April	May	June
1	08:35	07:51	06:38	05:08	17:34 (3)	03:42
	14:49	15:54	17:05	18:19	17:49 (3)	19:31
2	08:35	07:49	06:36	05:05	17:31 (3)	03:40
	14:50	15:57	17:08	18:22	17:51 (3)	19:33
3	08:35	07:46	06:33	05:02	17:29 (3)	03:37
	14:52	15:59	17:10	18:24	17:53 (3)	19:36
4	08:34	07:44	06:30	04:59	17:28 (3)	03:35
	14:53	16:02	17:13	18:27	17:54 (3)	19:38
5	08:33	07:42	06:27	04:56	17:26 (3)	03:32
	14:55	16:05	17:15	18:29	17:55 (3)	19:41
6	08:33	07:39	06:24	04:53	17:26 (3)	03:30
	14:56	16:07	17:18	18:31	17:56 (3)	19:43
7	08:32	07:37	15:32 (5)	06:21	04:50	17:25 (3)
	14:58	16:10	15:33 (5)	17:20	18:34	17:56 (3)
8	08:31	07:35	15:28 (5)	06:18	04:47	17:24 (3)
	15:00	16:12	15:35 (5)	17:22	18:36	17:56 (3)
9	08:30	07:32	15:27 (5)	06:16	04:44	17:23 (3)
	15:02	16:15	15:39 (5)	17:25	18:38	17:56 (3)
10	08:29	07:30	15:25 (5)	06:13	04:41	17:23 (3)
	15:04	16:17	15:41 (5)	17:27	18:41	17:56 (3)
11	08:28	07:27	15:24 (5)	06:10	04:38	17:22 (3)
	15:06	16:20	15:44 (5)	17:30	18:43	17:55 (3)
12	08:27	07:25	15:23 (5)	06:07	04:36	17:23 (3)
	15:08	16:23	15:47 (5)	17:32	18:46	17:56 (3)
13	08:25	07:22	15:23 (5)	06:04	04:33	17:23 (3)
	15:10	16:25	15:49 (5)	17:34	18:48	17:55 (3)
14	08:24	07:19	15:22 (5)	06:01	04:30	17:23 (3)
	15:12	16:28	15:49 (5)	17:37	18:50	17:54 (3)
15	08:23	07:17	15:22 (5)	05:58	04:27	17:23 (3)
	15:14	16:30	15:49 (5)	17:39	18:53	17:53 (3)
16	08:21	07:14	15:21 (5)	05:55	04:24	17:23 (3)
	15:16	16:33	15:49 (5)	17:42	18:55	17:52 (3)
17	08:20	07:12	15:21 (5)	05:52	04:21	17:25 (3)
	15:18	16:35	15:49 (5)	17:44	18:57	17:51 (3)
18	08:18	07:09	15:21 (5)	05:49	04:18	17:26 (3)
	15:20	16:38	15:49 (5)	17:46	19:00	17:49 (3)
19	08:16	07:06	15:21 (5)	05:46	04:15	17:27 (3)
	15:23	16:40	15:49 (5)	17:49	19:02	17:48 (3)
20	08:15	07:03	15:22 (5)	05:43	04:13	17:29 (3)
	15:25	16:43	15:49 (5)	17:51	19:05	17:46 (3)
21	08:13	07:01	15:22 (5)	05:40	04:10	17:31 (3)
	15:27	16:45	15:48 (5)	17:53	19:07	17:43 (3)
22	08:11	06:58	15:23 (5)	05:37	04:07	17:33 (3)
	15:30	16:48	15:47 (5)	17:56	19:09	17:41 (3)
23	08:09	06:55	15:24 (5)	05:34	04:04	17:34 (3)
	15:32	16:50	15:46 (5)	17:58	19:12	17:39 (3)
24	08:08	06:52	15:25 (5)	05:31	04:01	17:35 (3)
	15:35	16:53	15:45 (5)	18:01	19:14	17:42 (3)
25	08:06	06:50	15:26 (5)	05:28	03:59	17:36 (3)
	15:37	16:55	15:43 (5)	18:03	19:17	17:47 (3)
26	08:04	06:47	15:29 (5)	05:25	03:56	17:37 (3)
	15:39	16:58	15:40 (5)	18:05	19:19	17:50 (3)
27	08:02	06:44	15:30 (5)	05:22	03:53	17:38 (3)
	15:42	17:00	15:41 (5)	18:08	19:21	17:53 (3)
28	08:00	06:41	15:31 (5)	05:19	03:51	17:39 (3)
	15:44	17:03	15:42 (5)	18:10	19:24	17:56 (3)
29	07:58	06:38	15:32 (5)	05:16	03:48	17:40 (3)
	15:47	17:05	15:43 (5)	18:11	19:26	17:59 (3)
30	07:55	06:35	15:33 (5)	05:13	03:45	17:41 (3)
	15:49	17:08	15:44 (5)	18:12	19:28	17:58 (3)
31	07:53	06:32	15:34 (5)	05:10	03:42	17:42 (3)
	15:52	17:11	15:45 (5)	18:13	19:30	17:58 (3)
Potential sun hours	216	257	365	434	526	554
Total, worst case		420	8	560		
Sun reduction		0.29	0.28	0.30		
Oper. time red.		0.93	0.93	0.93		
Wind dir. red.		0.51	0.63	0.63		
Total reduction		0.14	0.16	0.18		
Total, real		58	1	99		

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:

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BV - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (278)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	July	August	September	October	November	December
1	02:27	03:22	04:33	17:21 (3)	05:42	06:56
	20:57	20:07	18:43	17:54 (3)	17:14	15:48
2	02:28	03:24	04:35	17:22 (3)	05:44	06:58
	20:56	20:04	18:40	17:55 (3)	17:12	15:45
3	02:29	03:26	04:38	17:21 (3)	05:46	07:01
	20:56	20:02	18:37	17:54 (3)	17:09	15:43
4	02:30	03:28	04:40	17:21 (3)	05:49	07:03
	20:55	20:00	18:34	17:53 (3)	17:06	15:40
5	02:31	03:31	04:42	17:21 (3)	05:51	07:06
	20:54	19:57	18:32	17:52 (3)	17:03	15:38
6	02:33	03:33	04:45	17:21 (3)	05:53	07:08
	20:53	19:55	18:29	17:51 (3)	17:00	15:36
7	02:34	03:35	04:47	17:22 (3)	05:56	07:11
	20:52	19:52	18:26	17:51 (3)	16:57	15:33
8	02:35	03:38	04:49	17:23 (3)	05:58	07:13
	20:51	19:50	18:23	17:49 (3)	16:54	15:31
9	02:37	03:40	04:51	17:23 (3)	06:00	07:16
	20:50	19:47	18:20	17:47 (3)	16:51	15:28
10	02:38	03:42	04:54	17:24 (3)	06:03	07:18
	20:48	19:44	18:17	17:44 (3)	16:48	15:26
11	02:40	03:45	04:56	17:26 (3)	06:05	07:21
	20:47	19:42	18:14	17:41 (3)	16:45	15:24
12	02:42	03:47	04:58	17:30 (3)	06:07	07:23
	20:46	19:39	18:11	17:39 (3)	16:42	15:22
13	02:43	03:49	05:01		06:10	07:26
	20:44	19:37	18:08		16:40	15:19
14	02:45	03:52	05:03		06:12	07:28
	20:43	19:34	18:05		16:37	15:17
15	02:47	03:54	05:05		06:14	07:31
	20:41	19:31	18:02		16:34	15:15
16	02:49	03:56	05:07		06:17	07:33
	20:40	19:28	17:59		16:31	15:13
17	02:50	03:59	05:10		06:19	07:35
	20:38	19:26	17:56		16:28	15:11
18	02:52	04:01	05:12		06:22	07:38
	20:36	19:23	17:53		16:25	15:09
19	02:54	04:03	05:14		06:24	07:40
	20:34	19:20	17:50		16:23	15:07
20	02:56	04:05	05:16		06:26	07:42
	20:33	19:17	17:47		16:20	15:05
21	02:58	04:08	05:19		06:29	07:45
	20:31	19:15	17:44		16:17	15:03
22	03:00	04:10	17:35 (3)	05:21	06:31	07:47
	20:29	19:12	17:48 (3)	17:41	16:14	15:02
23	03:02	04:12	17:32 (3)	05:23	06:34	07:49
	20:27	19:09	17:50 (3)	17:38	16:12	15:00
24	03:04	04:15	17:30 (3)	05:26	06:36	07:52
	20:25	19:06	17:51 (3)	17:35	16:09	14:58
25	03:06	04:17	17:28 (3)	05:28	06:39	07:54
	20:23	19:03	17:52 (3)	17:32	16:06	14:57
26	03:09	04:19	17:26 (3)	05:30	06:41	07:56
	20:20	19:01	17:53 (3)	17:29	16:04	14:55
27	03:11	04:22	17:26 (3)	05:32	06:44	07:58
	20:18	18:58	17:54 (3)	17:26	16:01	14:53
28	03:13	04:24	17:25 (3)	05:35	06:46	08:00
	20:16	18:55	17:55 (3)	17:23	15:58	14:52
29	03:15	04:26	17:24 (3)	05:37	06:48	08:03
	20:14	18:52	17:55 (3)	17:20	15:56	14:51
30	03:17	04:29	17:23 (3)	05:39	06:51	08:05
	20:12	18:49	17:55 (3)	17:17	15:53	14:49
31	03:19	04:31	17:22 (3)		06:53	08:06
	20:09	18:46	17:55 (3)		15:50	14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case		257	315	395	32	
Sun reduction		0.24	0.26	0.28	0.28	
Oper. time red.		0.93	0.93	0.93	0.93	
Wind dir. red.		0.63	0.63	0.51	0.51	
Total reduction		0.14	0.15	0.13	0.13	
Total, real		36	48	52	4	

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:

Gismarvik

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## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BW - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (279)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35	07:51	06:38	05:08	17:28 (3)	03:42
	14:49	15:54	17:05	18:19	17:49 (3)	19:31
2	08:35	07:49	06:36	05:05	17:26 (3)	03:40
	14:50	15:57	17:08	18:22	17:50 (3)	19:33
3	08:35	07:46	06:33	05:02	17:24 (3)	03:37
	14:52	15:59	17:10	18:24	17:51 (3)	19:36
4	08:34	07:44	06:30	04:59	17:23 (3)	03:35
	14:53	16:02	17:13	18:27	17:51 (3)	19:38
5	08:33	07:42	06:27	04:56	17:22 (3)	03:32
	14:55	16:05	17:15	18:29	17:52 (3)	19:41
6	08:33	07:39	06:24	04:53	17:22 (3)	03:30
	14:56	16:07	17:18	18:31	17:53 (3)	19:43
7	08:32	07:37	15:30 (5)	06:21	04:50	17:21 (3)
	14:58	16:10	15:33 (5)	17:20	18:34	17:53 (3)
8	08:31	07:35	15:26 (5)	06:18	04:47	17:20 (3)
	15:00	16:12	15:35 (5)	17:22	18:36	17:52 (3)
9	08:30	07:32	15:25 (5)	06:16	04:44	17:20 (3)
	15:02	16:15	15:39 (5)	17:25	18:38	17:52 (3)
10	08:29	07:30	15:24 (5)	06:13	04:41	17:19 (3)
	15:04	16:17	15:41 (5)	17:27	18:41	17:51 (3)
11	08:28	07:27	15:23 (5)	06:10	04:38	17:19 (3)
	15:06	16:20	15:44 (5)	17:30	18:43	17:51 (3)
12	08:27	07:25	15:22 (5)	06:07	04:36	17:20 (3)
	15:08	16:23	15:46 (5)	17:32	18:46	17:51 (3)
13	08:25	07:22	15:22 (5)	06:04	04:33	17:20 (3)
	15:10	16:25	15:47 (5)	17:34	18:48	17:50 (3)
14	08:24	07:19	15:21 (5)	06:01	04:30	17:20 (3)
	15:12	16:28	15:48 (5)	17:37	18:50	17:49 (3)
15	08:23	07:17	15:20 (5)	05:58	04:27	17:21 (3)
	15:14	16:30	15:48 (5)	17:39	18:53	17:47 (3)
16	08:21	07:14	15:20 (5)	05:55	04:24	17:21 (3)
	15:16	16:33	15:48 (5)	17:42	18:55	17:46 (3)
17	08:20	07:12	15:20 (5)	05:52	04:21	17:23 (3)
	15:18	16:35	15:48 (5)	17:44	18:57	17:45 (3)
18	08:18	07:09	15:20 (5)	05:49	04:18	17:25 (3)
	15:20	16:38	15:47 (5)	17:46	19:00	17:43 (3)
19	08:16	07:06	15:20 (5)	05:46	04:15	17:27 (3)
	15:23	16:40	15:47 (5)	17:49	19:02	17:40 (3)
20	08:15	07:03	15:21 (5)	05:43	04:13	17:32 (3)
	15:25	16:43	15:47 (5)	17:51	19:05	17:35 (3)
21	08:13	07:01	15:22 (5)	05:40	04:10	17:35 (3)
	15:27	16:45	15:47 (5)	17:53	19:07	17:35 (3)
22	08:11	06:58	15:22 (5)	05:37	04:07	17:35 (3)
	15:30	16:48	15:46 (5)	17:56	19:09	17:35 (3)
23	08:09	06:55	15:23 (5)	05:34	04:04	17:35 (3)
	15:32	16:50	15:44 (5)	17:58	19:12	17:35 (3)
24	08:08	06:52	15:25 (5)	05:31	04:01	17:35 (3)
	15:35	16:53	15:43 (5)	18:01	19:14	17:35 (3)
25	08:06	06:50	15:27 (5)	05:28	03:59	17:35 (3)
	15:37	16:55	15:40 (5)	18:03	19:17	17:35 (3)
26	08:04	06:47	15:30 (5)	05:25	03:56	17:35 (3)
	15:39	16:58	15:36 (5)	18:05	19:19	17:35 (3)
27	08:02	06:44	15:23 (5)	05:23	03:53	17:35 (3)
	15:42	17:00	15:25 (5)	18:08	19:21	17:35 (3)
28	08:00	06:41	15:20 (5)	05:20	03:51	17:35 (3)
	15:44	17:03	15:20 (5)	18:10	19:24	17:35 (3)
29	07:58		15:17 (5)	05:17	03:48	17:35 (3)
	15:47		15:18 (5)	18:12	19:26	17:35 (3)
30	07:55		15:14 (5)	05:14	17:34 (3)	17:35 (3)
	15:49		15:15 (5)	18:15	19:29	17:35 (3)
31	07:53		15:11 (5)	05:11	17:30 (3)	17:35 (3)
	15:52		15:17 (5)	18:17	19:31	17:35 (3)
Potential sun hours	216	257	365	434	526	554
Total, worst case		411	26	518		
Sun reduction		0.29	0.28	0.30		
Oper. time red.		0.93	0.93	0.93		
Wind dir. red.		0.50	0.62	0.62		
Total reduction		0.14	0.16	0.18		
Total, real		56	4	91		

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:

Gismarvik

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## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BW - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (279)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum

813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	July	August	September	October	November	December
1	02:27	03:22	04:33	17:18 (3)	05:42	06:56
	20:57	20:07	18:43	32 17:50 (3)	17:14	15:48
2	02:28	03:24	04:35	17:18 (3)	05:44	06:58
	20:56	20:04	18:40	32 17:50 (3)	17:12	15:45
3	02:29	03:26	04:38	17:18 (3)	05:46	07:01
	20:56	20:02	18:37	32 17:50 (3)	17:09	15:08
4	02:30	03:28	04:40	17:17 (3)	05:49	07:03
	20:55	20:00	18:34	32 17:49 (3)	17:06	15:04
5	02:31	03:31	04:42	17:17 (3)	05:51	07:06
	20:54	19:57	18:32	32 17:49 (3)	17:03	15:02
6	02:33	03:33	04:45	17:17 (3)	05:53	07:08
	20:53	19:55	18:29	31 17:48 (3)	17:00	15:00
7	02:34	03:35	04:47	17:18 (3)	05:56	07:11
	20:52	19:52	18:26	30 17:48 (3)	16:57	15:33
8	02:35	03:38	04:49	17:18 (3)	05:58	07:13
	20:51	19:50	18:23	29 17:47 (3)	16:54	15:31
9	02:37	03:40	04:51	17:18 (3)	06:00	07:16
	20:50	19:47	18:20	27 17:45 (3)	16:51	15:28
10	02:38	03:42	04:54	17:19 (3)	06:03	07:18
	20:48	19:44	18:17	24 17:43 (3)	16:48	15:26
11	02:40	03:45	04:56	17:20 (3)	06:05	07:21
	20:47	19:42	18:14	21 17:41 (3)	16:45	15:24
12	02:42	03:47	04:58	17:22 (3)	06:07	07:23
	20:46	19:39	18:11	17 17:39 (3)	16:42	15:22
13	02:43	03:49	05:01	17:24 (3)	06:10	07:26
	20:44	19:37	18:08	12 17:36 (3)	16:40	15:19
14	02:45	03:52	05:03		06:12	07:28
	20:43	19:34	18:05		16:37	15:17
15	02:47	03:54	05:05		06:14	07:31
	20:41	19:31	18:02		16:34	15:15
16	02:49	03:56	05:07		06:17	15:15
	20:40	19:28	17:59		16:31	15:13
17	02:50	03:59	05:10		06:19	14:58
	20:38	19:26	17:56		16:28	15:13
18	02:52	04:01	05:12		06:22	14:55
	20:36	19:23	17:53		16:25	15:14
19	02:54	04:03	05:14		06:24	14:54
	20:34	19:20	17:50		16:23	15:16
20	02:56	04:05	05:16		06:26	14:53
	20:33	19:17	17:47		16:20	15:17
21	02:58	04:08	05:19		06:29	14:51
	20:31	19:15	17:44		16:17	15:17
22	03:00	04:10	05:21		06:31	14:51
	20:29	19:12	17:41		16:14	15:18
23	03:02	04:12	17:35 (3)	05:23	06:34	14:50
	20:27	19:09	5 17:40 (3)	17:38	16:12	15:17
24	03:04	04:15	17:30 (3)	05:26	06:36	14:50
	20:25	19:06	14 17:44 (3)	17:35	16:09	15:18
25	03:06	04:17	17:27 (3)	05:28	06:39	14:50
	20:23	19:03	19 17:46 (3)	17:32	16:06	15:18
26	03:09	04:19	17:25 (3)	05:30	06:41	14:49
	20:20	19:01	22 17:47 (3)	17:29	16:04	15:17
27	03:11	04:22	17:24 (3)	05:32	06:44	14:50
	20:18	18:58	25 17:49 (3)	17:26	16:01	15:17
28	03:13	04:24	17:22 (3)	05:35	06:46	14:50
	20:16	18:55	27 17:49 (3)	17:23	15:58	15:17
29	03:15	04:26	17:21 (3)	05:37	06:48	14:51
	20:14	18:52	29 17:50 (3)	17:20	15:56	15:17
30	03:17	04:29	17:20 (3)	05:39	06:51	14:51
	20:12	18:49	30 17:50 (3)	17:17	15:53	15:15
31	03:19	04:31	17:19 (3)		06:53	14:52
	20:09	18:46	31 17:50 (3)		15:50	15:13
Potential sun hours	551	481	387	318	232	194
Total, worst case		202	351	379	39	
Sun reduction		0.24	0.26	0.28	0.28	
Oper. time red.		0.93	0.93	0.93	0.93	
Wind dir. red.		0.62	0.62	0.50	0.50	
Total reduction		0.14	0.15	0.13	0.13	
Total, real		28	53	50	5	

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:

Gismarvik

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Calculated:

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### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BX - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (280)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	14:54 (5) 15:15 (5)	06:38 17:05	16:16 (4) 16:33 (4)	05:08 18:19
2	08:35 14:50	07:49 15:57	14:54 (5) 15:18 (5)	06:36 17:08	16:16 (4) 16:36 (4)	05:05 18:22
3	08:35 14:52	07:46 15:59	14:54 (5) 15:19 (5)	06:33 17:10	16:16 (4) 16:36 (4)	05:02 18:24
4	08:34 14:53	07:44 16:02	14:54 (5) 15:19 (5)	06:30 17:13	16:16 (4) 16:36 (4)	04:59 18:27
5	08:33 14:55	07:42 16:05	14:54 (5) 15:19 (5)	06:27 17:15	16:16 (4) 16:35 (4)	04:56 18:29
6	08:33 14:56	07:39 16:07	14:55 (5) 15:20 (5)	06:24 17:18	16:17 (4) 16:34 (4)	04:53 18:31
7	08:32 14:58	07:37 16:10	14:55 (5) 15:19 (5)	06:21 17:20	16:18 (4) 16:32 (4)	04:50 18:34
8	08:31 15:00	07:35 16:12	14:55 (5) 15:18 (5)	06:18 17:22	16:20 (4) 16:30 (4)	04:47 18:36
9	08:30 15:02	07:32 16:15	14:56 (5) 15:19 (5)	06:16 17:25	04:44 18:38	03:22 19:50
10	08:29 15:04	07:30 16:17	14:57 (5) 15:18 (5)	06:13 17:27	04:41 18:41	03:20 19:52
11	08:28 15:06	07:27 16:20	14:58 (5) 15:17 (5)	06:10 17:30	04:38 18:43	03:17 19:55
12	08:27 15:08	07:25 16:23	14:59 (5) 15:15 (5)	06:07 17:32	04:36 18:46	03:15 19:57
13	08:25 15:10	07:22 16:25	15:02 (5) 15:14 (5)	06:04 17:34	16:56 (3) 17:04 (3)	04:33 18:48
14	08:24 15:12	07:19 16:28	06:01 17:37	8 14	16:53 (3) 17:07 (3)	04:30 18:50
15	08:23 15:14	07:17 16:30	05:58 17:39	14 18	16:51 (3) 17:09 (3)	04:27 18:53
16	08:21 15:16	07:14 16:33	05:55 17:42	18 23	16:49 (3) 17:12 (3)	04:24 18:55
17	08:20 15:18	07:12 16:35	05:52 17:44	23 26	16:48 (3) 17:14 (3)	04:21 18:57
18	08:18 15:20	07:09 16:38	05:49 17:46	26 29	16:47 (3) 17:16 (3)	04:18 19:00
19	08:16 15:23	07:06 16:40	05:46 17:49	29 30	16:46 (3) 17:16 (3)	04:15 19:02
20	08:15 15:25	07:03 16:43	05:43 17:51	30 31	16:45 (3) 17:16 (3)	04:13 19:05
21	08:13 15:27	07:01 16:45	05:40 17:53	31 31	16:45 (3) 17:16 (3)	04:10 19:07
22	08:11 15:30	06:58 16:48	05:37 17:56	31 32	16:44 (3) 17:16 (3)	04:07 19:09
23	08:09 15:32	06:55 16:50	05:34 17:58	32 33	16:44 (3) 17:28 (2)	04:04 19:12
24	08:08 15:35	06:52 16:53	05:31 18:01	33 36	16:44 (3) 17:30 (2)	04:01 19:14
25	08:06 15:37	06:50 16:55	16:20 (4) 16:23 (4)	36 39	16:44 (3) 17:33 (2)	03:59 19:17
26	08:04 15:39	06:47 16:58	16:19 (4) 16:25 (4)	39 42	16:44 (3) 17:35 (2)	03:56 19:19
27	08:02 15:42	14:57 (5) 15:00 (5)	06:44 17:00	42 43	16:45 (3) 17:37 (2)	03:53 19:21
28	08:00 15:44	14:56 (5) 15:04 (5)	06:41 17:03	43 44	16:46 (3) 17:40 (2)	03:51 19:24
29	07:58 15:47	14:56 (5) 15:07 (5)	16:31 (4) 18:12	44 44	16:47 (3) 17:42 (2)	03:48 19:26
30	07:55 15:49	14:55 (5) 15:09 (5)	18:12 18:15	44 41	16:48 (3) 17:42 (2)	03:45 19:29
31	07:53 15:52	14:55 (5) 15:13 (5)	05:11 18:17	41 37	16:50 (3) 17:46 (1)	03:43 20:37
Potential sun hours	216	257	365	434	526	554
Total, worst case	54	317	738	164		
Sun reduction	0.27	0.29	0.28	0.30		
Oper. time red.	0.93	0.93	0.93	0.93		
Wind dir. red.	0.48	0.49	0.56	0.62		
Total reduction	0.12	0.13	0.15	0.17		
Total, real	7	42	108	28		

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:  
**Gismarvik**

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Calculated:  
15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

Calculation: Skyggekast Gismarvik Shadow receptor: BX - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (280)

**Assumptions for shadow calculations**

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []  
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30  
Operational time  
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1281 1143 697 478 515 675 1091 8182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	16:38 (3) 16:42 (3)	06:56 15:48
2	02:28 20:56	03:24 20:04	04:35 18:40	05:44 17:12	16:38 (3) 15:45	06:58 14:26 (5)
3	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	16:38 (3) 15:43	06:58 14:24 (5)
4	02:30 20:55	03:28 20:00	04:40 18:34	17:41 (1) 17:50 (1)	05:49 17:39 (1)	07:03 15:40
5	02:31 20:54	03:31 19:57	04:42 18:32	17:51 (1) 17:51 (1)	05:51 17:03	15:59 (4) 15:38
6	02:33 20:53	03:33 19:55	04:45 18:29	17:37 (1) 17:52 (1)	05:53 17:00	15:55 (4) 15:36
7	02:34 20:52	03:35 19:52	04:47 18:26	17:23 (2) 17:53 (1)	05:56 16:57	15:54 (4) 15:33
8	02:35 20:51	03:38 19:50	04:49 18:23	17:18 (2) 17:51 (1)	05:58 16:54	15:52 (4) 15:31
9	02:37 20:50	03:40 19:47	04:51 18:20	17:16 (2) 17:47 (1)	06:00 16:51	15:52 (4) 15:28
10	02:38 20:48	03:42 19:44	04:54 18:17	17:14 (2) 17:44 (1)	06:03 16:48	15:50 (4) 15:26
11	02:40 20:47	03:45 19:42	04:56 18:14	17:12 (2) 17:41 (1)	06:05 16:45	15:50 (4) 15:24
12	02:42 20:46	03:47 19:39	04:58 18:11	16:43 (3) 17:39 (1)	06:07 16:42	15:50 (4) 15:22
13	02:43 20:44	03:49 19:37	05:01 18:08	16:40 (3) 17:33 (2)	06:10 16:40	15:50 (4) 15:19
14	02:45 20:43	03:52 19:34	05:03 18:05	16:37 (3) 17:33 (2)	06:12 16:37	15:50 (4) 15:17
15	02:47 20:41	03:54 19:31	05:05 18:02	16:35 (3) 17:30 (2)	06:14 16:34	15:51 (4) 15:15
16	02:48 20:40	03:56 19:28	05:07 17:59	16:34 (3) 17:26 (2)	06:17 16:31	15:51 (4) 15:13
17	02:50 20:38	03:59 19:26	05:10 17:56	16:33 (3) 17:24 (2)	06:19 16:28	15:53 (4) 15:11
18	02:52 20:36	04:01 19:23	05:12 17:53	16:32 (3) 17:21 (2)	06:22 16:25	15:53 (4) 15:09
19	02:54 20:34	04:03 19:20	05:14 17:50	16:31 (3) 17:18 (2)	06:24 16:23	15:52 (4) 15:07
20	02:56 20:33	04:05 19:17	05:16 17:47	16:30 (3) 17:14 (2)	06:26 16:20	15:52 (4) 15:05
21	02:58 20:31	04:08 19:15	05:19 17:44	16:30 (3) 17:02 (3)	06:29 16:17	15:52 (4) 15:03
22	03:00 20:29	04:10 19:12	05:21 17:41	16:29 (3) 17:01 (3)	06:31 16:14	15:52 (4) 15:02
23	03:02 20:27	04:12 19:09	05:23 17:38	16:29 (3) 17:00 (3)	06:34 16:12	15:52 (4) 15:00
24	03:04 20:25	04:15 19:06	05:26 17:35	16:29 (3) 16:59 (3)	06:36 16:09	15:52 (4) 14:58
25	03:06 20:23	04:17 19:03	05:28 17:32	16:30 (3) 16:59 (3)	06:39 16:06	15:52 (4) 14:57
26	03:09 20:20	04:19 19:01	05:30 17:29	16:30 (3) 16:57 (3)	06:41 16:04	15:52 (4) 14:55
27	03:11 20:18	04:22 18:58	05:32 17:26	16:30 (3) 16:53 (3)	06:44 16:01	15:52 (4) 14:53
28	03:13 20:16	04:24 18:55	05:35 17:23	16:32 (3) 16:51 (3)	06:46 15:58	14:35 (5) 14:40 (5)
29	03:15 20:14	04:26 18:52	05:37 17:20	16:32 (3) 16:48 (3)	06:48 15:56	14:31 (5) 14:44 (5)
30	03:17 20:12	04:29 18:49	05:39 17:17	16:34 (3) 16:44 (3)	06:51 15:53	14:28 (5) 14:45 (5)
31	03:19 20:09	04:31 18:46		16:53 15:50	06:53 14:46 (5)	14:27 (5) 14:46 (5)
Potential sun hours	551	481	387	318	232	194
Total, worst case			771	234	289	
Sun reduction			0.26	0.28	0.28	
Oper. time red.			0.93	0.93	0.93	
Wind dir. red.			0.58	0.52	0.48	
Total reduction			0.14	0.14	0.13	
Total, real			108	32	37	

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BY - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (281)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	
1	08:35 14:49	07:51 15:54	15:03 (5) 17:05	06:38 17:05	16:24 (4) 18:19	05:08 17:48 (2)	02:36 19:31
2	08:35 14:50	07:49 15:57	15:02 (5) 17:08	06:36 17:08	16:23 (4) 18:22	05:05 17:51 (1)	02:34 19:33
3	08:35 14:52	07:46 15:59	15:02 (5) 17:10	06:33 17:10	16:22 (4) 18:24	05:02 17:53 (1)	02:33 19:36
4	08:34 14:53	07:44 16:02	15:01 (5) 17:13	06:30 17:13	16:22 (4) 18:27	04:59 17:55 (1)	02:32 19:38
5	08:33 14:55	07:42 16:05	15:00 (5) 17:15	06:27 17:15	16:21 (4) 18:29	04:56 17:57 (1)	02:30 19:41
6	08:33 14:56	07:39 16:07	15:01 (5) 17:18	06:24 17:18	16:21 (4) 18:31	04:53 18:00 (1)	02:29 19:43
7	08:32 14:58	07:37 16:10	15:00 (5) 17:20	06:21 17:20	16:21 (4) 18:34	04:50 17:29 (2)	02:28 19:45
8	08:31 15:00	07:35 16:12	15:00 (5) 17:22	06:18 17:22	16:22 (4) 18:36	04:47 18:01 (1)	02:27 19:48
9	08:30 15:02	07:32 16:15	15:01 (5) 17:25	06:16 17:25	16:23 (4) 18:38	04:44 18:00 (1)	02:26 19:50
10	08:29 15:04	07:30 16:17	15:01 (5) 17:27	06:13 17:27	16:25 (4) 18:41	04:41 17:47 (1)	02:25 19:52
11	08:28 15:06	07:27 16:20	15:01 (5) 17:30	06:10 17:30	16:39 (4) 18:43	04:38 17:55 (1)	02:25 19:55
12	08:27 15:08	07:25 16:23	15:02 (5) 17:32	06:07 17:32	16:36 (4) 18:43	04:36 18:55	02:24 19:57
13	08:25 15:10	07:22 16:25	15:02 (5) 17:34	06:04 17:34	16:23 (4) 18:48	04:33 18:48	02:23 19:59
14	08:24 15:12	07:19 16:28	15:04 (5) 17:37	06:01 17:37	16:39 (4) 18:50	04:31 18:50	02:23 20:02
15	08:23 15:14	07:17 16:30	15:05 (5) 17:39	05:58 17:39	16:36 (4) 18:53	04:27 18:53	02:23 20:04
16	08:21 15:16	07:14 16:33	15:07 (5) 17:42	05:55 17:42	16:24 (4) 18:55	04:24 18:55	02:22 20:06
17	08:20 15:18	07:12 16:35	15:11 (5) 17:44	05:52 17:44	17:06 (3) 18:57	04:21 18:57	02:22 20:08
18	08:18 15:20	07:09 16:38	15:16 (5) 17:46	05:49 17:46	17:03 (3) 19:00	04:18 19:00	02:22 20:11
19	08:16 15:23	07:06 16:40	05:46 17:49	05:46 17:49	17:00 (3) 19:02	04:15 19:02	02:22 20:13
20	08:15 15:25	07:03 16:43	05:43 17:51	05:43 17:51	16:58 (3) 19:05	04:13 19:05	02:22 20:15
21	08:13 15:27	07:01 16:45	05:40 17:53	05:40 17:53	16:57 (3) 19:07	04:10 19:07	02:22 20:17
22	08:11 15:30	06:58 16:48	05:37 17:56	05:37 17:56	16:56 (3) 19:09	04:07 19:09	02:22 20:19
23	08:09 15:32	06:55 16:50	05:34 17:58	05:34 17:58	16:55 (3) 19:12	04:04 19:12	02:22 20:21
24	08:08 15:35	06:52 16:53	05:31 18:01	05:31 18:01	16:54 (3) 19:14	04:01 19:14	02:22 20:23
25	08:06 15:37	06:50 16:55	05:28 18:03	05:28 18:03	16:53 (3) 19:17	03:59 19:17	02:23 20:25
26	08:04 15:39	06:47 16:58	05:25 18:05	05:25 18:05	16:53 (3) 19:19	03:56 19:19	02:23 20:27
27	08:02 15:42	06:44 17:00	05:23 18:08	05:23 18:08	16:52 (3) 19:21	03:53 19:21	02:24 20:29
28	08:00 15:44	06:41 17:03	16:26 (4) 18:10	05:20 18:10	16:52 (3) 19:24	03:51 19:24	02:25 20:31
29	07:58 15:47	06:38 17:05	16:31 (4) 18:12	05:17 18:12	16:52 (3) 19:26	03:48 19:26	02:25 20:33
30	07:55 15:49	15:05 (5) 15:09 (5)	05:14 18:15	05:14 18:15	16:52 (3) 19:29	03:45 19:29	02:26 20:35
31	07:53 15:52	15:05 (5) 15:13 (5)	05:11 18:17	05:11 18:17	16:52 (3) 17:46 (2)	03:43 17:46 (2)	02:37 20:37
Potential sun hours	216	257	365	434	526	554	
Total, worst case	12	353	638	343			
Sun reduction	0.27	0.29	0.28	0.30			
Oper. time red.	0.93	0.93	0.93	0.93			
Wind dir. red.	0.49	0.49	0.56	0.61			
Total reduction	0.12	0.13	0.15	0.17			
Total, real	1	47	94	59			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BY - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (281)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	03:22	04:33	17:48 (1)	05:42	06:56
	20:57	20:07	18:43	6 17:54 (1)	17:14	15:48
2	02:28	03:24	04:35	17:46 (1)	05:44	16:07 (4)
	20:56	20:04	18:40	11 17:57 (1)	17:12	5 16:12 (4)
3	02:29	03:26	04:38	17:44 (1)	05:46	16:03 (4)
	20:56	20:02	18:37	14 17:58 (1)	17:09	12 16:15 (4)
4	02:30	03:28	04:40	17:29 (2)	05:49	16:01 (4)
	20:55	20:00	18:34	21 17:58 (1)	17:06	16 16:17 (4)
5	02:31	03:31	04:42	17:25 (2)	05:51	15:59 (4)
	20:54	19:57	18:32	29 17:58 (1)	17:03	18 16:17 (4)
6	02:33	03:33	04:45	17:23 (2)	05:53	15:58 (4)
	20:53	19:55	18:29	31 17:56 (1)	17:00	19 16:17 (4)
7	02:34	03:35	04:47	16:56 (3)	05:56	15:58 (4)
	20:52	19:52	18:26	40 17:54 (1)	16:57	20 16:18 (4)
8	02:35	03:38	04:49	16:52 (3)	05:58	15:57 (4)
	20:51	19:50	18:23	47 17:51 (1)	16:54	21 16:18 (4)
9	02:37	03:40	04:51	16:49 (3)	06:00	15:57 (4)
	20:50	19:47	18:20	48 17:47 (1)	16:51	21 16:18 (4)
10	02:38	03:42	04:54	16:47 (3)	06:03	15:56 (4)
	20:48	19:44	18:17	47 17:44 (1)	16:48	18 16:14 (4)
11	02:40	03:45	04:56	16:45 (3)	06:05	15:57 (4)
	20:47	19:42	18:14	49 17:40 (2)	16:45	15 16:12 (4)
12	02:42	03:47	04:58	16:45 (3)	06:07	15:57 (4)
	20:46	19:39	18:11	48 17:39 (2)	16:42	11 16:08 (4)
13	02:43	03:49	05:01	16:44 (3)	06:10	15:58 (4)
	20:44	19:37	18:08	47 17:36 (2)	16:40	8 16:06 (4)
14	02:45	03:52	05:03	16:42 (3)	06:12	15:59 (4)
	20:43	19:34	18:05	46 17:33 (2)	16:37	3 16:02 (4)
15	02:47	03:54	05:05	16:41 (3)	06:14	07:31
	20:41	19:31	18:02	43 17:30 (2)	16:34	15:15
16	02:49	03:56	05:07	16:41 (3)	06:17	07:33
	20:40	19:28	17:59	38 17:26 (2)	16:31	15:13
17	02:50	03:59	05:10	16:41 (3)	06:19	07:35
	20:38	19:26	17:56	34 17:24 (2)	16:28	15:11
18	02:52	04:01	05:12	16:41 (3)	06:22	07:38
	20:36	19:23	17:53	31 17:12 (3)	16:25	15:09
19	02:54	04:03	05:14	16:40 (3)	06:24	07:40
	20:34	19:20	17:50	31 17:11 (3)	16:23	15:07
20	02:56	04:05	05:16	16:40 (3)	06:26	07:42
	20:33	19:17	17:47	30 17:10 (3)	16:20	15:05
21	02:58	04:08	05:19	16:41 (3)	06:29	07:45
	20:31	19:15	17:44	29 17:10 (3)	16:17	15:03
22	03:00	04:10	05:21	16:41 (3)	06:31	07:47
	20:29	19:12	17:41	27 17:08 (3)	16:14	15:02
23	03:02	04:12	05:23	16:42 (3)	06:34	07:49
	20:27	19:09	17:38	24 17:06 (3)	16:12	15:00
24	03:04	04:15	05:26	16:43 (3)	06:36	07:52
	20:25	19:06	17:35	19 17:02 (3)	16:09	14:58
25	03:06	04:17	05:28	16:45 (3)	06:39	14:40 (5)
	20:23	19:03	17:32	15 17:00 (3)	16:06	8 14:48 (5)
26	03:09	04:19	05:30	16:47 (3)	06:41	14:36 (5)
	20:20	19:01	17:29	10 16:57 (3)	16:04	14 14:50 (5)
27	03:11	04:22	05:32	06:44	14:34 (5)	07:58
	20:18	18:58	17:26	16:01	18 14:52 (5)	14:53
28	03:13	04:24	05:35	06:46	14:33 (5)	08:00
	20:16	18:55	17:23	15:58	20 14:53 (5)	14:52
29	03:15	04:26	05:37	06:48	14:32 (5)	08:03
	20:14	18:52	17:20	15:56	23 14:55 (5)	14:51
30	03:17	04:29	05:39	06:51	14:31 (5)	08:05
	20:12	18:49	17:17	15:53	23 14:54 (5)	14:49
31	03:19	04:31	05:41	06:53	14:31 (5)	08:06
	20:09	18:46	17:15	15:50	24 14:55 (5)	14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case			815	317	232	
Sun reduction			0.26	0.28	0.28	
Oper. time red.			0.93	0.93	0.93	
Wind dir. red.			0.59	0.51	0.49	
Total reduction			0.14	0.13	0.13	
Total, real			117	42	30	

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

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

Gismarvik

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**Kjeller Vindteknikk AS**  
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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BZ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (282)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	15:06 (5) 17:05	06:38 17:05	16:25 (4) 16:33 (4)	05:08 18:19
2	08:35 14:50	07:49 15:57	15:04 (5) 17:08	06:36 17:08	16:24 (4) 16:36 (4)	05:05 18:22
3	08:35 14:52	07:46 15:59	15:04 (5) 17:10	06:33 17:10	16:23 (4) 16:38 (4)	05:02 18:24
4	08:34 14:53	07:44 16:02	15:03 (5) 17:13	06:30 17:13	16:22 (4) 16:41 (4)	04:59 18:27
5	08:33 14:55	07:42 16:05	15:02 (5) 17:15	06:27 17:15	16:22 (4) 16:43 (4)	04:56 18:29
6	08:33 14:56	07:39 16:07	15:03 (5) 17:18	06:24 17:18	16:21 (4) 16:42 (4)	04:53 18:31
7	08:32 14:58	07:37 16:10	15:02 (5) 17:20	06:21 17:20	16:22 (4) 16:42 (4)	04:50 18:34
8	08:31 15:00	07:35 16:12	15:02 (5) 17:22	06:18 17:22	16:22 (4) 16:41 (4)	04:47 18:36
9	08:30 15:02	07:32 16:15	15:03 (5) 17:25	06:16 17:25	16:24 (4) 16:41 (4)	04:44 18:38
10	08:29 15:04	07:30 16:17	15:03 (5) 17:27	06:13 17:27	16:25 (4) 16:39 (4)	04:41 18:41
11	08:28 15:06	07:27 16:20	15:03 (5) 17:30	06:10 17:30	16:27 (4) 16:37 (4)	04:38 18:43
12	08:27 15:08	07:25 16:23	15:03 (5) 17:32	06:07 17:32	16:37 (4) 18:46	18:43 18:46
13	08:25 15:10	07:22 16:25	15:04 (5) 17:34	06:04 17:34	18:48 18:48	18:48 18:48
14	08:24 15:12	07:19 16:28	15:05 (5) 17:37	06:01 17:37	18:50 18:50	18:50 18:50
15	08:23 15:14	07:17 16:30	15:06 (5) 17:39	05:58 17:39	18:53 18:53	18:53 18:53
16	08:21 15:16	07:14 16:33	15:08 (5) 17:42	05:55 17:42	18:55 18:55	18:55 18:55
17	08:20 15:18	07:12 16:35	15:10 (5) 17:44	05:52 17:44	17:08 (3) 17:14 (3)	04:21 18:57
18	08:18 15:20	07:09 16:38	15:20 (5) 17:46	05:49 17:46	17:03 (3) 17:16 (3)	04:18 19:00
19	08:16 15:23	07:06 16:40	05:46 17:49	17:01 (3) 17:19 (3)	04:15 19:02	19:02 19:02
20	08:15 15:25	07:03 16:43	05:43 17:51	17:19 (3) 17:21 (3)	04:13 19:05	19:05 19:05
21	08:13 15:27	07:01 16:45	05:40 17:53	17:21 (3) 17:23 (3)	04:10 19:07	19:07 19:07
22	08:11 15:30	06:58 16:48	05:37 17:56	17:23 (3) 17:23 (3)	04:07 19:09	19:09 19:09
23	08:09 15:32	06:55 16:50	05:34 17:58	17:23 (3) 17:24 (3)	04:04 19:12	19:12 19:12
24	08:08 15:35	06:52 16:53	05:31 18:01	17:24 (3) 17:24 (3)	04:01 19:14	19:14 19:14
25	08:06 15:37	06:50 16:55	05:28 18:03	17:24 (3) 17:24 (3)	03:59 19:17	19:17 19:17
26	08:04 15:39	06:47 16:58	05:25 18:05	17:24 (3) 17:35 (2)	03:56 19:19	19:19 19:19
27	08:02 15:42	06:44 17:00	05:23 18:08	17:35 (2) 17:37 (2)	19:19 19:21	19:21 19:21
28	08:00 15:44	06:41 17:03	16:26 (4) 16:31 (4)	05:20 18:10	16:52 (3) 17:40 (2)	03:51 19:24
29	07:58 15:47		05:17 18:12	17:40 (2) 17:42 (2)	19:24 19:26	19:26 19:26
30	07:55 15:49		05:14 18:15	17:42 (2) 17:44 (2)	03:45 19:29	19:29 19:29
31	07:53 15:52	15:07 (5) 15:13 (5)	05:11 18:17	16:52 (3) 17:46 (2)	03:43 19:29	19:29 19:29
Potential sun hours	216	257	365	434	526	554
Total, worst case	6	349	628	233		
Sun reduction	0.27	0.29	0.28	0.30		
Oper. time red.	0.93	0.93	0.93	0.93		
Wind dir. red.	0.49	0.49	0.56	0.60		
Total reduction	0.12	0.13	0.15	0.17		
Total, real	1	46	93	39		

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:

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: BZ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (282)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	July	August	September	October	November	December					
1	02:27	03:22	04:33	05:42	06:56	08:07					
	20:57	20:07	18:43	17:14	15:48	14:48					
2	02:28	03:24	04:35	05:44	16:06 (4)	06:58					
	20:56	20:04	18:40	17:12	16:14 (4)	15:45					
					8	26					
3	02:29	03:26	04:38	05:46	16:03 (4)	07:01					
	20:56	20:02	18:37	17:09	16:16 (4)	15:43					
					13	26					
4	02:30	03:28	04:40	17:29 (2)	05:49	16:01 (4)	07:03				
	20:55	20:00	18:34	5	17:34 (2)	17:06	16:17 (4)	15:40			
					16	25	16:00 (4)	07:06			
5	02:31	03:31	04:42	17:25 (2)	05:51	16:18 (4)	15:38	25	14:57 (5)	14:44	
	20:54	19:57	18:32	12	17:37 (2)	17:03	15:58 (4)	07:08	14:33 (5)	08:16	
6	02:33	03:33	04:45	17:23 (2)	05:53	16:18 (4)	15:36	24	14:57 (5)	14:43	
	20:53	19:55	18:29	15	17:38 (2)	17:00	15:58 (4)	07:11	14:34 (5)	08:18	
7	02:34	03:35	04:47	16:56 (3)	05:56	16:19 (4)	15:33	20	14:54 (5)	14:42	
	20:52	19:52	18:26	28	17:40 (2)	16:57	15:57 (4)	07:13	14:34 (5)	08:19	
8	02:35	03:38	04:49	16:52 (3)	05:58	16:18 (4)	15:31	17	14:51 (5)	14:41	
	20:51	19:50	18:23	36	17:40 (2)	16:54	15:57 (4)	07:16	14:35 (5)	08:21	
9	02:37	03:40	04:51	16:49 (3)	06:00	16:18 (4)	15:28	13	14:48 (5)	14:40	
	20:50	19:47	18:20	42	17:40 (2)	16:51	15:57 (4)	07:18	14:37 (5)	08:22	
10	02:38	03:42	04:54	16:47 (3)	06:03	16:14 (4)	15:26	9	14:46 (5)	14:40	
	20:48	19:44	18:17	46	17:40 (2)	16:48	15:58 (4)	07:21	14:38 (5)	08:24	
11	02:40	03:45	04:56	16:45 (3)	06:05	16:12 (4)	15:24	5	14:43 (5)	14:39	
	20:47	19:42	18:14	47	17:39 (2)	16:45	15:58 (4)	07:23		08:25	
12	02:42	03:47	04:58	16:45 (3)	06:07	16:12 (4)	15:22	10	16:08 (4)	15:22	
	20:46	19:39	18:11	48	17:39 (2)	16:42	15:59 (4)	07:26		08:26	
13	02:43	03:49	05:01	16:44 (3)	06:10	16:06 (4)	15:19	7	16:06 (4)	15:19	
	20:44	19:37	18:08	47	17:36 (2)	16:40	16:00 (4)	07:28		08:28	
14	02:45	03:52	05:03	16:42 (3)	06:12	16:02 (4)	15:17	2	16:02 (4)	15:17	
	20:43	19:34	18:05	46	17:33 (2)	16:37				07:31	08:29
15	02:47	03:54	05:05	16:42 (3)	06:14		15:15				14:38
	20:41	19:31	18:02	42	17:30 (2)	16:34	07:33				08:30
16	02:49	03:56	05:07	16:41 (3)	06:17		15:13				14:38
	20:40	19:28	17:59	38	17:26 (2)	16:31	07:35				08:31
17	02:50	03:59	05:10	16:41 (3)	06:19		15:11				14:38
	20:38	19:26	17:56	34	17:24 (2)	16:28	07:38				08:32
18	02:52	04:01	05:12	16:41 (3)	06:22		15:09				14:38
	20:36	19:23	17:53	31	17:12 (3)	16:25	07:40				08:33
19	02:54	04:03	05:14	16:40 (3)	06:24		15:07				14:38
	20:34	19:20	17:50	31	17:11 (3)	16:23	07:42				08:33
20	02:56	04:05	05:16	16:40 (3)	06:26		15:05				14:39
	20:33	19:17	17:47	29	17:09 (3)	16:20	07:45				08:34
21	02:58	04:08	05:19	16:41 (3)	06:29		15:03				14:39
	20:31	19:15	17:44	28	17:09 (3)	16:17	07:47				08:35
22	03:00	04:10	05:21	16:42 (3)	06:31		15:02				14:39
	20:29	19:12	17:41	26	17:08 (3)	16:14	07:49				08:35
23	03:02	04:12	05:23	16:42 (3)	06:34		15:00				14:40
	20:27	19:09	17:38	24	17:06 (3)	16:12	14:44 (5)	07:52			08:35
24	03:04	04:15	05:26	16:43 (3)	06:36		14:46 (5)	14:58			14:40
	20:25	19:06	17:35	19	17:02 (3)	16:09	14:39 (5)	07:54			08:36
25	03:06	04:17	05:28	16:45 (3)	06:39		14:51 (5)	14:57			14:41
	20:23	19:03	17:32	15	17:00 (3)	16:06	14:36 (5)	07:56			08:36
26	03:09	04:19	05:30	16:48 (3)	06:41		14:52 (5)	14:55			14:42
	20:20	19:01	17:29	9	16:57 (3)	16:04	14:35 (5)	07:58			08:36
27	03:11	04:22	05:32		06:44		14:54 (5)	14:53			14:43
	20:18	18:58	17:26		16:01		14:34 (5)	08:00			08:36
28	03:13	04:24	05:35		06:46		14:55 (5)	14:52			14:44
	20:16	18:55	17:23		15:58		14:34 (5)	08:03			08:36
29	03:15	04:26	05:37		06:48		14:56 (5)	14:51			14:45
	20:14	18:52	17:20		15:56		14:32 (5)	08:05			08:36
30	03:17	04:29	05:39		06:51		14:56 (5)	14:49			14:46
	20:12	18:49	17:17		15:53		14:32 (5)				08:36
31	03:19	04:31			06:53		14:57 (5)				14:47
	20:09	18:46			15:50						194
Potential sun hours	551	481	387	318	232						
Total, worst case			698	329	215						
Sun reduction			0.26	0.28	0.28						
Oper. time red.			0.93	0.93	0.93						
Wind dir. red.			0.58	0.51	0.49						
Total reduction			0.14	0.13	0.13						
Total, real			99	44	27						

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

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

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CA - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (283)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum

813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	06:38 17:05	15:55 (3) 16:24 (3)	05:08 18:19	03:42 19:31
2	08:35 14:50	07:49 15:57	06:36 17:08	15:55 (3) 16:24 (3)	05:05 18:22	03:40 19:33
3	08:35 14:52	07:46 15:59	06:33 17:10	15:55 (3) 16:23 (3)	05:02 18:24	03:37 19:36
4	08:34 14:53	07:44 16:02	06:30 17:13	15:55 (3) 16:22 (3)	04:59 18:27	03:35 19:38
5	08:33 14:55	07:42 16:05	06:27 17:15	15:56 (3) 16:22 (3)	04:56 18:29	03:32 19:41
6	08:33 14:56	07:39 16:07	06:24 17:18	15:56 (3) 16:20 (3)	04:53 18:31	03:30 19:43
7	08:32 14:58	07:37 16:10	06:21 17:20	15:58 (3) 16:19 (3)	04:50 18:34	03:27 19:45
8	08:31 15:00	07:35 16:12	06:18 17:22	16:00 (3) 16:52 (2)	04:47 18:36	03:24 19:48
9	08:30 15:02	07:32 16:15	06:16 17:25	16:02 (3) 16:54 (2)	04:44 18:38	03:22 19:50
10	08:29 15:04	07:30 16:17	06:13 17:27	16:07 (3) 16:57 (2)	04:41 18:41	03:20 19:52
11	08:28 15:06	07:27 16:20	06:10 17:30	16:45 (2) 16:59 (2)	04:38 18:43	03:17 19:55
12	08:27 15:08	07:25 16:22	15:45 (4) 15:47 (4)	06:07 17:32	16:44 (2) 17:02 (2)	03:15 19:57
13	08:25 15:10	14:21 (5) 16:25	15:45 (4) 15:50 (4)	06:04 17:34	16:44 (2) 17:04 (2)	03:12 19:59
14	08:24 15:12	14:21 (5) 16:28	15:44 (4) 15:53 (4)	06:01 17:37	16:44 (2) 17:05 (2)	03:10 20:02
15	08:23 15:14	14:21 (5) 16:30	15:44 (4) 15:56 (4)	05:58 17:39	16:44 (2) 17:05 (2)	03:08 20:04
16	08:21 15:16	14:21 (5) 16:33	15:43 (4) 15:58 (4)	05:55 17:42	16:44 (2) 17:04 (2)	03:06 20:06
17	08:20 15:18	14:21 (5) 16:35	15:43 (4) 16:01 (4)	05:52 17:44	16:45 (2) 17:02 (2)	03:03 20:08
18	08:18 15:20	14:21 (5) 16:38	15:43 (4) 16:02 (4)	05:49 17:46	16:46 (2) 17:01 (2)	03:01 20:11
19	08:17 15:23	14:21 (5) 16:40	15:44 (4) 16:02 (4)	05:46 17:49	16:48 (2) 17:19 (1)	02:59 20:13
20	08:15 15:25	14:21 (5) 16:43	15:45 (4) 16:10 (3)	05:43 17:51	17:14 (1) 17:21 (1)	02:57 20:15
21	08:13 15:27	14:21 (5) 16:45	15:46 (4) 16:12 (3)	05:40 17:53	17:13 (1) 17:23 (1)	02:55 20:17
22	08:11 15:30	14:21 (5) 16:48	15:47 (4) 16:15 (3)	05:37 17:56	17:13 (1) 17:26 (1)	02:53 20:19
23	08:09 15:32	14:22 (5) 16:50	15:50 (4) 16:18 (3)	05:34 17:58	17:13 (1) 17:28 (1)	02:51 20:21
24	08:08 15:35	14:23 (5) 16:53	15:58 (3) 16:20 (3)	05:31 18:01	17:13 (1) 17:28 (1)	02:49 20:23
25	08:06 15:37	14:22 (5) 16:55	15:57 (3) 16:23 (3)	05:28 18:03	17:14 (1) 17:27 (1)	02:47 20:25
26	08:04 15:39	14:23 (5) 16:58	15:56 (3) 16:24 (3)	05:25 18:05	17:15 (1) 17:25 (1)	02:45 20:27
27	08:02 15:42	14:24 (5) 17:00	15:56 (3) 16:24 (3)	05:23 18:08	17:18 (1) 17:22 (1)	02:44 20:29
28	08:00 15:44	14:25 (5) 17:03	15:55 (3) 16:24 (3)	05:20 18:10	03:51 19:24	02:42 20:31
29	07:58 15:47	14:27 (5) 17:05	05:17 18:12	03:48 19:26	02:40 20:33	02:25 20:58
30	07:55 15:49	14:28 (5) 17:07	05:14 18:15	03:45 19:29	02:39 20:35	02:26 20:58
31	07:53 15:52	14:31 (5) 17:09	05:11 18:17	03:42 19:31	02:37 20:37	02:26 20:58
Potential sun hours	216	257	365	434	526	554
Total, worst case	287	324	487			
Sun reduction	0.27	0.29	0.28			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.53	0.52	0.54			
Total reduction	0.13	0.14	0.14			
Total, real	38	46	68			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CA - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (283)

### Assumptions for shadow calculations

Maximum distance for influence	1 500 m	Sunshine probability S/S0 (Sun hours/Possible sun hours) []
Minimum sun height over horizon for influence	3 °	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Day step for calculation	1 days	0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30
Time step for calculation	1 minutes	Operational time
		N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
		813 231 221 428 610 1281 1143 697 478 515 675 1091 8182
		Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	16:23 (2) 16:42 (2)	06:56 15:48
2	02:28 20:56	03:24 20:05	04:35 18:40	05:44 17:12	16:23 (2) 16:39 (2)	06:58 15:45
3	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	16:23 (2) 16:35 (2)	07:01 15:43
4	02:30 20:55	03:28 20:00	04:40 18:34	05:49 17:06	15:41 (3) 16:33 (2)	07:03 15:40
5	02:31 20:54	03:31 19:57	04:42 18:32	05:51 17:03	15:37 (3) 16:29 (2)	07:06 15:38
6	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	15:35 (3) 15:55 (3)	07:08 15:36
7	02:34 20:52	03:35 19:52	04:47 18:26	05:56 16:57	15:33 (3) 15:56 (3)	07:11 15:33
8	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	15:32 (3) 15:56 (3)	07:13 15:31
9	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	15:31 (3) 15:58 (3)	07:16 15:28
10	02:38 20:49	03:42 19:44	04:54 18:17	06:03 16:48	15:30 (3) 15:57 (3)	07:18 15:26
11	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	15:30 (3) 15:58 (3)	07:21 15:24
12	02:42 20:46	03:47 19:39	04:58 18:11	06:07 16:42	15:29 (3) 15:58 (3)	07:23 15:22
13	02:43 20:44	03:49 19:37	05:01 18:08	06:10 16:40	15:29 (3) 15:58 (3)	07:26 15:19
14	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	15:28 (3) 15:57 (3)	07:28 15:17
15	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	15:29 (3) 15:57 (3)	07:31 15:15
16	02:48 20:40	03:56 19:28	05:07 17:59	17:08 (1) 17:09 (1)	15:28 (3) 15:56 (3)	07:33 15:13
17	02:50 20:38	03:59 19:26	05:10 17:56	17:04 (1) 17:13 (1)	15:29 (3) 15:54 (3)	07:35 15:11
18	02:52 20:36	04:01 19:23	05:12 17:53	17:01 (1) 17:14 (1)	15:29 (3) 15:50 (3)	07:38 15:09
19	02:54 20:34	04:03 19:20	05:14 17:50	17:00 (1) 17:15 (1)	15:20 (4) 15:48 (3)	07:40 15:07
20	02:56 20:33	04:05 19:17	05:16 17:47	16:59 (1) 17:14 (1)	15:18 (4) 15:45 (3)	07:42 15:05
21	02:58 20:31	04:08 19:15	05:19 17:44	16:59 (1) 17:12 (1)	15:15 (4) 15:42 (3)	07:45 15:03
22	03:00 20:29	04:10 19:12	05:21 17:41	16:58 (1) 17:09 (1)	15:15 (4) 15:39 (3)	07:47 15:02
23	03:02 20:27	04:12 19:09	05:23 17:38	16:58 (1) 17:06 (1)	15:13 (4) 15:32 (4)	07:49 15:00
24	03:04 20:25	04:15 19:06	05:26 17:35	16:32 (2) 17:02 (1)	15:13 (4) 15:32 (4)	07:52 14:58
25	03:06 20:23	04:17 19:03	05:28 17:32	16:29 (2) 17:00 (1)	15:13 (4) 15:30 (4)	07:54 14:57
26	03:08 20:20	04:19 19:01	05:30 17:29	16:27 (2) 16:44 (2)	15:12 (4) 15:27 (4)	07:56 14:55
27	03:11 20:18	04:22 18:58	05:32 17:26	16:25 (2) 16:44 (2)	15:13 (4) 15:24 (4)	07:58 14:53
28	03:13 20:16	04:24 18:55	05:35 17:23	16:25 (2) 16:45 (2)	15:14 (4) 15:22 (4)	08:00 14:52
29	03:15 20:14	04:26 18:52	05:37 17:20	16:24 (2) 16:45 (2)	15:15 (4) 15:19 (4)	08:03 14:51
30	03:17 20:12	04:29 18:49	05:39 17:17	16:23 (2) 16:44 (2)	15:15 (4) 15:16 (4)	08:05 14:49
31	03:19 20:09	04:31 18:46		06:53 15:50		
Potential sun hours	551	481	387	317	232	194
Total, worst case			212	614	289	
Sun reduction			0.26	0.28	0.28	
Oper. time red.			0.93	0.93	0.93	
Wind dir. red.			0.55	0.52	0.53	
Total reduction			0.13	0.14	0.14	
Total, real			28	84	40	

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CB - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (284)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	17:35 (5) 17:49 (5)	03:43 19:31
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	17:33 (5) 17:51 (5)	03:40 19:33
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	17:32 (5) 17:53 (5)	03:37 19:36
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	17:31 (5) 17:55 (5)	03:35 19:38
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	17:29 (5) 17:57 (5)	03:32 19:41
6	08:32 14:57	07:39 16:07	06:24 17:18	04:53 18:31	17:30 (5) 17:59 (5)	03:30 19:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	17:29 (5) 17:59 (5)	03:27 19:45
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	17:28 (5) 17:59 (5)	03:25 19:48
9	08:30 15:02	07:32 16:15	06:16 17:25	04:44 18:38	17:28 (5) 17:59 (5)	03:22 19:50
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	17:27 (5) 17:58 (5)	03:20 19:52
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	17:27 (5) 17:57 (5)	03:17 19:55
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	17:28 (5) 17:57 (5)	03:15 19:57
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	17:28 (5) 17:56 (5)	03:12 19:59
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	17:29 (5) 18:18 (4)	03:10 20:02
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	17:29 (5) 18:20 (4)	03:08 20:04
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	17:30 (5) 18:22 (4)	03:06 20:06
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	17:32 (5) 18:25 (4)	03:03 20:08
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	17:34 (5) 18:27 (4)	03:01 20:11
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	17:38 (5) 18:29 (4)	02:59 20:13
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	18:13 (4) 18:32 (4)	02:57 20:15
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	18:12 (4) 18:33 (4)	02:55 20:17
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	18:12 (4) 18:32 (4)	02:53 20:19
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	18:13 (4) 18:32 (4)	02:51 20:21
24	08:08 15:35	06:52 16:53	05:31 18:01	04:01 19:14	18:14 (4) 18:30 (4)	02:49 20:23
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	18:14 (4) 18:28 (4)	02:47 20:25
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 19:19	18:16 (4) 18:27 (4)	02:45 20:27
27	08:02 15:42	06:44 17:00	05:23 18:08	03:53 19:21	18:19 (4) 18:23 (4)	02:44 20:29
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	20:29 20:31
29	07:57 15:47	06:38 17:05	05:17 18:12	03:48 19:26	02:40 20:33	19:27 (3) 20:33
30	07:55 15:49	06:35 17:02	05:14 18:15	03:45 19:29	02:39 20:35	19:26 (3) 20:35
31	07:53 15:52	06:32 17:00	05:11 18:17	03:42 19:31	02:37 20:37	19:27 (3) 20:37
Potential sun hours	216	257	365	434	526	554
Total, worst case			10	634	381	708
Sun reduction			0.28	0.30	0.35	0.30
Oper. time red.			0.93	0.93	0.93	0.93
Wind dir. red.			0.63	0.64	0.74	0.74
Total reduction			0.16	0.18	0.24	0.21
Total, real			2	114	92	147

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CB - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (284)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	19:33 (3) 03:22	19:23 (2) 04:33	17:26 (5) 05:42	06:56	08:07
	24	19:57 (3) 20:07	19:29 (2) 18:43	17:56 (5) 17:14	15:48	14:48
2	02:28	19:33 (3) 03:24	19:24 (2) 04:36	17:26 (5) 05:44	06:58	08:09
	24	19:57 (3) 20:04	19:27 (2) 18:40	17:57 (5) 17:12	15:45	14:47
3	02:29	19:33 (3) 03:26	19:33 (3) 04:38	17:26 (5) 05:46	07:01	08:10
	25	19:58 (3) 20:02	18:37	17:57 (5) 17:09	15:43	14:46
4	02:30	19:33 (3) 03:29	19:33 (3) 04:40	17:25 (5) 05:49	07:03	08:12
	25	19:58 (3) 20:00	18:34	17:56 (5) 17:06	15:40	14:45
5	02:32	19:33 (3) 03:31	19:33 (3) 04:42	17:25 (5) 05:51	07:06	08:14
	25	19:58 (3) 19:57	18:31	17:55 (5) 17:03	15:38	14:44
6	02:33	19:33 (3) 03:33	19:33 (3) 04:45	17:25 (5) 05:53	07:08	08:16
	25	19:58 (3) 19:55	18:29	17:55 (5) 17:00	15:36	14:43
7	02:34	19:34 (3) 03:35	19:34 (3) 04:47	17:26 (5) 05:56	07:11	08:18
	25	19:59 (3) 19:52	18:26	17:54 (5) 16:57	15:33	14:42
8	02:35	19:34 (3) 03:38	19:34 (3) 04:49	17:26 (5) 05:58	07:13	08:19
	25	19:59 (3) 19:50	18:23	17:51 (5) 16:54	15:31	14:41
9	02:37	19:34 (3) 03:40	19:34 (3) 04:51	17:26 (5) 06:00	07:16	08:21
	25	19:59 (3) 19:47	18:20	17:47 (5) 16:51	15:28	14:40
10	02:38	19:34 (3) 03:42	19:34 (3) 04:54	17:27 (5) 06:03	07:18	08:22
	25	19:59 (3) 19:44	18:17	17:44 (5) 16:48	15:26	14:40
11	02:40	19:35 (3) 03:45	19:35 (3) 04:56	17:27 (5) 06:05	07:21	08:24
	25	20:00 (3) 19:42	18:14	17:41 (5) 16:45	15:24	14:39
12	02:42	19:34 (3) 03:47	19:34 (3) 04:58	17:30 (5) 06:07	07:23	08:25
	26	20:00 (3) 19:39	18:11	17:39 (5) 16:42	15:22	14:39
13	02:43	19:35 (3) 03:49	19:35 (3) 05:01	17:32 (5) 06:10	07:26	08:26
	25	20:00 (3) 19:37	18:08	17:36 (5) 16:40	15:20	14:39
14	02:45	19:35 (3) 03:52	19:35 (3) 05:03	17:36 (5) 06:12	07:28	08:28
	24	19:59 (3) 19:34	18:05	16:37	15:17	14:38
15	02:47	19:36 (3) 03:54	19:36 (3) 05:05	16:34	07:30	08:29
	22	19:58 (3) 19:31	18:02	16:34	15:15	14:38
16	02:49	19:35 (3) 03:56	18:26 (4) 05:07	06:17	07:33	08:30
	21	19:56 (3) 19:28	18:32 (4) 17:59	16:31	15:13	14:38
17	02:50	19:36 (3) 03:59	18:23 (4) 05:10	06:19	07:35	08:31
	19	19:55 (3) 19:26	18:34 (4) 17:56	16:28	15:11	14:38
18	02:52	19:37 (3) 04:01	18:20 (4) 05:12	06:22	07:38	08:32
	17	19:54 (3) 19:23	18:35 (4) 17:53	16:25	15:09	14:38
19	02:54	19:28 (2) 04:03	18:19 (4) 05:14	06:24	07:40	08:33
	23	19:52 (3) 19:20	18:36 (4) 17:50	16:23	15:07	14:38
20	02:56	19:26 (2) 04:06	18:19 (4) 05:16	06:26	07:42	08:33
	24	19:51 (3) 19:17	18:37 (4) 17:47	16:20	15:05	14:39
21	02:58	19:26 (2) 04:08	18:18 (4) 05:19	06:29	07:45	08:34
	23	19:49 (3) 19:15	18:38 (4) 17:44	16:17	15:03	14:39
22	03:00	19:25 (2) 04:10	18:17 (4) 05:21	06:31	07:47	08:34
	23	19:48 (3) 19:12	18:38 (4) 17:41	16:14	15:02	14:39
23	03:02	19:23 (2) 04:12	18:16 (4) 05:23	06:34	07:49	08:35
	22	19:45 (3) 19:09	18:35 (4) 17:38	16:12	15:00	14:40
24	03:04	19:23 (2) 04:15	17:41 (5) 05:26	06:36	07:52	08:35
	21	19:44 (3) 19:06	18:32 (4) 17:35	16:09	14:58	14:41
25	03:06	19:23 (2) 04:17	17:37 (5) 05:28	06:39	07:54	08:36
	19	19:42 (3) 19:03	18:29 (4) 17:32	16:06	14:57	14:41
26	03:09	19:23 (2) 04:19	17:34 (5) 05:30	06:41	07:56	08:36
	17	19:40 (2) 19:00	18:27 (4) 17:29	16:04	14:55	14:42
27	03:11	19:23 (2) 04:22	17:33 (5) 05:32	06:43	07:58	08:36
	15	19:38 (2) 18:58	18:25 (4) 17:26	16:01	14:53	14:43
28	03:13	19:23 (2) 04:24	17:31 (5) 05:35	06:46	08:00	08:36
	14	19:37 (2) 18:55	18:22 (4) 17:23	15:58	14:52	14:44
29	03:15	19:23 (2) 04:26	17:30 (5) 05:37	06:48	08:02	08:36
	12	19:35 (2) 18:52	18:19 (4) 17:20	15:56	14:51	14:45
30	03:17	19:23 (2) 04:29	17:28 (5) 05:39	06:51	08:05	08:36
	10	19:33 (2) 18:49	17:56 (5) 17:17	15:53	14:49	14:46
31	03:19	19:23 (2) 04:31	17:27 (5) 05:41	06:53	08:07	08:36
	8	19:31 (2) 18:46	17:56 (5) 17:17	15:51	14:47	14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	658	360	301			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.74	0.65	0.63			
Total reduction	0.18	0.15	0.15			
Total, real	118	52	46			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CC - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (285)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:39	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:54	17:05	18:20	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:09
	14:50	15:57	17:08	18:22	19:33	20:40	20:57	20:05	18:40	17:12	15:45	14:47
3	08:35	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	15:59	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:45
5	08:33	07:42	06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44
6	08:33	07:39	06:24	04:53	03:29	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:56	16:07	17:17	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:45	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:18	04:47	03:24	02:27	02:35	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:16	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29	07:30	06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	08:22
	15:04	16:17	17:27	18:41	19:52	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:27	07:25	06:07	04:36	03:15	02:24	02:41	03:47	04:58	06:07	07:23	08:25
	15:08	16:22	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39
13	08:25	07:22	06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	08:27
	15:10	16:25	17:34	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:19	14:38
14	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	07:17	05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20	07:12	05:52	04:21	03:03	02:22	02:50	03:58	05:10	06:19	07:35	08:31
	15:18	16:35	17:44	18:58	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:20	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:17	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
20	08:15	07:03	05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:43	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:33	19:17	17:47	16:20	15:05	14:38
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27	16:45	17:53	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
22	08:11	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35
	15:30	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
23	08:10	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	08:35
	15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:53	05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	08:36
	15:34	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	14:40
25	08:06	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
	15:37	16:55	18:03	19:17	20:25	20:59	20:23	19:03	17:32	16:06	14:56	14:41
26	08:04	06:47	05:25	03:56	02:45	02:23	03:08	04:19	05:30	06:41	07:56	08:36
	15:39	16:58	18:05	19:19	20:27	20:59	20:20	19:01	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:44	07:58	08:36
	15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00	06:41	05:20	03:50	02:42	02:25	03:13	04:24	05:35	06:46	08:00	08:36
	15:44	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:23	15:58	14:52	14:44
29	07:58		05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	08:03	08:36
	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45
30	07:55		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:49		18:15	19:29	20:35	20:58	20:12	18:49	17:17	15:53	14:49	14:46
31	07:53		05:11		02:37		03:19	04:31		06:53		08:36
	15:52		18:17		20:37		20:09	18:46		15:50		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CD - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (286)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	17:32 (5) 17:49 (5)	03:43 19:31
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	17:31 (5) 17:51 (5)	03:40 19:33
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	17:29 (5) 17:53 (5)	03:37 19:36
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	17:28 (5) 17:55 (5)	03:35 19:38
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	17:27 (5) 17:57 (5)	03:32 19:41
6	08:32 14:57	07:39 16:07	06:24 17:18	04:53 18:31	17:27 (5) 17:58 (5)	03:30 19:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	17:27 (5) 17:57 (5)	03:27 19:45
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	17:26 (5) 17:57 (5)	03:25 19:48
9	08:30 15:02	07:32 16:15	06:16 17:25	04:44 18:38	17:26 (5) 17:56 (5)	03:22 19:50
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	17:26 (5) 17:56 (5)	03:20 19:52
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	17:26 (5) 17:55 (5)	03:17 19:55
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	17:27 (5) 17:55 (5)	03:15 19:57
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	17:27 (5) 17:53 (5)	03:12 19:59
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	17:28 (5) 18:18 (4)	03:10 20:02
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	17:29 (5) 18:20 (4)	03:08 20:04
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	17:30 (5) 18:22 (4)	03:06 20:06
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	17:33 (5) 18:25 (4)	03:03 20:08
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	17:37 (5) 18:27 (4)	03:01 20:11
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	18:11 (4) 18:29 (4)	02:59 20:13
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	18:11 (4) 18:32 (4)	02:57 20:15
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	18:11 (4) 18:31 (4)	02:55 20:17
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	18:11 (4) 18:30 (4)	02:53 20:19
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	18:12 (4) 18:29 (4)	02:51 20:21
24	08:08 15:35	06:52 16:53	05:31 18:01	04:01 19:14	18:13 (4) 18:28 (4)	02:49 20:23
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	18:14 (4) 18:26 (4)	02:47 20:25
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 19:19	18:17 (4) 18:24 (4)	02:45 20:27
27	08:02 15:42	06:44 17:00	05:23 18:08	03:53 19:21	02:44 20:29	20:29
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	20:31
29	07:57 15:47	06:38 17:06	05:17 18:12	03:48 19:26	02:40 20:33	20:33
30	07:55 15:49	06:35 17:09	05:14 18:15	03:45 19:29	02:39 20:35	20:35
31	07:53 15:52	06:32 17:12	05:11 18:17	03:42 19:31	02:37 20:37	20:37
Potential sun hours	216	257	365	434	526	554
Total, worst case			19	612	407	684
Sun reduction			0.28	0.30	0.35	0.30
Oper. time red.			0.93	0.93	0.93	0.93
Wind dir. red.			0.63	0.64	0.74	0.74
Total reduction			0.16	0.18	0.24	0.21
Total, real			3	109	98	142

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CD - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (286)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	19:31 (3) 03:22	19:21 (2) 04:33	17:25 (5) 05:42	06:56	08:07
	20:57	23 19:54 (3) 20:07	8 19:29 (2) 18:43	29 17:54 (5) 17:14	15:48	14:48
2	02:28	19:31 (3) 03:24	19:22 (2) 04:36	17:25 (5) 05:44	06:58	08:09
	20:56	24 19:55 (3) 20:04	5 19:27 (2) 18:40	30 17:55 (5) 17:12	15:45	14:47
3	02:29	19:32 (3) 03:26	19:22 (2) 04:38	17:24 (5) 05:46	07:01	08:10
	20:56	23 19:55 (3) 20:02	2 19:24 (2) 18:37	30 17:54 (5) 17:09	15:43	14:46
4	02:30	19:32 (3) 03:29	04:40	17:23 (5) 05:49	07:03	08:12
	20:55	23 19:55 (3) 20:00	18:34	31 17:54 (5) 17:06	15:40	14:45
5	02:32	19:32 (3) 03:31	04:42	17:23 (5) 05:51	07:06	08:14
	20:54	24 19:56 (3) 19:57	18:31	30 17:53 (5) 17:03	15:38	14:44
6	02:33	19:31 (3) 03:33	04:45	17:23 (5) 05:53	07:08	08:16
	20:53	25 19:56 (3) 19:55	18:29	30 17:53 (5) 17:00	15:36	14:43
7	02:34	19:32 (3) 03:35	04:47	17:23 (5) 05:56	07:11	08:18
	20:52	25 19:57 (3) 19:52	18:26	30 17:53 (5) 16:57	15:33	14:42
8	02:35	19:32 (3) 03:38	04:49	17:23 (5) 05:58	07:13	08:19
	20:51	25 19:57 (3) 19:50	18:23	28 17:51 (5) 16:54	15:31	14:41
9	02:37	19:32 (3) 03:40	04:51	17:24 (5) 06:00	07:16	08:21
	20:50	25 19:57 (3) 19:47	18:20	23 17:47 (5) 16:51	15:28	14:40
10	02:38	19:32 (3) 03:42	04:54	17:24 (5) 06:03	07:18	08:22
	20:48	25 19:57 (3) 19:44	18:17	20 17:44 (5) 16:48	15:26	14:40
11	02:40	19:32 (3) 03:45	04:56	17:24 (5) 06:05	07:21	08:24
	20:47	26 19:58 (3) 19:42	18:14	17 17:41 (5) 16:45	15:24	14:39
12	02:42	19:32 (3) 03:47	04:58	17:26 (5) 06:07	07:23	08:25
	20:46	26 19:58 (3) 19:39	18:11	13 17:39 (5) 16:42	15:22	14:39
13	02:43	19:33 (3) 03:49	05:01	17:28 (5) 06:10	07:26	08:26
	20:44	25 19:58 (3) 19:37	18:08	8 17:36 (5) 16:40	15:20	14:39
14	02:45	19:33 (3) 03:52	05:03	17:31 (5) 06:12	07:28	08:28
	20:43	25 19:58 (3) 19:34	18:05	2 17:33 (5) 16:37	15:17	14:38
15	02:47	19:33 (3) 03:54	05:05	06:14	07:30	08:29
	20:41	25 19:58 (3) 19:31	18:02	16:34	15:15	14:38
16	02:49	19:33 (3) 03:56	05:07	06:17	07:33	08:30
	20:40	23 19:56 (3) 19:28	17:59	16:31	15:13	14:38
17	02:50	19:33 (3) 03:59	18:23 (4) 05:10	06:19	07:35	08:31
	20:38	22 19:55 (3) 19:26	8 18:31 (4) 17:56	16:28	15:11	14:38
18	02:52	19:34 (3) 04:01	18:20 (4) 05:12	06:22	07:38	08:32
	20:36	20 19:54 (3) 19:23	13 18:33 (4) 17:53	16:25	15:09	14:38
19	02:54	19:34 (3) 04:03	18:18 (4) 05:14	06:24	07:40	08:33
	20:34	18 19:52 (3) 19:20	16 18:34 (4) 17:50	16:23	15:07	14:38
20	02:56	19:26 (2) 04:06	18:18 (4) 05:16	06:26	07:42	08:33
	20:32	24 19:51 (3) 19:17	17 18:35 (4) 17:47	16:20	15:05	14:39
21	02:58	19:25 (2) 04:08	18:17 (4) 05:19	06:29	07:45	08:34
	20:31	24 19:49 (3) 19:15	19 18:36 (4) 17:44	16:17	15:03	14:39
22	03:00	19:23 (2) 04:10	18:16 (4) 05:21	06:31	07:47	08:34
	20:29	24 19:47 (3) 19:12	20 18:36 (4) 17:41	16:14	15:02	14:39
23	03:02	19:23 (2) 04:12	18:15 (4) 05:23	06:34	07:49	08:35
	20:27	22 19:45 (3) 19:09	20 18:35 (4) 17:38	16:12	15:00	14:40
24	03:04	19:22 (2) 04:15	18:14 (4) 05:26	06:36	07:52	08:35
	20:25	22 19:44 (3) 19:06	18 18:32 (4) 17:35	16:09	14:58	14:41
25	03:06	19:22 (2) 04:17	17:38 (5) 05:28	06:39	07:54	08:36
	20:22	20 19:42 (3) 19:03	22 18:29 (4) 17:32	16:06	14:57	14:41
26	03:09	19:21 (2) 04:19	17:34 (5) 05:30	06:41	07:56	08:36
	20:20	19 19:40 (3) 19:00	27 18:27 (4) 17:29	16:04	14:55	14:42
27	03:11	19:21 (2) 04:22	17:33 (5) 05:32	06:43	07:58	08:36
	20:18	17 19:38 (2) 18:58	28 18:25 (4) 17:26	16:01	14:53	14:43
28	03:13	19:21 (2) 04:24	17:30 (5) 05:35	06:46	08:00	08:36
	20:16	16 19:37 (2) 18:55	29 18:22 (4) 17:23	15:58	14:52	14:44
29	03:15	19:21 (2) 04:26	17:29 (5) 05:37	06:48	08:02	08:36
	20:14	14 19:35 (2) 18:52	27 18:19 (4) 17:20	15:56	14:51	14:45
30	03:17	19:21 (2) 04:29	17:27 (5) 05:39	06:51	08:05	08:36
	20:11	12 19:33 (2) 18:49	26 17:53 (5) 17:17	15:53	14:49	14:46
31	03:19	19:21 (2) 04:31	17:26 (5) 17:17	06:53	14:49	08:36
	20:09	10 19:31 (2) 18:46	28 17:54 (5) 17:17	15:51	14:47	14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	676	333	321			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.74	0.65	0.63			
Total reduction	0.18	0.15	0.15			
Total, real	121	49	49			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CE - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (287)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	15:04 (5) 17:05	06:38 17:05	16:21 (4) 16:33 (4)	05:08 18:19
2	08:35 14:50	07:49 15:57	15:03 (5) 17:08	06:36 17:08	16:20 (4) 16:36 (4)	05:05 18:22
3	08:35 14:52	07:46 15:59	15:03 (5) 17:10	06:33 17:10	16:19 (4) 16:38 (4)	05:02 18:24
4	08:34 14:53	07:44 16:02	15:02 (5) 17:13	06:30 17:13	16:19 (4) 16:40 (4)	04:59 18:27
5	08:33 14:55	07:42 16:05	15:01 (5) 17:15	06:27 17:15	16:19 (4) 16:39 (4)	04:56 18:29
6	08:33 14:56	07:39 16:07	15:02 (5) 17:18	06:24 17:18	16:19 (4) 16:38 (4)	04:53 18:31
7	08:32 14:58	07:37 16:10	15:01 (5) 17:20	06:21 17:20	16:20 (4) 16:38 (4)	04:50 18:34
8	08:31 15:00	07:35 16:12	15:01 (5) 17:22	06:18 17:22	16:21 (4) 16:36 (4)	04:47 18:36
9	08:30 15:02	07:32 16:15	15:02 (5) 17:25	06:16 17:25	16:23 (4) 16:35 (4)	04:44 18:38
10	08:29 15:04	07:30 16:17	15:02 (5) 17:27	06:13 17:27	16:26 (4) 16:32 (4)	04:41 18:41
11	08:28 15:06	07:27 16:20	15:02 (5) 17:30	06:10 17:30	16:32 (4) 18:43	04:38 18:43
12	08:27 15:08	07:25 16:23	15:03 (5) 17:32	06:07 17:32	18:46 18:46	04:36 18:46
13	08:25 15:10	07:22 16:25	15:05 (5) 17:34	06:04 17:34	04:33 18:48	18:48 19:59
14	08:24 15:12	07:19 16:28	15:06 (5) 17:37	06:01 17:37	04:30 18:50	18:50 20:02
15	08:23 15:14	07:17 16:30	15:07 (5) 17:39	05:58 17:39	17:00 (3) 17:09 (3)	04:27 18:53
16	08:21 15:16	07:14 16:33	15:10 (5) 17:42	05:55 17:42	9 17:12 (3) 17:12 (3)	18:55 18:55
17	08:20 15:18	07:12 16:35	15:11 (5) 17:44	05:52 17:44	15 17:14 (3) 17:14 (3)	18:57 18:57
18	08:18 15:20	07:09 16:38	15:12 (5) 17:46	05:49 17:46	19 17:16 (3) 17:16 (3)	19:00 19:00
19	08:16 15:23	07:06 16:40	15:13 (5) 17:49	05:46 17:49	25 17:17 (3) 17:17 (3)	19:02 19:02
20	08:15 15:25	07:03 16:43	15:14 (5) 17:51	05:43 17:51	27 17:18 (3) 17:18 (3)	19:05 19:05
21	08:13 15:27	07:01 16:45	15:15 (5) 17:53	05:40 17:53	28 17:18 (3) 17:18 (3)	19:07 19:07
22	08:11 15:30	06:58 16:48	15:16 (5) 17:56	05:37 17:56	29 17:18 (3) 17:18 (3)	19:09 19:09
23	08:09 15:32	06:55 16:50	15:17 (5) 17:58	05:34 17:58	30 17:18 (3) 17:18 (3)	19:12 19:12
24	08:08 15:35	06:52 16:53	15:18 (5) 18:01	05:31 18:01	30 17:18 (3) 17:18 (3)	19:14 19:14
25	08:06 15:37	06:50 16:55	15:19 (5) 18:03	05:28 18:03	30 17:18 (3) 17:17 (3)	19:17 19:17
26	08:04 15:39	06:47 16:58	15:20 (5) 18:05	05:25 18:05	29 17:17 (3) 17:17 (3)	19:19 19:19
27	08:02 15:42	06:44 17:00	16:23 (4) 18:08	05:23 18:08	28 17:16 (3) 17:16 (3)	19:21 19:21
28	08:00 15:44	06:41 17:03	16:22 (4) 18:10	05:20 18:10	27 17:15 (3) 17:15 (3)	19:24 19:24
29	07:58 15:47	06:40 17:05	16:21 (4) 18:12	05:17 18:12	25 17:14 (3) 17:14 (3)	19:26 19:26
30	07:55 15:49	15:07 (5) 15:09 (5)	16:20 (4) 18:15	05:14 18:15	23 17:12 (3) 17:12 (3)	19:29 19:29
31	07:53 15:52	15:06 (5) 15:13 (5)	16:19 (4) 18:17	05:11 18:17	19 17:10 (3) 17:10 (3)	19:31 19:31
Potential sun hours	216	257	365	434	526	554
Total, worst case	9	332	573	24		
Sun reduction	0.27	0.29	0.28	0.30		
Oper. time red.	0.93	0.93	0.93	0.93		
Wind dir. red.	0.49	0.49	0.55	0.56		
Total reduction	0.12	0.13	0.14	0.16		
Total, real	1	44	83	4		

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:

Gismarvik

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Gunnar Randres vei 12

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Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CE - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (287)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	06:56 15:48	08:07 14:48
2	02:28 20:56	03:24 20:04	04:35 18:40	05:44 17:12	06:58 15:45	08:09 14:47
3	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	08:10 14:46
4	02:30 20:55	03:28 20:00	04:40 18:34	05:49 17:06	16:01 (4) 16:12 (4)	07:03 15:40
5	02:31 20:54	03:31 19:57	04:42 18:32	05:51 17:03	15:58 (4) 16:13 (4)	07:06 15:38
6	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	15:56 (4) 16:13 (4)	07:08 15:36
7	02:34 20:52	03:35 19:52	04:47 18:26	05:56 16:57	15:56 (4) 16:15 (4)	07:11 15:33
8	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	15:55 (4) 16:14 (4)	07:13 15:31
9	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	15:55 (4) 16:15 (4)	07:16 15:28
10	02:38 20:48	03:42 19:44	04:54 18:17	16:49 (3) 16:57 (3)	06:03 16:48	07:18 15:26
11	02:40 20:47	03:45 19:42	04:56 18:14	16:45 (3) 17:00 (3)	06:05 16:45	07:21 15:24
12	02:42 20:46	03:47 19:39	04:58 18:11	16:42 (3) 17:01 (3)	06:07 16:42	07:23 15:22
13	02:43 20:44	03:49 19:37	05:01 18:08	16:41 (3) 17:03 (3)	06:10 16:40	07:26 15:19
14	02:45 20:43	03:52 19:34	05:03 18:05	16:39 (3) 17:04 (3)	06:12 16:37	07:28 15:17
15	02:47 20:41	03:54 19:31	05:05 18:02	16:38 (3) 17:04 (3)	06:14 16:34	07:31 15:15
16	02:48 20:40	03:56 19:28	05:07 17:59	16:36 (3) 17:04 (3)	06:17 16:31	07:33 15:13
17	02:50 20:38	03:59 19:26	05:10 17:56	16:36 (3) 17:05 (3)	06:19 16:28	07:35 15:11
18	02:52 20:36	04:01 19:23	05:12 17:53	16:35 (3) 17:05 (3)	06:22 16:25	07:38 15:09
19	02:54 20:34	04:03 19:20	05:14 17:50	16:34 (3) 17:05 (3)	06:24 16:23	07:40 15:07
20	02:56 20:33	04:05 19:17	05:16 17:47	16:34 (3) 17:04 (3)	06:26 16:20	07:42 15:05
21	02:58 20:31	04:08 19:15	05:19 17:44	16:34 (3) 17:04 (3)	06:29 16:17	07:45 15:03
22	03:00 20:29	04:10 19:12	05:21 17:41	16:34 (3) 17:03 (3)	06:31 16:14	07:47 15:02
23	03:02 20:27	04:12 19:09	05:23 17:38	16:34 (3) 17:02 (3)	06:34 16:12	07:49 15:00
24	03:04 20:25	04:15 19:06	05:26 17:35	16:34 (3) 17:01 (3)	06:36 16:09	07:52 14:58
25	03:06 20:23	04:17 19:03	05:28 17:32	16:36 (3) 17:00 (3)	06:39 16:06	07:54 14:57
26	03:09 20:20	04:19 19:01	05:30 17:29	16:36 (3) 16:57 (3)	06:41 16:04	07:56 14:55
27	03:11 20:18	04:22 18:58	05:32 17:26	16:37 (3) 16:53 (3)	06:44 16:01	07:58 14:53
28	03:13 20:16	04:24 18:55	05:35 17:23	16:40 (3) 16:51 (3)	06:46 15:58	08:00 14:52
29	03:15 20:14	04:26 18:52	05:37 17:20	16:45 (3) 16:47 (3)	06:48 15:56	08:03 14:51
30	03:17 20:12	04:29 18:49	05:39 17:17	06:51 15:53	06:51 14:54 (5)	08:05 14:49
31	03:19 20:09	04:31 18:46		06:53 15:50	14:32 (5) 14:55 (5)	08:06 14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case			451	283	218	
Sun reduction			0.26	0.28	0.28	
Oper. time red.			0.93	0.93	0.93	
Wind dir. red.			0.56	0.51	0.49	
Total reduction			0.14	0.13	0.13	
Total, real			61	38	28	

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CF - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (288)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:06
	14:49	15:54	17:05	18:19	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:58	08:08
	14:50	15:57	17:08	18:22	19:33	20:40	20:56	20:04	18:40	17:12	15:45	14:47
3	08:34	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:10
	14:52	16:00	17:10	18:24	19:36	20:41	20:56	20:02	18:37	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:03	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:45
5	08:33	07:42	06:27	04:56	03:32	02:31	02:32	03:31	04:42	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:40	20:45	20:54	19:57	18:31	17:03	15:38	14:44
6	08:32	07:39	06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:57	16:07	17:18	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:55	07:11	08:17
	14:58	16:10	17:20	18:34	19:45	20:47	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:34	06:18	04:47	03:25	02:27	02:36	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:15	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:29	14:41
10	08:29	07:30	06:13	04:41	03:20	02:26	02:39	03:42	04:54	06:03	07:18	08:22
	15:04	16:17	17:27	18:41	19:52	20:51	20:48	19:44	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:26	07:24	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
	15:08	16:23	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39
13	08:25	07:22	06:04	04:33	03:13	02:24	02:43	03:49	05:01	06:10	07:26	08:26
	15:10	16:25	17:34	18:48	19:59	20:54	20:44	19:36	18:08	16:40	15:20	14:39
14	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:14	07:30	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:07	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:39	19:28	17:59	16:31	15:13	14:38
17	08:20	07:11	05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31
	15:18	16:35	17:44	18:57	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:21	16:38	17:46	19:00	20:10	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:16	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:32
	15:23	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
20	08:15	07:03	05:43	04:13	02:57	02:22	02:56	04:06	05:16	06:26	07:42	08:33
	15:25	16:43	17:51	19:05	20:15	20:58	20:32	19:17	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27	16:45	17:53	19:07	20:17	20:59	20:30	19:15	17:44	16:17	15:04	14:39
22	08:11	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:34
	15:30	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
23	08:09	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	08:35
	15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:07	06:52	05:31	04:02	02:49	02:23	03:04	04:15	05:26	06:36	07:52	08:35
	15:35	16:53	18:01	19:14	20:23	20:59	20:24	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
	15:37	16:55	18:03	19:17	20:25	20:59	20:22	19:03	17:32	16:06	14:57	14:41
26	08:04	06:47	05:25	03:56	02:45	02:24	03:09	04:19	05:30	06:41	07:56	08:36
	15:40	16:58	18:05	19:19	20:27	20:59	20:20	19:00	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:43	07:58	08:36
	15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:54	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:00	08:36
	15:44	17:03	18:10	19:24	20:31	20:58	20:16	18:55	17:23	15:58	14:52	14:44
29	07:57		05:17	03:48	02:40	02:26	03:15	04:26	05:37	06:48	08:02	08:36
	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45
30	07:55		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:04	08:36
	15:49		18:15	19:29	20:35	20:58	20:11	18:49	17:17	15:53	14:49	14:46
31	07:53		05:11		02:37		03:20	04:31		06:53		08:36
	15:52		18:17		20:36		20:09	18:46		15:51		14:47
Potential sun hours	217	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CG - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (289)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35	07:51	06:38	05:08	17:20 (5)	03:43
	14:49	15:54	17:05	18:19	29 17:49 (5)	19:31
2	08:35	07:49	06:36	05:05	17:19 (5)	03:40
	14:50	15:57	17:08	18:22	30 17:49 (5)	19:33
3	08:34	07:46	06:33	05:02	17:19 (5)	03:37
	14:52	16:00	17:10	18:24	30 17:49 (5)	19:36
4	08:34	07:44	06:30	04:59	17:18 (5)	03:35
	14:53	16:02	17:13	18:27	30 17:48 (5)	19:38
5	08:33	07:42	06:27	04:56	17:18 (5)	03:32
	14:55	16:05	17:15	18:29	30 17:48 (5)	19:41
6	08:33	07:39	06:24	04:53	17:19 (5)	03:30
	14:57	16:07	17:18	18:31	29 17:48 (5)	19:43
7	08:32	07:37	06:21	04:50	17:19 (5)	03:27
	14:58	16:10	17:20	18:34	28 17:47 (5)	19:45
8	08:31	07:35	06:18	04:47	17:19 (5)	03:25
	15:00	16:12	17:22	18:36	27 17:46 (5)	19:48
9	08:30	07:32	06:16	04:44	17:19 (5)	03:22
	15:02	16:15	17:25	18:38	26 17:45 (5)	19:50
10	08:29	07:30	06:13	04:41	17:20 (5)	03:20
	15:04	16:17	17:27	18:41	24 17:44 (5)	19:52
11	08:28	07:27	06:10	04:38	17:20 (5)	03:17
	15:06	16:20	17:30	18:43	24 18:11 (4)	19:55
12	08:27	07:25	06:07	04:36	17:23 (5)	03:15
	15:08	16:23	17:32	18:46	23 18:14 (4)	19:57
13	08:25	07:22	06:04	04:33	17:25 (5)	03:12
	15:10	16:25	17:34	18:48	21 18:16 (4)	19:59
14	08:24	07:19	06:01	04:30	17:28 (5)	03:10
	15:12	16:28	17:37	18:50	18 18:18 (4)	20:02
15	08:23	07:17	05:58	04:27	18:06 (4)	03:08
	15:14	16:30	17:39	18:53	14 18:20 (4)	20:04
16	08:21	07:14	05:55	04:24	18:05 (4)	03:06
	15:16	16:33	17:42	18:55	17 18:22 (4)	20:06
17	08:20	07:11	05:52	04:21	18:05 (4)	03:03
	15:18	16:35	17:44	18:57	20 18:25 (4)	20:08
18	08:18	07:09	05:49	04:18	18:05 (4)	03:01
	15:21	16:38	17:46	19:00	20 18:25 (4)	20:11
19	08:16	07:06	05:46	04:15	18:05 (4)	02:59
	15:23	16:40	17:49	19:02	19 18:24 (4)	20:13
20	08:15	07:03	05:43	04:13	18:06 (4)	02:57
	15:25	16:43	17:51	19:05	18 18:24 (4)	20:15
21	08:13	07:01	05:40	04:10	18:07 (4)	02:55
	15:27	16:45	17:53	19:07	15 18:22 (4)	20:17
22	08:11	06:58	05:37	04:07	18:08 (4)	02:53
	15:30	16:48	17:56	19:09	12 18:20 (4)	20:19
23	08:09	06:55	05:34	04:04	18:10 (4)	02:51
	15:32	16:50	17:58	19:12	9 18:19 (4)	20:21
24	08:08	06:52	05:31	04:01	02:49	19:40 (3)
	15:35	16:53	18:01	19:14	26 19:41 (3)	20:59
25	08:06	06:50	05:28	03:59	02:47	19:16 (3)
	15:37	16:55	18:03	19:17	25 19:41 (3)	20:59
26	08:04	06:47	05:25	17:32 (5)	03:56	19:15 (3)
	15:39	16:58	18:05	3 17:35 (5)	19:19	26 19:41 (3)
27	08:02	06:44	05:23	17:28 (5)	03:53	19:16 (3)
	15:42	17:00	18:08	9 17:37 (5)	19:21	25 19:41 (3)
28	08:00	06:41	05:20	17:26 (5)	03:51	19:16 (3)
	15:44	17:03	18:10	14 17:40 (5)	19:24	26 19:42 (3)
29	07:57	06:38	05:17	17:24 (5)	03:48	19:16 (3)
	15:47	17:06	18:12	18 17:42 (5)	19:26	25 19:41 (3)
30	07:55	06:36	05:14	17:23 (5)	03:45	19:17 (3)
	15:49	17:08	18:15	21 17:44 (5)	19:29	24 19:41 (3)
31	07:53	06:34	05:11	17:21 (5)	03:43	19:17 (3)
	15:52	17:10	18:17	25 17:46 (5)	19:37	24 19:41 (3)
Potential sun hours	216	257	365	434	513	554
Total, worst case			90	513	489	541
Sun reduction			0.28	0.30	0.35	0.30
Oper. time red.			0.93	0.93	0.93	0.93
Wind dir. red.			0.62	0.63	0.74	0.74
Total reduction			0.16	0.18	0.24	0.21
Total, real			14	90	117	112

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CG - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (289)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	19:26 (3) 03:22	19:15 (2) 04:33	17:19 (5) 05:42	06:56	08:07
	20:57	19:44 (3) 20:07	19:29 (2) 18:43	18:10 (4) 17:14	15:48	14:48
2	02:28	19:26 (3) 03:24	19:15 (2) 04:36	17:19 (5) 05:44	06:58	08:09
	20:56	19:45 (3) 20:04	19:27 (2) 18:40	17:43 (5) 17:12	15:45	14:47
3	02:29	19:26 (3) 03:26	19:15 (2) 04:38	17:17 (5) 05:46	07:01	08:10
	20:56	19:45 (3) 20:02	19:24 (2) 18:37	17:43 (5) 17:09	15:43	14:46
4	02:30	19:25 (3) 03:29	19:15 (2) 04:40	17:16 (5) 05:49	07:03	08:12
	20:55	19:46 (3) 20:00	19:22 (2) 18:34	17:43 (5) 17:06	15:40	14:45
5	02:32	19:25 (3) 03:31	19:16 (2) 04:42	17:15 (5) 05:51	07:06	08:14
	20:54	19:46 (3) 19:57	19:20 (2) 18:31	17:44 (5) 17:03	15:38	14:44
6	02:33	19:25 (3) 03:33	19:16 (2) 04:45	17:14 (5) 05:53	07:08	08:16
	20:53	19:46 (3) 19:55	19:18 (2) 18:29	17:43 (5) 17:00	15:36	14:43
7	02:34	19:26 (3) 03:35	19:16 (2) 04:47	17:14 (5) 05:56	07:11	08:18
	20:52	19:48 (3) 19:52	19:26 (3) 18:26	17:44 (5) 16:57	15:33	14:42
8	02:35	19:25 (3) 03:38	19:16 (2) 04:49	17:13 (5) 05:58	07:13	08:19
	20:51	19:48 (3) 19:50	19:23 (3) 18:23	17:44 (5) 16:54	15:31	14:41
9	02:37	19:25 (3) 03:40	19:15 (2) 04:51	17:13 (5) 06:00	07:16	08:21
	20:50	19:48 (3) 19:47	19:20 (3) 18:20	17:43 (5) 16:51	15:28	14:40
10	02:38	19:25 (3) 03:42	19:15 (2) 04:54	17:13 (5) 06:03	07:18	08:22
	20:48	19:48 (3) 19:44	19:17 (2) 18:17	17:42 (5) 16:48	15:26	14:40
11	02:40	19:25 (3) 03:45	19:15 (2) 04:56	17:12 (5) 06:05	07:21	08:24
	20:47	19:49 (3) 19:42	19:14 (2) 18:14	17:41 (5) 16:45	15:24	14:39
12	02:42	19:25 (3) 03:47	19:15 (2) 04:58	17:13 (5) 06:07	07:23	08:25
	20:46	19:49 (3) 19:39	19:11 (2) 18:11	17:38 (5) 16:42	15:22	14:39
13	02:43	19:25 (3) 03:49	19:15 (2) 05:01	17:14 (5) 06:10	07:26	08:26
	20:44	19:50 (3) 19:37	19:08 (2) 18:08	17:36 (5) 16:40	15:20	14:39
14	02:45	19:25 (3) 03:52	19:15 (2) 05:03	17:14 (5) 06:12	07:28	08:28
	20:43	19:50 (3) 19:34	19:05 (2) 18:05	17:33 (5) 16:37	15:17	14:38
15	02:47	19:25 (3) 03:54	19:15 (2) 05:05	17:15 (5) 06:14	07:30	08:29
	20:41	19:50 (3) 19:31	19:02 (2) 18:02	17:30 (5) 16:34	15:15	14:38
16	02:49	19:25 (3) 03:56	19:15 (2) 05:07	17:16 (5) 06:17	07:33	08:30
	20:40	19:50 (3) 19:28	19:09 (2) 17:59	17:26 (5) 16:31	15:13	14:38
17	02:50	19:25 (3) 03:59	19:15 (2) 05:10	17:19 (5) 06:19	07:35	08:31
	20:38	19:51 (3) 19:26	19:06 (2) 17:56	17:24 (5) 16:28	15:11	14:38
18	02:52	19:25 (3) 04:01	19:15 (2) 05:12	17:19 (5) 06:22	07:38	08:32
	20:36	19:51 (3) 19:23	19:05 (2) 17:53	17:25 (5) 16:25	15:09	14:38
19	02:54	19:25 (3) 04:03	19:15 (2) 05:14	17:19 (5) 06:24	07:40	08:33
	20:34	19:50 (3) 19:20	19:04 (2) 17:50	17:23 (5) 16:23	15:07	14:38
20	02:56	19:25 (3) 04:06	18:15 (4) 05:16	17:19 (5) 06:26	07:42	08:33
	20:32	19:51 (3) 19:17	18:25 (4) 17:47	17:20 (5) 16:20	15:05	14:39
21	02:58	19:26 (3) 04:08	18:13 (4) 05:19	17:19 (5) 06:29	07:45	08:34
	20:31	19:49 (3) 19:15	18:26 (4) 17:44	17:17 (5) 16:17	15:03	14:39
22	03:00	19:25 (3) 04:10	18:11 (4) 05:21	17:17 (5) 06:31	07:47	08:34
	20:29	19:47 (3) 19:12	18:27 (4) 17:41	17:16 (5) 16:14	15:02	14:39
23	03:02	19:21 (2) 04:12	18:10 (4) 05:23	17:16 (5) 06:34	07:49	08:35
	20:27	19:45 (3) 19:09	18:28 (4) 17:38	17:15 (5) 16:12	15:00	14:40
24	03:04	19:19 (2) 04:15	18:09 (4) 05:26	17:15 (5) 06:36	07:52	08:35
	20:25	19:44 (3) 19:06	18:28 (4) 17:35	17:14 (5) 16:09	14:58	14:41
25	03:06	19:18 (2) 04:17	18:08 (4) 05:28	17:14 (5) 06:39	07:54	08:36
	20:22	19:42 (3) 19:03	18:28 (4) 17:32	17:13 (5) 16:06	14:57	14:41
26	03:09	19:17 (2) 04:19	18:07 (4) 05:30	17:13 (5) 06:41	07:56	08:36
	20:20	19:40 (3) 19:00	18:27 (4) 17:29	17:12 (5) 16:04	14:55	14:42
27	03:11	19:17 (2) 04:22	18:08 (4) 05:32	17:12 (5) 06:43	07:58	08:36
	20:18	19:38 (3) 18:58	18:25 (4) 17:26	17:11 (5) 16:01	14:53	14:43
28	03:13	19:16 (2) 04:24	18:07 (4) 05:35	17:11 (5) 06:46	08:00	08:36
	20:16	19:37 (3) 18:55	18:22 (4) 17:23	17:10 (5) 15:58	14:52	14:44
29	03:15	19:16 (2) 04:26	17:29 (5) 05:37	17:09 (5) 06:48	08:02	08:36
	20:14	19:35 (3) 18:52	18:19 (4) 17:20	17:08 (5) 15:56	14:51	14:45
30	03:17	19:15 (2) 04:29	17:24 (5) 05:39	17:07 (5) 06:51	08:05	08:36
	20:11	19:33 (2) 18:49	18:16 (4) 17:17	17:06 (5) 15:53	14:49	14:46
31	03:19	19:15 (2) 04:31	17:22 (5) 05:41	17:05 (5) 06:53	08:06	08:36
	20:09	19:31 (2) 18:46	18:13 (4) 17:14	17:04 (5) 15:51	14:47	14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	697	259	404			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.74	0.67	0.62			
Total reduction	0.18	0.15	0.15			
Total, real	125	39	60			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CH - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (290)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35	07:51	06:38	05:08	17:02 (3)	03:42
	14:49	15:54	17:05	18:19	17:49 (2)	19:31
2	08:35	07:49	06:36	05:05	17:02 (3)	03:40
	14:50	15:57	17:08	18:22	17:51 (2)	19:33
3	08:35	07:46	06:33	05:02	17:01 (3)	03:37
	14:52	15:59	17:10	18:24	17:52 (2)	19:36
4	08:34	07:44	06:30	16:36 (4)	04:59	17:01 (3)
	14:53	16:02	17:13	16:41 (4)	18:27	17:55 (1)
5	08:33	07:42	06:27	16:33 (4)	04:56	17:01 (3)
	14:55	16:05	17:15	16:43 (4)	18:29	17:57 (1)
6	08:33	07:39	15:21 (5)	06:24	16:32 (4)	04:53
	14:56	16:07	15:30 (5)	17:18	16:46 (4)	18:31
7	08:32	07:37	15:19 (5)	06:21	16:31 (4)	04:50
	14:58	16:10	15:33 (5)	17:20	16:48 (4)	18:34
8	08:31	07:35	15:17 (5)	06:18	16:30 (4)	04:47
	15:00	16:12	15:35 (5)	17:22	16:50 (4)	18:36
9	08:30	07:32	15:17 (5)	06:16	16:30 (4)	04:44
	15:02	16:15	15:37 (5)	17:25	16:51 (4)	18:38
10	08:29	07:30	15:16 (5)	06:13	16:30 (4)	04:41
	15:04	16:17	15:38 (5)	17:27	16:51 (4)	18:41
11	08:28	07:27	15:15 (5)	06:10	16:30 (4)	04:38
	15:06	16:20	15:38 (5)	17:30	16:50 (4)	18:43
12	08:27	07:25	15:14 (5)	06:07	16:30 (4)	04:36
	15:08	16:23	15:38 (5)	17:32	16:49 (4)	18:46
13	08:25	07:22	15:15 (5)	06:04	16:31 (4)	04:33
	15:10	16:25	15:40 (5)	17:34	16:48 (4)	18:48
14	08:24	07:19	15:14 (5)	06:01	16:32 (4)	04:30
	15:12	16:28	15:40 (5)	17:37	16:47 (4)	18:50
15	08:23	07:17	15:14 (5)	05:58	16:33 (4)	04:27
	15:14	16:30	15:39 (5)	17:39	16:45 (4)	18:53
16	08:21	07:14	15:14 (5)	05:55	16:37 (4)	04:24
	15:16	16:33	15:39 (5)	17:42	16:41 (4)	18:55
17	08:20	07:12	15:14 (5)	05:52	04:21	03:03
	15:18	16:35	15:39 (5)	17:44	18:57	20:08
18	08:18	07:09	15:15 (5)	05:49	04:18	03:01
	15:20	16:38	15:38 (5)	17:46	19:00	20:11
19	08:16	07:06	15:15 (5)	05:46	04:15	02:59
	15:23	16:40	15:37 (5)	17:49	19:02	20:13
20	08:15	07:03	15:17 (5)	05:43	04:13	02:57
	15:25	16:43	15:37 (5)	17:51	19:05	20:15
21	08:13	07:01	15:18 (5)	05:40	04:10	02:55
	15:27	16:45	15:35 (5)	17:53	19:07	20:17
22	08:11	06:58	15:20 (5)	05:37	04:07	02:53
	15:30	16:48	15:33 (5)	17:56	19:09	20:19
23	08:09	06:55	15:23 (5)	05:34	17:18 (3)	04:04
	15:32	16:50	15:30 (5)	17:58	17:22 (3)	19:12
24	08:08	06:52	05:31	04:01	17:13 (3)	04:01
	15:35	16:53	18:01	14	17:27 (3)	19:14
25	08:06	06:50	05:28	03:59	17:10 (3)	03:59
	15:37	16:55	18:03	19	17:29 (3)	19:17
26	08:04	06:47	05:25	03:56	17:08 (3)	03:56
	15:39	16:58	18:05	22	17:30 (3)	19:19
27	08:02	06:44	05:23	03:53	17:07 (3)	03:53
	15:42	17:00	18:08	24	17:31 (3)	19:21
28	08:00	06:41	05:20	03:51	17:05 (3)	03:51
	15:44	17:03	18:10	27	17:32 (3)	19:24
29	07:58		05:17	03:48	17:04 (3)	03:48
	15:47		18:12	28	17:32 (3)	19:26
30	07:55		05:14	03:45	17:03 (3)	03:45
	15:49		18:15	34	17:44 (2)	19:29
31	07:53		05:11	03:43	17:03 (3)	
	15:52		18:17	38	17:46 (2)	
Potential sun hours	216	257	365	434	526	554
Total, worst case		358	405	573		
Sun reduction		0.29	0.28	0.30		
Oper. time red.		0.93	0.93	0.93		
Wind dir. red.		0.50	0.56	0.61		
Total reduction		0.14	0.15	0.17		
Total, real		48	60	99		

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CH - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (290)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	July	August	September	October	November	December	
1	02:27   03:22		04:33	17:09 (3)   05:42	16:10 (4)   06:56	14:45 (5)   08:07	
	20:57   20:07		18:43	18:03 (1)   17:14	16:28 (4)   15:48	15:07 (5)   14:48	
2	02:28   03:24		04:35	17:06 (3)   05:44	16:08 (4)   06:58	14:47 (5)   08:09	
	20:56   20:04		18:40	18:04 (1)   17:12	16:28 (4)   15:45	15:06 (5)   14:47	
3	02:29   03:26		04:38	17:03 (3)   05:46	16:07 (4)   07:01	14:47 (5)   08:10	
	20:56   20:02		18:37	18:04 (1)   17:09	16:28 (4)   15:43	15:04 (5)   14:46	
4	02:30   03:28		04:40	17:01 (3)   05:49	16:08 (4)   07:03	14:49 (5)   08:12	
	20:55   20:00		18:34	18:02 (1)   17:06	16:28 (4)   15:40	15:02 (5)   14:45	
5	02:31   03:31		04:42	16:59 (3)   05:51	16:07 (4)   07:06	14:51 (5)   08:14	
	20:54   19:57		18:32	17:59 (1)   17:03	16:27 (4)   15:38	14:59 (5)   14:44	
6	02:33   03:33		04:45	16:58 (3)   05:53	16:07 (4)   07:08		08:16
	20:53   19:55		18:29	17:56 (1)   17:00	16:26 (4)   15:36		14:43
7	02:34   03:35		04:47	16:58 (3)   05:56	16:08 (4)   07:11		08:18
	20:52   19:52		18:26	17:54 (1)   16:57	16:24 (4)   15:33		14:42
8	02:35   03:38		04:49	16:57 (3)   05:58	16:08 (4)   07:13		08:19
	20:51   19:50		18:23	17:51 (1)   16:54	16:20 (4)   15:31		14:41
9	02:37   03:40		04:51	16:56 (3)   06:00	16:10 (4)   07:16		08:21
	20:50   19:47		18:20	17:47 (2)   16:51	16:18 (4)   15:28		14:40
10	02:38   03:42		04:54	16:55 (3)   06:03	16:12 (4)   07:18		08:22
	20:48   19:44		18:17	17:44 (2)   16:48	16:14 (4)   15:26		14:40
11	02:40   03:45		04:56	16:54 (3)   06:05		07:21	08:24
	20:47   19:42		18:14	17:41 (2)   16:45		15:24	14:39
12	02:42   03:47		04:58	16:54 (3)   06:07		07:23	08:25
	20:46   19:39		18:11	17:38 (2)   16:42		15:22	14:39
13	02:43   03:49		05:01	16:55 (3)   06:10		07:26	08:26
	20:44   19:37		18:08	17:36 (2)   16:40		15:19	14:39
14	02:45   03:52		05:03	16:54 (3)   06:12		07:28	08:28
	20:43   19:34		18:05	17:23 (3)   16:37		15:17	14:38
15	02:47   03:54		05:05	16:55 (3)   06:14		07:31	08:29
	20:41   19:31		18:02	17:21 (3)   16:34		15:15	14:38
16	02:49   03:56		05:07	16:55 (3)   06:17		07:33	08:30
	20:40   19:28		17:59	17:20 (3)   16:31		15:13	14:38
17	02:50   03:59		05:10	16:56 (3)   06:19		07:35	08:31
	20:38   19:26		17:56	17:19 (3)   16:28		15:11	14:38
18	02:52   04:01		05:12	16:57 (3)   06:22		07:38	08:32
	20:36   19:23		17:53	17:17 (3)   16:25		15:09	14:38
19	02:54   04:03		05:14	16:59 (3)   06:24		14:53 (5)   07:40	08:33
	20:34   19:20		17:50	17:14 (3)   16:23	9	15:02 (5)   15:07	14:38
20	02:56   04:05		05:16	17:02 (3)   06:26		14:50 (5)   07:42	08:33
	20:33   19:17		17:47	17:10 (3)   16:20	15	15:05 (5)   15:05	14:39
21	02:58   04:08		05:19		06:29	14:48 (5)   07:45	08:34
	20:31   19:15		17:44		16:17	15:06 (5)   15:03	14:39
22	03:00   04:10		05:21		06:31	14:47 (5)   07:47	08:35
	20:29   19:12		17:41		16:14	15:07 (5)   15:02	14:39
23	03:02   04:12		05:23		06:34	14:45 (5)   07:49	08:35
	20:27   19:09		17:38		16:12	15:07 (5)   15:00	14:40
24	03:04   04:15		05:26		06:36	14:45 (5)   07:52	08:35
	20:25   19:06		17:35		16:09	15:08 (5)   14:58	14:40
25	03:06   04:17		05:28		06:39	14:44 (5)   07:54	08:36
	20:23   19:03		17:32		16:06	15:09 (5)   14:57	14:41
26	03:09   04:19		05:30		06:41	14:43 (5)   07:56	08:36
	20:20   19:01		17:29		16:04	15:08 (5)   14:55	14:42
27	03:11   04:22		05:32		06:44	14:43 (5)   07:58	08:36
	20:18   18:58		17:26		16:01	15:09 (5)   14:53	14:43
28	03:13   04:24		05:35	16:15 (4)   06:46		14:44 (5)   08:00	08:36
	20:16   18:55		17:23	16:25 (4)   15:58	25	15:09 (5)   14:52	14:44
29	03:15   04:26	17:55 (1)   05:37		16:12 (4)   06:48		14:44 (5)   08:03	08:36
	20:14   18:52	4	17:59 (1)   17:20	16:26 (4)   15:56	25	15:09 (5)   14:51	14:45
30	03:17   04:29	17:52 (1)   05:39		16:10 (4)   06:51		14:44 (5)   08:05	08:36
	20:12   18:49	9	18:01 (1)   17:17	16:27 (4)   15:53	24	15:08 (5)   14:49	14:46
31	03:19   04:31	17:37 (2)			06:53	14:45 (5)	08:36
	20:09   18:46	17	18:02 (1)		15:50	15:07 (5)	14:47
Potential sun hours	551	481	387	318		232	194
Total, worst case		30	807	435		79	
Sun reduction		0.24	0.26	0.28		0.28	
Oper. time red.		0.93	0.93	0.93		0.93	
Wind dir. red.		0.64	0.60	0.51		0.50	
Total reduction		0.14	0.15	0.13		0.13	
Total, real		4	118	58		10	

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:

Gismarvik

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15.08.2011 12:14 / 103

Licensed user:

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NO-2007 Kjeller  
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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CI - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (291)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	03:42 19:31	02:36 20:38	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	06:56 15:48	14:55 (5) 15:10 (5)	08:07 14:48
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:33	02:34 20:40	02:28 20:56	03:24 20:04	04:35 18:40	05:44 17:12	06:58 15:45	14:58 (5) 15:07 (5)	08:09 14:47
3	08:35 14:52	07:46 15:59	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	15:07 (5) 15:16 (5)	08:10 14:46
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:28 20:00	04:40 18:34	05:49 17:06	07:03 15:40	15:17 (5) 15:26 (5)	08:12 14:45
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:41	02:30 20:45	02:31 20:54	03:31 19:57	04:42 18:32	05:51 17:03	07:06 15:38	15:27 (5) 15:36 (5)	08:14 14:44
6	08:33 14:56	07:39 16:07	06:24 17:18	04:53 18:31	03:30 19:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36	15:37 (5) 15:46 (5)	08:16 14:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:48	02:34 20:52	03:35 19:52	04:47 18:26	05:56 16:57	07:11 15:33	15:47 (5) 15:56 (5)	08:18 14:42
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	03:25 19:48	02:27 20:49	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 15:31	15:57 (5) 16:06 (5)	08:19 14:41
9	08:30 15:02	07:32 16:15	06:16 17:25	04:44 18:38	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	07:16 15:28	16:17 (5) 16:26 (5)	08:21 14:40
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:52	02:25 20:51	02:38 20:48	03:42 19:44	04:54 18:17	06:03 16:48	07:18 15:26	16:37 (5) 16:46 (5)	08:22 14:40
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:52	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24	16:57 (5) 17:06 (5)	08:24 14:39
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	03:15 19:57	02:24 20:53	02:42 20:46	03:47 19:39	04:58 18:11	06:07 16:42	07:23 15:22	17:17 (5) 17:26 (5)	08:25 14:39
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	03:12 19:59	02:23 20:54	02:43 20:44	03:49 19:37	05:01 18:08	06:10 16:40	07:26 15:19	17:27 (5) 17:36 (5)	08:26 14:39
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:17	17:37 (5) 17:46 (5)	08:28 14:38
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:23 20:56	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	07:31 15:15	17:47 (5) 17:56 (5)	08:29 14:38
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	02:22 20:57	02:49 20:40	03:56 19:28	05:07 17:59	06:17 16:31	07:33 15:13	17:57 (5) 18:06 (5)	08:30 14:38
17	08:20 15:18	07:12 16:35	05:52 17:44	04:21 18:57	03:03 20:08	02:22 20:57	02:50 20:38	03:59 19:26	05:10 17:56	06:19 16:28	07:35 15:11	18:17 (5) 18:26 (5)	08:31 14:38
18	08:18 15:20	07:09 16:38	05:49 17:46	04:18 19:00	03:01 20:11	02:22 20:58	02:52 20:36	04:01 19:23	05:12 17:53	06:22 16:25	07:38 15:12	18:37 (5) 18:46 (5)	08:32 14:38
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	02:59 20:13	02:22 20:58	02:54 20:34	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:14	18:57 (5) 19:06 (5)	08:33 14:38
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	02:57 20:15	02:22 20:59	02:56 20:33	04:05 19:17	05:16 17:47	06:26 16:20	07:42 15:15	19:17 (5) 19:26 (5)	08:33 14:39
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	02:55 20:17	02:22 20:59	02:58 20:31	04:08 19:15	05:19 17:44	06:29 16:17	07:45 15:15	19:37 (5) 19:46 (5)	08:34 14:39
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	02:53 20:19	02:22 20:59	03:00 20:29	04:10 19:12	05:21 17:41	06:31 16:14	07:47 15:16	19:57 (5) 20:06 (5)	08:35 14:39
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	02:51 20:21	02:22 20:59	03:02 20:27	04:12 19:09	05:23 17:38	06:34 16:12	07:49 15:15	20:17 (5) 20:26 (5)	08:35 14:40
24	08:08 15:35	06:52 16:53	05:31 18:01	04:01 19:14	02:49 20:23	02:22 20:59	03:04 20:25	04:15 19:06	05:26 17:35	06:36 16:09	07:52 15:15	20:37 (5) 20:46 (5)	08:35 14:41
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	02:47 20:25	02:23 20:59	03:06 20:23	04:17 19:03	05:28 17:32	06:39 16:06	07:54 15:16	20:57 (5) 21:06 (5)	08:36 14:41
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 19:19	02:45 20:27	02:23 20:59	03:09 20:20	04:19 19:01	05:30 17:29	06:41 16:04	07:56 15:15	21:17 (5) 21:26 (5)	08:36 14:42
27	08:02 15:42	06:44 17:00	05:23 18:08	03:53 19:21	02:44 20:29	02:24 20:59	03:11 20:18	04:22 18:58	05:32 17:26	06:43 16:01	07:58 15:15	21:37 (5) 21:46 (5)	08:36 14:43
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	02:25 20:59	03:13 20:16	04:24 18:55	05:35 17:23	06:46 15:58	08:00 15:14	21:57 (5) 22:06 (5)	08:36 14:44
29	07:58 15:47		05:17 18:12	03:48 19:26	02:40 20:33	02:25 20:58	03:15 20:14	04:26 18:52	05:37 17:20	06:48 15:56	08:03 15:14	22:17 (5) 22:26 (5)	08:36 14:45
30	07:55 15:49		05:14 18:15	03:45 19:29	02:39 20:35	02:26 20:58	03:17 20:12	04:29 18:49	05:39 17:17	06:51 15:53	08:05 15:12	22:37 (5) 22:46 (5)	08:36 14:46
31	07:53 15:52		05:11 18:17	02:37 19:29	02:37 20:35	02:37 20:58	03:19 20:09	04:31 18:46	06:53 15:50	08:05 15:11	08:05 15:11	22:57 (5) 23:06 (5)	08:36 14:47
Potential sun hours	216	257	355	434	526	554	551	481	387	318	232	194	194
Total, worst case			355							342		24	
Sun reduction			0.29							0.28		0.28	
Oper. time red.			0.93							0.93		0.93	
Wind dir. red.			0.50							0.50		0.50	
Total reduction			0.14							0.13		0.13	
Total, real			48							45		3	

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:

Gismarvik

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15.08.2011 12:14 / 104

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Gunnar Randres vei 12  
NO-2007 Kjeller  
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Calculated:

15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

Calculation: Skyggekast Gismarvik Shadow receptor: CJ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (292)

**Assumptions for shadow calculations**

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December		
1	08:36 14:49	13:44 (3) 13:57 (3)	07:51 15:54	06:39 17:05	05:08 18:20	03:42 19:31	02:36 20:38	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	06:56 15:48	08:07 14:48	13:32 (3) 15:47 (3)
2	08:35 14:50	13:44 (3) 13:58 (3)	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:33	02:34 20:40	02:28 20:57	03:24 20:05	04:35 18:40	05:44 17:12	06:58 15:45	08:09 14:47	13:31 (3) 13:47 (3)
3	08:35 14:52	13:44 (3) 14:00 (3)	07:47 15:59	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	08:11 14:46	13:31 (3) 13:47 (3)
4	08:34 14:53	13:45 (3) 14:02 (3)	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:28 20:00	04:40 18:34	05:49 17:06	07:03 15:40	08:12 14:44	13:32 (3) 13:49 (3)
5	08:33 14:55	13:46 (3) 14:03 (3)	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:41	02:30 20:45	02:31 20:54	03:31 19:57	04:42 18:32	05:51 17:03	07:06 15:38	08:14 14:44	13:32 (3) 13:49 (3)
6	08:33 14:56	13:46 (3) 14:04 (3)	07:39 16:07	06:24 17:17	04:53 18:31	03:29 19:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36	08:16 14:43	13:32 (3) 13:50 (3)
7	08:32 14:58	13:47 (3) 14:04 (3)	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:48	02:34 20:52	03:35 19:52	04:47 18:26	05:56 16:57	07:11 15:33	08:18 14:42	13:33 (3) 13:50 (3)
8	08:31 15:00	13:47 (3) 14:04 (3)	07:35 16:12	06:18 17:22	04:47 18:36	03:24 19:48	02:27 20:49	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 15:31	08:19 14:41	13:33 (3) 13:50 (3)
9	08:30 15:02	13:48 (3) 14:04 (3)	07:32 16:15	06:16 17:25	04:44 18:38	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	07:16 15:28	08:21 14:40	13:34 (3) 13:49 (3)
10	08:29 15:04	13:48 (3) 14:04 (3)	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:52	02:25 20:51	02:38 20:49	03:42 19:45	04:54 18:17	06:03 16:48	07:18 15:26	08:22 14:40	13:33 (3) 13:48 (3)
11	08:28 15:06	13:50 (3) 14:05 (3)	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:52	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24	08:24 14:39	13:34 (3) 13:47 (3)
12	08:27 15:08	13:50 (3) 14:04 (3)	07:25 16:22	06:07 17:32	04:35 18:46	03:15 19:57	02:24 20:53	02:41 20:46	03:47 19:39	04:58 18:11	06:07 16:42	07:23 15:22	08:25 14:39	13:35 (3) 13:47 (3)
13	08:25 15:10	13:51 (3) 14:04 (3)	07:22 16:25	06:04 17:34	04:33 18:48	03:12 19:59	02:23 20:54	02:43 20:44	03:49 19:37	05:01 18:08	06:10 16:40	07:26 15:19	08:27 14:38	13:35 (3) 13:46 (3)
14	08:24 15:12	13:53 (3) 14:04 (3)	07:19 16:28	06:01 17:37	04:30 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:17	08:28 14:38	13:36 (3) 13:46 (3)
15	08:23 15:14	13:54 (3) 14:03 (3)	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:22 20:56	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	07:31 15:15	08:29 14:38	13:36 (3) 13:45 (3)
16	08:21 15:16	13:57 (3) 14:01 (3)	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	02:22 20:57	02:48 20:40	03:56 19:29	05:07 17:59	06:17 16:31	07:33 15:13	08:30 14:38	13:36 (3) 13:45 (3)
17	08:20 15:18	14:01 (3)	07:12 16:35	05:52 17:44	04:21 18:58	03:03 20:08	02:22 20:57	02:50 20:38	03:58 19:26	05:10 17:56	06:19 16:18	07:35 15:11	08:31 14:38	13:37 (3) 13:44 (3)
18	08:18 15:20	14:01 (3)	07:09 16:38	05:49 17:46	04:18 19:00	03:01 20:11	02:22 20:58	02:52 20:36	04:01 19:23	05:12 17:53	06:22 16:25	07:38 15:09	08:32 14:38	13:37 (3) 13:44 (3)
19	08:17 15:23	14:01 (3)	07:06 16:40	05:46 17:49	04:15 19:02	02:59 20:13	02:22 20:58	02:54 20:34	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:07	08:33 14:38	13:38 (3) 13:45 (3)
20	08:15 15:25	14:01 (3)	07:03 16:43	05:43 17:51	04:13 19:05	02:57 20:15	02:22 20:59	02:56 20:33	04:05 19:17	05:16 17:47	06:26 16:20	07:43 15:05	08:33 14:38	13:39 (3) 13:45 (3)
21	08:13 15:27	14:01 (3)	07:01 16:45	05:40 17:53	04:10 19:07	02:55 20:17	02:22 20:59	02:58 20:31	04:08 19:15	05:19 17:44	06:29 16:17	07:45 15:03	08:34 14:39	13:39 (3) 13:45 (3)
22	08:11 15:30	14:01 (3)	06:58 16:48	05:37 17:56	04:07 19:09	02:53 20:19	02:22 20:59	03:00 20:29	04:10 19:12	05:21 17:41	06:31 16:14	07:47 15:02	08:35 14:39	13:40 (3) 13:46 (3)
23	08:10 15:32	14:01 (3)	06:55 16:50	05:34 17:58	04:04 19:12	02:51 20:21	02:22 20:59	03:02 20:27	04:12 19:09	05:23 17:38	06:34 16:12	07:49 15:00	08:35 14:40	13:40 (3) 13:46 (3)
24	08:08 15:34	14:01 (3)	06:53 16:53	05:31 18:01	04:01 19:14	02:49 20:23	02:22 20:59	03:04 20:25	04:15 19:06	05:26 17:35	06:36 16:09	07:52 14:58	08:36 14:40	13:40 (3) 13:46 (3)
25	08:06 15:37	14:01 (3)	06:50 16:55	05:28 18:03	03:59 19:17	02:47 20:25	02:23 20:59	03:06 20:23	04:17 19:03	05:28 17:32	06:39 16:06	07:54 14:56	08:36 14:41	13:41 (3) 13:48 (3)
26	08:04 15:39	14:01 (3)	06:47 16:58	05:25 18:05	03:56 19:19	02:45 20:27	02:23 20:59	03:08 20:20	04:19 19:01	05:30 17:29	06:41 16:04	07:56 14:55	08:36 14:42	13:42 (3) 13:49 (3)
27	08:02 15:42	14:01 (3)	06:44 17:00	05:23 18:08	03:53 19:21	02:44 20:29	02:24 20:59	03:11 20:18	04:22 18:58	05:32 17:26	06:44 16:01	07:58 14:53	08:36 14:43	13:41 (3) 13:49 (3)
28	08:00 15:44	14:01 (3)	06:41 17:03	05:20 18:10	03:50 19:24	02:42 20:31	02:25 20:59	03:13 20:16	04:24 18:55	05:35 17:23	06:46 15:58	08:01 14:52	08:36 14:44	13:42 (3) 13:50 (3)
29	07:58 15:47	14:01 (3)	06:38 17:06	05:17 18:12	03:48 19:26	02:40 20:33	02:25 20:58	03:15 20:14	04:26 18:52	05:37 17:20	06:48 15:56	08:03 14:50	08:36 14:45	13:43 (3) 13:52 (3)
30	07:55 15:49	14:01 (3)	06:35 17:09	05:14 18:15	03:45 19:29	02:39 20:35	02:26 20:58	03:17 20:12	04:29 18:49	05:39 17:17	06:51 15:53	08:05 14:49	08:36 14:46	13:43 (3) 13:53 (3)
31	07:53 15:52	14:01 (3)	06:32 17:12	05:11 18:17	03:42 19:29	02:37 20:37	02:27 20:59	03:19 20:09	04:31 18:46	06:53 15:50	08:06 14:49	08:06 14:46	08:36 14:47	13:43 (3) 13:55 (3)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	50	339	
Total, worst case	227											50	339	
Sun reduction	0.27											0.28	0.30	
Oper. time red.	0.93											0.93	0.93	
Wind dir. red.	0.57											0.57	0.57	
Total reduction	0.14											0.15	0.16	
Total, real	32											7	54	

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)

Project:

Gismarvik

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15.08.2011 12:14 / 105

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CK - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (293)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	17:30 (5) 17:49 (5)	03:43 19:31
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	17:29 (5) 17:51 (5)	03:40 19:33
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	17:28 (5) 17:53 (5)	03:37 19:36
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	17:27 (5) 17:55 (5)	03:35 19:38
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	17:26 (5) 17:55 (5)	03:32 19:41
6	08:32 14:57	07:39 16:07	06:24 17:18	04:53 18:31	17:26 (5) 17:56 (5)	03:30 19:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	17:26 (5) 17:56 (5)	03:27 19:45
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	17:25 (5) 17:55 (5)	03:25 19:48
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	17:25 (5) 17:54 (5)	03:22 19:50
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	17:25 (5) 17:53 (5)	03:20 19:52
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	17:25 (5) 17:52 (5)	03:17 19:55
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	17:27 (5) 17:52 (5)	03:15 19:57
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	17:27 (5) 18:16 (4)	03:12 19:59
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	17:28 (5) 18:18 (4)	03:10 20:02
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	17:30 (5) 18:20 (4)	03:08 20:04
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	17:32 (5) 18:22 (4)	03:06 20:06
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	18:10 (4) 18:25 (4)	03:03 20:08
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	18:10 (4) 18:27 (4)	03:01 20:11
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	18:09 (4) 18:29 (4)	02:59 20:13
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	18:10 (4) 18:30 (4)	02:57 20:15
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	18:10 (4) 18:29 (4)	02:55 20:17
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	18:10 (4) 18:27 (4)	02:53 20:19
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	18:12 (4) 18:27 (4)	02:51 20:21
24	08:08 15:35	06:52 16:53	05:31 18:01	04:01 19:14	18:13 (4) 18:25 (4)	02:49 20:23
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	18:15 (4) 18:21 (4)	02:47 20:25
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 19:19	02:45 20:27	20:23 20:29
27	08:02 15:42	06:44 17:00	05:23 18:08	03:53 19:21	02:44 20:29	20:24 20:29
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	20:25 20:31
29	07:57 15:47	06:38 17:05	05:17 18:12	03:48 19:26	02:40 20:33	20:26 20:33
30	07:55 15:49	06:35 17:02	05:14 18:15	03:45 19:29	02:39 20:35	20:24 20:35
31	07:53 15:52	06:32 17:00	05:11 18:17	03:42 19:31	02:37 20:37	20:22 20:37
Potential sun hours	216	257	365	434	526	554
Total, worst case			29	565	433	597
Sun reduction			0.28	0.30	0.35	0.30
Oper. time red.			0.93	0.93	0.93	0.93
Wind dir. red.			0.63	0.64	0.74	0.74
Total reduction			0.16	0.18	0.24	0.21
Total, real			5	101	104	124

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

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

Gismarvik

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15.08.2011 12:14 / 106

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CK - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (293)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	19:29 (3) 03:22	19:19 (2) 04:33	17:24 (5) 05:42	06:56	08:07
	20:57	19:49 (3) 20:07	19:29 (2) 18:43	17:51 (5) 17:14	15:48	14:48
2	02:28	19:29 (3) 03:24	19:19 (2) 04:36	17:24 (5) 05:44	06:58	08:09
	20:56	19:50 (3) 20:04	19:27 (2) 18:40	17:52 (5) 17:12	15:45	14:47
3	02:29	19:29 (3) 03:26	19:19 (2) 04:38	17:23 (5) 05:46	07:01	08:10
	20:56	19:50 (3) 20:02	19:24 (2) 18:37	17:52 (5) 17:09	15:43	14:46
4	02:30	19:29 (3) 03:29	19:20 (2) 04:40	17:22 (5) 05:49	07:03	08:12
	20:55	19:51 (3) 20:00	19:22 (2) 18:34	17:52 (5) 17:06	15:40	14:45
5	02:32	19:29 (3) 03:31	19:22 (2) 04:42	17:22 (5) 05:51	07:06	08:14
	20:54	19:51 (3) 19:57	18:31	17:52 (5) 17:03	15:38	14:44
6	02:33	19:29 (3) 03:33	18:45	17:21 (5) 05:53	07:08	08:16
	20:53	19:51 (3) 19:55	18:29	17:51 (5) 17:00	15:36	14:43
7	02:34	19:30 (3) 03:35	18:47	17:22 (5) 05:56	07:11	08:18
	20:52	19:53 (3) 19:52	18:26	17:51 (5) 16:57	15:33	14:42
8	02:35	19:29 (3) 03:38	18:49	17:22 (5) 05:58	07:13	08:19
	20:51	19:53 (3) 19:50	18:23	17:50 (5) 16:54	15:31	14:41
9	02:37	19:29 (3) 03:40	18:51	17:22 (5) 06:00	07:16	08:21
	20:50	19:53 (3) 19:47	18:20	17:47 (5) 16:51	15:28	14:40
10	02:38	19:29 (3) 03:42	18:54	17:22 (5) 06:03	07:18	08:22
	20:48	19:53 (3) 19:44	18:17	17:44 (5) 16:48	15:26	14:40
11	02:40	19:29 (3) 03:45	18:56	17:23 (5) 06:05	07:21	08:24
	20:47	19:54 (3) 19:42	18:14	17:41 (5) 16:45	15:24	14:39
12	02:42	19:29 (3) 03:47	18:58	17:23 (5) 06:07	07:23	08:25
	20:46	19:54 (3) 19:39	18:11	17:38 (5) 16:42	15:22	14:39
13	02:43	19:30 (3) 03:49	18:51	17:25 (5) 06:10	07:26	08:26
	20:44	19:54 (3) 19:37	18:08	17:36 (5) 16:40	15:20	14:39
14	02:45	19:29 (3) 03:52	18:53	17:27 (5) 06:12	07:28	08:28
	20:43	19:54 (3) 19:34	18:05	17:33 (5) 16:37	15:17	14:38
15	02:47	19:30 (3) 03:54	18:55	17:28 (5) 06:14	07:30	08:29
	20:41	19:55 (3) 19:31	18:02	17:34 (5) 16:34	15:15	14:38
16	02:49	19:29 (3) 03:56	18:57	17:29 (5) 06:17	07:33	08:30
	20:40	19:54 (3) 19:28	17:59	17:31 (5) 16:31	15:13	14:38
17	02:50	19:30 (3) 03:59	18:59	17:30 (5) 06:19	07:35	08:31
	20:38	19:55 (3) 19:26	17:56	17:28 (5) 16:28	15:11	14:38
18	02:52	19:30 (3) 04:01	18:21 (4) 05:12	17:27 (5) 06:22	07:38	08:32
	20:36	19:54 (3) 19:23	18:29 (4) 17:53	17:25 (5) 16:25	15:09	14:38
19	02:54	19:30 (3) 04:03	18:18 (4) 05:14	17:24 (5) 06:24	07:40	08:33
	20:34	19:52 (3) 19:20	18:30 (4) 17:50	17:23 (5) 16:23	15:07	14:38
20	02:56	19:30 (3) 04:06	18:17 (4) 05:16	17:22 (5) 06:26	07:42	08:33
	20:32	19:51 (3) 19:17	18:32 (4) 17:47	17:21 (5) 16:20	15:05	14:39
21	02:58	19:26 (2) 04:08	18:16 (4) 05:19	17:20 (5) 06:29	07:45	08:34
	20:31	19:49 (3) 19:15	18:33 (4) 17:44	17:19 (5) 16:17	15:03	14:39
22	03:00	19:23 (2) 04:10	18:15 (4) 05:21	17:18 (5) 06:31	07:47	08:34
	20:29	19:47 (3) 19:12	18:33 (4) 17:41	17:17 (5) 16:14	15:02	14:39
23	03:02	19:22 (2) 04:12	18:14 (4) 05:23	17:16 (5) 06:34	07:49	08:35
	20:27	19:45 (3) 19:09	18:33 (4) 17:38	17:15 (5) 16:12	15:00	14:40
24	03:04	19:21 (2) 04:15	18:13 (4) 05:26	17:14 (5) 06:36	07:52	08:35
	20:25	19:44 (3) 19:06	18:32 (4) 17:35	17:13 (5) 16:09	14:58	14:41
25	03:06	19:20 (2) 04:17	18:12 (4) 05:28	17:12 (5) 06:39	07:54	08:36
	20:22	19:42 (3) 19:03	18:29 (4) 17:32	17:11 (5) 16:06	14:57	14:41
26	03:09	19:20 (2) 04:19	17:39 (5) 05:30	17:10 (5) 06:41	07:56	08:36
	20:20	19:40 (3) 19:00	18:27 (4) 17:29	17:09 (5) 16:04	14:55	14:42
27	03:11	19:19 (2) 04:22	17:34 (5) 05:32	17:08 (5) 06:43	07:58	08:36
	20:18	19:38 (3) 18:58	18:25 (4) 17:26	17:07 (5) 16:01	14:53	14:43
28	03:13	19:19 (2) 04:24	17:31 (5) 05:35	17:06 (5) 06:46	08:00	08:36
	20:16	19:37 (2) 18:55	18:22 (4) 17:23	17:05 (5) 15:58	14:52	14:44
29	03:15	19:19 (2) 04:26	17:29 (5) 05:37	17:04 (5) 06:48	08:02	08:36
	20:14	19:35 (2) 18:52	18:19 (4) 17:20	17:03 (5) 15:56	14:51	14:45
30	03:17	19:19 (2) 04:29	17:27 (5) 05:39	17:02 (5) 06:51	08:05	08:36
	20:11	19:33 (2) 18:49	18:16 (4) 17:17	17:01 (5) 15:53	14:49	14:46
31	03:19	19:19 (2) 04:31	17:26 (5) 05:41	17:00 (5) 06:53	08:06	08:36
	20:09	19:31 (2) 18:46	17:15 (5) 05:44	16:59 (5) 15:51	14:47	14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	676	296	328			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.74	0.66	0.63			
Total reduction	0.18	0.15	0.15			
Total, real	121	43	50			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CL - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (294)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	14:48 (2)   08:07
	14:49	15:54	17:05	18:20	19:31	20:38	20:57	20:07	18:43	17:14	15:48	15:05 (2)   14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	14:48 (2)   08:09
	14:50	15:57	17:08	18:22	19:33	20:40	20:57	20:05	18:40	17:12	15:45	15:06 (2)   14:47
3	08:35	07:46	15:20 (2)   06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	14:47 (2)   08:11
	14:52	15:59	2 15:21 (2)   17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	15:04 (2)   14:46
4	08:34	07:44	15:19 (2)   06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	14:48 (2)   08:12
	14:53	16:02	5 15:24 (2)   17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	15:02 (2)   14:45
5	08:33	07:42	15:19 (2)   06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	14:48 (2)   08:14
	14:55	16:05	8 15:27 (2)   17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	11 14:59 (2)   14:44
6	08:33	07:39	15:19 (2)   06:24	04:53	03:29	02:29	02:33	03:33	04:45	05:53	07:08	14:49 (2)   08:16
	14:56	16:07	11 15:30 (2)   17:17	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	8 14:57 (2)   14:43
7	08:32	07:37	15:18 (2)   06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	14:50 (2)   08:18
	14:58	16:10	15 15:33 (2)   17:20	18:34	19:45	20:48	20:52	19:52	18:26	16:57	15:33	4 14:54 (2)   14:42
8	08:31	07:35	15:18 (2)   06:18	04:47	03:24	02:27	02:35	03:38	04:49	05:58	07:13	14:51 (2)   08:19
	15:00	16:12	17 15:35 (2)   17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	2 14:52 (2)   14:41
9	08:30	07:32	15:19 (2)   06:16	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	14:50 (2)   08:21
	15:02	16:15	17 15:36 (2)   17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29	07:30	15:19 (2)   06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	14:40
	15:04	16:17	17 15:36 (2)   17:27	18:41	19:52	20:51	20:49	19:44	18:17	16:48	15:26	14:40
11	08:28	07:27	15:19 (2)   06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	14:00 (3)   08:24
	15:06	16:20	16 15:35 (2)   17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	6 14:06 (3)   14:39
12	08:27	07:25	15:20 (2)   06:07	04:36	03:15	02:24	02:41	03:47	04:58	06:07	07:23	13:58 (3)   08:25
	15:08	16:22	14 15:34 (2)   17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	11 14:09 (3)   14:39
13	08:25	14:19 (3)   07:22	15:22 (2)   06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	13:57 (3)   08:26
	15:10	3 14:22 (3)   16:25	11 15:33 (2)   17:34	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:19	14 14:11 (3)   14:38
14	08:24	14:20 (3)   07:19	15:25 (2)   06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	13:55 (3)   08:28
	15:12	5 14:25 (3)   16:28	6 15:31 (2)   17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	16 14:11 (3)   14:38
15	08:23	14:19 (3)   07:17	05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	13:55 (3)   08:29
	15:14	9 14:28 (3)   16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	17 14:12 (3)   14:38
16	08:21	14:19 (3)   07:14	05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	13:54 (3)   08:30
	15:16	11 14:30 (3)   16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	19 14:13 (3)   14:38
17	08:20	14:19 (3)   07:12	05:52	04:21	03:03	02:22	02:50	03:58	05:10	06:19	07:35	13:54 (3)   08:31
	15:18	14 14:33 (3)   16:35	17:44	18:58	20:08	20:57	20:38	19:26	17:56	16:28	15:11	20 14:14 (3)   14:38
18	08:18	14:19 (3)   07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	13:55 (3)   08:32
	15:20	17 14:36 (3)   16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	20 14:15 (3)   14:38
19	08:17	14:19 (3)   07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	13:54 (3)   08:33
	15:23	19 14:38 (3)   16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	20 14:14 (3)   14:38
20	08:15	14:19 (3)   07:03	05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:43	13:54 (3)   08:33
	15:25	21 14:40 (3)   16:43	17:51	19:05	20:15	20:59	20:33	19:17	17:47	16:20	15:05	21 14:15 (3)   14:38
21	08:13	14:19 (3)   07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	13:55 (3)   08:34
	15:27	20 14:39 (3)   16:45	17:53	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	20 14:15 (3)   14:39
22	08:11	14:19 (3)   06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	13:55 (3)   08:35
	15:30	21 14:40 (3)   16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	21 14:16 (3)   14:39
23	08:10	14:20 (3)   06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	13:55 (3)   08:35
	15:32	20 14:40 (3)   16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	19 14:14 (3)   14:40
24	08:08	14:21 (3)   06:53	05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	13:56 (3)   08:36
	15:34	20 14:41 (3)   16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	17 14:13 (3)   14:40
25	08:06	14:20 (3)   06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	13:57 (3)   08:36
	15:37	20 14:40 (3)   16:55	18:03	19:17	20:25	20:59	20:23	19:03	17:32	16:06	14:56	14 14:11 (3)   14:41
26	08:04	14:21 (3)   06:47	05:25	03:56	02:45	02:23	03:08	04:19	05:30	06:41	07:56	13:57 (3)   08:36
	15:39	19 14:40 (3)   16:58	18:05	19:19	20:27	20:59	20:20	19:01	17:29	16:04	14:55	11 14:08 (3)   14:42
27	08:02	14:23 (3)   06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:44	07:58	13:58 (3)   08:36
	15:42	17 14:40 (3)   17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:53	9 14:07 (3)   14:43
28	08:00	14:23 (3)   06:41	05:20	03:50	02:42	02:25	03:13	04:24	05:35	06:46	08:00	13:59 (3)   08:36
	15:44	16 14:39 (3)   17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:23	15:58	8 15:01 (2)   14:52	5 14:04 (3)   14:44
29	07:58	14:25 (3)	05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	14:51 (2)   08:03	14:00 (3)   08:36
	15:47	14 14:39 (3)	18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	12 15:03 (2)   14:51	3 14:03 (3)   14:45
30	07:55	14:26 (3)	05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	14:49 (2)   08:05	08:36
	15:49	11 14:37 (3)	18:15	19:29	20:35	20:58	20:12	18:49	17:17	15:53	14 15:03 (2)   14:49	14:46
31	07:53	14:30 (3)	05:11	03:42	02:37	02:25	03:19	04:31	05:41	06:53	14:49 (2)	08:36
	15:52	5 14:35 (3)	18:17	19:31	20:37	20:57	20:09	18:46	17:15	15:50	15 15:04 (2)	14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194
Total, worst case	282	139									374	
Sun reduction	0.27	0.29								0.28	0.28	
Oper. time red.	0.93	0.93								0.93	0.93	
Wind dir. red.	0.53	0.50								0.50	0.53	
Total reduction	0.13	0.13								0.13	0.14	
Total, real	38	19								6	51	

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)	Minutes with flicker	Last time (hh:mm) with flicker
			(WTG causing flicker last time)

Project:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CM - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (295)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	17:21 (5) 17:49 (5)	03:43 19:31
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	17:20 (5) 17:49 (5)	03:40 19:33
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	17:19 (5) 17:49 (5)	03:37 19:36
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	17:19 (5) 17:48 (5)	03:35 19:38
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	17:18 (5) 17:48 (5)	03:32 19:41
6	08:32 14:57	07:39 16:07	06:24 17:18	04:53 18:31	17:19 (5) 17:48 (5)	03:30 19:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	17:19 (5) 17:47 (5)	03:27 19:45
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	17:19 (5) 17:46 (5)	03:25 19:48
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	17:20 (5) 17:45 (5)	03:22 19:50
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	17:20 (5) 17:43 (5)	03:20 19:52
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	17:21 (5) 18:11 (4)	03:17 19:55
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	17:24 (5) 18:14 (4)	03:15 19:57
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	17:26 (5) 18:16 (4)	03:12 19:59
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	18:06 (4) 18:18 (4)	03:10 20:02
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	18:05 (4) 18:20 (4)	03:08 20:04
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	18:04 (4) 18:22 (4)	03:06 20:06
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	18:05 (4) 18:25 (4)	03:03 20:08
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	18:05 (4) 18:24 (4)	03:01 20:11
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	18:05 (4) 18:23 (4)	02:59 20:13
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	18:06 (4) 18:23 (4)	02:57 20:15
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	18:07 (4) 18:21 (4)	02:55 20:17
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	18:08 (4) 18:19 (4)	02:53 20:19
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	18:12 (4) 18:16 (4)	02:51 20:21
24	08:08 15:35	06:52 16:53	05:31 18:01	04:01 19:14	02:49 20:23	20:59
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	02:47 20:25	20:59
26	08:04 15:39	06:47 16:58	05:25 18:05	17:32 (5) 17:35 (5)	03:56 19:19	20:59
27	08:02 15:42	06:44 17:00	05:23 18:08	17:28 (5) 17:37 (5)	03:53 19:21	20:59
28	08:00 15:44	06:41 17:03	05:20 18:10	17:26 (5) 17:40 (5)	03:51 19:24	20:59
29	07:57 15:47	06:38 17:05	05:17 18:12	17:24 (5) 17:42 (5)	03:48 19:26	20:59
30	07:55 15:49	06:35 17:07	05:14 18:15	17:23 (5) 17:44 (5)	03:45 19:29	20:59
31	07:53 15:52	06:32 17:09	05:11 18:17	17:22 (5) 17:46 (5)	03:42 19:31	20:59
Potential sun hours	216	257	365	434	526	554
Total, worst case			89	491	498	429
Sun reduction			0.28	0.30	0.35	0.30
Oper. time red.			0.93	0.93	0.93	0.93
Wind dir. red.			0.62	0.63	0.74	0.74
Total reduction			0.16	0.18	0.24	0.21
Total, real			14	87	119	89

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

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

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CM - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (295)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	19:25 (3) 03:22	19:14 (2) 04:33	17:20 (5) 05:42	06:56	08:07
	20:57	19:40 (3) 20:07	19:29 (2) 18:43	18:10 (4) 17:14	15:48	14:48
2	02:28	19:25 (3) 03:24	19:14 (2) 04:36	17:19 (5) 05:44	06:58	08:09
	20:56	19:41 (3) 20:04	19:27 (2) 18:40	17:42 (5) 17:12	15:45	14:47
3	02:29	19:25 (3) 03:26	19:14 (2) 04:38	17:18 (5) 05:46	07:01	08:10
	20:56	19:42 (3) 20:02	19:24 (2) 18:37	17:43 (5) 17:09	15:43	14:46
4	02:30	19:25 (3) 03:29	19:14 (2) 04:40	17:16 (5) 05:49	07:03	08:12
	20:55	19:42 (3) 20:00	19:22 (2) 18:34	17:43 (5) 17:06	15:40	14:45
5	02:32	19:25 (3) 03:31	19:14 (2) 04:42	17:15 (5) 05:51	07:06	08:14
	20:54	19:43 (3) 19:57	19:20 (2) 18:31	17:43 (5) 17:03	15:38	14:44
6	02:33	19:24 (3) 03:33	19:15 (2) 04:45	17:14 (5) 05:53	07:08	08:16
	20:53	19:43 (3) 19:55	19:18 (2) 18:29	17:43 (5) 17:00	15:36	14:43
7	02:34	19:25 (3) 03:35	19:14 (2) 04:47	17:14 (5) 05:56	07:11	08:18
	20:52	19:45 (3) 19:52	19:26 (2) 18:26	17:44 (5) 16:57	15:33	14:42
8	02:35	19:25 (3) 03:38	19:14 (2) 04:49	17:14 (5) 05:58	07:13	08:19
	20:51	19:45 (3) 19:50	19:23 (2) 18:23	17:43 (5) 16:54	15:31	14:41
9	02:37	19:24 (3) 03:40	19:14 (2) 04:51	17:13 (5) 06:00	07:16	08:21
	20:50	19:45 (3) 19:47	19:20 (2) 18:20	17:43 (5) 16:51	15:28	14:40
10	02:38	19:24 (3) 03:42	19:14 (2) 04:54	17:13 (5) 06:03	07:18	08:22
	20:48	19:45 (3) 19:44	19:17 (2) 18:17	17:42 (5) 16:48	15:26	14:40
11	02:40	19:24 (3) 03:45	19:14 (2) 04:56	17:13 (5) 06:05	07:21	08:24
	20:47	19:46 (3) 19:42	19:14 (2) 18:14	17:41 (5) 16:45	15:24	14:39
12	02:42	19:23 (3) 03:47	19:14 (2) 04:58	17:13 (5) 06:07	07:23	08:25
	20:46	19:46 (3) 19:39	19:11 (2) 18:11	17:38 (5) 16:42	15:22	14:39
13	02:43	19:24 (3) 03:49	19:14 (2) 05:01	17:14 (5) 06:10	07:26	08:26
	20:44	19:47 (3) 19:37	19:08 (2) 18:08	17:36 (5) 16:40	15:19	14:39
14	02:45	19:23 (3) 03:52	19:14 (2) 05:03	17:14 (5) 06:12	07:28	08:28
	20:43	19:47 (3) 19:34	19:05 (2) 18:05	17:33 (5) 16:37	15:17	14:38
15	02:47	19:24 (3) 03:54	19:14 (2) 05:05	17:15 (5) 06:14	07:30	08:29
	20:41	19:48 (3) 19:31	19:02 (2) 18:02	17:30 (5) 16:34	15:15	14:38
16	02:49	19:23 (3) 03:56	19:14 (2) 05:07	17:16 (5) 06:17	07:33	08:30
	20:40	19:48 (3) 19:28	19:07 (2) 17:59	17:26 (5) 16:31	15:13	14:38
17	02:50	19:23 (3) 03:59	19:14 (2) 05:10	17:19 (5) 06:19	07:35	08:31
	20:38	19:48 (3) 19:26	19:05 (2) 17:56	17:24 (5) 16:28	15:11	14:38
18	02:52	19:24 (3) 04:01	19:14 (2) 05:12	17:16 (5) 06:22	07:38	08:32
	20:36	19:49 (3) 19:23	19:05 (2) 17:53	17:25 (5) 16:25	15:09	14:38
19	02:54	19:23 (3) 04:03	19:14 (2) 05:14	17:16 (5) 06:24	07:40	08:33
	20:34	19:48 (3) 19:20	19:04 (2) 17:50	17:23 (5) 16:23	15:07	14:38
20	02:56	19:23 (3) 04:06	18:17 (4) 05:16	17:16 (5) 06:26	07:42	08:33
	20:32	19:49 (3) 19:17	18:23 (4) 17:47	17:19 (5) 16:20	15:05	14:39
21	02:58	19:24 (3) 04:08	18:13 (4) 05:19	17:16 (5) 06:29	07:45	08:34
	20:31	19:49 (3) 19:15	18:25 (4) 17:44	17:17 (5) 16:17	15:03	14:39
22	03:00	19:23 (3) 04:10	18:11 (4) 05:21	17:16 (5) 06:31	07:47	08:34
	20:29	19:47 (3) 19:12	18:26 (4) 17:41	17:16 (5) 16:14	15:02	14:39
23	03:02	19:24 (3) 04:12	18:10 (4) 05:23	17:16 (5) 06:34	07:49	08:35
	20:27	19:45 (3) 19:09	18:27 (4) 17:38	17:16 (5) 16:12	15:00	14:40
24	03:04	19:20 (2) 04:15	18:09 (4) 05:26	17:16 (5) 06:36	07:52	08:35
	20:25	19:44 (3) 19:06	18:27 (4) 17:35	17:16 (5) 16:09	14:58	14:41
25	03:06	19:18 (2) 04:17	18:08 (4) 05:28	17:16 (5) 06:39	07:54	08:36
	20:22	19:42 (3) 19:03	18:27 (4) 17:32	17:16 (5) 16:06	14:57	14:41
26	03:09	19:17 (2) 04:19	18:07 (4) 05:30	17:16 (5) 06:41	07:56	08:36
	20:20	19:40 (3) 19:00	18:27 (4) 17:29	17:16 (5) 16:04	14:55	14:42
27	03:11	19:16 (2) 04:22	18:07 (4) 05:32	17:16 (5) 06:43	07:58	08:36
	20:18	19:38 (3) 18:58	18:25 (4) 17:26	17:16 (5) 16:01	14:53	14:43
28	03:13	19:15 (2) 04:24	18:07 (4) 05:35	17:16 (5) 06:46	08:00	08:36
	20:16	19:37 (3) 18:55	18:22 (4) 17:23	17:16 (5) 15:58	14:52	14:44
29	03:15	19:15 (2) 04:26	18:07 (4) 05:37	17:16 (5) 06:48	08:02	08:36
	20:14	19:35 (3) 18:52	18:19 (4) 17:20	17:16 (5) 15:56	14:51	14:45
30	03:17	19:14 (2) 04:29	17:26 (5) 05:39	17:16 (5) 06:51	08:05	08:36
	20:11	19:33 (3) 18:49	18:16 (4) 17:17	17:16 (5) 15:53	14:49	14:46
31	03:19	19:14 (2) 04:31	17:23 (5) 05:41	17:16 (5) 06:53	08:06	08:36
	20:09	19:31 (2) 18:46	18:13 (4) 17:14	17:16 (5) 15:51	14:47	14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	667	249	396			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.74	0.67	0.62			
Total reduction	0.18	0.15	0.15			
Total, real	119	37	59			

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:

Gismarvik

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Gunnar Randres vei 12

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CN - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (296)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	17:30 (5) 17:49 (5)	03:43 19:31
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	17:29 (5) 17:51 (5)	03:40 19:33
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	17:28 (5) 17:53 (5)	03:37 19:36
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	17:27 (5) 17:55 (5)	03:35 19:38
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	17:26 (5) 17:55 (5)	03:32 19:41
6	08:32 14:57	07:39 16:07	06:24 17:18	04:53 18:31	17:27 (5) 17:56 (5)	03:30 19:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	17:26 (5) 17:56 (5)	03:27 19:45
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	17:26 (5) 17:55 (5)	03:25 19:48
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	17:26 (5) 17:54 (5)	03:22 19:50
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	17:26 (5) 17:53 (5)	03:20 19:52
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	17:26 (5) 17:52 (5)	03:17 19:55
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	17:27 (5) 17:52 (5)	03:15 19:57
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	17:28 (5) 18:16 (4)	03:12 19:59
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	17:29 (5) 18:18 (4)	03:10 20:02
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	17:30 (5) 18:20 (4)	03:08 20:04
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	17:33 (5) 18:22 (4)	03:06 20:06
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	18:10 (4) 18:25 (4)	03:03 20:08
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	18:10 (4) 18:27 (4)	03:01 20:11
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	18:09 (4) 18:29 (4)	02:59 20:13
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	18:10 (4) 18:29 (4)	02:57 20:15
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	18:10 (4) 18:28 (4)	02:55 20:17
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	18:10 (4) 18:27 (4)	02:53 20:19
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	18:12 (4) 18:26 (4)	02:51 20:21
24	08:08 15:35	06:52 16:53	05:31 18:01	04:01 19:14	18:13 (4) 18:24 (4)	02:49 20:23
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	18:16 (4) 18:20 (4)	02:47 20:25
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 19:19	02:45 20:27	20:27
27	08:02 15:42	06:44 17:00	05:23 18:08	03:53 19:21	02:44 20:29	20:29
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	20:31
29	07:57 15:47	06:38 17:05	05:17 18:12	03:48 19:26	02:40 20:33	20:33
30	07:55 15:49	06:35 17:02	05:14 18:15	03:45 19:29	02:39 20:35	20:35
31	07:53 15:52	06:32 17:00	05:11 18:17	03:42 19:31	02:37 20:37	20:37
Potential sun hours	216	257	365	434	549	554
Total, worst case			29	549	439	560
Sun reduction			0.28	0.30	0.35	0.30
Oper. time red.			0.93	0.93	0.93	0.93
Wind dir. red.			0.63	0.64	0.74	0.74
Total reduction			0.16	0.18	0.24	0.21
Total, real			5	98	106	116

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CN - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (296)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	19:29 (3) 03:22	19:18 (2) 04:33	17:25 (5) 05:42	06:56	08:07
	19:57	19:48 (3) 20:07	19:29 (2) 18:43	17:51 (5) 17:14	15:48	14:48
2	02:28	19:29 (3) 03:24	19:18 (2) 04:36	17:25 (5) 05:44	06:58	08:09
	20:56	19:48 (3) 20:04	19:27 (2) 18:40	17:52 (5) 17:12	15:45	14:47
3	02:29	19:29 (3) 03:26	19:18 (2) 04:38	17:24 (5) 05:46	07:01	08:10
	20:56	19:49 (3) 20:02	19:24 (2) 18:37	17:52 (5) 17:09	15:43	14:46
4	02:30	19:29 (3) 03:29	19:19 (2) 04:40	17:23 (5) 05:49	07:03	08:12
	20:55	19:49 (3) 20:00	19:22 (2) 18:34	17:52 (5) 17:06	15:40	14:45
5	02:32	19:29 (3) 03:31	19:19 (2) 04:42	17:22 (5) 05:51	07:06	08:14
	20:54	19:49 (3) 19:57	19:20 (2) 18:31	17:52 (5) 17:03	15:38	14:44
6	02:33	19:28 (3) 03:33	19:19 (2) 04:45	17:22 (5) 05:53	07:08	08:16
	20:53	19:50 (3) 19:55	19:29 (2) 18:29	17:51 (5) 17:00	15:36	14:43
7	02:34	19:29 (3) 03:35	19:19 (2) 04:47	17:22 (5) 05:56	07:11	08:18
	20:52	19:51 (3) 19:52	19:26 (2) 18:26	17:51 (5) 16:57	15:33	14:42
8	02:35	19:29 (3) 03:38	19:19 (2) 04:49	17:22 (5) 05:58	07:13	08:19
	20:51	19:51 (3) 19:50	19:23 (2) 18:23	17:50 (5) 16:54	15:31	14:41
9	02:37	19:28 (3) 03:40	19:18 (2) 04:51	17:22 (5) 06:00	07:16	08:21
	20:50	19:51 (3) 19:47	19:20 (2) 18:20	17:47 (5) 16:51	15:28	14:40
10	02:38	19:28 (3) 03:42	19:18 (2) 04:54	17:22 (5) 06:03	07:18	08:22
	20:48	19:51 (3) 19:44	19:17 (2) 18:17	17:44 (5) 16:48	15:26	14:40
11	02:40	19:29 (3) 03:45	19:18 (2) 04:56	17:23 (5) 06:05	07:21	08:24
	20:47	19:52 (3) 19:42	19:14 (2) 18:14	17:41 (5) 16:45	15:24	14:39
12	02:42	19:28 (3) 03:47	19:18 (2) 04:58	17:23 (5) 06:07	07:23	08:25
	20:46	19:52 (3) 19:39	19:11 (2) 18:11	17:38 (5) 16:42	15:22	14:39
13	02:43	19:29 (3) 03:49	19:18 (2) 05:01	17:25 (5) 06:10	07:26	08:26
	20:44	19:53 (3) 19:37	19:08 (2) 18:08	17:36 (5) 16:40	15:20	14:39
14	02:45	19:28 (3) 03:52	19:17 (2) 05:03	17:27 (5) 06:12	07:28	08:28
	20:43	19:53 (3) 19:34	19:05 (2) 18:05	17:33 (5) 16:37	15:17	14:38
15	02:47	19:29 (3) 03:54	19:16 (2) 05:05	17:28 (5) 06:14	07:30	08:29
	20:41	19:53 (3) 19:31	19:02 (2) 18:02	17:34 (5) 16:34	15:15	14:38
16	02:49	19:28 (3) 03:56	19:15 (2) 05:07	17:29 (5) 06:17	07:33	08:30
	20:40	19:53 (3) 19:28	19:00 (2) 17:59	17:31 (5) 16:31	15:13	14:38
17	02:50	19:29 (3) 03:59	19:14 (2) 05:10	17:30 (5) 06:19	07:35	08:31
	20:38	19:54 (3) 19:26	19:00 (2) 17:56	17:32 (5) 16:28	15:11	14:38
18	02:52	19:29 (3) 04:01	18:21 (4) 05:12	17:33 (5) 06:22	07:38	08:32
	20:36	19:54 (3) 19:23	18:27 (4) 17:53	17:35 (5) 16:25	15:09	14:38
19	02:54	19:29 (3) 04:03	18:18 (4) 05:14	17:36 (5) 06:24	07:40	08:33
	20:34	19:52 (3) 19:20	18:30 (4) 17:50	17:37 (5) 16:23	15:07	14:38
20	02:56	19:29 (3) 04:06	18:17 (4) 05:16	17:38 (5) 06:26	07:42	08:33
	20:32	19:51 (3) 19:17	18:32 (4) 17:47	17:39 (5) 16:20	15:05	14:39
21	02:58	19:30 (3) 04:08	18:16 (4) 05:19	17:40 (5) 06:29	07:45	08:34
	20:31	19:49 (3) 19:15	18:32 (4) 17:44	17:41 (5) 16:17	15:03	14:39
22	03:00	19:24 (2) 04:10	18:15 (4) 05:21	17:42 (5) 06:31	07:47	08:34
	20:29	19:47 (3) 19:12	18:33 (4) 17:41	17:43 (5) 16:14	15:02	14:39
23	03:02	19:22 (2) 04:12	18:14 (4) 05:23	17:44 (5) 06:34	07:49	08:35
	20:27	19:45 (3) 19:09	18:33 (4) 17:38	17:45 (5) 16:12	15:00	14:40
24	03:04	19:21 (2) 04:15	18:13 (4) 05:26	17:46 (5) 06:36	07:52	08:35
	20:25	19:44 (3) 19:06	18:32 (4) 17:35	17:47 (5) 16:09	14:58	14:41
25	03:06	19:20 (2) 04:17	18:12 (4) 05:28	17:48 (5) 06:39	07:54	08:36
	20:22	19:42 (3) 19:03	18:29 (4) 17:32	17:49 (5) 16:06	14:57	14:41
26	03:09	19:19 (2) 04:19	18:12 (4) 05:30	17:50 (5) 06:41	07:56	08:36
	20:20	19:40 (3) 19:00	18:27 (4) 17:29	17:51 (5) 16:04	14:55	14:42
27	03:11	19:19 (2) 04:22	17:35 (5) 05:32	17:52 (5) 06:43	07:58	08:36
	20:18	19:38 (3) 18:58	18:25 (4) 17:26	17:53 (5) 16:01	14:53	14:43
28	03:13	19:19 (2) 04:24	17:32 (5) 05:35	17:54 (5) 06:46	08:00	08:36
	20:16	19:37 (3) 18:55	18:22 (4) 17:23	17:55 (5) 15:58	14:52	14:44
29	03:15	19:18 (2) 04:26	17:30 (5) 05:37	17:56 (5) 06:48	08:02	08:36
	20:14	19:35 (2) 18:52	18:19 (4) 17:20	17:57 (5) 15:56	14:51	14:45
30	03:17	19:18 (2) 04:29	17:28 (5) 05:39	17:58 (5) 06:51	08:05	08:36
	20:11	19:33 (2) 18:49	18:16 (4) 17:17	17:59 (5) 15:53	14:49	14:46
31	03:19	19:18 (2) 04:31	17:26 (5) 05:41	18:00 (5) 06:53	08:06	08:36
	20:09	19:31 (2) 18:46	17:51 (5) 05:43	18:01 (5) 15:51	14:47	14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	663	290	323			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.74	0.66	0.63			
Total reduction	0.18	0.15	0.15			
Total, real	119	43	49			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CO - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (297)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	17:13 (5) 17:43 (5)	03:43 19:31
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	17:13 (5) 17:42 (5)	03:40 19:33
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	17:13 (5) 17:42 (5)	03:37 19:36
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	17:13 (5) 17:41 (5)	03:35 19:38
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	17:13 (5) 17:40 (5)	03:32 19:41
6	08:33 14:57	07:39 16:07	06:24 17:18	04:53 18:31	17:14 (5) 17:40 (5)	03:30 19:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	17:15 (5) 17:38 (5)	03:27 19:45
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	17:16 (5) 17:37 (5)	03:25 19:48
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	17:17 (5) 18:07 (4)	03:22 19:50
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	17:20 (5) 18:09 (4)	03:20 19:52
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	18:02 (4) 18:11 (4)	03:17 19:55
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	18:02 (4) 18:14 (4)	03:15 19:57
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	18:01 (4) 18:16 (4)	03:12 19:59
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	18:01 (4) 18:18 (4)	03:10 20:02
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	18:00 (4) 18:20 (4)	03:08 20:04
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	18:00 (4) 18:20 (4)	03:06 20:06
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	18:01 (4) 18:20 (4)	03:03 20:08
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	18:02 (4) 18:18 (4)	03:01 20:11
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	18:02 (4) 18:17 (4)	02:59 20:13
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	18:05 (4) 18:16 (4)	02:57 20:15
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	18:07 (4) 18:12 (4)	02:55 20:17
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	02:53 20:19	20:59
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	02:51 20:21	20:59
24	08:08 15:35	06:52 16:53	05:31 18:01	17:24 (5) 17:30 (5)	04:01 19:14	02:49 20:23
25	08:06 15:37	06:50 16:55	05:28 18:03	17:21 (5) 17:33 (5)	03:59 19:17	02:47 20:25
26	08:04 15:39	06:47 16:58	05:25 18:05	17:19 (5) 17:35 (5)	03:56 19:19	02:45 20:27
27	08:02 15:42	06:44 17:00	05:23 18:08	17:18 (5) 17:37 (5)	03:53 19:21	02:44 20:29
28	08:00 15:44	06:41 17:03	05:20 18:10	17:16 (5) 17:40 (5)	03:51 19:24	02:42 20:31
29	07:57 15:47		05:17 18:12	17:15 (5) 17:42 (5)	03:48 19:26	02:40 20:33
30	07:55 15:49		05:14 18:15	17:15 (5) 17:43 (5)	03:45 19:29	02:39 20:35
31	07:53 15:52		05:11 18:17	17:14 (5) 17:43 (5)	03:43 19:31	02:37 20:37
Potential sun hours	216	257	365	434	526	554
Total, worst case			161	407	537	141
Sun reduction			0.28	0.30	0.35	0.30
Oper. time red.			0.93	0.93	0.93	0.93
Wind dir. red.			0.61	0.63	0.73	0.74
Total reduction			0.16	0.18	0.24	0.21
Total, real			25	71	128	29

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CO - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (297)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27 20:57	03:22 20:07	19:10 (2) 04:33	18:01 (4) 05:42	06:56 08:07	08:07
2	02:28 20:56	19:25 (3) 03:24	19:10 (2) 04:36	17:19 (5) 05:44	06:58 08:09	08:09
3	02:29 20:56	19:31 (3) 03:26	19:27 (2) 04:38	18:08 (4) 05:46	17:12 07:01	14:47 08:10
4	02:30 20:55	19:24 (3) 03:29	19:10 (2) 04:40	17:13 (5) 05:49	17:09 07:03	14:46 08:12
5	02:32 20:54	19:33 (3) 03:31	19:22 (2) 04:42	17:34 (5) 05:51	17:06 07:06	14:45 08:14
6	02:33 20:53	19:23 (3) 03:33	19:10 (2) 04:45	17:11 (5) 05:53	17:03 07:08	14:44 08:16
7	02:34 20:52	19:35 (3) 03:35	19:18 (2) 04:47	17:35 (5) 05:56	17:00 07:11	14:43 08:18
8	02:35 20:51	19:22 (3) 03:38	19:10 (2) 04:49	17:09 (5) 05:58	16:57 07:13	14:42 08:19
9	02:37 20:50	19:37 (3) 03:40	19:15 (2) 04:51	17:08 (5) 06:00	16:54 07:16	14:41 08:21
10	02:38 20:48	19:21 (3) 03:42	18:23 (2) 04:54	17:07 (5) 06:03	16:51 07:18	14:40 08:22
11	02:40 20:47	19:20 (3) 03:45	18:29 (2) 04:56	17:06 (5) 06:05	16:51 07:21	14:39 08:24
12	02:42 20:46	19:39 (3) 03:47	18:14 (2) 04:58	17:36 (5) 06:07	16:45 07:23	14:39 08:25
13	02:43 20:44	19:20 (3) 03:49	18:11 (2) 05:01	17:05 (5) 06:10	16:42 07:26	14:39 08:26
14	02:45 20:43	19:41 (3) 03:52	18:08 (2) 05:03	17:35 (5) 06:12	16:40 07:28	14:39 08:28
15	02:47 20:41	19:19 (3) 03:54	18:05 (2) 05:05	17:06 (5) 06:14	16:37 07:30	14:38 08:29
16	02:49 20:40	19:42 (3) 03:56	18:02 (2) 05:07	17:30 (5) 06:17	16:34 07:33	14:38 08:30
17	02:50 20:38	19:18 (3) 03:59	17:59 (2) 05:10	17:06 (5) 06:19	16:31 07:35	14:38 08:31
18	02:52 20:36	19:42 (3) 04:01	17:56 (2) 05:12	17:08 (5) 06:22	16:28 07:38	14:38 08:32
19	02:54 20:34	19:19 (3) 04:03	17:53 (2) 05:14	17:24 (5) 06:25	16:28 07:40	14:38 08:33
20	02:56 20:32	19:18 (3) 04:06	17:50 (2) 05:16	17:10 (5) 06:26	16:23 07:42	14:38 08:33
21	02:58 20:31	19:43 (3) 04:08	17:47 (2) 05:19	17:18 (5) 06:29	16:20 07:45	14:39 08:34
22	03:00 20:29	19:18 (3) 04:10	17:44 (2) 05:21	17:14 (5) 06:31	16:20 07:47	14:39 08:34
23	03:02 20:27	19:43 (3) 04:12	18:11 (4) 05:23	17:06 (5) 06:34	16:14 07:49	14:39 08:35
24	03:04 20:25	19:18 (3) 04:15	18:08 (4) 05:26	18:19 (4) 06:36	16:12 07:52	14:40 08:35
25	03:06 20:22	19:43 (3) 04:17	18:21 (4) 05:28	18:06 (4) 06:39	16:09 07:54	14:41 08:36
26	03:09 20:20	19:19 (3) 04:19	18:04 (4) 05:30	18:21 (4) 06:41	16:06 07:56	14:41 08:36
27	03:11 20:18	19:17 (2) 04:19	18:03 (4) 05:32	18:22 (4) 06:43	16:04 07:58	14:42 08:36
28	03:13 20:16	19:40 (3) 04:22	18:22 (4) 05:34	18:03 (4) 06:43	16:04 07:58	14:42 08:36
29	03:15 20:14	19:38 (3) 04:24	18:23 (4) 05:36	18:23 (4) 06:46	16:01 08:00	14:43 08:36
30	03:17 20:11	19:13 (2) 04:24	18:02 (4) 05:35	18:02 (4) 06:46	15:58 08:00	14:44 08:36
31	03:19 20:09	19:37 (3) 04:26	18:22 (4) 05:37	18:22 (4) 06:48	15:52 08:02	14:44 08:36
Potential sun hours	551	481	387	318	232	194
Total, worst case	597	240	424			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.73	0.68	0.61			
Total reduction	0.18	0.15	0.15			
Total, real	106	37	62			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CP - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (298)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35	07:51	06:38	05:08	17:00 (5)	03:43
	14:49	15:54	17:05	18:19	17:21 (5)	19:31
2	08:35	07:49	06:36	05:05	17:01 (5)	03:40
	14:50	15:57	17:08	18:22	17:19 (5)	19:33
3	08:34	07:46	06:33	05:02	17:03 (5)	03:37
	14:52	16:00	17:10	18:24	17:17 (5)	19:36
4	08:34	07:44	06:30	04:59	17:07 (5)	03:35
	14:53	16:02	17:13	18:27	17:11 (5)	19:38
5	08:33	07:42	06:27	04:56	17:53 (4)	03:32
	14:55	16:05	17:15	18:29	17:57 (4)	19:41
6	08:33	07:39	06:24	04:53	17:53 (4)	03:30
	14:57	16:07	17:18	18:31	18:00 (4)	19:43
7	08:32	07:37	06:21	04:50	17:52 (4)	03:27
	14:58	16:10	17:20	18:34	18:03 (4)	19:45
8	08:31	07:35	06:18	04:47	17:51 (4)	03:25
	15:00	16:12	17:22	18:36	18:05 (4)	19:48
9	08:30	07:32	06:16	04:44	17:50 (4)	03:22
	15:02	16:15	17:25	18:38	18:07 (4)	19:50
10	08:29	07:30	06:13	04:41	17:50 (4)	03:20
	15:04	16:17	17:27	18:41	18:09 (4)	19:52
11	08:28	07:27	06:10	04:38	17:49 (4)	03:17
	15:06	16:20	17:30	18:43	18:09 (4)	19:55
12	08:27	07:25	06:07	04:36	17:50 (4)	03:15
	15:08	16:23	17:32	18:46	18:09 (4)	19:57
13	08:25	07:22	06:04	04:33	17:50 (4)	03:12
	15:10	16:25	17:34	18:48	18:08 (4)	19:59
14	08:24	07:19	06:01	04:30	17:51 (4)	03:10
	15:12	16:28	17:37	18:50	18:07 (4)	20:02
15	08:23	07:17	05:58	04:27	17:52 (4)	03:08
	15:14	16:30	17:39	18:53	18:05 (4)	20:04
16	08:21	07:14	05:55	04:24	17:54 (4)	03:06
	15:16	16:33	17:42	18:55	18:02 (4)	20:06
17	08:20	07:11	05:52	17:10 (5)	04:21	03:03
	15:18	16:35	17:44	17:14 (5)	18:57	20:08
18	08:18	07:09	05:49	17:07 (5)	04:18	03:01
	15:21	16:38	17:46	17:16 (5)	19:00	20:11
19	08:16	07:06	05:46	17:05 (5)	04:15	02:59
	15:23	16:40	17:49	17:19 (5)	19:02	20:13
20	08:15	07:03	05:43	17:03 (5)	04:13	02:57
	15:25	16:43	17:51	17:21 (5)	19:05	20:15
21	08:13	07:01	05:40	17:02 (5)	04:10	02:55
	15:27	16:45	17:53	17:23 (5)	19:07	20:17
22	08:11	06:58	05:37	17:01 (5)	04:07	02:53
	15:30	16:48	17:56	17:26 (5)	19:09	20:19
23	08:09	06:55	05:34	17:00 (5)	04:04	02:51
	15:32	16:50	17:58	17:28 (5)	19:12	20:21
24	08:08	06:52	05:31	16:59 (5)	04:01	02:49
	15:35	16:53	18:01	17:28 (5)	19:14	20:23
25	08:06	06:50	05:28	16:58 (5)	03:59	02:47
	15:37	16:55	18:03	17:28 (5)	19:17	20:25
26	08:04	06:47	05:25	16:58 (5)	03:56	02:45
	15:39	16:58	18:05	17:27 (5)	19:19	20:27
27	08:02	06:44	05:23	16:58 (5)	03:53	02:44
	15:42	17:00	18:08	17:27 (5)	19:21	20:29
28	08:00	06:41	05:20	16:58 (5)	03:51	02:42
	15:44	17:03	18:10	17:26 (5)	19:24	20:31
29	07:57		05:17	16:58 (5)	03:48	02:40
	15:47		18:12	17:25 (5)	19:26	20:33
30	07:55		05:14	16:58 (5)	03:45	18:52 (2)
	15:49		18:15	17:24 (5)	19:29	18:54 (2)
31	07:53		05:11	16:59 (5)		02:37
	15:52		18:17	17:23 (5)		20:37
Potential sun hours	216	257	365	434	526	554
Total, worst case			341	225	578	
Sun reduction			0.28	0.30	0.35	
Oper. time red.			0.93	0.93	0.93	
Wind dir. red.			0.58	0.63	0.72	
Total reduction			0.15	0.18	0.24	
Total, real			51	39	136	

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CP - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (298)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	03:22	19:04 (2) 04:33	17:48 (4) 05:42	06:56	08:07
	20:57	20:07	25 19:29 (3) 18:43	20 18:08 (4) 17:14	15:48	14:48
2	02:28	03:24	19:02 (2) 04:36	17:48 (4) 05:44	06:58	08:09
	20:56	20:04	25 19:27 (3) 18:40	20 18:08 (4) 17:12	15:45	14:47
3	02:29	03:26	19:01 (2) 04:38	17:48 (4) 05:46	07:01	08:10
	20:56	20:02	23 19:24 (3) 18:37	17 18:05 (4) 17:09	15:43	14:46
4	02:30	03:29	19:00 (2) 04:40	17:48 (4) 05:49	07:03	08:12
	20:55	20:00	22 19:22 (3) 18:34	14 18:02 (4) 17:06	15:40	14:45
5	02:31	03:31	19:00 (2) 04:42	17:48 (4) 05:51	07:06	08:14
	20:54	19:57	20 19:20 (3) 18:31	11 17:59 (4) 17:03	15:38	14:44
6	02:33	03:33	18:59 (2) 04:45	8 17:48 (4) 05:53	07:08	08:16
	20:53	19:55	19 19:18 (2) 18:29	8 17:56 (4) 17:00	15:36	14:43
7	02:34	03:35	18:59 (2) 04:47	5 17:49 (4) 05:56	07:11	08:18
	20:52	19:52	16 19:15 (2) 18:26	5 17:54 (4) 16:57	15:33	14:42
8	02:35	03:38	18:59 (2) 04:49	4 17:04 (5) 05:58	07:13	08:19
	20:51	19:50	14 19:13 (2) 18:23	4 17:51 (4) 16:54	15:31	14:41
9	02:37	03:40	18:58 (2) 04:51	13 17:11 (5) 16:51	15:28	14:40
	20:50	19:47	12 19:10 (2) 18:20	13 17:11 (5) 16:51	15:28	14:40
10	02:38	03:42	18:58 (2) 04:54	16:55 (5) 06:03	07:18	08:22
	20:48	19:44	10 19:08 (2) 18:17	17 17:12 (5) 16:48	15:26	14:40
11	02:40	03:45	18:59 (2) 04:56	16:52 (5) 06:05	07:21	08:24
	20:47	19:42	6 19:05 (2) 18:14	21 17:13 (5) 16:45	15:24	14:39
12	02:42	03:47	18:59 (2) 04:58	16:50 (5) 06:07	07:23	08:25
	20:46	19:39	4 19:03 (2) 18:11	24 17:14 (5) 16:42	15:22	14:39
13	02:43	19:16 (3) 03:49	05:01	16:50 (5) 06:10	07:26	08:26
	20:44	2 19:18 (3) 19:37	18:08	25 17:15 (5) 16:40	15:19	14:39
14	02:45	19:12 (3) 03:52	05:03	16:48 (5) 06:12	07:28	08:28
	20:43	9 19:21 (3) 19:34	18:05	28 17:16 (5) 16:37	15:17	14:38
15	02:47	19:11 (3) 03:54	05:05	16:47 (5) 06:14	07:30	08:29
	20:41	12 19:23 (3) 19:31	18:02	28 17:15 (5) 16:34	15:15	14:38
16	02:49	19:10 (3) 03:56	05:07	16:46 (5) 06:17	07:33	08:30
	20:40	14 19:24 (3) 19:28	17:59	29 17:15 (5) 16:31	15:13	14:38
17	02:50	19:09 (3) 03:59	05:10	16:46 (5) 06:19	07:35	08:31
	20:38	16 19:25 (3) 19:26	17:56	30 17:16 (5) 16:28	15:11	14:38
18	02:52	19:09 (3) 04:01	05:12	16:46 (5) 06:22	07:38	08:32
	20:36	17 19:26 (3) 19:23	17:53	29 17:15 (5) 16:25	15:09	14:38
19	02:54	19:07 (3) 04:03	05:14	16:45 (5) 06:24	07:40	08:33
	20:34	19 19:26 (3) 19:20	17:50	29 17:14 (5) 16:23	15:07	14:38
20	02:56	19:07 (3) 04:06	05:16	16:45 (5) 06:26	07:42	08:33
	20:32	20 19:27 (3) 19:17	17:47	28 17:13 (5) 16:20	15:05	14:39
21	02:58	19:07 (3) 04:08	05:19	16:46 (5) 06:29	07:45	08:34
	20:31	21 19:28 (3) 19:15	17:44	26 17:12 (5) 16:17	15:03	14:39
22	03:00	19:05 (3) 04:10	05:21	16:46 (5) 06:31	07:47	08:34
	20:29	23 19:28 (3) 19:12	17:41	23 17:09 (5) 16:14	15:02	14:39
23	03:02	19:05 (3) 04:12	05:23	16:47 (5) 06:34	07:49	08:35
	20:27	24 19:29 (3) 19:09	17:38	19 17:06 (5) 16:12	15:00	14:40
24	03:04	19:05 (3) 04:15	05:26	16:47 (5) 06:36	07:52	08:35
	20:25	24 19:29 (3) 19:06	17:35	15 17:02 (5) 16:09	14:58	14:41
25	03:06	19:05 (3) 04:17	05:28	16:49 (5) 06:39	07:54	08:36
	20:22	25 19:30 (3) 19:03	17:32	11 17:00 (5) 16:06	14:57	14:41
26	03:09	19:05 (3) 04:19	05:30	16:51 (5) 06:41	07:56	08:36
	20:20	25 19:30 (3) 19:01	17:29	6 16:57 (5) 16:04	14:55	14:42
27	03:11	19:05 (3) 04:22	17:57 (4) 05:32	06:43	07:58	08:36
	20:18	26 19:31 (3) 18:58	8 18:05 (4) 17:26	16:01	14:53	14:43
28	03:13	19:05 (3) 04:24	17:54 (4) 05:35	06:46	08:00	08:36
	20:16	26 19:31 (3) 18:55	13 18:07 (4) 17:23	15:58	14:52	14:44
29	03:15	19:05 (3) 04:26	17:52 (4) 05:37	06:48	08:02	08:36
	20:14	26 19:31 (3) 18:52	16 18:08 (4) 17:20	15:56	14:51	14:45
30	03:17	19:05 (3) 04:29	17:50 (4) 05:39	06:51	08:05	08:36
	20:11	26 19:31 (3) 18:49	18 18:08 (4) 17:17	15:53	14:49	14:46
31	03:19	19:05 (3) 04:31	17:49 (4) 05:41	06:53	08:06	08:36
	20:09	26 19:31 (3) 18:46	19 18:08 (4) 17:17	15:50	14:47	14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	381	270	500			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.73	0.70	0.59			
Total reduction	0.18	0.16	0.14			
Total, real	67	42	71			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CQ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (299)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June		
1	08:35	07:51	06:38	05:08	17:45 (4)	03:43		
	14:49	15:54	17:05	18:19	4 17:49 (4)	19:31		
2	08:35	07:49	06:36	05:05	17:43 (4)	03:40		
	14:50	15:57	17:08	18:22	8 17:51 (4)	19:33		
3	08:34	07:46	06:33	05:02	17:42 (4)	03:37		
	14:52	16:00	17:10	18:24	11 17:53 (4)	19:36		
4	08:34	07:44	06:30	04:59	17:41 (4)	03:35		
	14:53	16:02	17:13	18:27	14 17:55 (4)	19:38		
5	08:33	07:42	06:27	04:56	17:40 (4)	03:32		
	14:55	16:05	17:15	18:29	17 17:57 (4)	19:41		
6	08:33	07:39	06:24	04:53	17:41 (4)	03:30		
	14:57	16:07	17:18	18:31	19 18:00 (4)	19:43		
7	08:32	07:37	06:21	04:50	17:40 (4)	03:27		
	14:58	16:10	17:20	18:34	21 18:01 (4)	19:45		
8	08:31	07:35	06:18	04:47	17:40 (4)	03:25		
	15:00	16:12	17:22	18:36	20 18:00 (4)	19:48		
9	08:30	07:32	06:16	04:44	17:41 (4)	03:22		
	15:02	16:15	17:25	18:38	18 17:59 (4)	19:50		
10	08:29	07:30	06:13	04:41	17:41 (4)	03:20		
	15:04	16:17	17:27	18:41	16 17:57 (4)	19:52		
11	08:28	07:27	06:10	04:38	17:43 (4)	03:17		
	15:06	16:20	17:30	18:43	12 17:55 (4)	19:55		
12	08:27	07:25	06:07	16:56 (5)	04:36	17:46 (4)	03:15	
	15:08	16:23	17:32	6 17:02 (5)	18:46	7 17:53 (4)	19:57	
13	08:25	07:22	06:04	16:53 (5)	04:33	03:12	18:41 (3)	02:24
	15:10	16:25	17:34	11 17:04 (5)	18:48	19:59	26 19:07 (3)	20:54
14	08:24	07:19	06:01	16:51 (5)	04:30	03:10	18:42 (3)	02:23
	15:12	16:28	17:37	16 17:07 (5)	18:50	20:02	24 19:06 (3)	20:55
15	08:23	07:17	05:58	16:50 (5)	04:27	03:08	18:42 (3)	02:23
	15:14	16:30	17:39	19 17:09 (5)	18:53	20:04	24 19:06 (3)	20:56
16	08:21	07:14	05:55	16:48 (5)	04:24	03:06	18:43 (3)	02:22
	15:16	16:33	17:42	24 17:12 (5)	18:55	20:06	22 19:05 (3)	20:57
17	08:20	07:12	05:52	16:47 (5)	04:21	03:03	18:43 (3)	02:22
	15:18	16:35	17:44	27 17:14 (5)	18:57	20:08	22 19:05 (3)	20:57
18	08:18	07:09	05:49	16:46 (5)	04:18	03:01	18:45 (3)	02:22
	15:21	16:38	17:46	29 17:15 (5)	19:00	20:11	20 19:05 (3)	20:58
19	08:16	07:06	05:46	16:46 (5)	04:15	02:59	18:46 (3)	02:22
	15:23	16:40	17:49	29 17:15 (5)	19:02	20:13	18 19:04 (3)	20:58
20	08:15	07:03	05:43	16:45 (5)	04:13	02:57	18:47 (3)	02:22
	15:25	16:43	17:51	29 17:14 (5)	19:05	20:15	16 19:03 (3)	20:59
21	08:13	07:01	05:40	16:45 (5)	04:10	02:55	18:48 (3)	02:22
	15:27	16:45	17:53	29 17:14 (5)	19:07	20:17	13 19:01 (3)	20:59
22	08:11	06:58	05:37	16:45 (5)	04:07	02:53	18:51 (3)	02:22
	15:30	16:48	17:56	28 17:13 (5)	19:09	20:19	9 19:00 (3)	20:59
23	08:09	06:55	05:34	16:45 (5)	04:04	02:51	18:54 (3)	02:22
	15:32	16:50	17:58	28 17:13 (5)	19:12	20:21	2 18:56 (3)	20:59
24	08:08	06:52	05:31	16:45 (5)	04:01	02:49	02:22	02:22
	15:35	16:53	18:01	27 17:12 (5)	19:14	20:23	20:59	20:59
25	08:06	06:50	05:28	16:46 (5)	03:59	02:47	02:23	02:23
	15:37	16:55	18:03	25 17:11 (5)	19:17	20:25	20:59	20:59
26	08:04	06:47	05:25	16:47 (5)	03:56	18:44 (2)	02:45	02:23
	15:39	16:58	18:05	22 17:09 (5)	19:19	2 18:45 (2)	20:27	20:59
27	08:02	06:44	05:23	16:48 (5)	03:53	18:42 (2)	02:44	02:24
	15:42	17:00	18:08	19 17:07 (5)	19:21	5 18:47 (2)	20:29	20:59
28	08:00	06:41	05:20	16:50 (5)	03:51	18:42 (2)	02:42	02:25
	15:44	17:03	18:10	15 17:05 (5)	19:24	7 18:49 (2)	20:31	20:59
29	07:57	06:38	05:17	16:53 (5)	03:48	18:41 (2)	02:40	02:25
	15:47	17:05	18:12	8 17:01 (5)	19:26	10 18:51 (2)	20:33	20:58
30	07:55	06:35	05:14	03:45	19:29	13 18:54 (2)	20:35	02:26
	15:49	17:07	18:15	19:29	13 18:54 (2)	20:35	20:58	20:58
31	07:53	06:33	05:11	03:43	19:27	13 18:52 (2)	20:33	02:26
	15:52	17:09	18:17	19:27	13 18:52 (2)	20:33	20:58	20:58
Potential sun hours	216	257	365	434	526	554		
Total, worst case			391	204	478			
Sun reduction			0.28	0.30	0.35			
Oper. time red.			0.93	0.93	0.93			
Wind dir. red.			0.55	0.65	0.71			
Total reduction			0.14	0.18	0.23			
Total, real			56	37	111			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CQ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (299)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	03:22	18:52 (3) 04:33	17:41 (4) 05:42	16:34 (5) 06:56	08:07
	20:57	20:07	19:18 (3) 18:43	17:54 (4) 17:14	16:42 (5) 15:48	14:48
2	02:28	03:24	18:52 (3) 04:35	17:40 (4) 05:44	16:36 (5) 06:58	08:09
	20:56	20:04	19:18 (3) 18:40	17:56 (4) 17:12	16:39 (5) 15:45	14:47
3	02:29	03:26	18:52 (3) 04:38	17:39 (4) 05:46	17:01	08:10
	20:56	20:02	19:18 (3) 18:37	17:57 (4) 17:09	15:43	14:46
4	02:30	03:29	18:52 (3) 04:40	17:38 (4) 05:49	17:03	08:12
	20:55	20:00	19:18 (3) 18:34	17:57 (4) 17:06	15:40	14:45
5	02:31	03:31	18:52 (3) 04:42	17:37 (4) 05:51	17:06	08:14
	20:54	19:57	19:18 (3) 18:32	17:57 (4) 17:03	15:38	14:44
6	02:33	03:33	18:52 (2) 04:45	17:36 (4) 05:53	17:08	08:16
	20:53	19:55	19:18 (3) 18:29	17:56 (4) 17:00	15:36	14:43
7	02:34	03:35	18:51 (2) 04:47	17:36 (4) 05:56	17:11	08:18
	20:52	19:52	19:15 (3) 18:26	17:54 (4) 16:57	15:33	14:42
8	02:35	03:38	18:50 (2) 04:49	17:36 (4) 05:58	17:13	08:19
	20:51	19:50	19:13 (3) 18:23	17:51 (4) 16:54	15:31	14:41
9	02:37	03:40	18:50 (2) 04:51	17:36 (4) 06:00	17:16	08:21
	20:50	19:47	19:10 (3) 18:20	17:47 (4) 16:51	15:28	14:40
10	02:38	03:42	18:49 (2) 04:54	17:36 (4) 06:03	17:18	08:22
	20:48	19:44	19:08 (2) 18:17	17:44 (4) 16:48	15:26	14:40
11	02:40	03:45	18:49 (2) 04:56	17:37 (4) 06:05	17:21	08:24
	20:47	19:42	19:05 (2) 18:14	17:41 (4) 16:45	15:24	14:39
12	02:42	03:47	18:48 (2) 04:58	17:36 (4) 06:07	17:23	08:25
	20:46	19:39	19:03 (2) 18:11	17:42	15:22	14:39
13	02:43	03:49	18:49 (2) 05:01	17:36 (4) 06:10	17:26	08:26
	20:44	19:37	19:01 (2) 18:08	16:40	15:19	14:39
14	02:45	03:52	18:49 (2) 05:03	16:44 (5) 06:12	17:28	08:28
	20:43	19:34	18:59 (2) 18:05	16:51 (5) 16:37	15:17	14:38
15	02:47	03:54	18:49 (2) 05:05	16:40 (5) 06:14	17:30	08:29
	20:41	19:31	18:56 (2) 18:02	16:54 (5) 16:34	15:15	14:38
16	02:49	03:56	18:50 (2) 05:07	16:37 (5) 06:17	17:33	08:30
	20:40	19:28	18:53 (2) 17:59	16:56 (5) 16:31	15:13	14:38
17	02:50	03:59	18:50 (2) 05:10	16:36 (5) 06:19	17:35	08:31
	20:38	19:26	17:56	16:57 (5) 16:28	15:11	14:38
18	02:52	04:01	18:50 (2) 05:12	16:34 (5) 06:22	17:38	08:32
	20:36	19:23	17:53	16:58 (5) 16:25	15:09	14:38
19	02:54	04:03	18:50 (2) 05:14	16:32 (5) 06:24	17:40	08:33
	20:34	19:20	17:50	16:58 (5) 16:23	15:07	14:38
20	02:56	04:06	18:50 (2) 05:16	16:31 (5) 06:26	17:42	08:33
	20:32	19:17	17:47	16:58 (5) 16:20	15:05	14:39
21	02:58	19:02 (3) 04:08	18:50 (2) 05:19	16:31 (5) 06:29	17:45	08:34
	20:31	19:08 (3) 19:15	17:44	16:59 (5) 16:17	15:03	14:39
22	03:00	18:59 (3) 04:10	18:50 (2) 05:21	16:30 (5) 06:31	17:47	08:35
	20:29	19:10 (3) 19:12	17:41	16:59 (5) 16:14	15:02	14:39
23	03:02	18:58 (3) 04:12	18:50 (2) 05:23	16:29 (5) 06:34	17:49	08:35
	20:27	19:12 (3) 19:09	17:38	16:58 (5) 16:12	15:00	14:40
24	03:04	18:56 (3) 04:15	18:50 (2) 05:26	16:29 (5) 06:36	17:52	08:35
	20:25	19:13 (3) 19:06	17:35	16:57 (5) 16:09	14:58	14:41
25	03:06	18:56 (3) 04:17	18:50 (2) 05:28	16:29 (5) 06:39	17:54	08:36
	20:22	19:14 (3) 19:03	17:32	16:58 (5) 16:06	14:57	14:41
26	03:09	18:55 (3) 04:19	18:50 (2) 05:30	16:29 (5) 06:41	17:56	08:36
	20:20	19:15 (3) 19:01	17:29	16:57 (5) 16:04	14:55	14:42
27	03:11	18:54 (3) 04:22	18:50 (2) 05:32	16:29 (5) 06:43	17:58	08:36
	20:18	19:16 (3) 18:58	17:26	16:53 (5) 16:01	14:53	14:43
28	03:13	18:54 (3) 04:24	18:50 (2) 05:35	16:30 (5) 06:46	18:00	08:36
	20:16	19:17 (3) 18:55	17:23	16:51 (5) 15:58	14:52	14:44
29	03:15	18:53 (3) 04:26	18:50 (2) 05:37	16:31 (5) 06:48	18:02	08:36
	20:14	19:17 (3) 18:52	17:20	16:48 (5) 15:56	14:51	14:45
30	03:17	18:53 (3) 04:29	18:50 (2) 05:39	16:31 (5) 06:51	18:05	08:36
	20:11	19:18 (3) 18:49	17:17	16:44 (5) 15:53	14:49	14:46
31	03:19	18:52 (3) 04:31	17:44 (4) 17:52 (4)	16:31 (5) 06:53	18:08	08:36
	20:09	19:18 (3) 18:46	8	17:52 (4) 15:50	14:47	14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	206	313	546	11		
Sun reduction	0.26	0.24	0.26	0.28		
Oper. time red.	0.93	0.93	0.93	0.93		
Wind dir. red.	0.71	0.71	0.57	0.55		
Total reduction	0.17	0.16	0.14	0.14		
Total, real	36	50	76	2		

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CR - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (300)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June		
1	08:35	07:51	06:38	05:08	17:04 (5)	03:43	02:36	19:11 (3)
	14:49	15:54	17:05	18:19	26 17:30 (5)	19:31	20:38	6 19:17 (3)
2	08:35	07:49	06:36	05:05	17:05 (5)	03:40	18:55 (2)	02:34
	14:50	15:57	17:08	18:22	24 17:29 (5)	19:33	3 18:58 (2)	20:40
3	08:34	07:46	06:33	05:02	17:06 (5)	03:37	18:54 (2)	02:33
	14:52	16:00	17:10	18:24	21 17:27 (5)	19:36	6 19:00 (2)	20:42
4	08:34	07:44	06:30	04:59	17:07 (5)	03:35	18:53 (2)	02:32
	14:53	16:02	17:13	18:27	19 17:26 (5)	19:38	9 19:02 (2)	20:43
5	08:33	07:42	06:27	04:56	17:09 (5)	03:32	18:53 (2)	02:30
	14:55	16:05	17:15	18:29	14 17:23 (5)	19:41	11 19:04 (2)	20:45
6	08:33	07:39	06:24	04:53	17:14 (5)	03:30	18:53 (2)	02:29
	14:57	16:07	17:18	18:31	7 18:00 (4)	19:43	14 19:07 (2)	20:46
7	08:32	07:37	06:21	04:50	17:57 (4)	03:27	18:53 (2)	02:28
	14:58	16:10	17:20	18:34	6 18:03 (4)	19:45	15 19:08 (2)	20:47
8	08:31	07:35	06:18	04:47	17:56 (4)	03:25	18:53 (2)	02:27
	15:00	16:12	17:22	18:36	9 18:05 (4)	19:48	17 19:10 (2)	20:49
9	08:30	07:32	06:15	04:44	17:55 (4)	03:22	18:53 (2)	02:26
	15:02	16:15	17:25	18:38	12 18:07 (4)	19:50	20 19:13 (3)	20:50
10	08:29	07:30	06:13	04:41	17:54 (4)	03:20	18:54 (2)	02:26
	15:04	16:17	17:27	18:41	15 18:09 (4)	19:52	21 19:15 (3)	20:51
11	08:28	07:27	06:10	04:38	17:54 (4)	03:17	18:55 (2)	02:25
	15:06	16:20	17:30	18:43	17 18:11 (4)	19:55	22 19:17 (3)	20:52
12	08:27	07:25	06:07	04:36	17:54 (4)	03:15	18:55 (2)	02:24
	15:08	16:23	17:32	18:46	20 18:14 (4)	19:57	23 19:18 (3)	20:53
13	08:25	07:22	06:04	04:33	17:54 (4)	03:12	18:57 (2)	02:24
	15:10	16:25	17:34	18:48	20 18:14 (4)	19:59	23 19:20 (3)	20:54
14	08:24	07:19	06:01	04:30	17:54 (4)	03:10	18:59 (2)	02:23
	15:12	16:28	17:37	18:50	19 18:13 (4)	20:02	23 19:22 (3)	20:55
15	08:23	07:17	05:58	04:27	17:55 (4)	03:08	18:59 (3)	02:23
	15:14	16:30	17:39	18:53	16 18:11 (4)	20:04	25 19:24 (3)	20:56
16	08:21	07:14	05:55	04:24	17:56 (4)	03:06	18:58 (3)	02:22
	15:16	16:33	17:42	18:55	13 18:09 (4)	20:06	26 19:24 (3)	20:57
17	08:20	07:11	05:52	04:21	17:58 (4)	03:03	18:58 (3)	02:22
	15:18	16:35	17:44	18:57	10 18:08 (4)	20:08	26 19:24 (3)	20:57
18	08:18	07:09	05:49	04:18	03:01	18:59 (3)	02:22	18:59 (3)
	15:21	16:38	17:46	19:00	26 19:25 (3)	20:58	19:25 (3)	20:58
19	08:16	07:06	05:46	17:17 (5)	04:15	02:59	18:59 (3)	02:22
	15:23	16:40	17:49	2 17:19 (5)	19:02	20:13	26 19:25 (3)	20:58
20	08:15	07:03	05:43	17:14 (5)	04:13	02:57	18:59 (3)	02:22
	15:25	16:43	17:51	7 17:21 (5)	19:05	20:15	25 19:24 (3)	20:59
21	08:13	07:01	05:40	17:11 (5)	04:10	02:55	19:00 (3)	02:22
	15:27	16:45	17:53	12 17:23 (5)	19:07	20:17	24 19:24 (3)	20:59
22	08:11	06:58	05:37	17:10 (5)	04:07	02:53	19:01 (3)	02:22
	15:30	16:48	17:56	16 17:26 (5)	19:09	20:19	23 19:24 (3)	20:59
23	08:09	06:55	05:34	17:08 (5)	04:04	02:51	19:01 (3)	02:22
	15:32	16:50	17:58	20 17:28 (5)	19:12	20:21	22 19:23 (3)	20:59
24	08:08	06:52	05:31	17:07 (5)	04:01	02:49	19:01 (3)	02:23
	15:35	16:53	18:01	23 17:30 (5)	19:14	20:23	22 19:23 (3)	20:59
25	08:06	06:50	05:28	17:06 (5)	03:59	02:47	19:02 (3)	02:23
	15:37	16:55	18:03	27 17:33 (5)	19:17	20:25	21 19:23 (3)	20:59
26	08:04	06:47	05:25	17:05 (5)	03:56	02:45	19:02 (3)	02:23
	15:39	16:58	18:05	29 17:34 (5)	19:19	20:27	20 19:22 (3)	20:59
27	08:02	06:44	05:23	17:05 (5)	03:53	02:44	19:04 (3)	02:24
	15:42	17:00	18:08	29 17:34 (5)	19:21	20:29	18 19:22 (3)	20:59
28	08:00	06:41	05:20	17:04 (5)	03:51	02:42	19:05 (3)	02:25
	15:44	17:03	18:10	29 17:33 (5)	19:24	20:31	16 19:21 (3)	20:58
29	07:57	05:17	17:04 (5)	03:48	02:40	19:05 (3)	02:25	19:05 (3)
	15:47	18:12	29 17:33 (5)	19:26	20:33	15 19:20 (3)	20:58	19:07 (3)
30	07:55	05:14	17:04 (5)	03:45	02:39	19:07 (3)	02:26	19:19 (3)
	15:49	18:15	28 17:32 (5)	19:29	20:35	12 19:19 (3)	20:58	19:09 (3)
31	07:53	05:11	17:04 (5)	03:43	02:37	19:09 (3)	02:26	19:18 (3)
	15:52	18:17	27 17:31 (5)	19:31	20:37	9 19:18 (3)	20:58	19:18 (3)
Potential sun hours	216	257	365	434	526	554	6	
Total, worst case			278	268	563		0.30	
Sun reduction			0.28	0.30	0.35		0.30	
Oper. time red.			0.93	0.93	0.93		0.93	
Wind dir. red.			0.59	0.62	0.73		0.73	
Total reduction			0.15	0.17	0.24		0.20	
Total, real			43	47	133		1	

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:

Gismarvik

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Kjeller Vindteknikk AS

Gunnar Randres vei 12

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(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CR - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (300)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	03:22	19:06 (2) 04:33	17:53 (4) 05:42	06:56	08:07
	20:57	20:07	19:29 (3) 18:43	18:10 (4) 17:14	15:48	14:48
2	02:28	03:24	19:05 (2) 04:36	17:53 (4) 05:44	06:58	08:09
	20:56	20:04	19:27 (3) 18:40	18:08 (4) 17:12	15:45	14:47
3	02:29	03:26	19:04 (2) 04:38	17:53 (4) 05:46	07:01	08:10
	20:56	20:02	19:24 (3) 18:37	18:05 (4) 17:09	15:43	14:46
4	02:30	03:29	19:04 (2) 04:40	17:53 (4) 05:49	07:03	08:12
	20:55	20:00	19:22 (3) 18:34	18:02 (4) 17:06	15:40	14:45
5	02:31	03:31	19:03 (2) 04:42	17:53 (4) 05:51	07:06	08:14
	20:54	19:57	19:20 (2) 18:31	17:59 (4) 17:03	15:38	14:44
6	02:33	03:33	19:03 (2) 04:45	17:09 (5) 05:53	07:08	08:16
	20:53	19:55	19:18 (2) 18:29	17:56 (4) 17:00	15:36	14:43
7	02:34	03:35	19:02 (2) 04:47	17:05 (5) 05:56	07:11	08:18
	20:52	19:52	19:15 (2) 18:26	17:19 (5) 16:57	15:33	14:42
8	02:35	03:38	19:02 (2) 04:49	17:02 (5) 05:58	07:13	08:19
	20:51	19:50	19:13 (2) 18:23	17:21 (5) 16:54	15:31	14:41
9	02:37	03:40	19:02 (2) 04:51	17:00 (5) 06:00	07:16	08:21
	20:50	19:47	19:10 (2) 18:20	17:22 (5) 16:51	15:28	14:40
10	02:38	03:42	19:03 (2) 04:54	16:58 (5) 06:03	07:18	08:22
	20:48	19:44	19:08 (2) 18:17	17:22 (5) 16:48	15:26	14:40
11	02:40	19:20 (3) 03:45	19:03 (2) 04:56	16:57 (5) 06:05	07:21	08:24
	20:47	19:23 (3) 19:42	19:05 (2) 18:14	17:23 (5) 16:45	15:24	14:39
12	02:42	19:17 (3) 03:47	04:58	16:56 (5) 06:07	07:23	08:25
	20:46	19:25 (3) 19:39	18:11	17:23 (5) 16:42	15:22	14:39
13	02:43	19:16 (3) 03:49	05:01	16:55 (5) 06:10	07:26	08:26
	20:44	19:27 (3) 19:37	18:08	17:24 (5) 16:40	15:19	14:39
14	02:45	19:15 (3) 03:52	05:03	16:55 (5) 06:12	07:28	08:28
	20:43	19:28 (3) 19:34	18:05	17:23 (5) 16:37	15:17	14:38
15	02:47	19:14 (3) 03:54	05:05	16:54 (5) 06:14	07:30	08:29
	20:41	19:30 (3) 19:31	18:02	17:23 (5) 16:34	15:15	14:38
16	02:49	19:13 (3) 03:56	05:07	16:53 (5) 06:17	07:33	08:30
	20:40	19:30 (3) 19:28	17:59	17:22 (5) 16:31	15:13	14:38
17	02:50	19:13 (3) 03:59	05:10	16:54 (5) 06:19	07:35	08:31
	20:38	19:31 (3) 19:26	17:56	17:23 (5) 16:28	15:11	14:38
18	02:52	19:12 (3) 04:01	05:12	16:54 (5) 06:22	07:38	08:32
	20:36	19:32 (3) 19:23	17:53	17:21 (5) 16:25	15:09	14:38
19	02:54	19:11 (3) 04:03	05:14	16:53 (5) 06:24	07:40	08:33
	20:34	19:32 (3) 19:20	17:50	17:18 (5) 16:23	15:07	14:38
20	02:56	19:11 (3) 04:06	05:16	16:54 (5) 06:26	07:42	08:33
	20:32	19:33 (3) 19:17	17:47	17:14 (5) 16:20	15:05	14:39
21	02:58	19:11 (3) 04:08	05:19	16:55 (5) 06:29	07:45	08:34
	20:31	19:34 (3) 19:15	17:44	17:12 (5) 16:17	15:03	14:39
22	03:00	19:10 (3) 04:10	05:21	16:56 (5) 06:31	07:47	08:34
	20:29	19:33 (3) 19:12	17:41	17:09 (5) 16:14	15:02	14:39
23	03:02	19:10 (3) 04:12	05:23	16:57 (5) 06:34	07:49	08:35
	20:27	19:34 (3) 19:09	17:38	17:06 (5) 16:12	15:00	14:40
24	03:04	19:10 (3) 04:15	05:26	16:59 (5) 06:36	07:52	08:35
	20:25	19:34 (3) 19:06	17:35	17:02 (5) 16:09	14:58	14:41
25	03:06	19:10 (3) 04:17	18:05 (4) 05:28	06:39	07:54	08:36
	20:22	19:35 (3) 19:03	18:06 (4) 17:32	16:06	14:57	14:41
26	03:09	19:10 (3) 04:19	18:00 (4) 05:30	06:41	07:56	08:36
	20:20	19:35 (3) 19:01	18:10 (4) 17:29	16:04	14:55	14:42
27	03:11	19:10 (3) 04:22	17:58 (4) 05:32	06:43	07:58	08:36
	20:18	19:35 (3) 18:58	18:12 (4) 17:26	16:01	14:53	14:43
28	03:13	19:10 (3) 04:24	17:57 (4) 05:35	06:46	08:00	08:36
	20:16	19:35 (3) 18:55	18:13 (4) 17:23	15:58	14:52	14:44
29	03:15	19:10 (3) 04:26	17:55 (4) 05:37	06:48	08:02	08:36
	20:14	19:35 (3) 18:52	18:14 (4) 17:20	15:56	14:51	14:45
30	03:17	19:09 (2) 04:29	17:54 (4) 05:39	06:51	08:05	08:36
	20:11	19:33 (3) 18:49	18:14 (4) 17:17	15:53	14:49	14:46
31	03:19	19:07 (2) 04:31	17:53 (4)	06:53	08:36	08:36
	20:09	19:31 (3) 18:46	18:13 (4)	15:50	14:47	14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	416	255	456			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.73	0.69	0.60			
Total reduction	0.18	0.15	0.14			
Total, real	73	39	66			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CS - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (301)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December		
1	08:36 14:49	13:50 (3) 13:57 (3)	07:51 15:54	06:39 17:05	05:08 18:20	03:42 19:31	02:36 20:38	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	06:56 15:48	08:07 14:48	13:36 (3) 18 13:54 (3)
2	08:35 14:50	13:50 (3) 13:58 (3)	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:33	02:34 20:40	02:28 20:57	03:24 20:05	04:35 18:40	05:44 17:12	06:58 15:45	08:09 14:47	13:36 (3) 18 13:54 (3)
3	08:35 14:52	13:50 (3) 14:00 (3)	07:47 15:59	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	08:11 14:46	13:36 (3) 18 13:54 (3)
4	08:34 14:53	13:51 (3) 14:02 (3)	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:28 20:00	04:40 18:34	05:49 17:06	07:03 15:40	08:12 14:44	13:37 (3) 18 13:55 (3)
5	08:33 14:55	13:51 (3) 14:04 (3)	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:41	02:30 20:45	02:31 20:54	03:31 19:57	04:42 18:32	05:51 17:03	07:06 15:38	08:14 14:44	13:38 (3) 16 13:54 (3)
6	08:33 14:56	13:52 (3) 14:06 (3)	07:39 16:07	06:24 17:17	04:53 18:31	03:29 19:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36	08:16 14:43	13:38 (3) 14 13:52 (3)
7	08:32 14:58	13:52 (3) 14:08 (3)	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:48	02:34 20:52	03:35 19:52	04:47 18:26	05:56 16:57	07:11 15:33	08:18 14:42	13:38 (3) 13 13:51 (3)
8	08:31 15:00	13:52 (3) 14:10 (3)	07:35 16:12	06:18 17:22	04:47 18:36	03:24 19:48	02:27 20:49	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 15:31	08:19 14:41	13:39 (3) 11 13:50 (3)
9	08:30 15:02	13:53 (3) 14:11 (3)	07:32 16:15	06:16 17:25	04:44 18:38	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	07:16 15:28	08:21 14:40	13:40 (3) 9 13:49 (3)
10	08:29 15:04	13:53 (3) 14:11 (3)	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:52	02:25 20:51	02:38 20:49	03:42 19:45	04:54 18:17	06:03 16:48	07:18 15:26	08:22 14:40	13:39 (3) 9 13:48 (3)
11	08:28 15:06	13:54 (3) 14:12 (3)	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:52	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24	08:24 14:39	13:40 (3) 7 13:47 (3)
12	08:27 15:08	13:54 (3) 14:11 (3)	07:25 16:22	06:07 17:32	04:35 18:46	03:15 19:57	02:24 20:53	02:41 20:46	03:47 19:39	04:58 18:11	06:07 16:42	07:23 15:22	08:25 14:39	13:41 (3) 6 13:47 (3)
13	08:25 15:10	13:55 (3) 14:11 (3)	07:22 16:25	06:04 17:34	04:33 18:48	03:12 19:59	02:23 20:54	02:43 20:44	03:49 19:37	05:01 18:08	06:10 16:40	07:26 15:19	08:27 14:38	13:41 (3) 5 13:46 (3)
14	08:24 15:12	13:56 (3) 14:12 (3)	07:19 16:28	06:01 17:37	04:30 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:17	08:28 14:38	13:42 (3) 4 13:46 (3)
15	08:23 15:14	13:57 (3) 14:12 (3)	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:22 20:56	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	07:31 15:15	08:29 14:38	13:43 (3) 2 13:45 (3)
16	08:21 15:16	13:58 (3) 14:11 (3)	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	02:22 20:57	02:48 20:40	03:56 19:29	05:07 17:59	06:17 16:31	07:33 15:13	08:30 14:38	13:43 (3) 2 13:45 (3)
17	08:20 15:18	13:59 (3) 14:11 (3)	07:12 16:35	05:52 17:44	04:21 18:58	03:03 20:08	02:22 20:57	02:50 20:38	03:58 19:26	05:10 17:56	06:19 16:28	07:35 15:11	08:31 14:38	13:43 (3)
18	08:18 15:20	14:01 (3) 14:10 (3)	07:09 16:38	05:49 17:46	04:18 19:00	03:01 20:11	02:22 20:58	02:52 20:36	04:01 19:23	05:12 17:53	06:22 16:25	07:38 15:09	08:32 14:38	13:43 (3)
19	08:17 15:23	14:03 (3) 14:09 (3)	07:06 16:40	05:46 17:49	04:15 19:02	02:59 20:13	02:22 20:58	02:54 20:34	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:07	08:33 14:38	13:43 (3)
20	08:15 15:25	14:09 (3) 16:43	07:03 17:51	05:43 19:05	04:13 19:05	02:57 20:15	02:22 20:59	02:56 20:33	04:05 19:17	05:16 17:47	06:26 16:20	07:43 15:05	08:33 14:38	13:43 (3)
21	08:13 15:27	16:43 16:45	07:01 17:53	05:40 19:07	04:10 19:07	02:55 20:17	02:22 20:59	02:58 20:31	04:08 19:15	05:19 17:44	06:29 16:17	07:45 15:03	08:34 14:39	13:43 (3)
22	08:11 15:30	16:45 16:48	06:58 17:56	05:37 19:09	04:07 19:09	02:53 20:19	02:22 20:59	03:00 20:29	04:10 19:12	05:21 17:41	06:31 16:14	07:47 15:02	08:35 14:39	13:43 (3)
23	08:10 15:32	16:48 16:50	06:55 17:58	05:34 19:12	04:04 19:21	02:51 20:21	02:22 20:59	03:02 20:27	04:12 19:09	05:23 17:38	06:34 16:12	07:49 15:00	08:35 14:40	13:39 (3) 6 13:45 (3)
24	08:08 15:34	16:55 16:53	06:53 18:01	05:31 19:14	04:01 19:14	02:49 20:23	02:22 20:59	03:04 20:25	04:15 19:06	05:26 17:35	06:36 16:09	07:52 14:58	08:36 14:40	13:38 (3) 9 13:47 (3)
25	08:06 15:37	16:58 16:55	06:50 18:03	05:28 19:17	03:59 19:17	02:47 20:25	02:23 20:59	03:06 20:23	04:17 19:03	05:28 17:32	06:39 16:06	07:54 14:56	08:36 14:41	13:37 (3) 12 13:49 (3)
26	08:04 15:39	16:47 16:58	06:47 18:05	05:25 19:19	03:56 19:19	02:45 20:27	02:23 20:59	03:08 20:20	04:19 19:01	05:30 17:29	06:41 16:04	07:56 14:55	08:36 14:42	13:36 (3) 14 13:50 (3)
27	08:02 15:42	16:44 17:00	06:44 18:08	05:23 19:21	03:53 19:21	02:44 20:29	02:24 20:59	03:11 20:18	04:22 18:58	05:32 17:26	06:44 16:01	07:58 14:53	08:36 14:43	13:36 (3) 15 13:51 (3)
28	08:00 15:44	16:41 17:03	06:41 18:10	05:20 19:24	03:50 19:24	02:42 20:31	02:25 20:59	03:13 20:16	04:24 18:55	05:35 17:23	06:46 15:58	08:01 14:52	08:36 14:44	13:35 (3) 16 13:51 (3)
29	07:58 15:47	16:41 16:48	06:41 18:10	05:20 19:24	03:50 19:24	02:42 20:31	02:25 20:59	03:13 20:16	04:24 18:55	05:35 17:23	06:46 15:58	08:01 14:52	08:36 14:44	13:35 (3) 2 13:50 (3)
30	07:55 15:49	16:41 16:48	06:41 18:10	05:20 19:24	03:50 19:24	02:42 20:31	02:25 20:59	03:13 20:16	04:24 18:55	05:35 17:23	06:46 15:58	08:01 14:52	08:36 14:44	13:35 (3) 3 13:52 (3)
31	07:53 15:52	16:41 16:48	06:41 18:10	05:20 19:24	03:50 19:24	02:42 20:31	02:25 20:59	03:13 20:16	04:24 18:55	05:35 17:23	06:46 15:58	08:01 14:52	08:36 14:44	13:35 (3) 4 13:53 (3)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194	188	135 (3)
Total, worst case	255										104		188	
Sun reduction	0.27										0.28		0.30	
Oper. time red.	0.93										0.93		0.93	
Wind dir. red.	0.56										0.56		0.56	
Total reduction	0.14										0.15		0.16	
Total, real	36										15		29	

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:

Gismarvik

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Gunnar Randres vei 12

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CT - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (302)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	17:38 (5) 17:49 (5)	03:43 19:31
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	17:36 (5) 17:51 (5)	03:40 19:33
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	17:34 (5) 17:53 (5)	03:37 19:36
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	17:33 (5) 17:55 (5)	03:35 19:38
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	17:32 (5) 17:57 (5)	03:32 19:41
6	08:32 14:57	07:39 16:07	06:24 17:18	04:53 18:31	17:32 (5) 18:00 (5)	03:30 19:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	17:31 (5) 18:00 (5)	03:27 19:45
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	17:31 (5) 18:00 (5)	03:25 19:48
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	17:30 (5) 17:59 (5)	03:22 19:50
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	17:30 (5) 17:58 (5)	03:20 19:52
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	17:30 (5) 17:58 (5)	03:17 19:55
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	17:31 (5) 17:58 (5)	03:15 19:57
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	17:31 (5) 17:56 (5)	03:12 19:59
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	17:32 (5) 18:18 (4)	03:10 20:02
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	17:33 (5) 18:20 (4)	03:08 20:04
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	17:34 (5) 18:22 (4)	03:06 20:06
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	17:37 (5) 18:25 (4)	03:03 20:08
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	17:41 (5) 18:27 (4)	03:01 20:11
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	18:12 (4) 18:29 (4)	02:59 20:13
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	18:13 (4) 18:32 (4)	02:57 20:15
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	18:12 (4) 18:31 (4)	02:55 20:17
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	18:12 (4) 18:30 (4)	02:53 20:19
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	18:14 (4) 18:30 (4)	02:51 20:21
24	08:08 15:35	06:52 16:53	05:31 18:01	04:01 19:14	18:14 (4) 18:28 (4)	02:49 20:23
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	18:16 (4) 18:26 (4)	02:47 20:25
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 19:19	18:20 (4) 18:22 (4)	02:45 20:27
27	08:02 15:42	06:44 17:00	05:23 18:08	03:53 19:21	02:44 20:29	20:29
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	20:31
29	07:57 15:47	06:38 17:05	05:17 18:12	03:48 19:26	02:40 20:33	20:33
30	07:55 15:49	06:35 17:02	05:14 18:15	03:45 19:29	02:39 20:35	20:35
31	07:53 15:52	06:32 17:00	05:11 18:17	17:40 (5) 17:46 (5)	02:37 20:37	20:37
Potential sun hours	216	257	365	434	526	554
Total, worst case			6	549	407	574
Sun reduction			0.28	0.30	0.35	0.30
Oper. time red.			0.93	0.93	0.93	0.93
Wind dir. red.			0.63	0.64	0.74	0.74
Total reduction			0.16	0.18	0.24	0.21
Total, real			1	98	98	119

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CT - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (302)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	19:31 (3) 03:22	19:20 (2) 04:33	17:29 (5) 05:42	06:56	08:07
	20:57	19:50 (3) 20:07	19:29 (2) 18:43	17:57 (5) 17:14	15:48	14:48
2	02:28	19:31 (3) 03:24	19:20 (2) 04:36	17:29 (5) 05:44	06:58	08:09
	20:56	19:50 (3) 20:04	19:27 (2) 18:40	17:57 (5) 17:12	15:45	14:47
3	02:29	19:31 (3) 03:26	19:21 (2) 04:38	17:28 (5) 05:46	07:01	08:10
	20:56	19:51 (3) 20:02	19:24 (2) 18:37	17:57 (5) 17:09	15:43	14:46
4	02:30	19:31 (3) 03:29	19:21 (2) 04:40	17:28 (5) 05:49	07:03	08:12
	20:55	19:51 (3) 20:00	19:22 (2) 18:34	17:57 (5) 17:06	15:40	14:45
5	02:32	19:31 (3) 03:31	19:21 (2) 04:42	17:27 (5) 05:51	07:06	08:14
	20:54	19:52 (3) 19:57	18:31	17:56 (5) 17:03	15:38	14:44
6	02:33	19:30 (3) 03:33	18:45	17:27 (5) 05:53	07:08	08:16
	20:53	19:52 (3) 19:55	18:29	17:55 (5) 17:00	15:36	14:43
7	02:34	19:31 (3) 03:35	18:47	17:28 (5) 05:56	07:11	08:18
	20:52	19:53 (3) 19:52	18:26	17:54 (5) 16:57	15:33	14:42
8	02:35	19:31 (3) 03:38	18:49	17:28 (5) 05:58	07:13	08:19
	20:51	19:53 (3) 19:50	18:23	17:51 (5) 16:54	15:31	14:41
9	02:37	19:31 (3) 03:40	18:51	17:28 (5) 06:00	07:16	08:21
	20:50	19:53 (3) 19:47	18:20	17:47 (5) 16:51	15:28	14:40
10	02:38	19:30 (3) 03:42	18:54	17:29 (5) 06:03	07:18	08:22
	20:48	19:53 (3) 19:44	18:17	17:44 (5) 16:48	15:26	14:40
11	02:40	19:31 (3) 03:45	18:56	17:30 (5) 06:05	07:21	08:24
	20:47	19:54 (3) 19:42	18:14	17:41 (5) 16:45	15:24	14:39
12	02:42	19:31 (3) 03:47	18:58	17:31 (5) 06:07	07:23	08:25
	20:46	19:54 (3) 19:39	18:11	17:38 (5) 16:42	15:22	14:39
13	02:43	19:31 (3) 03:49	18:59	17:35 (5) 06:10	07:26	08:26
	20:44	19:55 (3) 19:37	18:08	17:36 (5) 16:40	15:20	14:39
14	02:45	19:31 (3) 03:52	19:03	16:12	07:28	08:28
	20:43	19:55 (3) 19:34	18:05	16:37	15:17	14:38
15	02:47	19:31 (3) 03:54	19:05	16:14	07:30	08:29
	20:41	19:55 (3) 19:31	18:02	16:34	15:15	14:38
16	02:49	19:31 (3) 03:56	19:07	16:17	07:33	08:30
	20:40	19:55 (3) 19:28	17:59	16:31	15:13	14:38
17	02:50	19:31 (3) 03:59	18:25 (4) 05:10	16:19	07:35	08:31
	20:38	19:55 (3) 19:26	18:30 (4) 17:56	16:28	15:11	14:38
18	02:52	19:32 (3) 04:01	18:22 (4) 05:12	16:22	07:38	08:32
	20:36	19:54 (3) 19:23	18:33 (4) 17:53	16:25	15:09	14:38
19	02:54	19:31 (3) 04:03	18:20 (4) 05:14	16:24	07:40	08:33
	20:34	19:52 (3) 19:20	18:34 (4) 17:50	16:23	15:07	14:38
20	02:56	19:32 (3) 04:06	18:19 (4) 05:16	16:26	07:42	08:33
	20:32	19:51 (3) 19:17	18:36 (4) 17:47	16:20	15:05	14:39
21	02:58	19:28 (2) 04:08	18:18 (4) 05:19	16:29	07:45	08:34
	20:31	19:49 (3) 19:15	18:36 (4) 17:44	16:17	15:03	14:39
22	03:00	19:24 (2) 04:10	18:17 (4) 05:21	16:31	07:47	08:34
	20:29	19:47 (3) 19:12	18:36 (4) 17:41	16:14	15:02	14:39
23	03:02	19:23 (2) 04:12	18:16 (4) 05:23	16:34	07:49	08:35
	20:27	19:45 (3) 19:09	18:35 (4) 17:38	16:12	15:00	14:40
24	03:04	19:22 (2) 04:15	18:16 (4) 05:26	16:36	07:52	08:35
	20:25	19:44 (3) 19:06	18:32 (4) 17:35	16:09	14:58	14:41
25	03:06	19:21 (2) 04:17	17:42 (5) 05:28	16:39	07:54	08:36
	20:22	19:42 (3) 19:03	18:29 (4) 17:32	16:06	14:57	14:41
26	03:09	19:21 (2) 04:19	17:38 (5) 05:30	16:41	07:56	08:36
	20:20	19:40 (3) 19:00	18:27 (4) 17:29	16:04	14:55	14:42
27	03:11	19:21 (2) 04:22	17:36 (5) 05:32	16:43	07:58	08:36
	20:18	19:38 (3) 18:58	18:25 (4) 17:26	16:01	14:53	14:43
28	03:13	19:20 (2) 04:24	17:34 (5) 05:35	16:46	08:00	08:36
	20:16	19:37 (2) 18:55	18:22 (4) 17:23	15:58	14:52	14:44
29	03:15	19:20 (2) 04:26	17:32 (5) 05:37	16:48	08:02	08:36
	20:14	19:35 (2) 18:52	18:19 (4) 17:20	15:56	14:51	14:45
30	03:17	19:20 (2) 04:29	17:31 (5) 05:39	16:51	08:05	08:36
	20:11	19:33 (2) 18:49	17:56 (5) 17:17	15:53	14:49	14:46
31	03:19	19:20 (2) 04:31	17:30 (5) 17:17	16:53	14:49	14:46
	20:09	19:31 (2) 18:46	17:57 (5) 17:17	15:51	14:47	14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	637	317	274			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.74	0.66	0.63			
Total reduction	0.18	0.15	0.15			
Total, real	114	47	42			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CU - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (303)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June			
1	08:35	07:51	06:38	15:49 (5)	05:08	03:42	02:36		
	14:49	15:54	17:05	26 16:15 (5)	18:19	19:31	20:38		
2	08:35	07:49	06:36	15:49 (5)	05:05	03:40	02:34		
	14:50	15:57	17:08	25 16:14 (5)	18:22	19:33	20:40		
3	08:34	07:46	06:33	15:49 (5)	05:02	03:37	02:33		
	14:52	15:59	17:10	25 16:14 (5)	18:24	19:36	20:42		
4	08:34	07:44	06:30	15:49 (5)	04:59	03:35	02:32		
	14:53	16:02	17:13	24 16:13 (5)	18:27	19:38	20:43		
5	08:33	07:42	06:27	15:50 (5)	04:56	03:32	02:30		
	14:55	16:05	17:15	22 16:12 (5)	18:29	19:41	20:45		
6	08:33	07:39	06:24	15:52 (5)	04:53	03:30	02:29		
	14:56	16:07	17:18	18 16:10 (5)	18:31	19:43	20:46		
7	08:32	07:37	06:21	15:53 (5)	04:50	03:27	02:28		
	14:58	16:10	17:20	15 16:08 (5)	18:34	19:45	20:48		
8	08:31	07:35	06:18	15:57 (5)	04:47	17:53 (3)	03:25	02:27	
	15:00	16:12	17:22	7 16:04 (5)	18:36	10 18:03 (3)	19:48	20:49	
9	08:30	07:32	06:16	15:59 (5)	04:44	17:50 (3)	03:22	02:26	
	15:02	16:15	17:25	15 18:05 (3)	19:50	17:47 (3)	03:20	02:26	
10	08:29	07:30	06:13	15:59 (5)	04:41	17:47 (3)	03:20	02:26	
	15:04	16:17	17:27	22 18:09 (2)	19:52	17:45 (3)	03:17	02:25	
11	08:28	07:27	06:10	15:59 (5)	04:38	17:45 (3)	03:17	02:25	
	15:06	16:20	17:30	26 18:11 (2)	19:55	17:43 (3)	03:15	02:24	
12	08:27	07:25	06:07	15:59 (5)	04:36	17:43 (3)	03:15	02:24	
	15:08	16:23	17:32	29 18:14 (2)	19:57	17:42 (3)	03:12	02:23	
13	08:25	07:22	06:04	15:59 (5)	04:33	17:44 (3)	03:12	02:23	
	15:10	16:25	17:34	32 18:16 (2)	19:59	17:43 (3)	03:10	02:23	
14	08:24	07:19	06:01	15:59 (5)	04:30	17:43 (3)	03:10	02:23	
	15:12	16:28	17:37	35 18:18 (2)	20:02	17:42 (3)	03:08	02:23	
15	08:23	07:17	05:58	17:05 (4)	04:27	17:42 (3)	03:08	02:23	
	15:14	16:30	17:39	4 17:09 (4)	18:53	17:41 (3)	03:06	02:22	
16	08:21	07:14	05:55	17:02 (4)	04:24	17:41 (3)	03:06	02:22	
	15:16	16:33	17:42	10 17:12 (4)	18:55	17:41 (3)	03:03	02:22	
17	08:20	07:12	05:52	17:01 (4)	04:21	17:41 (3)	03:03	02:22	
	15:18	16:35	17:44	13 17:14 (4)	18:57	17:41 (3)	03:01	02:22	
18	08:18	07:09	05:49	16:59 (4)	04:18	17:41 (3)	03:01	02:22	
	15:20	16:38	17:46	17 17:16 (4)	19:00	17:40 (3)	02:59	02:22	
19	08:16	07:06	05:46	16:59 (4)	04:15	17:40 (3)	02:59	02:22	
	15:23	16:40	5 16:05 (5)	17:49	19 17:18 (4)	19:02	18:17 (2)	20:13	20:58
20	08:15	07:03	05:43	16:58 (4)	04:13	17:41 (3)	02:57	02:22	
	15:25	16:43	13 16:10 (5)	17:51	20 17:18 (4)	19:05	18:16 (2)	20:15	20:59
21	08:13	07:01	05:40	16:58 (4)	04:10	17:41 (3)	02:55	02:22	
	15:27	16:45	17 16:12 (5)	17:53	20 17:18 (4)	19:07	18:15 (2)	20:17	20:59
22	08:11	06:58	05:37	16:57 (4)	04:07	17:41 (3)	02:53	02:22	
	15:30	16:48	20 16:13 (5)	17:56	21 17:18 (4)	19:09	18:12 (2)	20:19	20:59
23	08:09	06:55	05:34	16:58 (4)	04:04	17:43 (3)	02:51	02:22	
	15:32	16:50	22 16:14 (5)	17:58	19 17:17 (4)	19:12	18:10 (2)	20:21	20:59
24	08:08	06:52	05:31	16:58 (4)	04:01	17:43 (3)	02:49	02:22	
	15:35	16:53	24 16:15 (5)	18:01	18 17:16 (4)	19:14	18:05 (3)	20:23	20:59
25	08:06	06:50	05:28	16:59 (4)	03:59	17:44 (3)	02:47	02:23	
	15:37	16:55	25 16:15 (5)	18:03	15 17:14 (4)	19:17	18:03 (3)	20:25	20:59
26	08:04	06:47	05:25	17:00 (4)	03:56	17:46 (3)	02:45	02:23	
	15:39	16:58	26 16:15 (5)	18:05	12 17:12 (4)	19:19	18:01 (3)	20:27	20:59
27	08:02	06:44	05:23	17:03 (4)	03:53	17:48 (3)	02:44	02:24	
	15:42	17:00	27 16:16 (5)	18:08	6 17:09 (4)	19:21	10 17:58 (3)	20:29	20:59
28	08:00	06:41	05:20	17:03 (4)	03:51	17:48 (3)	02:42	02:25	
	15:44	17:03	26 16:15 (5)	18:10	19:24	17:48 (3)	02:40	02:25	
29	07:57		05:17	17:03 (4)	03:48	17:48 (3)	02:40	02:25	
	15:47		18:12	19:26	17:48 (3)	17:48 (3)	02:38	02:26	
30	07:55		05:14	17:03 (4)	03:45	17:48 (3)	02:38	02:26	
	15:49		18:15	19:29	17:48 (3)	17:48 (3)	02:37	02:26	
31	07:53		05:11	17:03 (4)	03:42	17:48 (3)	02:37	02:26	
	15:52		18:17	19:31	17:48 (3)	17:48 (3)	02:36	02:26	
Potential sun hours	216	257	365	434	526	554			
Total, worst case		205	356	548					
Sun reduction		0.29	0.28	0.30					
Oper. time red.		0.93	0.93	0.93					
Wind dir. red.		0.52	0.54	0.65					
Total reduction		0.14	0.14	0.18					
Total, real		29	51	100					

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CU - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (303)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum

813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	July	August	September	October	November	December			
1	02:27	03:22	04:33	17:44 (3)	05:42	06:56	08:07		
	20:57	20:07	18:43	26 18:10 (2)	17:14	15:48	14:48		
2	02:28	03:24	04:35	17:46 (3)	05:44	06:58	08:09		
	20:56	20:04	18:40	22 18:08 (2)	17:12	15:45	14:47		
3	02:29	03:26	04:38	17:48 (3)	05:46	07:01	08:10		
	20:56	20:02	18:37	15 18:03 (3)	17:09	15:43	14:46		
4	02:30	03:28	04:40	17:50 (3)	05:49	07:03	08:12		
	20:55	20:00	18:34	10 18:00 (3)	17:06	15:40	14:45		
5	02:31	03:31	04:42	17:51	05:51	07:06	08:14		
	20:54	19:57	18:32	17:03	15:38	14:44			
6	02:33	03:33	04:45	17:53	05:53	15:31 (5)	07:08	08:16	
	20:53	19:55	18:29	17:00	15:36	14:43			
7	02:34	03:35	04:47	17:56	05:56	15:29 (5)	07:11	08:18	
	20:52	19:52	18:26	16:57	15:33	14:42			
8	02:35	03:38	04:49	17:58	05:58	15:26 (5)	07:13	08:19	
	20:51	19:50	18:23	16:54	15:31	14:41			
9	02:37	03:40	04:51	18:00	06:00	15:25 (5)	07:16	08:21	
	20:50	19:47	18:20	16:51	15:28	14:40			
10	02:38	03:42	04:54	18:03	06:03	15:24 (5)	07:18	08:22	
	20:48	19:44	18:17	16:48	15:26	14:40			
11	02:40	03:45	04:56	18:05	06:05	15:23 (5)	07:21	08:24	
	20:47	19:42	18:14	16:45	15:24	14:39			
12	02:42	03:47	04:58	18:07	06:07	15:22 (5)	07:23	08:25	
	20:46	19:39	18:11	16:42	15:22	14:39			
13	02:43	03:49	05:01	18:08	06:10	15:22 (5)	07:26	08:26	
	20:44	19:37	18:08	16:40	15:19	14:39			
14	02:45	03:52	05:03	18:09	06:12	15:22 (5)	07:28	08:28	
	20:43	19:34	18:05	16:37	15:17	14:38			
15	02:47	03:54	05:05	18:10	06:14	15:22 (5)	07:30	08:29	
	20:41	19:31	18:02	16:34	15:15	14:38			
16	02:49	03:56	17:55 (3)	05:07	16:54 (4)	06:17	15:21 (5)	07:33	08:30
	20:40	19:28	11 18:06 (3)	17:59	2 16:55 (4)	16:31	26 15:47 (5)	15:13	14:38
17	02:50	03:59	17:52 (3)	05:10	16:49 (4)	06:19	15:22 (5)	07:35	08:31
	20:38	19:26	16 18:08 (3)	17:56	11 17:00 (4)	16:28	25 15:47 (5)	15:11	14:38
18	02:52	04:01	17:50 (3)	05:12	16:47 (4)	06:22	15:22 (5)	07:38	08:32
	20:36	19:23	19 18:09 (3)	17:53	15 17:02 (4)	16:25	24 15:46 (5)	15:09	14:38
19	02:54	04:03	17:48 (3)	05:14	16:45 (4)	06:24	15:23 (5)	07:40	08:33
	20:34	19:20	22 18:10 (3)	17:50	17 17:02 (4)	16:23	22 15:45 (5)	15:07	14:38
20	02:56	04:05	17:48 (3)	05:16	16:43 (4)	06:26	15:25 (5)	07:42	08:33
	20:32	19:17	28 18:16 (2)	17:47	19 17:02 (4)	16:20	19 15:44 (5)	15:05	14:39
21	02:58	04:08	17:47 (3)	05:19	16:43 (4)	06:29	15:25 (5)	07:45	08:34
	20:31	19:15	31 18:18 (2)	17:44	20 17:03 (4)	16:17	16 15:41 (5)	15:03	14:39
22	03:00	04:10	17:46 (3)	05:21	16:42 (4)	06:31	15:28 (5)	07:47	08:35
	20:29	19:12	33 18:19 (2)	17:41	21 17:03 (4)	16:14	11 15:39 (5)	15:02	14:39
23	03:02	04:12	17:45 (3)	05:23	16:42 (4)	06:34	15:00	07:49	08:35
	20:27	19:09	35 18:20 (2)	17:38	20 17:02 (4)	16:12	15:00	14:40	
24	03:04	04:15	17:44 (3)	05:26	16:41 (4)	06:36	14:58	07:52	08:35
	20:25	19:06	36 18:20 (2)	17:35	20 17:01 (4)	16:09	14:58	14:41	
25	03:06	04:17	17:43 (3)	05:28	16:42 (4)	06:39	14:57	07:54	08:36
	20:23	19:03	38 18:21 (2)	17:32	18 17:00 (4)	16:06	14:57	14:41	
26	03:09	04:19	17:43 (3)	05:30	16:42 (4)	06:41	14:55	07:56	08:36
	20:20	19:01	37 18:20 (2)	17:29	15 16:57 (4)	16:04	14:55	14:42	
27	03:11	04:22	17:44 (3)	05:32	16:43 (4)	06:43	14:53	07:58	08:36
	20:18	18:58	37 18:21 (2)	17:26	10 16:53 (4)	16:01	14:53	14:43	
28	03:13	04:24	17:43 (3)	05:35	16:45 (4)	06:46	14:52	08:00	08:36
	20:16	18:55	37 18:20 (2)	17:23	6 16:51 (4)	15:58	14:52	14:44	
29	03:15	04:26	17:43 (3)	05:37	16:47 (4)	06:48	14:51	08:03	08:36
	20:14	18:52	36 18:19 (2)	17:20	2 16:48 (4)	15:56	14:51	14:45	
30	03:17	04:29	17:44 (3)	05:39	16:48 (4)	06:51	14:50	08:05	08:36
	20:12	18:49	32 18:16 (2)	17:17	15:53	14:49	14:49	14:46	
31	03:19	04:31	17:44 (3)	05:41	16:50	06:53	14:49	08:06	08:36
	20:09	18:46	29 18:13 (2)	17:14	15:50	14:48	14:48	14:47	
Potential sun hours	551	481	387	318	232	194			
Total, worst case		477	269	369					
Sun reduction		0.24	0.26	0.28					
Oper. time red.		0.93	0.93	0.93					
Wind dir. red.		0.65	0.58	0.52					
Total reduction		0.15	0.14	0.14					
Total, real		70	38	50					

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CV - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (304)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June					
1	08:35	07:51	06:38	05:08	17:07 (5)	03:43	02:36	19:11 (3)			
	14:49	15:54	17:05	18:19	17:34 (5)	19:31	20:38	19:21 (3)			
2	08:35	07:49	06:36	05:05	17:07 (5)	03:40	18:57 (2)	02:34	19:12 (3)		
	14:50	15:57	17:08	18:22	17:33 (5)	19:33	2	18:58 (2)	20:40	6	19:18 (3)
3	08:34	07:46	06:33	05:02	17:08 (5)	03:37	18:56 (2)	02:33			
	14:52	16:00	17:10	18:24	17:32 (5)	19:36	4	19:00 (2)	20:42		
4	08:34	07:44	06:30	04:59	17:09 (5)	03:35	18:55 (2)	02:32			
	14:53	16:02	17:13	18:27	17:30 (5)	19:38	7	19:02 (2)	20:43		
5	08:33	07:42	06:27	04:56	17:10 (5)	03:32	18:55 (2)	02:30			
	14:55	16:05	17:15	18:29	17:28 (5)	19:41	9	19:04 (2)	20:45		
6	08:33	07:39	06:24	04:53	17:13 (5)	03:30	18:55 (2)	02:29			
	14:57	16:07	17:18	18:31	17:27 (5)	19:43	12	19:07 (2)	20:46		
7	08:32	07:37	06:21	04:50	17:17 (5)	03:27	18:54 (2)	02:28			
	14:58	16:10	17:20	18:34	8	18:03 (4)	19:45	14	19:08 (2)	20:47	
8	08:31	07:35	06:18	04:47	17:59 (4)	03:25	18:54 (2)	02:27			
	15:00	16:12	17:22	18:36	6	18:05 (4)	19:48	16	19:10 (2)	20:49	
9	08:30	07:32	06:15	04:44	17:58 (4)	03:22	18:55 (2)	02:26			
	15:02	16:15	17:25	18:38	9	18:07 (4)	19:50	18	19:13 (2)	20:50	
10	08:29	07:30	06:13	04:41	17:57 (4)	03:20	18:56 (2)	02:26			
	15:04	16:17	17:27	18:41	12	18:09 (4)	19:52	19	19:15 (3)	20:51	
11	08:28	07:27	06:10	04:38	17:56 (4)	03:17	18:56 (2)	02:25			
	15:06	16:20	17:30	18:43	15	18:11 (4)	19:55	21	19:17 (3)	20:52	
12	08:27	07:25	06:07	04:36	17:56 (4)	03:15	18:56 (2)	02:24			
	15:08	16:23	17:32	18:46	18	18:14 (4)	19:57	22	19:18 (3)	20:53	
13	08:25	07:22	06:04	04:33	17:56 (4)	03:12	18:58 (2)	02:24			
	15:10	16:25	17:34	18:48	20	18:16 (4)	19:59	22	19:20 (3)	20:54	
14	08:24	07:19	06:01	04:30	17:56 (4)	03:10	18:59 (2)	02:23			
	15:12	16:28	17:37	18:50	19	18:15 (4)	20:02	23	19:22 (3)	20:55	
15	08:23	07:17	05:58	04:27	17:56 (4)	03:08	19:01 (3)	02:23			
	15:14	16:30	17:39	18:53	18	18:14 (4)	20:04	23	19:24 (3)	20:56	
16	08:21	07:14	05:55	04:24	17:57 (4)	03:06	19:01 (3)	02:22			
	15:16	16:33	17:42	18:55	15	18:12 (4)	20:06	25	19:26 (3)	20:57	
17	08:20	07:11	05:52	04:21	17:59 (4)	03:03	19:01 (3)	02:22			
	15:18	16:35	17:44	18:57	13	18:12 (4)	20:08	25	19:26 (3)	20:57	
18	08:18	07:09	05:49	04:18	18:01 (4)	03:01	19:02 (3)	02:22			
	15:21	16:38	17:46	19:00	8	18:09 (4)	20:11	25	19:27 (3)	20:58	
19	08:16	07:06	05:46	04:15	02:59	19:02 (3)	02:22				
	15:23	16:40	17:49	19:02	20:13	25	19:27 (3)	20:58			
20	08:15	07:03	05:43	17:20 (5)	04:13	02:57	19:02 (3)	02:22			
	15:25	16:43	17:51	2	17:21 (5)	19:05	20:15	24	19:26 (3)	20:59	
21	08:13	07:01	05:40	17:17 (5)	04:10	02:55	19:02 (3)	02:22			
	15:27	16:45	17:53	6	17:23 (5)	19:07	20:17	24	19:26 (3)	20:59	
22	08:11	06:58	05:37	17:14 (5)	04:07	02:53	19:03 (3)	02:22			
	15:30	16:48	17:56	12	17:26 (5)	19:09	20:19	23	19:26 (3)	20:59	
23	08:09	06:55	05:34	17:13 (5)	04:04	02:51	19:03 (3)	02:22			
	15:32	16:50	17:58	15	17:28 (5)	19:12	20:21	23	19:26 (3)	20:59	
24	08:08	06:52	05:31	17:11 (5)	04:01	02:49	19:03 (3)	02:23			
	15:35	16:53	18:01	19	17:30 (5)	19:14	20:23	22	19:25 (3)	20:59	
25	08:06	06:50	05:28	17:10 (5)	03:59	02:47	19:04 (3)	02:23			
	15:37	16:55	18:03	23	17:33 (5)	19:17	20:25	21	19:25 (3)	20:59	
26	08:04	06:47	05:25	17:09 (5)	03:56	02:45	19:04 (3)	02:23			
	15:39	16:58	18:05	26	17:35 (5)	19:19	20:27	20	19:24 (3)	20:59	
27	08:02	06:44	05:23	17:08 (5)	03:53	02:44	19:05 (3)	02:24			
	15:42	17:00	18:08	29	17:37 (5)	19:21	20:29	19	19:24 (3)	20:59	
28	08:00	06:41	05:20	17:08 (5)	03:51	02:42	19:07 (3)	02:25			
	15:44	17:03	18:10	29	17:37 (5)	19:24	20:31	17	19:24 (3)	20:58	
29	07:57	05:17	03:48	17:07 (5)	03:48	02:40	19:07 (3)	02:25			
	15:47	18:12	29	17:36 (5)	19:26	20:33	16	19:23 (3)	20:58		
30	07:55	05:14	03:45	17:07 (5)	03:45	02:39	19:08 (3)	02:26			
	15:49	18:15	29	17:36 (5)	19:29	20:35	14	19:22 (3)	20:58		
31	07:53	05:11	03:43	17:07 (5)	03:43	02:37	19:10 (3)				
	15:52	18:17	28	17:35 (5)	19:28	20:37	12	19:22 (3)			
Potential sun hours	216	257	365	434	526	554	16				
Total, worst case			247	291	547	0.30					
Sun reduction			0.28	0.30	0.35	0.30					
Oper. time red.			0.93	0.93	0.93	0.93					
Wind dir. red.			0.59	0.62	0.73	0.73					
Total reduction			0.15	0.17	0.24	0.20					
Total, real			38	51	130	3					

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CV - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (304)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	03:22	19:07 (2) 04:33	17:55 (4) 05:42	06:56	08:07
	20:57	20:07	22 19:29 (3) 18:43	15 18:10 (4) 17:14	15:48	14:48
2	02:28	03:24	19:06 (2) 04:36	17:56 (4) 05:44	06:58	08:09
	20:56	20:04	21 19:27 (3) 18:40	12 18:08 (4) 17:12	15:45	14:47
3	02:29	03:26	19:06 (2) 04:38	17:56 (4) 05:46	07:01	08:10
	20:56	20:02	18 19:24 (3) 18:37	9 18:05 (4) 17:09	15:43	14:46
4	02:30	03:29	19:05 (2) 04:40	17:56 (4) 05:49	07:03	08:12
	20:55	20:00	17 19:22 (2) 18:34	6 18:02 (4) 17:06	15:40	14:45
5	02:31	03:31	19:05 (2) 04:42	17:13 (5) 05:51	07:06	08:14
	20:54	19:57	15 19:20 (2) 18:31	8 17:59 (4) 17:03	15:38	14:44
6	02:33	03:33	19:04 (2) 04:45	17:08 (5) 05:53	07:08	08:16
	20:53	19:55	14 19:18 (2) 18:29	14 17:22 (5) 17:00	15:36	14:43
7	02:34	03:35	19:04 (2) 04:47	17:06 (5) 05:56	07:11	08:18
	20:52	19:52	11 19:15 (2) 18:26	18 17:24 (5) 16:57	15:33	14:42
8	02:35	03:38	19:04 (2) 04:49	17:04 (5) 05:58	07:13	08:19
	20:51	19:50	9 19:13 (2) 18:23	21 17:25 (5) 16:54	15:31	14:41
9	02:37	03:40	19:04 (2) 04:51	17:02 (5) 06:00	07:16	08:21
	20:50	19:47	6 19:10 (2) 18:20	24 17:26 (5) 16:51	15:28	14:40
10	02:38	19:21 (3) 03:42	19:05 (2) 04:54	17:01 (5) 06:03	07:18	08:22
	20:48	3 19:24 (3) 19:44	3 19:08 (2) 18:17	25 17:26 (5) 16:48	15:26	14:40
11	02:40	19:19 (3) 03:45	04:56	16:59 (5) 06:05	07:21	08:24
	20:47	9 19:28 (3) 19:42	18:14	28 17:27 (5) 16:45	15:24	14:39
12	02:42	19:18 (3) 03:47	04:58	16:58 (5) 06:07	07:23	08:25
	20:46	11 19:29 (3) 19:39	18:11	28 17:26 (5) 16:42	15:22	14:39
13	02:43	19:17 (3) 03:49	05:01	16:58 (5) 06:10	07:26	08:26
	20:44	13 19:30 (3) 19:37	18:08	29 17:27 (5) 16:40	15:19	14:39
14	02:45	19:16 (3) 03:52	05:03	16:58 (5) 06:12	07:28	08:28
	20:43	15 19:31 (3) 19:34	18:05	29 17:27 (5) 16:37	15:17	14:38
15	02:47	19:16 (3) 03:54	05:05	16:57 (5) 06:14	07:30	08:29
	20:41	16 19:32 (3) 19:31	18:02	29 17:26 (5) 16:34	15:15	14:38
16	02:49	19:14 (3) 03:56	05:07	16:57 (5) 06:17	07:33	08:30
	20:40	19 19:33 (3) 19:28	17:59	28 17:25 (5) 16:31	15:13	14:38
17	02:50	19:14 (3) 03:59	05:10	16:57 (5) 06:19	07:35	08:31
	20:38	20 19:34 (3) 19:26	17:56	27 17:24 (5) 16:28	15:11	14:38
18	02:52	19:14 (3) 04:01	05:12	16:57 (5) 06:22	07:38	08:32
	20:36	21 19:35 (3) 19:23	17:53	24 17:21 (5) 16:25	15:09	14:38
19	02:54	19:13 (3) 04:03	05:14	16:58 (5) 06:24	07:40	08:33
	20:34	22 19:35 (3) 19:20	17:50	20 17:18 (5) 16:23	15:07	14:38
20	02:56	19:13 (3) 04:06	05:16	16:58 (5) 06:26	07:42	08:33
	20:32	22 19:35 (3) 19:17	17:47	16 17:14 (5) 16:20	15:05	14:39
21	02:58	19:13 (3) 04:08	05:19	17:00 (5) 06:29	07:45	08:34
	20:31	23 19:36 (3) 19:15	17:44	12 17:12 (5) 16:17	15:03	14:39
22	03:00	19:12 (3) 04:10	05:21	17:01 (5) 06:31	07:47	08:34
	20:29	24 19:36 (3) 19:12	17:41	8 17:09 (5) 16:14	15:02	14:39
23	03:02	19:12 (3) 04:12	05:23	17:03 (5) 06:34	07:49	08:35
	20:27	24 19:36 (3) 19:09	17:38	3 17:06 (5) 16:12	15:00	14:40
24	03:04	19:12 (3) 04:15	05:26	06:36	07:52	08:35
	20:25	25 19:37 (3) 19:06	17:35	16:09	14:58	14:41
25	03:06	19:12 (3) 04:17	18:03 (4) 05:28	06:39	07:54	08:36
	20:22	25 19:37 (3) 19:03	9 18:12 (4) 17:32	16:06	14:57	14:41
26	03:09	19:12 (3) 04:19	18:01 (4) 05:30	06:41	07:56	08:36
	20:20	25 19:37 (3) 19:00	12 18:13 (4) 17:29	16:04	14:55	14:42
27	03:11	19:12 (3) 04:22	18:00 (4) 05:32	06:43	07:58	08:36
	20:18	25 19:37 (3) 18:58	15 18:15 (4) 17:26	16:01	14:53	14:43
28	03:13	19:12 (3) 04:24	17:58 (4) 05:35	06:46	08:00	08:36
	20:16	25 19:37 (3) 18:55	18 18:16 (4) 17:23	15:58	14:52	14:44
29	03:15	19:12 (2) 04:26	17:57 (4) 05:37	06:48	08:02	08:36
	20:14	23 19:35 (3) 18:52	19 18:16 (4) 17:20	15:56	14:51	14:45
30	03:17	19:10 (2) 04:29	17:56 (4) 05:39	06:51	08:05	08:36
	20:11	23 19:33 (3) 18:49	20 18:16 (4) 17:17	15:53	14:49	14:46
31	03:19	19:08 (2) 04:31	17:55 (4)	06:53		08:36
	20:09	23 19:31 (3) 18:46	18 18:13 (4)	15:50		14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	436	247	433			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.73	0.69	0.60			
Total reduction	0.18	0.15	0.14			
Total, real	77	38	63			

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)	Minutes with flicker	Last time (hh:mm) with flicker
			(WTG causing flicker last time)



Project:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CW - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (305)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	17:41 (5) 17:49 (5)	03:43 19:31
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	17:40 (5) 17:51 (5)	03:40 19:33
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	17:39 (5) 17:53 (5)	03:37 19:36
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	17:38 (5) 17:55 (5)	03:35 19:38
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	17:37 (5) 17:57 (5)	03:32 19:41
6	08:32 14:57	07:39 16:07	06:24 17:18	04:53 18:31	17:37 (5) 18:00 (5)	03:30 19:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	17:36 (5) 18:03 (5)	03:27 19:45
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	17:36 (5) 18:05 (5)	03:25 19:48
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	17:36 (5) 18:04 (5)	03:22 19:50
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	17:36 (5) 18:03 (5)	03:20 19:52
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	17:36 (5) 18:02 (5)	03:17 19:55
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	17:37 (5) 18:02 (5)	03:15 19:57
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	17:38 (5) 18:01 (5)	03:12 19:59
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	17:39 (5) 17:59 (5)	03:10 20:02
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	17:40 (5) 18:20 (4)	03:08 20:04
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	17:42 (5) 18:22 (4)	03:06 20:06
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	18:17 (4) 18:25 (4)	03:03 20:08
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	18:16 (4) 18:27 (4)	03:01 20:11
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	18:16 (4) 18:29 (4)	02:59 20:13
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	18:16 (4) 18:32 (4)	02:57 20:15
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	18:17 (4) 18:34 (4)	02:55 20:17
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	18:17 (4) 18:33 (4)	02:53 20:19
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	18:19 (4) 18:32 (4)	02:51 20:21
24	08:08 15:35	06:52 16:53	05:31 18:01	04:01 19:14	18:20 (4) 18:29 (4)	02:49 20:23
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	02:47 20:25	02:47 20:25
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 19:19	02:45 20:27	02:45 20:27
27	08:02 15:42	06:44 17:00	05:23 18:08	03:53 19:21	02:44 20:29	02:44 20:29
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	02:42 20:31
29	07:57 15:47	06:38 17:05	05:17 18:12	03:48 19:26	02:40 20:33	02:40 20:33
30	07:55 15:49	06:35 17:02	05:14 18:15	03:45 19:29	02:39 20:35	02:39 20:35
31	07:53 15:52	06:32 17:00	05:11 18:17	17:43 (5) 17:46 (5)	02:37 20:37	02:37 20:37
Potential sun hours	216	257	365	434	526	554
Total, worst case			3	439	322	387
Sun reduction			0.28	0.30	0.35	0.30
Oper. time red.			0.93	0.93	0.93	0.93
Wind dir. red.			0.64	0.64	0.74	0.74
Total reduction			0.17	0.18	0.24	0.21
Total, real			0	79	78	80

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CW - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (305)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	July	August	September	October	November	December
1	02:27	19:37 (3) 03:22	19:23 (2) 04:33	17:35 (5) 05:42	06:56	08:07
	20:57	19:51 (3) 20:07	19:29 (2) 18:43	18:01 (5) 17:14	15:48	14:48
2	02:28	19:37 (3) 03:24	19:23 (2) 04:36	17:35 (5) 05:44	06:58	08:09
	20:56	19:51 (3) 20:04	19:27 (2) 18:40	18:02 (5) 17:12	15:45	14:47
3	02:29	19:37 (3) 03:26	19:23 (2) 04:38	17:34 (5) 05:46	07:01	08:10
	20:56	19:52 (3) 20:02	19:24 (2) 18:37	18:02 (5) 17:09	15:43	14:46
4	02:30	19:36 (3) 03:29	04:40	17:33 (5) 05:49	07:03	08:12
	20:55	19:53 (3) 20:00	18:34	18:02 (5) 17:06	15:40	14:45
5	02:32	19:36 (3) 03:31	04:42	17:33 (5) 05:51	07:06	08:14
	20:54	19:53 (3) 19:57	18:31	17:59 (5) 17:03	15:38	14:44
6	02:33	19:36 (3) 03:33	04:45	17:32 (5) 05:53	07:08	08:16
	20:53	19:53 (3) 19:55	18:29	17:56 (5) 17:00	15:36	14:43
7	02:34	19:36 (3) 03:35	04:47	17:33 (5) 05:56	07:11	08:18
	20:52	19:55 (3) 19:52	18:26	17:54 (5) 16:57	15:33	14:42
8	02:35	19:36 (3) 03:38	04:49	17:33 (5) 05:58	07:13	08:19
	20:51	19:55 (3) 19:50	18:23	17:51 (5) 16:54	15:31	14:41
9	02:37	19:35 (3) 03:40	04:51	17:33 (5) 06:00	07:16	08:21
	20:50	19:55 (3) 19:47	18:20	17:47 (5) 16:51	15:28	14:40
10	02:38	19:35 (3) 03:42	04:54	17:33 (5) 06:03	07:18	08:22
	20:48	19:56 (3) 19:44	18:17	17:44 (5) 16:48	15:26	14:40
11	02:40	19:35 (3) 03:45	04:56	17:34 (5) 06:05	07:21	08:24
	20:47	19:57 (3) 19:42	18:14	17:41 (5) 16:45	15:24	14:39
12	02:42	19:35 (3) 03:47	04:58	17:34 (5) 06:07	07:23	08:25
	20:46	19:57 (3) 19:39	18:11	17:38 (5) 16:42	15:22	14:39
13	02:43	19:35 (3) 03:49	05:01	06:10	07:26	08:26
	20:44	19:58 (3) 19:37	18:08	16:40	15:20	14:39
14	02:45	19:35 (3) 03:52	05:03	06:12	07:28	08:28
	20:43	19:57 (3) 19:34	18:05	16:37	15:17	14:38
15	02:47	19:35 (3) 03:54	05:05	06:14	07:30	08:29
	20:41	19:58 (3) 19:31	18:02	16:34	15:15	14:38
16	02:49	19:34 (3) 03:56	05:07	06:17	07:33	08:30
	20:40	19:56 (3) 19:28	17:59	16:31	15:13	14:38
17	02:50	19:35 (3) 03:59	05:10	06:19	07:35	08:31
	20:38	19:55 (3) 19:26	17:56	16:28	15:11	14:38
18	02:52	19:35 (3) 04:01	18:29 (4) 05:12	06:22	07:38	08:32
	20:36	19:54 (3) 19:23	3 18:32 (4) 17:53	16:25	15:09	14:38
19	02:54	19:35 (3) 04:03	18:25 (4) 05:14	06:24	07:40	08:33
	20:34	19:52 (3) 19:20	10 18:35 (4) 17:50	16:23	15:07	14:38
20	02:56	19:35 (3) 04:06	18:24 (4) 05:16	06:26	07:42	08:33
	20:32	19:51 (3) 19:17	14 18:38 (4) 17:47	16:20	15:05	14:39
21	02:58	19:35 (3) 04:08	18:22 (4) 05:19	06:29	07:45	08:34
	20:31	19:49 (3) 19:15	16 18:38 (4) 17:44	16:17	15:03	14:39
22	03:00	19:35 (3) 04:10	18:21 (4) 05:21	06:31	07:47	08:34
	20:29	19:47 (3) 19:12	17 18:38 (4) 17:41	16:14	15:02	14:39
23	03:02	19:30 (2) 04:12	18:20 (4) 05:23	06:34	07:49	08:35
	20:27	19:45 (3) 19:09	15 18:35 (4) 17:38	16:12	15:00	14:40
24	03:04	19:27 (2) 04:15	18:19 (4) 05:26	06:36	07:52	08:35
	20:25	19:44 (3) 19:06	13 18:32 (4) 17:35	16:09	14:58	14:41
25	03:06	19:26 (2) 04:17	18:19 (4) 05:28	06:39	07:54	08:36
	20:22	19:42 (3) 19:03	10 18:29 (4) 17:32	16:06	14:57	14:41
26	03:09	19:25 (2) 04:19	18:18 (4) 05:30	06:41	07:56	08:36
	20:20	19:40 (3) 19:00	9 18:27 (4) 17:29	16:04	14:55	14:42
27	03:11	19:24 (2) 04:22	17:45 (5) 05:32	06:43	07:58	08:36
	20:18	19:38 (2) 18:58	18 18:25 (4) 17:26	16:01	14:53	14:43
28	03:13	19:24 (2) 04:24	17:42 (5) 05:35	06:46	08:00	08:36
	20:16	19:37 (2) 18:55	20 18:22 (4) 17:23	15:58	14:52	14:44
29	03:15	19:23 (2) 04:26	17:40 (5) 05:37	06:48	08:02	08:36
	20:14	19:35 (2) 18:52	20 18:00 (5) 17:20	15:56	14:51	14:45
30	03:17	19:23 (2) 04:29	17:38 (5) 05:39	06:51	08:05	08:36
	20:11	19:33 (2) 18:49	22 18:00 (5) 17:17	15:53	14:49	14:46
31	03:19	19:23 (2) 04:31	17:36 (5)	06:53		08:36
	20:09	8 19:31 (2) 18:46	25 18:01 (5)	15:51		14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case		521	224	235		
Sun reduction		0.26	0.24	0.26		
Oper. time red.		0.93	0.93	0.93		
Wind dir. red.		0.74	0.66	0.64		
Total reduction		0.18	0.15	0.15		
Total, real		94	33	36		

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CX - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (306)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35	07:51	06:38	15:40 (5)	05:08	03:42
	14:49	15:54	17:05	16:01 (5)	18:19	19:31
2	08:35	07:49	06:36	15:42 (5)	05:05	03:40
	14:50	15:57	17:08	15:59 (5)	18:22	19:33
3	08:34	07:46	06:33	15:43 (5)	05:02	17:38 (3)
	14:52	15:59	17:10	15:57 (5)	18:24	17:49 (3)
4	08:34	07:44	06:30	15:47 (5)	04:59	17:35 (3)
	14:53	16:02	17:13	15:54 (5)	18:27	17:52 (3)
5	08:33	07:42	06:27		04:56	17:33 (3)
	14:55	16:05	17:15		18:29	17:53 (3)
6	08:33	07:39	06:24		04:53	17:32 (3)
	14:56	16:07	17:18		18:31	17:55 (3)
7	08:32	07:37	06:21		04:50	17:31 (3)
	14:58	16:10	17:20		18:34	17:56 (3)
8	08:31	07:35	06:18		04:47	17:30 (3)
	15:00	16:12	17:22		18:36	17:56 (3)
9	08:30	07:32	06:16		04:44	17:29 (3)
	15:02	16:15	17:25		18:38	17:56 (3)
10	08:29	07:30	06:13		04:41	17:28 (3)
	15:04	16:17	17:27		18:41	17:56 (3)
11	08:28	07:27	06:10	16:58 (4)	04:38	17:27 (3)
	15:06	16:20	17:30	16:59 (4)	18:43	17:56 (3)
12	08:27	07:25	06:07	16:54 (4)	04:36	17:28 (3)
	15:08	16:23	17:32	17:02 (4)	18:46	17:56 (3)
13	08:25	07:22	06:04	16:52 (4)	04:33	17:27 (3)
	15:10	16:25	17:34	17:04 (4)	18:48	17:56 (3)
14	08:24	07:19	06:01	16:51 (4)	04:30	17:27 (3)
	15:12	16:28	17:37	17:07 (4)	18:50	17:55 (3)
15	08:23	07:17	05:58	16:50 (4)	04:27	17:27 (3)
	15:14	16:30	17:39	17:09 (4)	18:53	17:54 (3)
16	08:21	07:14	15:46 (5)	16:49 (4)	04:24	17:27 (3)
	15:16	16:33	15:57 (5)	17:09 (4)	18:55	17:53 (3)
17	08:20	07:12	15:44 (5)	16:49 (4)	04:21	17:29 (3)
	15:18	16:35	16:00 (5)	17:09 (4)	18:57	17:52 (3)
18	08:18	07:09	15:42 (5)	16:48 (4)	04:18	17:29 (3)
	15:20	16:38	16:01 (5)	17:09 (4)	19:00	17:51 (3)
19	08:16	07:06	15:41 (5)	16:49 (4)	04:15	17:30 (3)
	15:23	16:40	16:02 (5)	17:08 (4)	19:02	17:49 (3)
20	08:15	07:03	15:41 (5)	16:49 (4)	04:13	17:33 (3)
	15:25	16:43	16:04 (5)	17:07 (4)	19:05	17:48 (3)
21	08:13	07:01	15:40 (5)	16:50 (4)	04:10	17:35 (3)
	15:27	16:45	16:04 (5)	17:06 (4)	19:07	17:44 (3)
22	08:11	06:58	15:39 (5)	16:51 (4)	04:07	
	15:30	16:48	16:05 (5)	17:04 (4)	19:09	
23	08:09	06:55	15:39 (5)	16:53 (4)	04:04	
	15:32	16:50	16:05 (5)	17:01 (4)	19:12	
24	08:08	06:52	15:39 (5)		04:01	
	15:35	16:53	16:04 (5)		19:14	
25	08:06	06:50	15:39 (5)		03:59	
	15:37	16:55	16:04 (5)		19:17	
26	08:04	06:47	15:39 (5)		03:56	
	15:39	16:58	16:04 (5)		19:19	
27	08:02	06:44	15:39 (5)		03:53	
	15:42	17:00	16:03 (5)		19:21	
28	08:00	06:41	15:40 (5)		03:51	
	15:44	17:03	16:02 (5)		19:24	
29	07:57		05:17		03:48	
	15:47		18:12		19:26	
30	07:55		05:14		03:45	
	15:49		18:15		19:29	
31	07:53		05:11			
	15:52		18:17			
Potential sun hours	216	257	365	434	526	554
Total, worst case		287	251	432		
Sun reduction		0.29	0.28	0.30		
Oper. time red.		0.93	0.93	0.93		
Wind dir. red.		0.52	0.53	0.63		
Total reduction		0.14	0.14	0.18		
Total, real		40	35	77		

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CX - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (306)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December			
1	02:27	03:22	04:33	17:26 (3)	05:42	16:33 (4)	06:56	08:07	
	20:57	20:07	18:43	29 17:55 (3)	17:14	9 16:42 (4)	15:48	14:48	
2	02:28	03:24	04:35	17:27 (3)	05:44	16:34 (4)	06:58	08:09	
	20:56	20:04	18:40	28 17:55 (3)	17:12	5 16:39 (4)	15:45	14:47	
3	02:29	03:26	04:38	17:27 (3)	05:46		07:01	08:10	
	20:56	20:02	18:37	27 17:54 (3)	17:09		15:43	14:46	
4	02:30	03:28	04:40	17:27 (3)	05:49		07:03	08:12	
	20:55	20:00	18:34	26 17:53 (3)	17:06		15:40	14:45	
5	02:31	03:31	04:42	17:27 (3)	05:51		07:06	08:14	
	20:54	19:57	18:32	25 17:52 (3)	17:03		15:38	14:44	
6	02:33	03:33	04:45	17:27 (3)	05:53		07:08	08:16	
	20:53	19:55	18:29	23 17:50 (3)	17:00		15:36	14:43	
7	02:34	03:35	04:47	17:29 (3)	05:56		07:11	08:18	
	20:52	19:52	18:26	20 17:49 (3)	16:57		15:33	14:42	
8	02:35	03:38	04:49	17:30 (3)	05:58		07:13	08:19	
	20:51	19:50	18:23	17 17:47 (3)	16:54		15:31	14:41	
9	02:37	03:40	04:51	17:32 (3)	06:00		07:16	08:21	
	20:50	19:47	18:20	12 17:44 (3)	16:51		15:28	14:40	
10	02:38	03:42	04:54		06:03		15:19 (5)	07:18	08:22
	20:48	19:44	18:17		16:48	11 15:30 (5)	15:26	14:40	
11	02:40	03:45	04:56		06:05		15:17 (5)	07:21	08:24
	20:47	19:42	18:14		16:45	16 15:33 (5)	15:24	14:39	
12	02:42	03:47	04:58		06:07		15:15 (5)	07:23	08:25
	20:46	19:39	18:11		16:42	19 15:34 (5)	15:22	14:39	
13	02:43	03:49	05:01		06:10		15:14 (5)	07:26	08:26
	20:44	19:37	18:08		16:40	21 15:35 (5)	15:19	14:39	
14	02:45	03:52	05:03		06:12		15:12 (5)	07:28	08:28
	20:43	19:34	18:05		16:37	23 15:35 (5)	15:17	14:38	
15	02:47	03:54	05:05		06:14		15:12 (5)	07:30	08:29
	20:41	19:31	18:02		16:34	24 15:36 (5)	15:15	14:38	
16	02:49	03:56	05:07		06:17		15:11 (5)	07:33	08:30
	20:40	19:28	17:59		16:31	25 15:36 (5)	15:13	14:38	
17	02:50	03:59	05:10		06:19		15:11 (5)	07:35	08:31
	20:38	19:26	17:56		16:28	25 15:36 (5)	15:11	14:38	
18	02:52	04:01	05:12		06:22		15:10 (5)	07:38	08:32
	20:36	19:23	17:53		16:25	25 15:35 (5)	15:09	14:38	
19	02:54	04:03	05:14		06:24		15:10 (5)	07:40	08:33
	20:34	19:20	17:50		16:23	26 15:36 (5)	15:07	14:38	
20	02:56	04:05	05:16		16:40 (4)	06:26	15:11 (5)	07:42	08:33
	20:32	19:17	17:47	6 16:46 (4)	16:20	25 15:36 (5)	15:05	14:39	
21	02:58	04:08	05:19		16:37 (4)	06:29	15:10 (5)	07:45	08:34
	20:31	19:15	17:44	12 16:49 (4)	16:17	24 15:34 (5)	15:03	14:39	
22	03:00	04:10	17:39 (3)	05:21	16:35 (4)	06:31	15:11 (5)	07:47	08:35
	20:29	19:12	10 17:49 (3)	17:41	15 16:50 (4)	16:14	23 15:34 (5)	15:02	14:39
23	03:02	04:12	17:36 (3)	05:23	16:33 (4)	06:34	15:11 (5)	07:49	08:35
	20:27	19:09	16 17:52 (3)	17:38	17 16:50 (4)	16:12	21 15:32 (5)	15:00	14:40
24	03:04	04:15	17:34 (3)	05:26	16:32 (4)	06:36	15:13 (5)	07:52	08:35
	20:25	19:06	19 17:53 (3)	17:35	19 16:51 (4)	16:09	18 15:31 (5)	14:58	14:41
25	03:06	04:17	17:32 (3)	05:28	16:31 (4)	06:39	15:15 (5)	07:54	08:36
	20:23	19:03	22 17:54 (3)	17:32	20 16:51 (4)	16:06	14 15:29 (5)	14:57	14:41
26	03:09	04:19	17:30 (3)	05:30	16:31 (4)	06:41	15:17 (5)	07:56	08:36
	20:20	19:01	24 17:54 (3)	17:29	20 16:51 (4)	16:04	9 15:26 (5)	14:55	14:42
27	03:11	04:22	17:30 (3)	05:32	16:30 (4)	06:43		07:58	08:36
	20:18	18:58	26 17:56 (3)	17:26	20 16:50 (4)	16:01		14:53	14:43
28	03:13	04:24	17:29 (3)	05:35	16:31 (4)	06:46		08:00	08:36
	20:16	18:55	27 17:56 (3)	17:23	19 16:50 (4)	15:58		14:52	14:44
29	03:15	04:26	17:28 (3)	05:37	16:31 (4)	06:48		08:03	08:36
	20:14	18:52	28 17:56 (3)	17:20	17 16:48 (4)	15:56		14:51	14:45
30	03:17	04:29	17:27 (3)	05:39	16:31 (4)	06:51		08:05	08:36
	20:12	18:49	28 17:55 (3)	17:17	13 16:44 (4)	15:53		14:49	14:46
31	03:19	04:31	17:27 (3)			06:53			08:36
	20:09	18:46	28 17:55 (3)			15:50			14:47
Potential sun hours	551	481	387		318		232	194	
Total, worst case		228	385	363					
Sun reduction		0.24	0.26	0.28					
Oper. time red.		0.93	0.93	0.93					
Wind dir. red.		0.63	0.59	0.52					
Total reduction		0.14	0.14	0.14					
Total, real		32	55	49					

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: Gismarvik

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Calculated: 15.08.2011 09:56/2.7.486



SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CY - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (307)

Assumptions for shadow calculations

Maximum distance for influence 1 500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30
Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for specific times of day (e.g., 08:35, 14:49) and summary statistics (Potential sun hours, Total, worst case, etc.).

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

Matrix with 2 rows and 4 columns: Day in month, Sun rise (hh:mm), Sun set (hh:mm), Minutes with flicker, First time (hh:mm) with flicker, Last time (hh:mm) with flicker, (WTG causing flicker first time), (WTG causing flicker last time)



Project:

Gismarvik

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15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CZ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (308)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1281 1143 697 478 515 675 1091 8182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35	07:51	06:38	05:08	17:01 (5)	03:43
	14:49	15:54	17:05	18:19	8 17:09 (5)	11 18:55 (2)
2	08:35	07:49	06:36	05:05		18:44 (2)
	14:50	15:57	17:08	18:22		18:44 (2)
3	08:34	07:46	06:33	05:02	17:50 (4)	14 18:58 (2)
	14:52	16:00	17:10	18:24	3 17:53 (4)	15 19:00 (2)
4	08:34	07:44	06:30	04:59	17:48 (4)	18:44 (2)
	14:53	16:02	17:13	18:27	7 17:55 (4)	18 19:02 (2)
5	08:33	07:42	06:27	04:56	17:47 (4)	18:45 (2)
	14:55	16:05	17:15	18:29	10 17:57 (4)	19 19:04 (3)
6	08:33	07:39	06:24	04:53	17:47 (4)	18:45 (2)
	14:57	16:07	17:18	18:31	13 18:00 (4)	22 19:07 (3)
7	08:32	07:37	06:21	04:50	17:46 (4)	18:45 (2)
	14:58	16:10	17:20	18:34	17 18:03 (4)	23 19:08 (3)
8	08:31	07:35	06:18	04:47	17:46 (4)	18:46 (2)
	15:00	16:12	17:22	18:36	19 18:05 (4)	24 19:10 (3)
9	08:30	07:32	06:15	04:44	17:46 (4)	18:47 (3)
	15:02	16:15	17:25	18:38	19 18:05 (4)	26 19:13 (3)
10	08:29	07:30	06:13	04:41	17:46 (4)	18:47 (3)
	15:04	16:17	17:27	18:41	18 18:04 (4)	26 19:13 (3)
11	08:28	07:27	06:10	04:38	17:46 (4)	18:47 (3)
	15:06	16:20	17:30	18:43	17 18:03 (4)	26 19:13 (3)
12	08:27	07:25	06:07	04:36	17:47 (4)	18:46 (3)
	15:08	16:23	17:32	18:46	16 18:03 (4)	26 19:12 (3)
13	08:25	07:22	06:04	04:33	17:49 (4)	18:46 (3)
	15:10	16:25	17:34	18:48	12 18:01 (4)	26 19:12 (3)
14	08:24	07:19	06:01	04:30	17:51 (4)	18:47 (3)
	15:12	16:28	17:37	18:50	6 17:57 (4)	25 19:12 (3)
15	08:23	07:17	05:58	17:05 (5)	04:27	18:47 (3)
	15:14	16:30	17:39	4 17:09 (5)	18:53	24 19:11 (3)
16	08:21	07:14	05:55	17:02 (5)	04:24	18:47 (3)
	15:16	16:33	17:42	10 17:12 (5)	18:55	24 19:11 (3)
17	08:20	07:11	05:52	17:00 (5)	04:21	18:48 (3)
	15:18	16:35	17:44	14 17:14 (5)	18:57	22 19:10 (3)
18	08:18	07:09	05:49	16:58 (5)	04:18	18:49 (3)
	15:21	16:38	17:46	18 17:16 (5)	19:00	22 19:11 (3)
19	08:16	07:06	05:46	16:57 (5)	04:15	18:50 (3)
	15:23	16:40	17:49	22 17:19 (5)	19:02	20 19:10 (3)
20	08:15	07:03	05:43	16:56 (5)	04:13	18:50 (3)
	15:25	16:43	17:51	25 17:21 (5)	19:05	19 19:09 (3)
21	08:13	07:01	05:40	16:55 (5)	04:10	18:51 (3)
	15:27	16:45	17:53	28 17:23 (5)	19:07	17 19:08 (3)
22	08:11	06:58	05:37	16:54 (5)	04:07	18:53 (3)
	15:30	16:48	17:56	29 17:23 (5)	19:09	14 19:07 (3)
23	08:09	06:55	05:34	16:54 (5)	04:04	18:54 (3)
	15:32	16:50	17:58	28 17:22 (5)	19:12	12 19:06 (3)
24	08:08	06:52	05:31	16:54 (5)	04:01	18:56 (3)
	15:35	16:53	18:01	28 17:22 (5)	19:14	8 19:04 (3)
25	08:06	06:50	05:28	16:54 (5)	03:59	18:53 (3)
	15:37	16:55	18:03	28 17:22 (5)	19:17	18:53 (3)
26	08:04	06:47	05:25	16:54 (5)	03:56	18:53 (3)
	15:39	16:58	18:05	27 17:21 (5)	19:19	18:53 (3)
27	08:02	06:44	05:23	16:54 (5)	03:53	18:53 (3)
	15:42	17:00	18:08	26 17:20 (5)	19:21	18:53 (3)
28	08:00	06:41	05:20	16:54 (5)	03:51	18:53 (3)
	15:44	17:03	18:10	25 17:19 (5)	19:24	18:49 (2)
29	07:57		05:17	16:55 (5)	03:48	18:45 (2)
	15:47		18:12	22 17:17 (5)	19:26	18:45 (2)
30	07:55		05:14	16:56 (5)	03:45	18:45 (2)
	15:49		18:15	19 17:15 (5)	19:29	18:45 (2)
31	07:53		05:11	16:58 (5)		18:54 (2)
	15:52		18:17	15 17:13 (5)		20:35
Potential sun hours	216	257	365	434	526	554
Total, worst case			368	182	483	
Sun reduction			0.28	0.30	0.35	
Oper. time red.			0.93	0.93	0.93	
Wind dir. red.			0.57	0.64	0.72	
Total reduction			0.15	0.18	0.23	
Total, real			54	33	113	

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:

Gismarvik

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**Kjeller Vindteknikk AS**  
Gunnar Randres vei 12  
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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: CZ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (308)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27 20:57	03:22 19:07 (3)	18:57 (3) 04:33	17:45 (4) 05:42	06:56 08:07	08:07
2	02:28 20:56	03:24 19:04 (3)	18:57 (3) 04:35	17:44 (4) 05:44	06:58 08:09	08:09
3	02:29 20:56	03:26 19:02 (3)	18:57 (3) 04:38	17:44 (4) 05:46	07:01 08:10	08:10
4	02:30 20:55	03:29 19:00 (3)	18:57 (3) 04:40	17:43 (4) 05:49	07:03 08:12	08:12
5	02:31 20:54	03:31 18:57 (2)	18:56 (2) 04:42	17:42 (4) 05:51	07:06 08:14	08:14
6	02:33 20:53	03:33 19:55	18:55 (2) 04:45	17:42 (4) 05:53	07:08 08:16	08:16
7	02:34 20:52	03:35 19:52	18:54 (2) 04:47	17:43 (4) 05:56	07:11 08:18	08:18
8	02:35 20:51	03:38 19:50	18:54 (2) 04:49	17:43 (4) 05:58	07:13 08:19	08:19
9	02:37 20:50	03:40 19:47	18:53 (2) 04:51	17:44 (4) 06:00	07:16 08:21	08:21
10	02:38 20:48	03:42 19:44	18:53 (2) 04:54	17:44 (4) 06:03	07:18 08:22	08:22
11	02:40 20:47	03:45 19:42	18:53 (2) 04:56	16:54 (5) 06:05	07:21 08:24	08:24
12	02:42 20:46	03:47 19:39	18:53 (2) 04:58	17:01 (5) 06:07	07:23 08:25	08:25
13	02:43 20:44	03:49 19:37	18:52 (2) 05:01	17:04 (5) 06:10	07:26 08:26	08:26
14	02:45 20:43	03:52 19:34	19:01 (2) 18:08	17:07 (5) 06:12	07:28 08:28	08:28
15	02:47 20:41	03:54 19:31	18:59 (2) 18:05	17:07 (5) 06:13	07:28 08:28	08:28
16	02:49 20:40	03:56 19:28	18:55 (2) 05:05	16:44 (5) 06:14	07:30 08:29	08:29
17	02:50 20:38	03:59 19:26	18:02 18:02	17:08 (5) 06:14	07:30 08:29	08:29
18	02:52 20:36	04:01 19:23	05:07 05:07	16:43 (5) 06:17	07:33 08:30	08:30
19	02:54 20:34	04:03 19:20	17:59 17:59	16:42 (5) 06:19	07:35 08:31	08:31
20	02:56 20:32	04:06 19:15 (3)	17:56 17:56	16:42 (5) 06:19	07:35 08:31	08:31
21	02:58 20:31	04:08 19:13 (3)	17:55 17:55	16:42 (5) 06:19	07:35 08:31	08:31
22	03:00 20:29	04:10 19:11 (3)	17:54 17:54	16:42 (5) 06:19	07:35 08:31	08:31
23	03:02 20:27	04:12 19:09 (3)	17:53 17:53	16:42 (5) 06:19	07:35 08:31	08:31
24	03:04 20:25	04:15 19:07 (3)	17:52 17:52	16:42 (5) 06:19	07:35 08:31	08:31
25	03:06 20:22	04:17 19:05 (3)	17:51 17:51	16:42 (5) 06:19	07:35 08:31	08:31
26	03:09 20:20	04:19 19:03 (3)	17:50 17:50	16:42 (5) 06:19	07:35 08:31	08:31
27	03:11 20:18	04:22 19:01 (3)	17:49 17:49	16:42 (5) 06:19	07:35 08:31	08:31
28	03:13 20:16	04:24 18:59 (3)	17:48 17:48	16:42 (5) 06:19	07:35 08:31	08:31
29	03:15 20:14	04:26 18:57 (3)	17:47 17:47	16:42 (5) 06:19	07:35 08:31	08:31
30	03:17 20:11	04:29 18:55 (3)	17:46 17:46	16:42 (5) 06:19	07:35 08:31	08:31
31	03:19 20:09	04:31 18:53 (3)	17:45 17:45	16:42 (5) 06:19	07:35 08:31	08:31
Potential sun hours	551	481	387	318	232	194
Total, worst case	244	293	504			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.72	0.71	0.58			
Total reduction	0.17	0.16	0.14			
Total, real	42	46	71			

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)

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Calculated:

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## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DA - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (309)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	17:43 (4) 17:49 (4)	03:43 19:31
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	17:42 (4) 17:51 (4)	03:40 19:33
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	17:41 (4) 17:53 (4)	03:37 19:36
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	17:40 (4) 17:55 (4)	03:35 19:38
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	17:39 (4) 17:57 (4)	03:32 19:41
6	08:33 14:57	07:39 16:07	06:24 17:18	04:53 18:31	17:40 (4) 18:00 (4)	03:30 19:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	17:40 (4) 17:59 (4)	03:27 19:45
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	17:40 (4) 17:58 (4)	03:25 19:48
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	17:41 (4) 17:57 (4)	03:22 19:50
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	17:42 (4) 17:55 (4)	03:20 19:52
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	17:43 (4) 17:53 (4)	03:17 19:55
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 17:02 (5)	03:15 19:57	19:03 (3)
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 17:04 (5)	03:12 19:59	18:40 (3)
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 17:07 (5)	03:10 20:02	18:40 (3)
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 17:09 (5)	03:08 20:04	18:41 (3)
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 17:12 (5)	03:06 20:06	18:42 (3)
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 17:14 (5)	03:03 20:08	18:43 (3)
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 17:15 (5)	03:01 20:11	18:45 (3)
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 17:15 (5)	02:59 20:13	18:47 (3)
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 17:14 (5)	02:57 20:15	18:49 (3)
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 17:14 (5)	02:55 20:17	18:55 (3)
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 17:13 (5)	02:53 20:19	18:55 (3)
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 17:12 (5)	02:51 20:21	18:55 (3)
24	08:08 15:35	06:52 16:53	05:31 18:01	04:01 17:11 (5)	02:49 20:23	18:55 (3)
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 17:10 (5)	02:47 20:25	18:55 (3)
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 17:08 (5)	02:45 18:41 (2)	18:45 (2)
27	08:02 15:42	06:44 17:00	05:23 18:08	03:53 17:06 (5)	02:44 18:40 (2)	18:47 (2)
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 17:03 (5)	02:42 18:40 (2)	18:49 (2)
29	07:57 15:47	06:38 17:05	05:17 18:12	03:48 17:02 (5)	02:40 18:39 (2)	18:49 (2)
30	07:55 15:49	06:35 17:07	05:14 18:15	03:45 17:01 (5)	02:39 18:38 (2)	18:51 (2)
31	07:53 15:52	06:32 17:09	05:11 18:17	17:45 (4) 17:46 (4)	02:37 20:37	18:54 (2)
Potential sun hours	216	257	365	434	526	554
Total, worst case			365	203		417
Sun reduction			0.28	0.30		0.35
Oper. time red.			0.93	0.93		0.93
Wind dir. red.			0.55	0.65		0.71
Total reduction			0.14	0.18		0.23
Total, real			52	37		96

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

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

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#### Assumptions for shadow calculations

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Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27 20:57	03:22 20:07	18:50 (3) 19:15 (3)	04:33 18:43	17:42 (4) 17:52 (4)	05:42 17:14
2	02:28 20:56	03:24 20:04	18:50 (3) 19:15 (3)	04:35 18:40	17:41 (4) 17:54 (4)	05:44 17:12
3	02:29 20:56	03:26 20:02	18:49 (3) 19:15 (3)	04:38 18:37	17:39 (4) 17:55 (4)	05:46 17:09
4	02:30 20:55	03:29 20:00	18:49 (3) 19:15 (3)	04:40 18:34	17:37 (4) 17:55 (4)	05:49 17:06
5	02:31 20:54	03:31 19:57	18:49 (3) 19:15 (3)	04:42 18:31	17:36 (4) 17:55 (4)	05:51 17:03
6	02:33 20:53	03:33 19:55	18:49 (3) 19:15 (3)	04:45 18:29	17:35 (4) 17:55 (4)	05:53 17:00
7	02:34 20:52	03:35 19:52	18:49 (3) 19:15 (3)	04:47 18:26	17:36 (4) 17:54 (4)	05:56 16:57
8	02:35 20:51	03:38 19:50	18:49 (2) 19:13 (3)	04:49 18:23	17:35 (4) 17:51 (4)	05:58 16:54
9	02:37 20:50	03:40 19:47	18:48 (2) 19:10 (3)	04:51 18:20	17:35 (4) 17:47 (4)	06:00 16:51
10	02:38 20:48	03:42 19:44	18:48 (2) 19:08 (3)	04:54 18:17	17:35 (4) 17:44 (4)	06:03 16:48
11	02:40 20:47	03:45 19:42	18:47 (2) 19:05 (2)	04:56 18:14	17:35 (4) 17:41 (4)	06:05 16:45
12	02:42 20:46	03:47 19:39	18:47 (2) 19:03 (2)	04:58 18:11	17:36 (4) 17:38 (4)	06:07 16:42
13	02:43 20:44	03:49 19:37	18:47 (2) 19:01 (2)	05:01 18:08	06:10 16:40	06:08 16:40
14	02:45 20:43	03:52 19:34	18:47 (2) 18:59 (2)	05:03 18:05	06:12 16:37	06:08 16:37
15	02:47 20:41	03:54 19:31	18:47 (2) 18:56 (2)	05:05 18:02	16:42 (5) 16:52 (5)	06:14 16:34
16	02:49 20:40	03:56 19:28	18:47 (2) 18:53 (2)	05:07 17:59	16:38 (5) 16:54 (5)	06:17 16:31
17	02:50 20:38	03:59 19:26	18:48 (2) 18:51 (2)	05:10 17:56	16:37 (5) 16:57 (5)	06:19 16:28
18	02:52 20:36	04:01 19:23	05:12 17:53	06:22 16:25	16:35 (5) 16:57 (5)	06:22 16:25
19	02:54 20:34	04:03 19:20	05:14 17:50	06:24 16:23	16:33 (5) 16:58 (5)	06:24 16:23
20	02:56 20:32	04:06 19:17	05:16 17:47	06:26 16:20	16:32 (5) 16:58 (5)	06:26 16:20
21	02:58 20:31	04:08 19:15	05:19 17:44	06:29 16:17	16:32 (5) 16:59 (5)	06:29 16:17
22	03:00 20:29	04:10 19:12	05:21 17:41	06:31 16:14	16:31 (5) 16:59 (5)	06:31 16:14
23	03:02 20:27	04:12 19:09	05:23 17:38	06:34 16:12	16:30 (5) 16:58 (5)	06:34 16:12
24	03:04 20:25	18:58 (3) 19:06 (3)	04:15 19:06	05:26 17:35	16:29 (5) 16:57 (5)	06:36 16:09
25	03:06 20:22	18:56 (3) 19:09 (3)	04:17 19:03	05:28 17:32	16:30 (5) 16:58 (5)	06:39 16:06
26	03:09 20:20	18:55 (3) 19:10 (3)	04:19 19:01	05:30 17:29	16:29 (5) 16:57 (5)	06:41 16:04
27	03:11 20:18	18:54 (3) 19:11 (3)	04:22 18:58	05:32 17:26	16:29 (5) 16:53 (5)	06:43 16:01
28	03:13 20:16	18:53 (3) 19:12 (3)	04:24 18:55	05:35 17:23	16:30 (5) 16:51 (5)	06:46 15:58
29	03:15 20:14	18:52 (3) 19:13 (3)	04:26 18:52	05:37 17:20	16:31 (5) 16:48 (5)	06:48 15:56
30	03:17 20:11	18:51 (3) 19:14 (3)	04:29 18:49	05:39 17:17	16:32 (5) 16:44 (5)	06:51 15:53
31	03:19 20:09	18:51 (3) 19:14 (3)	04:31 18:46	05:41 17:15	16:33 (5) 16:45 (5)	06:53 15:50
Potential sun hours	551	481	387	318	232	194
Total, worst case	139	324	519	11		
Sun reduction	0.26	0.24	0.26	0.28		
Oper. time red.	0.93	0.93	0.93	0.93		
Wind dir. red.	0.71	0.71	0.57	0.55		
Total reduction	0.17	0.16	0.14	0.14		
Total, real	24	51	72	2		

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:

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### Assumptions for shadow calculations

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Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	
1	08:35	07:51	06:38	05:08	17:47 (5)	03:43	
	14:49	15:54	17:05	18:19	2	17:49 (5)	19:31
2	08:35	07:49	06:36	05:05	17:45 (5)	03:40	
	14:50	15:57	17:08	18:22	6	17:51 (5)	19:33
3	08:34	07:46	06:33	05:02	17:43 (5)	03:37	
	14:52	16:00	17:10	18:24	10	17:53 (5)	19:36
4	08:34	07:44	06:30	04:59	17:42 (5)	03:35	
	14:53	16:02	17:13	18:27	13	17:55 (5)	19:38
5	08:33	07:42	06:27	04:56	17:41 (5)	03:32	
	14:55	16:05	17:15	18:29	16	17:57 (5)	19:41
6	08:32	07:39	06:24	04:53	17:41 (5)	03:30	
	14:57	16:07	17:18	18:31	19	18:00 (5)	19:43
7	08:32	07:37	06:21	04:50	17:40 (5)	03:27	
	14:58	16:10	17:20	18:34	23	18:03 (5)	19:45
8	08:31	07:35	06:18	04:47	17:40 (5)	03:25	
	15:00	16:12	17:22	18:36	25	18:05 (5)	19:48
9	08:30	07:32	06:15	04:44	17:39 (5)	03:22	
	15:02	16:15	17:25	18:38	28	18:07 (5)	19:50
10	08:29	07:30	06:13	04:41	17:39 (5)	03:20	
	15:04	16:17	17:27	18:41	28	18:07 (5)	19:52
11	08:28	07:27	06:10	04:38	17:39 (5)	03:17	
	15:06	16:20	17:30	18:43	27	18:06 (5)	19:55
12	08:27	07:25	06:07	04:36	17:40 (5)	03:15	
	15:08	16:23	17:32	18:46	26	18:06 (5)	19:57
13	08:25	07:22	06:04	04:33	17:41 (5)	03:12	
	15:10	16:25	17:34	18:48	24	18:05 (5)	19:59
14	08:24	07:19	06:01	04:30	17:41 (5)	03:10	
	15:12	16:28	17:37	18:50	22	18:03 (5)	20:02
15	08:23	07:17	05:58	04:27	17:42 (5)	03:08	
	15:14	16:30	17:39	18:53	19	18:01 (5)	20:04
16	08:21	07:14	05:55	04:24	17:44 (5)	03:06	
	15:16	16:33	17:42	18:55	18	18:22 (4)	20:06
17	08:20	07:11	05:52	04:21	17:47 (5)	03:03	
	15:18	16:35	17:44	18:57	16	18:25 (4)	20:08
18	08:18	07:09	05:49	04:18	18:18 (4)	03:01	
	15:21	16:38	17:46	19:00	9	18:27 (4)	20:11
19	08:16	07:06	05:46	04:15	18:18 (4)	02:59	
	15:23	16:40	17:49	19:02	11	18:29 (4)	20:13
20	08:15	07:03	05:43	04:13	18:18 (4)	02:57	
	15:25	16:43	17:51	19:05	14	18:32 (4)	20:15
21	08:13	07:01	05:40	04:10	18:18 (4)	02:55	
	15:27	16:45	17:53	19:07	16	18:34 (4)	20:17
22	08:11	06:58	05:37	04:07	18:18 (4)	02:53	
	15:30	16:48	17:56	19:09	17	18:35 (4)	20:19
23	08:09	06:55	05:34	04:04	18:20 (4)	02:51	
	15:32	16:50	17:58	19:12	14	18:34 (4)	20:21
24	08:08	06:52	05:31	04:01	18:21 (4)	02:49	
	15:35	16:53	18:01	19:14	11	18:32 (4)	20:23
25	08:06	06:50	05:28	03:59	18:23 (4)	02:47	
	15:37	16:55	18:03	19:17	6	18:29 (4)	20:25
26	08:04	06:47	05:25	03:56		02:45	
	15:39	16:58	18:05	19:19		19:26 (3)	02:23
27	08:02	06:44	05:23	03:53		02:44	
	15:42	17:00	18:08	19:21		19:47 (3)	02:29
28	08:00	06:41	05:20	03:51		02:42	
	15:44	17:03	18:10	19:24		19:49 (3)	02:25
29	07:57		05:17	03:48		02:40	
	15:47		18:12	19:26		19:27 (3)	02:25
30	07:55		05:14	03:45		02:39	
	15:49		18:15	19:29		19:49 (3)	02:26
31	07:53		05:11			02:37	
	15:52		18:17			19:28 (3)	
Potential sun hours	216	257	365	434	526	554	
Total, worst case				420	304		336
Sun reduction				0.30	0.35		0.30
Oper. time red.				0.93	0.93		0.93
Wind dir. red.				0.65	0.74		0.74
Total reduction				0.18	0.24		0.21
Total, real				76	73		70

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DB - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (310)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	19:38 (3) 03:22	19:24 (2) 04:33	17:38 (5) 05:42	06:56	08:07
	20:57	19:50 (3) 20:07	19:29 (2) 18:43	18:05 (5) 17:14	15:48	14:48
2	02:28	19:38 (3) 03:24	19:24 (2) 04:36	17:38 (5) 05:44	06:58	08:08
	20:56	19:51 (3) 20:04	19:27 (2) 18:40	18:06 (5) 17:12	15:45	14:47
3	02:29	19:38 (3) 03:26	19:24 (2) 04:38	17:37 (5) 05:46	07:01	08:10
	20:56	19:52 (3) 20:02	18:37	18:05 (5) 17:09	15:43	14:46
4	02:30	19:38 (3) 03:29	19:24 (2) 04:40	17:37 (5) 05:49	07:03	08:12
	20:55	19:53 (3) 20:00	18:34	18:02 (5) 17:06	15:40	14:45
5	02:32	19:37 (3) 03:31	19:24 (2) 04:42	17:36 (5) 05:51	07:06	08:14
	20:54	19:53 (3) 19:57	18:31	17:59 (5) 17:03	15:38	14:44
6	02:33	19:37 (3) 03:33	19:24 (2) 04:45	17:36 (5) 05:53	07:08	08:16
	20:53	19:54 (3) 19:55	18:29	17:56 (5) 17:00	15:36	14:43
7	02:34	19:37 (3) 03:35	19:24 (2) 04:47	17:37 (5) 05:56	07:11	08:18
	20:52	19:55 (3) 19:52	18:26	17:54 (5) 16:57	15:33	14:42
8	02:35	19:37 (3) 03:38	19:24 (2) 04:49	17:37 (5) 05:58	07:13	08:19
	20:51	19:55 (3) 19:50	18:23	17:51 (5) 16:54	15:31	14:41
9	02:37	19:36 (3) 03:40	19:24 (2) 04:51	17:37 (5) 06:00	07:16	08:21
	20:50	19:56 (3) 19:47	18:20	17:47 (5) 16:51	15:28	14:40
10	02:38	19:36 (3) 03:42	19:24 (2) 04:54	17:38 (5) 06:03	07:18	08:22
	20:48	19:56 (3) 19:44	18:17	17:44 (5) 16:48	15:26	14:40
11	02:40	19:36 (3) 03:45	19:24 (2) 04:56	17:39 (5) 06:05	07:21	08:24
	20:47	19:57 (3) 19:42	18:14	17:41 (5) 16:45	15:24	14:39
12	02:42	19:36 (3) 03:47	19:24 (2) 04:58	17:39 (5) 06:07	07:23	08:25
	20:46	19:57 (3) 19:39	18:11	16:42	15:22	14:39
13	02:43	19:36 (3) 03:49	19:24 (2) 05:01	16:40	15:20	14:39
	20:44	19:58 (3) 19:37	18:08	16:40	15:20	14:39
14	02:45	19:36 (3) 03:52	19:24 (2) 05:03	16:37	15:17	14:38
	20:43	19:58 (3) 19:34	18:05	16:37	15:17	14:38
15	02:47	19:36 (3) 03:54	19:24 (2) 05:05	16:34	15:15	14:38
	20:41	19:58 (3) 19:31	18:02	16:34	15:15	14:38
16	02:49	19:35 (3) 03:56	19:24 (2) 05:07	16:31	15:13	14:38
	20:40	19:56 (3) 19:28	17:59	16:31	15:13	14:38
17	02:50	19:36 (3) 03:59	19:24 (2) 05:10	16:28	15:11	14:38
	20:38	19:55 (3) 19:26	17:56	16:28	15:11	14:38
18	02:52	19:36 (3) 04:01	18:29 (4) 05:12	16:25	15:09	14:38
	20:36	19:54 (3) 19:23	18:36 (4) 17:53	16:25	15:09	14:38
19	02:54	19:35 (3) 04:03	18:26 (4) 05:14	16:23	15:07	14:38
	20:34	19:52 (3) 19:20	18:38 (4) 17:50	16:23	15:07	14:38
20	02:56	19:36 (3) 04:06	18:25 (4) 05:16	16:20	15:05	14:39
	20:32	19:51 (3) 19:17	18:40 (4) 17:47	16:20	15:05	14:39
21	02:58	19:36 (3) 04:08	18:24 (4) 05:19	16:17	15:03	14:39
	20:31	19:49 (3) 19:15	18:40 (4) 17:44	16:17	15:03	14:39
22	03:00	19:36 (3) 04:10	18:23 (4) 05:21	16:14	15:02	14:39
	20:29	19:47 (3) 19:12	18:38 (4) 17:41	16:14	15:02	14:39
23	03:02	19:31 (2) 04:12	18:22 (4) 05:23	16:11	15:00	14:40
	20:27	19:45 (3) 19:09	18:35 (4) 17:38	16:12	15:00	14:40
24	03:04	19:28 (2) 04:15	18:21 (4) 05:26	16:09	14:58	14:41
	20:25	19:44 (3) 19:06	18:32 (4) 17:35	16:09	14:58	14:41
25	03:06	19:27 (2) 04:17	18:21 (4) 05:28	16:06	14:57	14:41
	20:22	19:42 (3) 19:03	18:29 (4) 17:32	16:06	14:57	14:41
26	03:09	19:26 (2) 04:19	17:48 (5) 05:30	16:04	14:55	14:42
	20:20	19:40 (3) 19:00	18:27 (4) 17:29	16:04	14:55	14:42
27	03:11	19:25 (2) 04:22	17:46 (5) 05:32	16:01	14:53	14:43
	20:18	19:38 (2) 18:58	18:25 (4) 17:26	16:01	14:53	14:43
28	03:13	19:25 (2) 04:24	17:44 (5) 05:35	16:00	14:52	14:44
	20:16	19:37 (2) 18:55	18:03 (5) 17:23	15:58	14:52	14:44
29	03:15	19:24 (2) 04:26	17:42 (5) 05:37	15:56	14:51	14:45
	20:14	19:35 (2) 18:52	18:04 (5) 17:20	15:56	14:51	14:45
30	03:17	19:24 (2) 04:29	17:40 (5) 05:39	15:53	14:49	14:46
	20:11	19:33 (2) 18:49	18:04 (5) 17:17	15:53	14:49	14:46
31	03:19	19:24 (2) 04:31	17:39 (5) 05:41	15:51	14:47	14:47
	20:09	19:31 (2) 18:46	18:05 (5) 17:14	15:51	14:47	14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	492	234	200			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.74	0.66	0.64			
Total reduction	0.18	0.15	0.15			
Total, real	88	34	31			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DC - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (311)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	17:20 (5) 17:47 (5)	03:43 19:31
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	17:19 (5) 17:47 (5)	03:40 19:33
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	17:18 (5) 17:47 (5)	03:37 19:36
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	17:18 (5) 17:46 (5)	03:35 19:38
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	17:18 (5) 17:46 (5)	03:32 19:41
6	08:32 14:57	07:39 16:07	06:24 17:18	04:53 18:31	17:19 (5) 17:46 (5)	03:30 19:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	17:19 (5) 17:45 (5)	03:27 19:45
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	17:20 (5) 17:43 (5)	03:25 19:48
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	17:21 (5) 17:42 (5)	03:22 19:50
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	17:22 (5) 18:09 (4)	03:20 19:52
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	17:24 (5) 18:11 (4)	03:17 19:55
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	17:28 (5) 18:14 (4)	03:15 19:57
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	18:05 (4) 18:16 (4)	03:12 19:59
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	18:04 (4) 18:18 (4)	03:10 20:02
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	18:03 (4) 18:20 (4)	03:08 20:04
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	18:03 (4) 18:22 (4)	03:06 20:06
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	18:04 (4) 18:22 (4)	03:03 20:08
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	18:04 (4) 18:21 (4)	03:01 20:11
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	18:04 (4) 18:20 (4)	02:59 20:13
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	18:06 (4) 18:19 (4)	02:57 20:15
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	18:07 (4) 18:17 (4)	02:55 20:17
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	02:53 20:19	20:19
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	02:51 20:21	20:21
24	08:08 15:35	06:52 16:53	05:31 18:01	04:01 19:14	02:49 20:23	20:23
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	02:47 20:25	20:25
26	08:04 15:39	06:47 16:58	05:25 18:05	17:29 (5) 18:05	03:56 17:35 (5)	02:45 19:19
27	08:02 15:42	06:44 17:00	05:23 18:08	17:26 (5) 17:37 (5)	03:53 19:21	02:44 20:29
28	08:00 15:44	06:41 17:03	05:20 18:10	17:24 (5) 17:40 (5)	03:51 19:24	02:42 20:31
29	07:57 15:47	06:38 17:05	05:17 18:12	17:23 (5) 17:42 (5)	03:48 19:26	02:40 20:33
30	07:55 15:49	06:35 17:02	05:14 18:15	17:21 (5) 17:44 (5)	03:45 19:29	02:39 20:35
31	07:53 15:52	06:32 17:00	05:11 18:17	17:20 (5) 17:46 (5)	03:43 19:31	02:37 20:37
Potential sun hours	216	257	365	434	526	554
Total, worst case			101	424	511	105
Sun reduction			0.28	0.30	0.35	0.30
Oper. time red.			0.93	0.93	0.93	0.93
Wind dir. red.			0.61	0.63	0.73	0.74
Total reduction			0.16	0.18	0.24	0.21
Total, real			16	75	122	22

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DC - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (311)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	03:22	19:11 (2) 04:33	17:22 (5) 05:42	06:56	08:07
	20:57	20:07	19:29 (3) 18:43	18:10 (4) 17:14	15:48	14:48
2	02:28	03:24	19:11 (2) 04:35	17:21 (5) 05:44	06:58	08:09
	20:56	20:04	19:27 (2) 18:40	18:08 (4) 17:12	15:45	14:47
3	02:29	03:26	19:11 (2) 04:38	17:19 (5) 05:46	07:01	08:10
	20:56	20:02	19:24 (2) 18:37	17:40 (5) 17:09	15:43	14:46
4	02:30	19:26 (3) 03:29	19:10 (2) 04:40	17:17 (5) 05:49	07:03	08:12
	20:55	5 19:31 (3) 20:00	12 19:22 (2) 18:34	23 17:40 (5) 17:06	15:40	14:45
5	02:32	19:25 (3) 03:31	19:10 (2) 04:42	17:15 (5) 05:51	07:06	08:14
	20:54	8 19:33 (3) 19:57	10 19:20 (2) 18:31	26 17:41 (5) 17:03	15:38	14:44
6	02:33	19:24 (3) 03:33	19:11 (2) 04:45	17:14 (5) 05:53	07:08	08:16
	20:53	10 19:34 (3) 19:55	7 19:18 (2) 18:29	27 17:41 (5) 17:00	15:36	14:43
7	02:34	19:24 (3) 03:35	19:11 (2) 04:47	17:14 (5) 05:56	07:11	08:18
	20:52	12 19:36 (3) 19:52	4 19:15 (2) 18:26	28 17:42 (5) 16:57	15:33	14:42
8	02:35	19:23 (3) 03:38	19:11 (2) 04:49	17:13 (5) 05:58	07:13	08:19
	20:51	14 19:37 (3) 19:50	2 19:13 (2) 18:23	29 17:42 (5) 16:54	15:31	14:41
9	02:37	19:22 (3) 03:40	04:51	17:13 (5) 06:00	07:16	08:21
	20:50	15 19:37 (3) 19:47	18:20	28 17:41 (5) 16:51	15:28	14:40
10	02:38	19:22 (3) 03:42	04:54	17:12 (5) 06:03	07:18	08:22
	20:48	16 19:38 (3) 19:44	18:17	28 17:40 (5) 16:48	15:26	14:40
11	02:40	19:22 (3) 03:45	04:56	17:12 (5) 06:05	07:21	08:24
	20:47	17 19:39 (3) 19:42	18:14	28 17:40 (5) 16:45	15:24	14:39
12	02:42	19:21 (3) 03:47	04:58	17:12 (5) 06:07	07:23	08:25
	20:46	18 19:39 (3) 19:39	18:11	26 17:38 (5) 16:42	15:22	14:39
13	02:43	19:21 (3) 03:49	05:01	17:13 (5) 06:10	07:26	08:26
	20:44	19 19:40 (3) 19:37	18:08	23 17:36 (5) 16:40	15:19	14:39
14	02:45	19:20 (3) 03:52	05:03	17:13 (5) 06:12	07:28	08:28
	20:43	21 19:41 (3) 19:34	18:05	20 17:33 (5) 16:37	15:17	14:38
15	02:47	19:20 (3) 03:54	05:05	17:13 (5) 06:14	07:30	08:29
	20:41	21 19:41 (3) 19:31	18:02	17 17:30 (5) 16:34	15:15	14:38
16	02:49	19:20 (3) 03:56	05:07	17:14 (5) 06:17	07:33	08:30
	20:40	21 19:41 (3) 19:28	17:59	12 17:26 (5) 16:31	15:13	14:38
17	02:50	19:20 (3) 03:59	05:10	17:17 (5) 06:19	07:35	08:31
	20:38	22 19:42 (3) 19:26	17:56	7 17:24 (5) 16:28	15:11	14:38
18	02:52	19:20 (3) 04:01	05:12	17:19 (5) 06:22	07:38	08:32
	20:36	23 19:43 (3) 19:23	17:53	2 17:21 (5) 16:25	15:09	14:38
19	02:54	19:19 (3) 04:03	05:14	06:24	07:40	08:33
	20:34	24 19:43 (3) 19:20	17:50	16:23	15:07	14:38
20	02:56	19:19 (3) 04:06	05:16	06:26	07:42	08:33
	20:32	24 19:43 (3) 19:17	17:47	16:20	15:05	14:39
21	02:58	19:19 (3) 04:08	05:19	06:29	07:45	08:34
	20:31	25 19:44 (3) 19:15	17:44	16:17	15:03	14:39
22	03:00	19:19 (3) 04:10	18:12 (4) 05:21	06:31	07:47	08:34
	20:29	24 19:43 (3) 19:12	10 18:22 (4) 17:41	16:14	15:02	14:39
23	03:02	19:19 (3) 04:12	18:09 (4) 05:23	06:34	07:49	08:35
	20:27	24 19:43 (3) 19:09	14 18:23 (4) 17:38	16:12	15:00	14:40
24	03:04	19:19 (3) 04:15	18:08 (4) 05:26	06:36	07:52	08:35
	20:25	24 19:43 (3) 19:06	16 18:24 (4) 17:35	16:09	14:58	14:41
25	03:06	19:19 (3) 04:17	18:06 (4) 05:28	06:39	07:54	08:36
	20:22	23 19:42 (3) 19:03	18 18:24 (4) 17:32	16:06	14:57	14:41
26	03:09	19:18 (2) 04:19	18:05 (4) 05:30	06:41	07:56	08:36
	20:20	22 19:40 (3) 19:00	19 18:24 (4) 17:29	16:04	14:55	14:42
27	03:11	19:16 (2) 04:22	18:06 (4) 05:32	06:43	07:58	08:36
	20:18	22 19:38 (3) 18:58	19 18:25 (4) 17:26	16:01	14:53	14:43
28	03:13	19:14 (2) 04:24	18:05 (4) 05:35	06:46	08:00	08:36
	20:16	23 19:37 (3) 18:55	17 18:22 (4) 17:23	15:58	14:52	14:44
29	03:15	19:13 (2) 04:26	18:05 (4) 05:37	06:48	08:02	08:36
	20:14	22 19:35 (3) 18:52	14 18:19 (4) 17:20	15:56	14:51	14:45
30	03:17	19:12 (2) 04:29	18:04 (4) 05:39	06:51	08:05	08:36
	20:11	21 19:33 (3) 18:49	12 18:16 (4) 17:17	15:53	14:49	14:46
31	03:19	19:12 (2) 04:31	17:27 (5)	06:53	08:36	
	20:09	19 19:31 (3) 18:46	14 18:13 (4)	15:50	14:47	
Potential sun hours	551	481	387	318	232	194
Total, worst case	539	235	384			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.73	0.68	0.61			
Total reduction	0.18	0.15	0.15			
Total, real	96	36	57			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DD - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (312)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	14:52 (5) 15:14 (5)	06:38 17:05	16:08 (4) 16:23 (4)	05:08 18:19
2	08:35 14:50	07:49 15:57	14:52 (5) 15:14 (5)	06:36 17:08	16:10 (4) 16:21 (4)	05:05 18:22
3	08:35 14:52	07:46 15:59	14:53 (5) 15:14 (5)	06:33 17:10	16:13 (4) 16:18 (4)	05:02 18:24
4	08:34 14:53	07:44 16:02	14:53 (5) 15:14 (5)	06:30 17:13	16:39 (3) 16:41 (3)	04:59 18:27
5	08:33 14:55	07:42 16:05	14:53 (5) 15:13 (5)	06:27 17:15	16:35 (3) 16:43 (3)	04:56 18:29
6	08:33 14:56	07:39 16:07	14:55 (5) 15:13 (5)	06:24 17:17	16:33 (3) 16:46 (3)	04:53 18:31
7	08:32 14:58	07:37 16:10	14:55 (5) 15:12 (5)	06:21 17:20	16:32 (3) 16:48 (3)	04:50 18:34
8	08:31 15:00	07:35 16:12	14:56 (5) 15:11 (5)	06:18 17:22	16:31 (3) 16:51 (3)	04:47 18:36
9	08:30 15:02	07:32 16:15	14:59 (5) 15:09 (5)	06:16 17:25	16:31 (3) 16:54 (3)	04:44 18:38
10	08:29 15:04	07:30 16:17	06:13 17:27	23	16:30 (3) 16:56 (3)	04:41 18:41
11	08:28 15:06	07:27 16:20	06:10 17:30	26	16:29 (3) 16:57 (3)	04:38 18:43
12	08:27 15:08	07:25 16:22	06:07 17:32	28	16:29 (3) 16:56 (3)	04:36 18:46
13	08:25 15:10	07:22 16:25	06:04 17:34	27	16:29 (3) 16:56 (3)	04:33 18:48
14	08:24 15:12	07:19 16:28	06:01 17:37	27	16:29 (3) 16:56 (3)	04:30 18:50
15	08:23 15:14	07:17 16:30	05:58 17:39	26	16:29 (3) 16:55 (3)	04:27 18:53
16	08:21 15:16	07:14 16:33	05:55 17:42	25	16:29 (3) 16:54 (3)	04:24 18:55
17	08:20 15:18	07:12 16:35	05:52 17:44	25	16:30 (3) 17:14 (2)	04:21 18:57
18	08:18 15:20	07:09 16:38	05:49 17:46	27	16:31 (3) 17:16 (2)	04:18 19:00
19	08:17 15:23	07:06 16:40	05:46 17:49	28	16:32 (3) 17:19 (2)	04:15 19:02
20	08:15 15:25	07:03 16:43	05:43 17:51	29	16:34 (3) 17:21 (2)	04:13 19:05
21	08:13 15:27	07:01 16:45	05:40 17:53	27	17:06 (2) 17:23 (2)	04:10 19:07
22	08:11 15:30	06:58 16:48	05:37 16:09 (4)	17	17:06 (2) 17:26 (2)	04:07 19:09
23	08:09 15:32	06:55 16:50	05:34 16:15 (4)	20	17:06 (2) 17:26 (2)	04:04 19:09
24	08:08 15:35	06:52 16:53	05:31 16:08 (4)	19	17:06 (2) 17:25 (2)	04:01 19:12
25	08:06 15:37	14:54 (5) 14:55 (5)	06:50 16:23 (4)	18	17:07 (2) 17:33 (1)	03:59 19:17
26	08:04 15:39	14:53 (5) 14:58 (5)	06:47 16:25 (4)	18	17:08 (2) 17:35 (1)	03:56 19:19
27	08:02 15:42	14:52 (5) 15:00 (5)	06:44 16:25 (4)	16	17:10 (2) 17:37 (1)	03:53 19:21
28	08:00 15:44	14:52 (5) 15:04 (5)	06:41 16:24 (4)	11	17:29 (1) 17:40 (1)	03:51 19:24
29	07:58 15:47	14:52 (5) 15:07 (5)	05:17 18:12	14	17:28 (1) 17:42 (1)	03:48 19:26
30	07:55 15:49	14:52 (5) 15:09 (5)	05:14 18:15	14	17:29 (1) 17:43 (1)	03:45 19:29
31	07:53 15:52	14:52 (5) 15:13 (5)	05:11 18:17	13	17:29 (1) 17:42 (1)	03:43 19:29
Potential sun hours	216	257	365	434	526	554
Total, worst case	80	265	588	9		
Sun reduction	0.27	0.29	0.28	0.30		
Oper. time red.	0.93	0.93	0.93	0.93		
Wind dir. red.	0.49	0.50	0.55	0.61		
Total reduction	0.12	0.14	0.14	0.17		
Total, real	10	36	84	2		

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DD - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (312)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	16:08 (3) 16:35 (3)	06:56 15:48
2	02:28 20:56	03:24 20:04	04:35 18:40	05:44 17:12	16:07 (3) 16:35 (3)	06:58 15:45
3	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	16:07 (3) 16:34 (3)	07:01 15:43
4	02:30 20:55	03:28 20:00	04:40 18:34	05:49 17:06	16:08 (3) 16:33 (3)	07:03 15:40
5	02:31 20:54	03:31 19:57	04:42 18:32	05:51 17:03	16:08 (3) 16:29 (3)	07:06 15:38
6	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	16:08 (3) 16:26 (3)	07:08 15:36
7	02:34 20:52	03:35 19:52	04:47 18:26	05:56 16:57	16:09 (3) 16:24 (3)	07:11 15:33
8	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	16:10 (3) 16:20 (3)	07:13 15:31
9	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	16:12 (3) 16:18 (3)	07:16 15:28
10	02:38 20:49	03:42 19:44	04:54 18:17	06:03 16:48	07:18 15:26	08:22 14:40
11	02:40 20:47	03:45 19:42	04:56 18:14	17:23 (1) 17:32 (1)	06:05 16:45	08:24 14:39
12	02:42 20:46	03:47 19:39	04:58 18:11	17:21 (1) 17:33 (1)	06:07 16:42	08:25 14:39
13	02:43 20:44	03:49 19:37	05:01 18:08	17:20 (1) 17:34 (1)	06:10 16:40	08:26 14:38
14	02:45 20:43	03:52 19:34	05:03 18:05	17:19 (1) 17:33 (1)	06:12 16:37	08:28 14:38
15	02:47 20:41	03:54 19:31	05:05 18:02	17:18 (1) 17:30 (1)	06:14 16:34	08:29 14:38
16	02:48 20:40	03:56 19:28	05:07 17:59	16:59 (2) 17:26 (1)	06:17 16:31	08:30 14:38
17	02:50 20:38	03:59 19:26	05:10 17:56	16:57 (2) 17:24 (1)	06:19 16:28	08:31 14:38
18	02:52 20:36	04:01 19:23	05:12 17:53	16:54 (2) 17:21 (1)	06:22 16:25	08:32 14:38
19	02:54 20:34	04:03 19:20	05:14 17:50	16:53 (2) 17:11 (2)	06:24 16:23	08:33 14:38
20	02:56 20:33	04:05 19:17	05:16 17:47	16:51 (2) 17:11 (2)	06:26 16:20	08:33 14:39
21	02:58 20:31	04:08 19:15	05:19 17:44	16:51 (2) 17:11 (2)	06:29 16:17	08:34 14:39
22	03:00 20:29	04:10 19:12	05:21 17:41	16:51 (2) 17:09 (2)	06:31 16:14	08:35 14:39
23	03:02 20:27	04:12 19:09	05:23 17:38	16:19 (3) 17:06 (2)	06:34 16:12	08:35 14:40
24	03:04 20:25	04:15 19:06	05:26 17:35	16:16 (3) 17:02 (2)	06:36 16:09	08:35 14:40
25	03:06 20:23	04:17 19:03	05:28 17:32	16:14 (3) 17:00 (2)	06:39 16:06	08:36 14:41
26	03:08 20:20	04:19 19:01	05:30 17:29	16:12 (3) 16:57 (2)	06:41 16:04	08:36 14:42
27	03:11 20:18	04:22 18:58	05:32 17:26	16:10 (3) 16:53 (2)	06:44 16:01	08:36 14:43
28	03:13 20:16	04:24 18:55	05:35 17:23	16:10 (3) 16:36 (3)	06:46 15:58	08:36 14:44
29	03:15 20:14	04:26 18:52	05:37 17:20	16:09 (3) 16:35 (3)	06:48 15:56	08:36 14:45
30	03:17 20:12	04:29 18:49	05:39 17:17	16:08 (3) 16:35 (3)	06:51 15:53	08:36 14:46
31	03:19 20:09	04:31 18:46		06:53 15:50		08:36 14:47
Potential sun hours	551	481	387	317	232	194
Total, worst case			404	308	251	
Sun reduction			0.26	0.28	0.28	
Oper. time red.			0.93	0.93	0.93	
Wind dir. red.			0.56	0.53	0.49	
Total reduction			0.14	0.14	0.13	
Total, real			55	43	32	

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DE - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (313)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June			
1	08:35	07:51	06:38	05:08	17:13 (5)	03:43	02:36	19:12 (3)	
	14:49	15:54	17:05	18:19	28 17:41 (5)	19:31	20:38	12 19:24 (3)	
2	08:35	07:49	06:36	05:05	17:13 (5)	03:40	02:34	19:12 (3)	
	14:50	15:57	17:08	18:22	28 17:41 (5)	19:33	20:40	10 19:22 (3)	
3	08:34	07:46	06:33	05:02	17:13 (5)	03:37	18:59 (2)	02:33	19:14 (3)
	14:52	16:00	17:10	18:24	27 17:40 (5)	19:36	2 19:00 (2)	20:42	7 19:21 (3)
4	08:34	07:44	06:30	04:59	17:13 (5)	03:35	18:57 (2)	02:32	
	14:53	16:02	17:13	18:27	26 17:39 (5)	19:38	5 19:02 (2)	20:43	
5	08:33	07:42	06:27	04:56	17:13 (5)	03:32	18:57 (2)	02:30	
	14:55	16:05	17:15	18:29	25 17:38 (5)	19:41	7 19:04 (2)	20:45	
6	08:33	07:39	06:24	04:53	17:15 (5)	03:30	18:57 (2)	02:29	
	14:57	16:07	17:18	18:31	22 17:37 (5)	19:43	10 19:07 (2)	20:46	
7	08:32	07:37	06:21	04:50	17:16 (5)	03:27	18:56 (2)	02:28	
	14:58	16:10	17:20	18:34	19 17:35 (5)	19:45	12 19:08 (2)	20:47	
8	08:31	07:35	06:18	04:47	17:18 (5)	03:25	18:56 (2)	02:27	
	15:00	16:12	17:22	18:36	15 17:33 (5)	19:48	14 19:10 (2)	20:49	
9	08:30	07:32	06:15	04:44	17:20 (5)	03:22	18:57 (2)	02:26	
	15:02	16:15	17:25	18:38	14 18:07 (4)	19:50	16 19:13 (2)	20:50	
10	08:29	07:30	06:13	04:41	18:01 (4)	03:20	18:57 (2)	02:26	
	15:04	16:17	17:27	18:41	8 18:09 (4)	19:52	18 19:15 (3)	20:51	
11	08:28	07:27	06:10	04:38	18:00 (4)	03:17	18:58 (2)	02:25	
	15:06	16:20	17:30	18:43	11 18:11 (4)	19:55	19 19:17 (3)	20:52	
12	08:27	07:25	06:07	04:36	18:00 (4)	03:15	18:57 (2)	02:24	
	15:08	16:23	17:32	18:46	14 18:14 (4)	19:57	21 19:18 (3)	20:53	
13	08:25	07:22	06:04	04:33	18:00 (4)	03:12	18:58 (2)	02:24	
	15:10	16:25	17:34	18:48	16 18:16 (4)	19:59	22 19:20 (3)	20:54	
14	08:24	07:19	06:01	04:30	17:59 (4)	03:10	19:00 (2)	02:23	
	15:12	16:28	17:37	18:50	19 18:18 (4)	20:02	22 19:22 (3)	20:55	
15	08:23	07:17	05:58	04:27	17:59 (4)	03:08	19:01 (2)	02:23	
	15:14	16:30	17:39	18:53	19 18:18 (4)	20:04	23 19:24 (3)	20:56	
16	08:21	07:14	05:55	04:24	17:59 (4)	03:06	19:03 (3)	02:22	
	15:16	16:33	17:42	18:55	18 18:17 (4)	20:06	23 19:26 (3)	20:57	
17	08:20	07:11	05:52	04:21	18:01 (4)	03:03	19:03 (3)	02:22	
	15:18	16:35	17:44	18:57	16 18:17 (4)	20:08	25 19:28 (3)	20:57	
18	08:18	07:09	05:49	04:18	18:01 (4)	03:01	19:04 (3)	02:22	
	15:21	16:38	17:46	19:00	14 18:15 (4)	20:11	25 19:29 (3)	20:58	
19	08:16	07:06	05:46	04:15	18:03 (4)	02:59	19:04 (3)	02:22	
	15:23	16:40	17:49	19:02	10 18:13 (4)	20:13	25 19:29 (3)	20:58	
20	08:15	07:03	05:43	04:13	02:57		19:04 (3)	02:22	
	15:25	16:43	17:51	19:05	20:15	24 19:28 (3)	20:59		
21	08:13	07:01	05:40	04:10	02:55		19:04 (3)	02:22	
	15:27	16:45	17:53	19:07	20:17	24 19:28 (3)	20:59		
22	08:11	06:58	05:37	04:07	02:53		19:05 (3)	02:22	
	15:30	16:48	17:56	19:09	20:19	23 19:28 (3)	20:59		
23	08:09	06:55	05:34	17:25 (5)	04:04	02:51	19:05 (3)	02:22	
	15:32	16:50	17:58	3 17:28 (5)	19:12	20:21	23 19:28 (3)	20:59	
24	08:08	06:52	05:31	17:22 (5)	04:01	02:49	19:05 (3)	02:23	
	15:35	16:53	18:01	8 17:30 (5)	19:14	20:23	22 19:27 (3)	20:59	
25	08:06	06:50	05:28	17:20 (5)	03:59	02:47	19:06 (3)	02:23	
	15:37	16:55	18:03	13 17:33 (5)	19:17	20:25	21 19:27 (3)	20:59	
26	08:04	06:47	05:25	17:18 (5)	03:56	02:45	19:06 (3)	02:23	
	15:39	16:58	18:05	17 17:35 (5)	19:19	20:27	21 19:27 (3)	20:59	
27	08:02	06:44	05:23	17:17 (5)	03:53	02:44	19:07 (3)	02:24	
	15:42	17:00	18:08	20 17:37 (5)	19:21	20:29	20 19:27 (3)	20:59	
28	08:00	06:41	05:20	17:16 (5)	03:51	02:42	19:08 (3)	02:25	
	15:44	17:03	18:10	24 17:40 (5)	19:24	20:31	19 19:27 (3)	20:58	
29	07:57		05:17	17:15 (5)	03:48	02:40	19:08 (3)	02:25	
	15:47		18:12	27 17:42 (5)	19:26	20:33	17 19:25 (3)	20:58	
30	07:55		05:14	17:14 (5)	03:45	02:39	19:09 (3)	02:26	
	15:49		18:15	28 17:42 (5)	19:29	20:35	16 19:25 (3)	20:58	
31	07:53		05:11	17:13 (5)		02:37	19:11 (3)		
	15:52		18:17	29 17:42 (5)		20:37	14 19:25 (3)		
Potential sun hours	216	257	365	434	526	554			
Total, worst case			169	349	533	29			
Sun reduction			0.28	0.30	0.35	0.30			
Oper. time red.			0.93	0.93	0.93	0.93			
Wind dir. red.			0.60	0.63	0.73	0.73			
Total reduction			0.16	0.17	0.24	0.20			
Total, real			27	61	127	6			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DE - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (313)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	03:22	19:08 (2) 04:33	17:59 (4) 05:42	06:56	08:07
	20:57	20:07	19:29 (3) 18:43	18:10 (4) 17:14	15:48	14:48
2	02:28	03:24	19:08 (2) 04:35	18:00 (4) 05:44	06:58	08:09
	20:56	20:04	19:27 (3) 18:40	18:08 (4) 17:12	15:45	14:47
3	02:29	03:26	19:07 (2) 04:38	17:18 (5) 05:46	07:01	08:10
	20:56	20:02	19:24 (2) 18:37	18:05 (4) 17:09	15:43	14:46
4	02:30	03:29	19:07 (2) 04:40	17:15 (5) 05:49	07:03	08:12
	20:55	20:00	19:22 (2) 18:34	17:30 (5) 17:06	15:40	14:45
5	02:31	03:31	19:07 (2) 04:42	17:12 (5) 05:51	07:06	08:14
	20:54	19:57	19:20 (2) 18:31	17:32 (5) 17:03	15:38	14:44
6	02:33	03:33	19:06 (2) 04:45	17:10 (5) 05:53	07:08	08:16
	20:53	19:55	19:18 (2) 18:29	17:32 (5) 17:00	15:36	14:43
7	02:34	03:35	19:06 (2) 04:47	17:10 (5) 05:56	07:11	08:18
	20:52	19:52	19:15 (2) 18:26	17:34 (5) 16:57	15:33	14:42
8	02:35	03:38	19:07 (2) 04:49	17:08 (5) 05:58	07:13	08:19
	20:51	19:50	19:13 (2) 18:23	17:34 (5) 16:54	15:31	14:41
9	02:37	19:23 (3) 03:40	19:07 (2) 04:51	17:07 (5) 06:00	07:16	08:21
	20:50	19:27 (3) 19:47	19:10 (2) 18:20	17:34 (5) 16:51	15:28	14:40
10	02:38	19:21 (3) 03:42	19:07 (2) 04:54	17:06 (5) 06:03	07:18	08:22
	20:48	19:29 (3) 19:44	19:08 (2) 18:17	17:34 (5) 16:48	15:26	14:40
11	02:40	19:20 (3) 03:45	04:56	17:05 (5) 06:05	07:21	08:24
	20:47	19:31 (3) 19:42	18:14	17:34 (5) 16:45	15:24	14:39
12	02:42	19:19 (3) 03:47	04:58	17:05 (5) 06:07	07:23	08:25
	20:46	19:32 (3) 19:39	18:11	17:33 (5) 16:42	15:22	14:39
13	02:43	19:19 (3) 03:49	05:01	17:05 (5) 06:10	07:26	08:26
	20:44	19:33 (3) 19:37	18:08	17:33 (5) 16:40	15:19	14:39
14	02:45	19:17 (3) 03:52	05:03	17:05 (5) 06:12	07:28	08:28
	20:43	19:34 (3) 19:34	18:05	17:33 (5) 16:37	15:17	14:38
15	02:47	19:17 (3) 03:54	05:05	17:05 (5) 06:14	07:30	08:29
	20:41	19:35 (3) 19:31	18:02	17:30 (5) 16:34	15:15	14:38
16	02:49	19:16 (3) 03:56	05:07	17:05 (5) 06:17	07:33	08:30
	20:40	19:35 (3) 19:28	17:59	17:26 (5) 16:31	15:13	14:38
17	02:50	19:16 (3) 03:59	05:10	17:06 (5) 06:19	07:35	08:31
	20:38	19:36 (3) 19:26	17:56	17:24 (5) 16:28	15:11	14:38
18	02:52	19:16 (3) 04:01	05:12	17:07 (5) 06:22	07:38	08:32
	20:36	19:37 (3) 19:23	17:53	17:21 (5) 16:25	15:09	14:38
19	02:54	19:15 (3) 04:03	05:14	17:08 (5) 06:24	07:40	08:33
	20:34	19:37 (3) 19:20	17:50	17:18 (5) 16:23	15:07	14:38
20	02:56	19:15 (3) 04:06	05:16	17:10 (5) 06:26	07:42	08:33
	20:32	19:38 (3) 19:17	17:47	17:14 (5) 16:20	15:05	14:39
21	02:58	19:15 (3) 04:08	05:19	06:29	07:45	08:34
	20:31	19:38 (3) 19:15	17:44	16:17	15:03	14:39
22	03:00	19:14 (3) 04:10	05:21	06:31	07:47	08:34
	20:29	19:38 (3) 19:12	17:41	16:14	15:02	14:39
23	03:02	19:14 (3) 04:12	18:10 (4) 05:23	06:34	07:49	08:35
	20:27	19:38 (3) 19:09	18:14 (4) 17:38	16:12	15:00	14:40
24	03:04	19:14 (3) 04:15	18:06 (4) 05:26	06:36	07:52	08:35
	20:25	19:39 (3) 19:06	18:17 (4) 17:35	16:09	14:58	14:41
25	03:06	19:14 (3) 04:17	18:04 (4) 05:28	06:39	07:54	08:36
	20:22	19:39 (3) 19:03	18:18 (4) 17:32	16:06	14:57	14:41
26	03:09	19:14 (3) 04:19	18:02 (4) 05:30	06:41	07:56	08:36
	20:20	19:39 (3) 19:00	18:19 (4) 17:29	16:04	14:55	14:42
27	03:11	19:14 (3) 04:22	18:02 (4) 05:32	06:43	07:58	08:36
	20:18	19:38 (3) 18:58	18:20 (4) 17:26	16:01	14:53	14:43
28	03:13	19:14 (2) 04:24	18:01 (4) 05:35	06:46	08:00	08:36
	20:16	19:37 (3) 18:55	18:20 (4) 17:23	15:58	14:52	14:44
29	03:15	19:12 (2) 04:26	18:00 (4) 05:37	06:48	08:02	08:36
	20:14	19:35 (3) 18:52	18:19 (4) 17:20	15:56	14:51	14:45
30	03:17	19:10 (2) 04:29	18:00 (4) 05:39	06:51	08:05	08:36
	20:11	19:33 (3) 18:49	18:16 (4) 17:17	15:53	14:49	14:46
31	03:19	19:09 (2) 04:31	17:59 (4)	06:53		08:36
	20:09	19:31 (3) 18:46	18:13 (4)	15:50		14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case		451	249	400		
Sun reduction		0.26	0.24	0.26		
Oper. time red.		0.93	0.93	0.93		
Wind dir. red.		0.73	0.69	0.61		
Total reduction		0.18	0.15	0.15		
Total, real		80	38	59		

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DF - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (314)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35	07:51	06:38	05:08	17:01 (5)	03:43
	14:49	15:54	17:05	18:19	17:13 (5)	19:31
2	08:35	07:49	06:36	05:05		03:40
	14:50	15:57	17:08	18:22		19:33
3	08:34	07:46	06:33	05:02	17:51 (4)	03:37
	14:52	16:00	17:10	18:24	2 17:53 (4)	19:36
4	08:34	07:44	06:30	04:59	17:49 (4)	03:35
	14:53	16:02	17:13	18:27	6 17:55 (4)	19:38
5	08:33	07:42	06:27	04:56	17:48 (4)	03:32
	14:55	16:05	17:15	18:29	9 17:57 (4)	19:41
6	08:33	07:39	06:24	04:53	17:48 (4)	03:30
	14:57	16:07	17:18	18:31	12 18:00 (4)	19:43
7	08:32	07:37	06:21	04:50	17:47 (4)	03:27
	14:58	16:10	17:20	18:34	16 18:03 (4)	19:45
8	08:31	07:35	06:18	04:47	17:47 (4)	03:25
	15:00	16:12	17:22	18:36	18 18:05 (4)	19:48
9	08:30	07:32	06:15	04:44	17:46 (4)	03:22
	15:02	16:15	17:25	18:38	20 18:06 (4)	19:50
10	08:29	07:30	06:13	04:41	17:46 (4)	03:20
	15:04	16:17	17:27	18:41	19 18:05 (4)	19:52
11	08:28	07:27	06:10	04:38	17:47 (4)	03:17
	15:06	16:20	17:30	18:43	17 18:04 (4)	19:55
12	08:27	07:25	06:07	04:36	17:48 (4)	03:15
	15:08	16:23	17:32	18:46	16 18:04 (4)	19:57
13	08:25	07:22	06:04	04:33	17:49 (4)	03:12
	15:10	16:25	17:34	18:48	13 18:02 (4)	19:59
14	08:24	07:19	06:01	04:30	17:51 (4)	03:10
	15:12	16:28	17:37	18:50	8 17:59 (4)	20:02
15	08:23	07:17	05:58	04:27		03:08
	15:14	16:30	17:39	18:53		20:04
16	08:21	07:14	05:55	17:06 (5)	04:24	03:06
	15:16	16:33	17:42	6 17:12 (5)	18:55	20:06
17	08:20	07:11	05:52	17:03 (5)	04:21	03:03
	15:18	16:35	17:44	11 17:14 (5)	18:57	20:08
18	08:18	07:09	05:49	17:01 (5)	04:18	03:01
	15:21	16:38	17:46	15 17:16 (5)	19:00	20:11
19	08:16	07:06	05:46	17:00 (5)	04:15	02:59
	15:23	16:40	17:49	19 17:19 (5)	19:02	20:13
20	08:15	07:03	05:43	16:58 (5)	04:13	02:57
	15:25	16:43	17:51	23 17:21 (5)	19:05	20:15
21	08:13	07:01	05:40	16:57 (5)	04:10	02:55
	15:27	16:45	17:53	26 17:23 (5)	19:07	20:17
22	08:11	06:58	05:37	16:57 (5)	04:07	02:53
	15:30	16:48	17:56	27 17:24 (5)	19:09	20:19
23	08:09	06:55	05:34	16:56 (5)	04:04	02:51
	15:32	16:50	17:58	28 17:24 (5)	19:12	20:21
24	08:08	06:52	05:31	16:56 (5)	04:01	02:49
	15:35	16:53	18:01	28 17:24 (5)	19:14	20:23
25	08:06	06:50	05:28	16:55 (5)	03:59	02:47
	15:37	16:55	18:03	28 17:23 (5)	19:17	20:25
26	08:04	06:47	05:25	16:55 (5)	03:56	02:45
	15:39	16:58	18:05	28 17:23 (5)	19:19	20:27
27	08:02	06:44	05:23	16:56 (5)	03:53	02:44
	15:42	17:00	18:08	26 17:22 (5)	19:21	20:29
28	08:00	06:41	05:20	16:56 (5)	03:51	18:47 (2)
	15:44	17:03	18:10	25 17:21 (5)	19:24	2 18:49 (2)
29	07:57		05:17	16:57 (5)	03:48	18:46 (2)
	15:47		18:12	23 17:20 (5)	19:26	5 18:51 (2)
30	07:55		05:14	16:57 (5)	03:45	18:46 (2)
	15:49		18:15	21 17:18 (5)	19:29	8 18:54 (2)
31	07:53		05:11	16:59 (5)		02:37
	15:52		18:17	17 17:16 (5)		20:37
Potential sun hours	216	257	365	434	526	554
Total, worst case			351	183	467	
Sun reduction			0.28	0.30	0.35	
Oper. time red.			0.93	0.93	0.93	
Wind dir. red.			0.57	0.64	0.72	
Total reduction			0.15	0.18	0.23	
Total, real			52	33	109	

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DF - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (314)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December		
1	02:27 20:57	03:22 20:07	18:58 (3) 19:23 (3)	04:33 18:43	17:46 (4) 18:03 (4)	05:42 17:14	06:56 15:48	08:07 14:48
2	02:28 20:56	03:24 20:04	18:58 (3) 19:23 (3)	04:35 18:40	17:45 (4) 18:04 (4)	05:44 17:12	06:58 15:45	08:09 14:47
3	02:29 20:56	03:26 20:02	18:58 (3) 19:23 (3)	04:38 18:37	17:44 (4) 18:04 (4)	05:46 17:09	07:01 15:43	08:10 14:46
4	02:30 20:55	03:29 20:00	18:58 (2) 19:22 (3)	04:40 18:34	17:44 (4) 18:02 (4)	05:49 17:06	07:03 15:40	08:12 14:45
5	02:31 20:54	03:31 19:57	18:57 (2) 19:20 (3)	04:42 18:31	17:43 (4) 17:59 (4)	05:51 17:03	07:06 15:38	08:14 14:44
6	02:33 20:53	03:33 19:55	18:56 (2) 19:18 (3)	04:45 18:29	17:43 (4) 17:56 (4)	05:53 17:00	07:08 15:36	08:16 14:43
7	02:34 20:52	03:35 19:52	18:55 (2) 19:15 (3)	04:47 18:26	17:44 (4) 17:54 (4)	05:56 16:57	07:11 15:33	08:18 14:42
8	02:35 20:51	03:38 19:50	18:54 (2) 19:13 (3)	04:49 18:23	17:44 (4) 17:51 (4)	05:58 16:54	07:13 15:31	08:19 14:41
9	02:37 20:50	03:40 19:47	18:54 (2) 19:10 (2)	04:51 18:20	17:45 (4) 17:47 (4)	06:00 16:51	07:16 15:28	08:21 14:40
10	02:38 20:48	03:42 19:44	18:53 (2) 19:08 (2)	04:54 18:17	17:45 (4) 16:48	06:03 16:48	07:18 15:26	08:22 14:40
11	02:40 20:47	03:45 19:42	18:53 (2) 19:05 (2)	04:56 18:14	16:54 (5) 17:05 (5)	06:05 16:45	07:21 15:24	08:24 14:39
12	02:42 20:46	03:47 19:39	18:53 (2) 19:03 (2)	04:58 18:11	16:51 (5) 17:07 (5)	06:07 16:42	07:23 15:22	08:25 14:39
13	02:43 20:44	03:49 19:37	18:54 (2) 19:01 (2)	05:01 18:08	16:49 (5) 17:09 (5)	06:10 16:40	07:26 15:19	08:26 14:39
14	02:45 20:43	03:52 19:34	18:55 (2) 18:59 (2)	05:03 18:05	16:47 (5) 17:10 (5)	06:12 16:37	07:28 15:17	08:28 14:38
15	02:47 20:41	03:54 19:31	18:55 (2) 18:56 (2)	05:05 18:02	16:46 (5) 17:10 (5)	06:14 16:34	07:30 15:15	08:29 14:38
16	02:49 20:40	03:56 19:28	18:56 (2) 17:59	05:07 17:59	16:44 (5) 17:10 (5)	06:17 16:31	07:33 15:13	08:30 14:38
17	02:50 20:38	03:59 19:26	18:57 (2) 17:56	05:10 17:56	16:44 (5) 17:11 (5)	06:19 16:28	07:35 15:11	08:31 14:38
18	02:52 20:36	04:01 19:23	18:58 (2) 17:53	05:12 17:53	16:43 (5) 17:11 (5)	06:22 16:25	07:38 15:09	08:32 14:38
19	02:54 20:34	04:03 19:20	18:59 (2) 17:50	05:14 17:50	16:42 (5) 17:10 (5)	06:24 16:23	07:40 15:07	08:33 14:38
20	02:56 20:32	19:06 (3) 19:15 (3)	04:06 19:17	05:16 17:47	16:42 (5) 17:10 (5)	06:26 16:20	07:42 15:05	08:33 14:39
21	02:58 20:31	19:05 (3) 19:17 (3)	04:08 19:15	05:19 17:44	16:42 (5) 17:10 (5)	06:29 16:17	07:45 15:03	08:34 14:39
22	03:00 20:29	19:02 (3) 19:17 (3)	04:10 19:12	05:21 17:41	16:42 (5) 17:09 (5)	06:31 16:14	07:47 15:02	08:34 14:39
23	03:02 20:27	19:02 (3) 19:19 (3)	04:12 19:09	05:23 17:38	16:42 (5) 17:06 (5)	06:34 16:12	07:49 15:00	08:35 14:40
24	03:04 20:25	19:01 (3) 19:20 (3)	04:15 19:06	05:26 17:35	16:42 (5) 17:02 (5)	06:36 16:09	07:52 14:58	08:35 14:41
25	03:06 20:22	19:00 (3) 19:21 (3)	04:17 19:03	05:28 17:32	16:44 (5) 17:00 (5)	06:39 16:06	07:54 14:57	08:36 14:41
26	03:09 20:20	19:00 (3) 19:21 (3)	04:19 19:00	05:30 17:29	16:44 (5) 16:57 (5)	06:41 16:04	07:56 14:55	08:36 14:42
27	03:11 20:18	18:59 (3) 19:22 (3)	04:22 18:58	05:32 17:26	16:46 (5) 16:53 (5)	06:43 16:01	07:58 14:53	08:36 14:43
28	03:13 20:16	18:59 (3) 19:22 (3)	04:24 18:55	05:35 17:23	16:49 (5) 16:51 (5)	06:46 15:58	08:00 14:52	08:36 14:44
29	03:15 20:14	18:59 (3) 19:23 (3)	04:26 18:52	17:52 (4) 18:00 (4)	05:37 17:20	06:48 15:56	08:02 14:51	08:36 14:45
30	03:17 20:11	18:58 (3) 19:23 (3)	04:29 18:49	05:39 17:49 (4)	17:49 (4) 18:02 (4)	05:39 17:17	06:51 15:53	08:36 14:49
31	03:19 20:09	18:58 (3) 19:23 (3)	04:31 18:46	17:47 (4) 18:03 (4)	17:47 (4) 18:03 (4)	06:53 15:50	08:36 14:47	08:36 14:47
Potential sun hours	551	481	387	318	232	194		
Total, worst case	234	286	490					
Sun reduction	0.26	0.24	0.26					
Oper. time red.	0.93	0.93	0.93					
Wind dir. red.	0.72	0.71	0.59					
Total reduction	0.17	0.16	0.14					
Total, real	41	45	69					

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DG - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (315)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:54	17:05	18:20	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:09
	14:50	15:57	17:08	18:22	19:33	20:40	20:57	20:05	18:40	17:12	15:45	14:47
3	08:35	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	15:59	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:44
5	08:33	07:42	06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44
6	08:33	07:39	06:24	04:53	03:29	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:56	16:07	17:17	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:45	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:18	04:47	03:24	02:27	02:35	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:16	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29	07:30	06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	08:22
	15:04	16:17	17:27	18:41	19:52	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:27	07:25	06:07	04:35	03:15	02:24	02:41	03:47	04:58	06:07	07:23	08:25
	15:08	16:22	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39
13	08:25	07:22	06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	08:27
	15:10	16:25	17:34	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:19	14:38
14	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	07:17	05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20	07:12	05:52	04:21	03:03	02:22	02:50	03:58	05:10	06:19	07:35	08:31
	15:18	16:35	17:44	18:58	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:20	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:17	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
20	08:15	07:03	05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:43	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:33	19:17	17:47	16:20	15:05	14:38
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27	16:45	17:53	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
22	08:11	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35
	15:30	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
23	08:10	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	08:35
	15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:53	05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	08:36
	15:34	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	14:40
25	08:06	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
	15:37	16:55	18:03	19:17	20:25	20:59	20:23	19:03	17:32	16:06	14:56	14:41
26	08:04	06:47	05:25	03:56	02:45	02:23	03:08	04:19	05:30	06:41	07:56	08:36
	15:39	16:58	18:05	19:19	20:27	20:59	20:20	19:01	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:44	07:58	08:36
	15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00	06:41	05:20	03:50	02:42	02:25	03:13	04:24	05:35	06:46	08:00	08:36
	15:44	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:23	15:58	14:52	14:44
29	07:58		05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	08:03	08:36
	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:50	14:45
30	07:55		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:49		18:15	19:29	20:35	20:58	20:12	18:49	17:17	15:53	14:49	14:46
31	07:53		05:11		02:37		03:19	04:31		06:53		08:36
	15:52		18:17		20:37		20:09	18:46		15:50		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DH - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (316)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June												
1	08:35	07:51	06:38	05:08	03:43	02:36												
	14:49	15:54	17:05	18:19	19:31	20:38	22											
2	08:35	07:49	06:36	05:05	03:40	02:34												
	14:50	15:57	17:08	18:22	19:33	20:40	21											
3	08:34	07:46	06:33	05:02	03:37	02:33												
	14:52	16:00	17:10	18:24	19:36	20:42	21											
4	08:34	07:44	06:30	04:59	03:35	02:32												
	14:53	16:02	17:13	18:27	19:38	20:43	20											
5	08:33	07:42	06:27	04:56	17:53 (5)	03:32												
	14:55	16:05	17:15	18:29	4 17:57 (5)	19:41												
6	08:32	07:39	06:24	04:53	17:53 (5)	03:30												
	14:57	16:07	17:18	18:31	7 18:00 (5)	19:43												
7	08:32	07:37	06:21	04:50	17:51 (5)	03:27												
	14:58	16:10	17:20	18:34	12 18:03 (5)	19:45												
8	08:31	07:35	06:18	04:47	17:50 (5)	03:25												
	15:00	16:12	17:22	18:36	15 18:05 (5)	19:48												
9	08:30	07:32	06:15	04:44	17:49 (5)	03:22												
	15:02	16:15	17:25	18:38	18 18:07 (5)	19:50												
10	08:29	07:30	06:13	04:41	17:48 (5)	03:20												
	15:04	16:17	17:27	18:41	21 18:09 (5)	19:52												
11	08:28	07:27	06:10	04:38	17:48 (5)	03:17												
	15:06	16:20	17:30	18:43	23 18:11 (5)	19:55												
12	08:27	07:25	06:07	04:36	17:48 (5)	03:15												
	15:08	16:23	17:32	18:46	26 18:14 (5)	19:57	2											
13	08:25	07:22	06:04	04:33	17:48 (5)	03:12												
	15:10	16:25	17:34	18:48	27 18:15 (5)	19:59	3											
14	08:24	07:19	06:01	04:30	17:48 (5)	03:10												
	15:12	16:28	17:37	18:50	27 18:15 (5)	20:02	5											
15	08:23	07:17	05:58	04:27	17:48 (5)	03:08												
	15:14	16:30	17:39	18:53	26 18:14 (5)	20:04	7											
16	08:21	07:14	05:55	04:24	17:48 (5)	03:06												
	15:16	16:33	17:42	18:55	24 18:12 (5)	20:06	9											
17	08:20	07:11	05:52	04:21	17:50 (5)	03:03												
	15:18	16:35	17:44	18:57	22 18:12 (5)	20:08	10											
18	08:18	07:09	05:49	04:18	17:50 (5)	03:01												
	15:21	16:38	17:46	19:00	22 18:27 (4)	20:11	12											
19	08:16	07:06	05:46	04:15	17:52 (5)	02:59												
	15:23	16:40	17:49	19:02	21 18:29 (4)	20:13	13											
20	08:15	07:03	05:43	04:13	17:54 (5)	02:57												
	15:25	16:43	17:51	19:05	20 18:32 (4)	20:15	14											
21	08:13	07:01	05:40	04:10	18:23 (4)	02:55												
	15:27	16:45	17:53	19:07	11 18:34 (4)	20:17	13											
22	08:11	06:58	05:37	04:07	18:23 (4)	02:53												
	15:30	16:48	17:56	19:09	13 18:36 (4)	20:19	11											
23	08:09	06:55	05:34	04:04	18:24 (4)	02:51												
	15:32	16:50	17:58	19:12	14 18:38 (4)	20:21	8											
24	08:08	06:52	05:31	04:01	18:24 (4)	02:49												
	15:35	16:53	18:01	19:14	16 18:40 (4)	20:23	10											
25	08:06	06:50	05:28	03:59	18:24 (4)	02:47												
	15:37	16:55	18:03	19:17	15 18:39 (4)	20:25	11											
26	08:04	06:47	05:25	03:56	18:26 (4)	02:45												
	15:39	16:58	18:05	19:19	12 18:38 (4)	20:27	14											
27	08:02	06:44	05:23	03:53	18:28 (4)	02:44												
	15:42	17:00	18:08	19:21	7 18:35 (4)	20:29	15											
28	08:00	06:41	05:20	03:51		02:42												
	15:44	17:03	18:10	19:24		20:31	16											
29	07:57		05:17	03:48		02:40												
	15:47		18:12	19:26		20:33	18											
30	07:55		05:14	03:45		02:39												
	15:49		18:15	19:29		20:35	18											
31	07:53		05:11			02:37												
	15:52		18:17			20:37	20											
Potential sun hours	216	257	365	434	526	554												
Total, worst case				403	229	480												
Sun reduction				0.30	0.35	0.30												
Oper. time red.				0.93	0.93	0.93												
Wind dir. red.				0.66	0.74	0.74												
Total reduction				0.18	0.24	0.21												
Total, real				74	55	100												

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DH - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (316)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	19:41 (3) 03:22	19:28 (2) 04:33	17:47 (5) 05:42	06:56	08:07
	20:57	17 19:58 (3) 20:07	2 19:29 (2) 18:43	23 18:10 (5) 17:14	15:48	14:48
2	02:28	19:41 (3) 03:24	04:36	17:47 (5) 05:44	06:58	08:08
	20:56	17 19:58 (3) 20:04	18:40	21 18:08 (5) 17:12	15:45	14:47
3	02:29	19:41 (3) 03:26	04:38	17:47 (5) 05:46	07:01	08:10
	20:56	18 19:59 (3) 20:02	18:37	18 18:05 (5) 17:09	15:43	14:46
4	02:30	19:41 (3) 03:29	04:40	17:47 (5) 05:49	07:03	08:12
	20:55	18 19:59 (3) 20:00	18:34	15 18:02 (5) 17:06	15:40	14:45
5	02:32	19:41 (3) 03:31	04:42	17:47 (5) 05:51	07:06	08:14
	20:54	19 20:00 (3) 19:57	18:31	12 17:59 (5) 17:03	15:38	14:44
6	02:33	19:41 (3) 03:33	04:45	17:48 (5) 05:53	07:08	08:16
	20:53	19 20:00 (3) 19:55	18:29	8 17:56 (5) 17:00	15:36	14:43
7	02:34	19:42 (3) 03:35	04:47	17:49 (5) 05:56	07:11	08:18
	20:52	19 20:01 (3) 19:52	18:26	5 17:54 (5) 16:57	15:33	14:42
8	02:35	19:41 (3) 03:38	04:49	17:50 (5) 05:58	07:13	08:19
	20:51	21 20:02 (3) 19:50	18:23	2 17:51 (5) 16:54	15:31	14:41
9	02:37	19:41 (3) 03:40	04:51	06:00	07:16	08:21
	20:50	21 20:02 (3) 19:47	18:20	16:51	15:28	14:40
10	02:38	19:41 (3) 03:42	04:54	06:03	07:18	08:22
	20:48	21 20:02 (3) 19:44	18:17	16:48	15:26	14:40
11	02:40	19:41 (3) 03:45	04:56	06:05	07:21	08:24
	20:47	22 20:03 (3) 19:42	18:14	16:45	15:24	14:39
12	02:42	19:41 (3) 03:47	04:58	06:07	07:23	08:25
	20:46	20 20:01 (3) 19:39	18:11	16:42	15:22	14:39
13	02:43	19:41 (3) 03:49	05:01	06:10	07:26	08:26
	20:44	20 20:01 (3) 19:37	18:08	16:40	15:20	14:39
14	02:45	19:41 (3) 03:52	05:03	06:12	07:28	08:28
	20:43	18 19:59 (3) 19:34	18:05	16:37	15:17	14:38
15	02:47	19:41 (3) 03:54	05:05	06:14	07:30	08:29
	20:41	17 19:58 (3) 19:31	18:02	16:34	15:15	14:38
16	02:49	19:41 (3) 03:56	18:35 (4) 05:07	06:17	07:33	08:30
	20:40	15 19:56 (3) 19:28	8 18:43 (4) 17:59	16:31	15:13	14:38
17	02:50	19:41 (3) 03:59	18:32 (4) 05:10	06:19	07:35	08:31
	20:38	14 19:55 (3) 19:26	13 18:45 (4) 17:56	16:28	15:11	14:38
18	02:52	19:42 (3) 04:01	18:31 (4) 05:12	06:22	07:38	08:32
	20:36	12 19:54 (3) 19:23	15 18:46 (4) 17:53	16:25	15:09	14:38
19	02:54	19:41 (3) 04:03	18:29 (4) 05:14	06:24	07:40	08:33
	20:34	11 19:52 (3) 19:20	16 18:45 (4) 17:50	16:23	15:07	14:38
20	02:56	19:42 (3) 04:06	18:29 (4) 05:16	06:26	07:42	08:33
	20:32	9 19:51 (3) 19:17	15 18:44 (4) 17:47	16:20	15:05	14:39
21	02:58	19:35 (2) 04:08	18:29 (4) 05:19	06:29	07:45	08:34
	20:31	10 19:49 (3) 19:15	12 18:41 (4) 17:44	16:17	15:03	14:39
22	03:00	19:32 (2) 04:10	18:02 (5) 05:21	06:31	07:47	08:34
	20:29	13 19:47 (3) 19:12	15 18:38 (4) 17:41	16:14	15:02	14:39
23	03:02	19:31 (2) 04:12	17:58 (5) 05:23	06:34	07:49	08:35
	20:27	12 19:45 (3) 19:09	19 18:35 (4) 17:38	16:12	15:00	14:40
24	03:04	19:30 (2) 04:15	17:55 (5) 05:26	06:36	07:52	08:35
	20:25	14 19:44 (3) 19:06	22 18:32 (4) 17:35	16:09	14:58	14:41
25	03:06	19:29 (2) 04:17	17:53 (5) 05:28	06:39	07:54	08:36
	20:22	13 19:42 (2) 19:03	22 18:29 (4) 17:32	16:06	14:57	14:41
26	03:09	19:29 (2) 04:19	17:51 (5) 05:30	06:41	07:56	08:36
	20:20	11 19:40 (2) 19:00	23 18:14 (5) 17:29	16:04	14:55	14:42
27	03:11	19:29 (2) 04:22	17:51 (5) 05:32	06:43	07:58	08:36
	20:18	9 19:38 (2) 18:58	24 18:15 (5) 17:26	16:01	14:53	14:43
28	03:13	19:28 (2) 04:24	17:50 (5) 05:35	06:46	08:00	08:36
	20:16	9 19:37 (2) 18:55	25 18:15 (5) 17:23	15:58	14:52	14:44
29	03:15	19:28 (2) 04:26	17:49 (5) 05:37	06:48	08:02	08:36
	20:14	7 19:35 (2) 18:52	26 18:15 (5) 17:20	15:56	14:51	14:45
30	03:17	19:28 (2) 04:29	17:48 (5) 05:39	06:51	08:05	08:36
	20:11	5 19:33 (2) 18:49	27 18:15 (5) 17:17	15:53	14:49	14:46
31	03:19	19:28 (2) 04:31	17:47 (5) 05:41	06:53	08:06	08:36
	20:09	3 19:31 (2) 18:46	26 18:13 (5) 17:14	15:51	14:47	14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	454	310	104			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.74	0.66	0.65			
Total reduction	0.18	0.15	0.16			
Total, real	82	46	16			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DI - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (317)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:54	17:05	18:19	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:58	08:08
	14:50	15:57	17:08	18:22	19:33	20:40	20:56	20:04	18:40	17:12	15:45	14:47
3	08:34	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:10
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:03	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:45
5	08:33	07:42	06:27	04:56	03:32	02:30	02:32	03:31	04:42	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:31	17:03	15:38	14:44
6	08:32	07:39	06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:57	16:07	17:18	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:45	20:47	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:18	04:47	03:25	02:27	02:35	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:15	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29	07:30	06:13	04:41	03:20	02:26	02:38	03:42	04:54	06:03	07:18	08:22
	15:04	16:17	17:27	18:41	19:52	20:51	20:48	19:44	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:27	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
	15:08	16:23	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39
13	08:25	07:22	06:04	04:33	03:12	02:24	02:43	03:49	05:01	06:10	07:26	08:26
	15:10	16:25	17:34	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:20	14:39
14	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:14	07:30	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:07	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:28	17:59	16:31	15:13	14:38
17	08:20	07:11	05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31
	15:18	16:35	17:44	18:57	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:21	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:16	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
20	08:15	07:03	05:43	04:13	02:57	02:22	02:56	04:06	05:16	06:26	07:42	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:32	19:17	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27	16:45	17:53	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
22	08:11	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:34
	15:30	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
23	08:09	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	08:35
	15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:52	05:31	04:01	02:49	02:23	03:04	04:15	05:26	06:36	07:52	08:35
	15:35	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
	15:37	16:55	18:03	19:17	20:25	20:59	20:22	19:03	17:32	16:06	14:57	14:41
26	08:04	06:47	05:25	03:56	02:45	02:23	03:09	04:19	05:30	06:41	07:56	08:36
	15:39	16:58	18:05	19:19	20:27	20:59	20:20	19:00	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:43	07:58	08:36
	15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:00	08:36
	15:44	17:03	18:10	19:24	20:31	20:58	20:16	18:55	17:23	15:58	14:52	14:44
29	07:57		05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	08:02	08:36
	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45
30	07:55		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:49		18:15	19:29	20:35	20:58	20:11	18:49	17:17	15:53	14:49	14:46
31	07:53		05:11		02:37		03:19	04:31		06:53		08:36
	15:52		18:17		20:37		20:09	18:46		15:51		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DJ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (318)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35	07:51	06:38	05:08	17:45 (4)	03:43
	14:49	15:54	17:05	18:19	4 17:49 (4)	19:31
2	08:35	07:49	06:36	05:05	17:43 (4)	03:40
	14:50	15:57	17:08	18:22	8 17:51 (4)	19:33
3	08:34	07:46	06:33	05:02	17:42 (4)	03:37
	14:52	16:00	17:10	18:24	11 17:53 (4)	19:36
4	08:34	07:44	06:30	04:59	17:41 (4)	03:35
	14:53	16:02	17:13	18:27	14 17:55 (4)	19:38
5	08:33	07:42	06:27	04:56	17:40 (4)	03:32
	14:55	16:05	17:15	18:29	17 17:57 (4)	19:41
6	08:33	07:39	06:24	04:53	17:41 (4)	03:30
	14:57	16:07	17:18	18:31	19 18:00 (4)	19:43
7	08:32	07:37	06:21	04:50	17:41 (4)	03:27
	14:58	16:10	17:20	18:34	19 18:00 (4)	19:45
8	08:31	07:35	06:18	04:47	17:41 (4)	03:25
	15:00	16:12	17:22	18:36	18 17:59 (4)	19:48
9	08:30	07:32	06:15	04:44	17:42 (4)	03:22
	15:02	16:15	17:25	18:38	16 17:58 (4)	19:50
10	08:29	07:30	06:13	04:41	17:42 (4)	03:20
	15:04	16:17	17:27	18:41	14 17:56 (4)	19:52
11	08:28	07:27	06:10	04:38	17:44 (4)	03:17
	15:06	16:20	17:30	18:43	10 17:54 (4)	19:55
12	08:27	07:25	06:07	17:00 (5)	04:36	03:15
	15:08	16:23	17:32	2 17:02 (5)	18:46	19:57
13	08:25	07:22	06:04	16:57 (5)	04:33	03:12
	15:10	16:25	17:34	7 17:04 (5)	18:48	19:59
14	08:24	07:19	06:01	16:55 (5)	04:30	03:10
	15:12	16:28	17:37	12 17:07 (5)	18:50	20:02
15	08:23	07:17	05:58	16:53 (5)	04:27	03:08
	15:14	16:30	17:39	16 17:09 (5)	18:53	20:04
16	08:21	07:14	05:55	16:52 (5)	04:24	03:06
	15:16	16:33	17:42	20 17:12 (5)	18:55	20:06
17	08:20	07:11	05:52	16:50 (5)	04:21	03:03
	15:18	16:35	17:44	24 17:14 (5)	18:57	20:08
18	08:18	07:09	05:49	16:49 (5)	04:18	03:01
	15:21	16:38	17:46	27 17:16 (5)	19:00	20:11
19	08:16	07:06	05:46	16:49 (5)	04:15	02:59
	15:23	16:40	17:49	27 17:16 (5)	19:02	20:13
20	08:15	07:03	05:43	16:48 (5)	04:13	02:57
	15:25	16:43	17:51	28 17:16 (5)	19:05	20:15
21	08:13	07:01	05:40	16:48 (5)	04:10	02:55
	15:27	16:45	17:53	28 17:16 (5)	19:07	20:17
22	08:11	06:58	05:37	16:48 (5)	04:07	02:53
	15:30	16:48	17:56	27 17:15 (5)	19:09	20:19
23	08:09	06:55	05:34	16:48 (5)	04:04	02:51
	15:32	16:50	17:58	27 17:15 (5)	19:12	20:21
24	08:08	06:52	05:31	16:48 (5)	04:01	02:49
	15:35	16:53	18:01	26 17:14 (5)	19:14	20:23
25	08:06	06:50	05:28	16:49 (5)	03:59	02:47
	15:37	16:55	18:03	23 17:12 (5)	19:17	20:25
26	08:04	06:47	05:25	16:50 (5)	03:56	02:45
	15:39	16:58	18:05	21 17:11 (5)	19:19	20:27
27	08:02	06:44	05:23	16:51 (5)	03:53	02:44
	15:42	17:00	18:08	18 17:09 (5)	19:21	20:29
28	08:00	06:41	05:20	16:53 (5)	03:51	02:42
	15:44	17:03	18:10	14 17:07 (5)	19:24	20:31
29	07:57		05:17	16:56 (5)	03:48	02:40
	15:47		18:12	7 17:03 (5)	19:26	20:33
30	07:55		05:14	03:45		02:39
	15:49		18:15	19:29	15 18:54 (2)	20:35
31	07:53		05:11			02:37
	15:52		18:17			20:37
Potential sun hours	216	257	365	434	526	554
Total, worst case			354	197	394	
Sun reduction			0.28	0.30	0.35	
Oper. time red.			0.93	0.93	0.93	
Wind dir. red.			0.55	0.65	0.71	
Total reduction			0.14	0.18	0.23	
Total, real			51	36	91	

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

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

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DJ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (318)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27 20:57	03:22 20:07	18:51 (3) 19:15 (3)	04:33 18:43	17:43 (4) 17:53 (4)	05:42 17:14
2	02:28 20:56	03:24 20:04	18:50 (3) 19:15 (3)	04:35 18:40	17:41 (4) 17:55 (4)	05:44 17:12
3	02:29 20:56	03:26 20:02	18:50 (3) 19:15 (3)	04:38 18:37	17:40 (4) 17:56 (4)	05:46 17:09
4	02:30 20:55	03:29 20:00	18:50 (3) 19:15 (3)	04:40 18:34	17:38 (4) 17:56 (4)	05:49 17:06
5	02:31 20:54	03:31 19:57	18:49 (3) 19:15 (3)	04:42 18:31	17:37 (4) 17:56 (4)	05:51 17:03
6	02:33 20:53	03:33 19:55	18:49 (3) 19:15 (3)	04:45 18:29	17:36 (4) 17:56 (4)	05:53 17:00
7	02:34 20:52	03:35 19:52	18:49 (3) 19:15 (3)	04:47 18:26	17:37 (4) 17:54 (4)	05:56 16:57
8	02:35 20:51	03:38 19:50	18:49 (3) 19:13 (3)	04:49 18:23	17:36 (4) 17:51 (4)	05:58 16:54
9	02:37 20:50	03:40 19:47	18:49 (2) 19:10 (3)	04:51 18:20	17:36 (4) 17:47 (4)	06:00 16:51
10	02:38 20:48	03:42 19:44	18:48 (2) 19:08 (3)	04:54 18:17	17:36 (4) 17:44 (4)	06:03 16:48
11	02:40 20:47	03:45 19:42	18:47 (2) 19:05 (2)	04:56 18:14	17:37 (4) 17:41 (4)	06:05 16:45
12	02:42 20:46	03:47 19:39	18:47 (2) 19:03 (2)	04:58 18:11	16:07 16:42	06:07 16:22
13	02:43 20:44	03:49 19:37	18:48 (2) 19:01 (2)	05:01 18:08	06:10 16:40	06:26 16:20
14	02:45 20:43	03:52 19:34	18:47 (2) 18:59 (2)	05:03 18:05	16:48 (5) 16:52 (5)	06:12 16:37
15	02:47 20:41	03:54 19:31	18:47 (2) 18:56 (2)	05:05 18:02	16:43 (5) 16:56 (5)	06:14 16:34
16	02:49 20:40	03:56 19:28	18:48 (2) 18:53 (2)	05:07 17:59	16:40 (5) 16:57 (5)	06:17 16:31
17	02:50 20:38	03:59 19:26	18:48 (2) 18:51 (2)	05:10 17:56	16:38 (5) 16:59 (5)	06:19 16:28
18	02:52 20:36	04:01 19:23	05:12 17:53	06:22 17:00 (5)	16:37 (5) 16:25	06:22 16:25
19	02:54 20:34	04:03 19:20	05:14 17:50	06:24 17:00 (5)	16:35 (5) 16:23	06:24 16:23
20	02:56 20:32	04:06 19:17	05:16 17:47	06:26 17:00 (5)	16:34 (5) 16:20	06:26 16:20
21	02:58 20:31	04:08 19:15	05:19 17:44	06:29 17:01 (5)	16:34 (5) 16:17	06:29 16:17
22	03:00 20:29	04:10 19:12	05:21 17:41	06:31 17:01 (5)	16:33 (5) 16:14	06:31 16:14
23	03:02 20:27	04:12 19:09	05:23 17:38	06:34 17:00 (5)	16:32 (5) 16:12	06:34 16:12
24	03:04 20:25	19:00 (3) 19:05 (3)	04:15 19:06	05:26 17:35	16:32 (5) 16:59 (5)	06:36 16:09
25	03:06 20:22	18:57 (3) 19:08 (3)	04:17 19:03	05:28 17:32	16:32 (5) 16:59 (5)	06:39 16:06
26	03:09 20:20	18:56 (3) 19:10 (3)	04:19 19:01	05:30 17:29	16:32 (5) 16:57 (5)	06:41 16:04
27	03:11 20:18	18:54 (3) 19:11 (3)	04:22 18:58	05:32 17:26	16:32 (5) 16:53 (5)	06:43 16:01
28	03:13 20:16	18:53 (3) 19:12 (3)	04:24 18:55	05:35 17:23	16:33 (5) 16:51 (5)	06:46 15:58
29	03:15 20:14	18:53 (3) 19:13 (3)	04:26 18:52	05:37 17:20	16:34 (5) 16:48 (5)	06:48 15:56
30	03:17 20:11	18:52 (3) 19:14 (3)	04:29 18:49	05:39 17:17	16:35 (5) 16:44 (5)	06:51 15:53
31	03:19 20:09	18:51 (3) 19:14 (3)	04:31 18:46	05:41 17:15	16:44 (5) 15:50	06:53 15:50
Potential sun hours	551	481	387	318	232	194
Total, worst case	131	318	505	4		
Sun reduction	0.26	0.24	0.26	0.28		
Oper. time red.	0.93	0.93	0.93	0.93		
Wind dir. red.	0.71	0.71	0.58	0.55		
Total reduction	0.17	0.16	0.14	0.14		
Total, real	22	50	70	1		

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DK - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (319)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June		
1	08:35 14:49	07:51 15:54	14:37 (5) 17:05	06:38 17:05	15:57 (3) 16:23 (3)	05:08 18:19	03:42 19:31	02:36 20:38
2	08:35 14:50	07:49 15:57	14:40 (5) 17:08	06:36 17:08	15:57 (3) 16:23 (3)	05:05 18:22	03:40 19:33	02:34 20:40
3	08:35 14:52	07:46 15:59	14:45 (5) 17:10	06:33 17:10	15:57 (3) 16:22 (3)	05:02 18:24	03:37 19:36	02:33 20:42
4	08:34 14:53	07:44 16:02	14:48 (5) 17:13	06:30 17:13	15:58 (3) 16:21 (3)	04:59 18:27	03:35 19:38	02:32 20:43
5	08:33 14:55	07:42 16:05	14:51 (5) 17:15	06:27 17:15	15:59 (3) 16:20 (3)	04:56 18:29	03:32 19:41	02:30 20:45
6	08:33 14:56	07:39 16:07	14:54 (5) 17:17	06:24 17:17	16:00 (3) 16:18 (3)	04:53 18:31	03:30 19:43	02:29 20:46
7	08:32 14:58	07:37 16:10	14:57 (5) 17:20	06:21 17:20	16:02 (3) 16:48 (2)	04:50 18:34	03:27 19:45	02:28 20:48
8	08:31 15:00	07:35 16:12	15:00 (5) 17:22	06:18 17:22	16:05 (3) 16:51 (2)	04:47 18:36	03:24 19:48	02:27 20:49
9	08:30 15:02	07:32 16:15	15:03 (5) 17:25	06:16 17:25	16:44 (2) 16:54 (2)	04:44 18:38	03:22 19:50	02:26 20:50
10	08:29 15:04	07:30 16:17	15:06 (5) 17:27	06:13 17:27	16:43 (2) 16:57 (2)	04:41 18:41	03:20 19:52	02:25 20:51
11	08:28 15:06	07:27 16:20	15:09 (5) 17:30	06:10 17:30	16:42 (2) 16:59 (2)	04:38 18:43	03:17 19:55	02:25 20:52
12	08:27 15:08	07:25 16:22	15:12 (5) 17:32	06:07 17:32	16:42 (2) 17:02 (2)	04:36 18:46	03:15 19:57	02:24 20:53
13	08:25 15:10	07:22 16:25	15:15 (5) 17:34	06:04 17:34	16:42 (2) 17:01 (2)	04:33 18:48	03:12 19:59	02:23 20:54
14	08:24 15:12	07:19 16:28	15:18 (5) 17:37	06:01 17:37	16:42 (2) 17:00 (2)	04:30 18:50	03:10 20:02	02:23 20:55
15	08:23 15:14	07:17 16:30	15:21 (5) 17:39	05:58 17:39	16:43 (2) 16:59 (2)	04:27 18:53	03:08 20:04	02:22 20:56
16	08:21 15:16	07:14 16:33	15:24 (5) 17:42	05:55 17:42	16:44 (2) 16:58 (2)	04:24 18:55	03:06 20:06	02:22 20:57
17	08:20 15:18	14:31 (5) 16:35	15:27 (5) 17:44	05:52 17:44	16:45 (2) 16:56 (2)	04:21 18:57	03:03 20:08	02:22 20:57
18	08:18 15:20	14:31 (5) 16:38	15:30 (5) 17:46	05:49 17:46	16:56 (2) 18:57	04:18 19:00	03:01 20:11	02:22 20:58
19	08:17 15:23	14:31 (5) 16:40	15:33 (5) 17:49	05:46 17:49	19:00 19:02	20:11 20:13	20:58 20:58	
20	08:15 15:25	14:31 (5) 16:43	15:36 (5) 17:51	05:43 17:51	04:15 19:05	02:59 20:15	02:22 20:59	
21	08:13 15:27	14:30 (5) 16:45	15:39 (5) 17:53	05:40 17:53	04:10 19:07	02:55 20:17	02:22 20:59	
22	08:11 15:30	14:30 (5) 16:48	15:42 (5) 17:56	05:37 17:56	04:07 19:09	02:53 20:19	02:22 20:59	
23	08:09 15:32	14:31 (5) 16:55	15:45 (5) 17:58	05:34 17:58	04:04 19:12	02:51 20:21	02:22 20:59	
24	08:08 15:35	14:31 (5) 16:52	15:48 (5) 18:01	05:31 18:01	04:01 19:14	02:49 20:23	02:22 20:59	
25	08:06 15:37	14:31 (5) 16:55	15:51 (5) 18:03	05:28 18:03	03:59 19:17	02:47 20:25	02:23 20:59	
26	08:04 15:39	14:31 (5) 16:58	15:54 (5) 18:05	05:25 18:05	03:56 19:19	02:45 20:27	02:23 20:59	
27	08:02 15:42	14:31 (5) 17:00	15:57 (5) 18:08	05:23 18:08	03:53 19:21	02:44 20:29	02:24 20:59	
28	08:00 15:44	14:32 (5) 17:03	15:57 (5) 18:10	05:20 18:10	03:50 19:24	02:42 20:31	02:25 20:59	
29	07:58 15:47	14:34 (5) 17:05	15:57 (5) 18:12	05:17 18:12	03:48 19:26	02:40 20:33	02:25 20:58	
30	07:55 15:49	14:34 (5) 17:06	15:57 (5) 18:14	05:14 18:14	03:45 19:29	02:39 20:35	02:26 20:58	
31	07:53 15:52	14:36 (5) 17:07	15:57 (5) 18:15	05:11 18:15	03:42 19:29	02:37 20:37	02:26 20:58	
Potential sun hours	216	257	365	434	526	554		
Total, worst case	217	304	310					
Sun reduction	0.27	0.29	0.28					
Oper. time red.	0.93	0.93	0.93					
Wind dir. red.	0.52	0.52	0.53					
Total reduction	0.13	0.14	0.14					
Total, real	29	43	43					

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DK - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (319)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December			
1	02:27	03:22	04:33	05:42	16:21 (2)	06:56			
	20:57	20:07	18:43	17:14	20	16:41 (2)	15:48		
2	02:28	03:24	04:35	05:44	16:20 (2)	06:58			
	20:56	20:04	18:40	17:12	19	16:39 (2)	15:45		
3	02:29	03:26	04:38	05:46	16:20 (2)	07:01			
	20:56	20:02	18:37	17:09	15	16:35 (2)	15:43		
4	02:30	03:28	04:40	05:49	16:21 (2)	07:03			
	20:55	20:00	18:34	17:06	12	16:33 (2)	15:40		
5	02:31	03:31	04:42	05:51	16:21 (2)	07:06			
	20:54	19:57	18:32	17:03	8	16:29 (2)	15:38		
6	02:33	03:33	04:45	05:53	15:39 (3)	07:08			
	20:53	19:55	18:29	17:00	17	16:26 (2)	15:36		
7	02:34	03:35	04:47	05:56	15:37 (3)	07:11			
	20:52	19:52	18:26	16:57	19	16:24 (2)	15:33		
8	02:35	03:38	04:49	05:58	15:35 (3)	07:13			
	20:51	19:50	18:23	16:54	20	15:55 (3)	15:31		
9	02:37	03:40	04:51	06:00	15:34 (3)	07:16			
	20:50	19:47	18:20	16:51	22	15:56 (3)	15:28		
10	02:38	03:42	04:54	06:03	15:32 (3)	07:18			
	20:49	19:44	18:17	16:48	24	15:56 (3)	15:26		
11	02:40	03:45	04:56	06:05	15:32 (3)	07:21			
	20:47	19:42	18:14	16:45	25	15:57 (3)	15:24		
12	02:42	03:47	04:58	06:07	15:31 (3)	07:23			
	20:46	19:39	18:11	16:42	25	15:56 (3)	15:22		
13	02:43	03:49	05:01	06:10	15:31 (3)	07:26			
	20:44	19:37	18:08	16:40	26	15:57 (3)	15:19		
14	02:45	03:52	05:03	06:12	15:30 (3)	07:28			
	20:43	19:34	18:05	16:37	26	15:56 (3)	15:17		
15	02:47	03:54	05:05	06:14	15:31 (3)	07:31			
	20:41	19:31	18:02	16:34	25	15:56 (3)	15:15		
16	02:48	03:56	05:07	06:17	15:30 (3)	07:33			
	20:40	19:28	17:59	16:31	25	15:55 (3)	15:13		
17	02:50	03:59	05:10	06:19	15:31 (3)	07:35			
	20:38	19:26	17:56	16:28	23	15:54 (3)	15:11		
18	02:52	04:01	05:12	06:22	15:31 (3)	07:38			
	20:36	19:23	17:53	16:25	19	15:50 (3)	15:09		
19	02:54	04:03	05:14	06:24	15:22 (4)	07:40			
	20:34	19:20	17:50	16:23	23	15:48 (3)	15:07		
20	02:56	04:05	05:16	06:26	15:20 (4)	07:42			
	20:33	19:17	17:47	16:20	23	15:45 (3)	15:05		
21	02:58	04:08	05:19	06:29	15:17 (4)	07:45			
	20:31	19:15	17:44	16:17	22	15:42 (3)	15:03		
22	03:00	04:10	05:21	06:31	15:17 (4)	07:47			
	20:29	19:12	17:41	16:14	16	15:33 (4)	15:02		
23	03:02	04:12	05:23	06:34	15:15 (4)	07:49			
	20:27	19:09	17:38	16:12	18	15:33 (4)	15:00		
24	03:04	04:15	05:26	06:36	15:15 (4)	07:52			
	20:25	19:06	17:35	16:09	18	15:33 (4)	14:58		
25	03:06	04:17	05:28	06:39	15:16 (4)	07:54			
	20:23	19:03	17:32	16:06	14	15:30 (4)	14:57		
26	03:08	04:19	05:30	16:28 (2)	06:41	15:15 (4)	07:56		
	20:20	19:01	17:29	9	16:37 (2)	16:04	12	15:27 (4)	14:55
27	03:11	04:22	05:32	16:25 (2)	06:44	15:16 (4)	07:58		
	20:18	18:58	17:26	13	16:38 (2)	16:01	8	15:24 (4)	14:53
28	03:13	04:24	05:35	16:24 (2)	06:46	15:16 (4)	08:00		
	20:16	18:55	17:23	16	16:40 (2)	15:58	6	15:22 (4)	14:52
29	03:15	04:26	05:37	16:22 (2)	06:48	15:18 (4)	08:03		
	20:14	18:52	17:20	18	16:40 (2)	15:56	2	15:19 (4)	14:51
30	03:17	04:29	05:39	16:21 (2)	06:51	16:21 (2)	08:05		
	20:12	18:49	17:17	19	16:40 (2)	15:53	14:49		
31	03:19	04:31		06:53					
	20:09	18:46		15:50					
Potential sun hours	551	481	387	317		232		194	
Total, worst case			75		532		236		
Sun reduction			0.26		0.28		0.28		
Oper. time red.			0.93		0.93		0.93		
Wind dir. red.			0.53		0.52		0.52		
Total reduction			0.13		0.14		0.14		
Total, real			10		73		32		

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DL - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (320)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35	07:51	06:38	05:08	17:08 (5)	03:43
	14:49	15:54	17:05	18:19	17:35 (5)	19:31
2	08:35	07:49	06:36	05:05	17:09 (5)	03:40
	14:50	15:57	17:08	18:22	17:34 (5)	19:33
3	08:34	07:46	06:33	05:02	17:09 (5)	03:37
	14:52	16:00	17:10	18:24	17:33 (5)	19:36
4	08:34	07:44	06:30	04:59	17:10 (5)	03:35
	14:53	16:02	17:13	18:27	17:31 (5)	19:38
5	08:33	07:42	06:27	04:56	17:11 (5)	03:32
	14:55	16:05	17:15	18:29	17:30 (5)	19:41
6	08:33	07:39	06:24	04:53	17:14 (5)	03:30
	14:57	16:07	17:18	18:31	17:28 (5)	19:43
7	08:32	07:37	06:21	04:50	17:17 (5)	03:27
	14:58	16:10	17:20	18:34	18:03 (4)	19:45
8	08:31	07:35	06:18	04:47	17:59 (4)	03:25
	15:00	16:12	17:22	18:36	18:05 (4)	19:48
9	08:30	07:32	06:15	04:44	17:57 (4)	03:22
	15:02	16:15	17:25	18:38	18:07 (4)	19:50
10	08:29	07:30	06:13	04:41	17:56 (4)	03:20
	15:04	16:17	17:27	18:41	18:09 (4)	19:52
11	08:28	07:27	06:10	04:38	17:56 (4)	03:17
	15:06	16:20	17:30	18:43	18:11 (4)	19:55
12	08:27	07:25	06:07	04:36	17:56 (4)	03:15
	15:08	16:23	17:32	18:46	18:14 (4)	19:57
13	08:25	07:22	06:04	04:33	17:56 (4)	03:12
	15:10	16:25	17:34	18:48	18:15 (4)	19:59
14	08:24	07:19	06:01	04:30	17:56 (4)	03:10
	15:12	16:28	17:37	18:50	18:14 (4)	20:02
15	08:23	07:17	05:58	04:27	17:56 (4)	03:08
	15:14	16:30	17:39	18:53	18:13 (4)	20:04
16	08:21	07:14	05:55	04:24	17:57 (4)	03:06
	15:16	16:33	17:42	18:55	18:11 (4)	20:06
17	08:20	07:11	05:52	04:21	17:59 (4)	03:03
	15:18	16:35	17:44	18:57	18:10 (4)	20:08
18	08:18	07:09	05:49	04:18	18:01 (4)	03:01
	15:21	16:38	17:46	19:00	18:07 (4)	20:11
19	08:16	07:06	05:46	04:15	02:59	18:59 (3)
	15:23	16:40	17:49	19:02	20:13	19:23 (3)
20	08:15	07:03	05:43	04:13	02:57	18:59 (3)
	15:25	16:43	17:51	19:05	20:15	19:22 (3)
21	08:13	07:01	05:40	17:21 (5)	04:10	02:55
	15:27	16:45	17:53	2	17:23 (5)	19:07
22	08:11	06:58	05:37	17:17 (5)	04:07	02:53
	15:30	16:48	17:56	9	17:26 (5)	19:09
23	08:09	06:55	05:34	17:15 (5)	04:04	02:51
	15:32	16:50	17:58	13	17:28 (5)	19:12
24	08:08	06:52	05:31	17:14 (5)	04:01	02:49
	15:35	16:53	18:01	16	17:30 (5)	19:14
25	08:06	06:50	05:28	17:12 (5)	03:59	02:47
	15:37	16:55	18:03	21	17:33 (5)	19:17
26	08:04	06:47	05:25	17:11 (5)	03:56	02:45
	15:39	16:58	18:05	24	17:35 (5)	19:19
27	08:02	06:44	05:23	17:10 (5)	03:53	02:44
	15:42	17:00	18:08	27	17:37 (5)	19:21
28	08:00	06:41	05:20	17:09 (5)	03:51	02:42
	15:44	17:03	18:10	28	17:37 (5)	19:24
29	07:57	06:38	05:17	17:09 (5)	03:48	02:40
	15:47	17:05	18:12	28	17:37 (5)	19:26
30	07:55	06:36	05:14	17:09 (5)	03:45	02:39
	15:49	17:07	18:15	27	17:36 (5)	19:29
31	07:53	06:34	05:11	17:08 (5)	03:42	02:37
	15:52	17:09	18:17	28	17:36 (5)	19:30
Potential sun hours	216	257	365	434	526	554
Total, worst case			223	287	517	
Sun reduction			0.28	0.30	0.35	
Oper. time red.			0.93	0.93	0.93	
Wind dir. red.			0.59	0.62	0.73	
Total reduction			0.15	0.17	0.24	
Total, real			35	50	122	

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DL - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (320)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum

813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	July	August	September	October	November	December
1	02:27	03:22	19:06 (2) 04:33	17:55 (4) 05:42	06:56	08:07
	20:57	20:07	19:29 (3) 18:43	18:10 (4) 17:14	15:48	14:48
2	02:28	03:24	19:05 (2) 04:35	17:55 (4) 05:44	06:58	08:09
	20:56	20:04	19:27 (3) 18:40	18:08 (4) 17:12	15:45	14:47
3	02:29	03:26	19:04 (2) 04:38	17:55 (4) 05:46	07:01	08:10
	20:56	20:02	19:24 (3) 18:37	18:05 (4) 17:09	15:43	14:46
4	02:30	03:29	19:03 (2) 04:40	17:56 (4) 05:49	07:03	08:12
	20:55	20:00	19:22 (3) 18:34	18:02 (4) 17:06	15:40	14:45
5	02:31	03:31	19:03 (2) 04:42	17:13 (5) 05:51	07:06	08:14
	20:54	19:57	19:20 (2) 18:31	17:59 (4) 17:03	15:38	14:44
6	02:33	03:33	19:02 (2) 04:45	17:09 (5) 05:53	07:08	08:16
	20:53	19:55	19:18 (2) 18:29	17:23 (5) 17:00	15:36	14:43
7	02:34	03:35	19:02 (2) 04:47	17:07 (5) 05:56	07:11	08:18
	20:52	19:52	19:15 (2) 18:26	17:26 (5) 16:57	15:33	14:42
8	02:35	03:38	19:02 (2) 04:49	17:05 (5) 05:58	07:13	08:19
	20:51	19:50	19:13 (2) 18:23	17:26 (5) 16:54	15:31	14:41
9	02:37	03:40	19:02 (2) 04:51	17:03 (5) 06:00	07:16	08:21
	20:50	19:47	19:10 (2) 18:20	17:27 (5) 16:51	15:28	14:40
10	02:38	03:42	19:02 (2) 04:54	17:02 (5) 06:03	07:18	08:22
	20:48	19:44	19:08 (2) 18:17	17:27 (5) 16:48	15:26	14:40
11	02:40	03:45	19:03 (2) 04:56	17:01 (5) 06:05	07:21	08:24
	20:47	19:42	19:05 (2) 18:14	17:27 (5) 16:45	15:24	14:39
12	02:42	03:47	04:58	17:00 (5) 06:07	07:23	08:25
	20:46	19:39	18:11	17:27 (5) 16:42	15:22	14:39
13	02:43	19:19 (3) 03:49	05:01	17:00 (5) 06:10	07:26	08:26
	20:44	19:22 (3) 19:37	18:08	17:28 (5) 16:40	15:19	14:39
14	02:45	19:16 (3) 03:52	05:03	16:59 (5) 06:12	07:28	08:28
	20:43	19:24 (3) 19:34	18:05	17:27 (5) 16:37	15:17	14:38
15	02:47	19:15 (3) 03:54	05:05	16:59 (5) 06:14	07:30	08:29
	20:41	19:27 (3) 19:31	18:02	17:27 (5) 16:34	15:15	14:38
16	02:49	19:13 (3) 03:56	05:07	16:59 (5) 06:17	07:33	08:30
	20:40	19:27 (3) 19:28	17:59	17:26 (5) 16:31	15:13	14:38
17	02:50	19:13 (3) 03:59	05:10	16:59 (5) 06:19	07:35	08:31
	20:38	19:29 (3) 19:26	17:56	17:24 (5) 16:28	15:11	14:38
18	02:52	19:12 (3) 04:01	05:12	17:00 (5) 06:22	07:38	08:32
	20:36	19:30 (3) 19:23	17:53	17:21 (5) 16:25	15:09	14:38
19	02:54	19:11 (3) 04:03	05:14	17:00 (5) 06:24	07:40	08:33
	20:34	19:30 (3) 19:20	17:50	17:18 (5) 16:23	15:07	14:38
20	02:56	19:11 (3) 04:06	05:16	17:00 (5) 06:26	07:42	08:33
	20:32	19:31 (3) 19:17	17:47	17:14 (5) 16:20	15:05	14:39
21	02:58	19:11 (3) 04:08	05:19	17:03 (5) 06:29	07:45	08:34
	20:31	19:32 (3) 19:15	17:44	17:12 (5) 16:17	15:03	14:39
22	03:00	19:09 (3) 04:10	05:21	17:04 (5) 06:31	07:47	08:34
	20:29	19:31 (3) 19:12	17:41	17:09 (5) 16:14	15:02	14:39
23	03:02	19:09 (3) 04:12	05:23	06:34	07:49	08:35
	20:27	19:32 (3) 19:09	17:38	16:12	15:00	14:40
24	03:04	19:09 (3) 04:15	05:26	06:36	07:52	08:35
	20:25	19:33 (3) 19:06	17:35	16:09	14:58	14:41
25	03:06	19:09 (3) 04:17	18:03 (4) 05:28	06:39	07:54	08:36
	20:22	19:33 (3) 19:03	18:10 (4) 17:32	16:06	14:57	14:41
26	03:09	19:09 (3) 04:19	18:00 (4) 05:30	06:41	07:56	08:36
	20:20	19:33 (3) 19:00	18:12 (4) 17:29	16:04	14:55	14:42
27	03:11	19:09 (3) 04:22	17:59 (4) 05:32	06:43	07:58	08:36
	20:18	19:34 (3) 18:58	18:14 (4) 17:26	16:01	14:53	14:43
28	03:13	19:09 (3) 04:24	17:58 (4) 05:35	06:46	08:00	08:36
	20:16	19:34 (3) 18:55	18:15 (4) 17:23	15:58	14:52	14:44
29	03:15	19:09 (3) 04:26	17:57 (4) 05:37	06:48	08:02	08:36
	20:14	19:34 (3) 18:52	18:15 (4) 17:20	15:56	14:51	14:45
30	03:17	19:09 (3) 04:29	17:56 (4) 05:39	06:51	08:05	08:36
	20:11	19:33 (3) 18:49	18:15 (4) 17:17	15:53	14:49	14:46
31	03:19	19:07 (2) 04:31	17:55 (4)	06:53		08:36
	20:09	19:31 (3) 18:46	18:13 (4)	15:50		14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	371	263	413			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.73	0.69	0.60			
Total reduction	0.18	0.15	0.15			
Total, real	65	41	60			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DM - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (321)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June			
1	08:35	07:51	06:38	05:08	17:27 (5)	03:43	02:36	19:16 (3)	
	14:49	15:54	17:05	18:19	22 17:49 (5)	19:31	20:38	19 19:35 (3)	
2	08:35	07:49	06:36	05:05	17:26 (5)	03:40	02:34	19:16 (3)	
	14:50	15:57	17:08	18:22	25 17:51 (5)	19:33	20:40	18 19:34 (3)	
3	08:34	07:46	06:33	05:02	17:25 (5)	03:37	02:33	19:17 (3)	
	14:52	16:00	17:10	18:24	27 17:52 (5)	19:36	20:42	17 19:34 (3)	
4	08:34	07:44	06:30	04:59	17:25 (5)	03:35	02:32	19:18 (3)	
	14:53	16:02	17:13	18:27	27 17:52 (5)	19:38	20:43	15 19:33 (3)	
5	08:33	07:42	06:27	04:56	17:24 (5)	03:32	02:30	19:19 (3)	
	14:55	16:05	17:15	18:29	28 17:52 (5)	19:41	20:45	15 19:34 (3)	
6	08:32	07:39	06:24	04:53	17:25 (5)	03:30	19:05 (2)	02:29	19:20 (3)
	14:57	16:07	17:18	18:31	27 17:52 (5)	19:43	2 19:07 (2)	20:46	13 19:33 (3)
7	08:32	07:37	06:21	04:50	17:25 (5)	03:27	19:03 (2)	02:28	19:21 (3)
	14:58	16:10	17:20	18:34	27 17:52 (5)	19:45	5 19:08 (2)	20:47	12 19:33 (3)
8	08:31	07:35	06:18	04:47	17:25 (5)	03:25	19:03 (2)	02:27	19:21 (3)
	15:00	16:12	17:22	18:36	26 17:51 (5)	19:48	7 19:10 (2)	20:49	11 19:32 (3)
9	08:30	07:32	06:15	04:44	17:25 (5)	03:22	19:03 (2)	02:26	19:23 (3)
	15:02	16:15	17:25	18:38	25 17:50 (5)	19:50	10 19:13 (2)	20:50	9 19:32 (3)
10	08:29	07:30	06:13	04:41	17:25 (5)	03:20	19:03 (2)	02:26	19:24 (3)
	15:04	16:17	17:27	18:41	24 17:49 (5)	19:52	12 19:15 (2)	20:51	7 19:31 (3)
11	08:28	07:27	06:10	04:38	17:26 (5)	03:17	19:03 (2)	02:25	19:25 (3)
	15:06	16:20	17:30	18:43	21 17:47 (5)	19:55	14 19:17 (2)	20:52	4 19:29 (3)
12	08:27	07:25	06:07	04:36	17:28 (5)	03:15	19:03 (2)	02:24	
	15:08	16:23	17:32	18:46	21 18:14 (4)	19:57	15 19:18 (2)	20:53	
13	08:25	07:22	06:04	04:33	17:30 (5)	03:12	19:03 (2)	02:24	
	15:10	16:25	17:34	18:48	21 18:16 (4)	19:59	17 19:20 (3)	20:54	
14	08:24	07:19	06:01	04:30	17:33 (5)	03:10	19:03 (2)	02:23	
	15:12	16:28	17:37	18:50	17 18:18 (4)	20:02	19 19:22 (3)	20:55	
15	08:23	07:17	05:58	04:27	18:07 (4)	03:08	19:04 (2)	02:23	
	15:14	16:30	17:39	18:53	13 18:20 (4)	20:04	20 19:24 (3)	20:56	
16	08:21	07:14	05:55	04:24	18:07 (4)	03:06	19:05 (2)	02:22	
	15:16	16:33	17:42	18:55	15 18:22 (4)	20:06	21 19:26 (3)	20:57	
17	08:20	07:11	05:52	04:21	18:07 (4)	03:03	19:06 (2)	02:22	
	15:18	16:35	17:44	18:57	18 18:25 (4)	20:08	22 19:28 (3)	20:57	
18	08:18	07:09	05:49	04:18	18:07 (4)	03:01	19:09 (2)	02:22	
	15:21	16:38	17:46	19:00	19 18:26 (4)	20:11	22 19:31 (3)	20:58	
19	08:16	07:06	05:46	04:15	18:07 (4)	02:59	19:13 (3)	02:22	
	15:23	16:40	17:49	19:02	18 18:25 (4)	20:13	20 19:33 (3)	20:58	
20	08:15	07:03	05:43	04:13	18:08 (4)	02:57	19:12 (3)	02:22	
	15:25	16:43	17:51	19:05	16 18:24 (4)	20:15	22 19:34 (3)	20:59	
21	08:13	07:01	05:40	04:10	18:09 (4)	02:55	19:12 (3)	02:22	
	15:27	16:45	17:53	19:07	14 18:23 (4)	20:17	24 19:36 (3)	20:59	
22	08:11	06:58	05:37	04:07	18:10 (4)	02:53	19:13 (3)	02:22	
	15:30	16:48	17:56	19:09	11 18:21 (4)	20:19	24 19:37 (3)	20:59	
23	08:09	06:55	05:34	04:04	18:14 (4)	02:51	19:13 (3)	02:22	
	15:32	16:50	17:58	19:12	4 18:18 (4)	20:21	23 19:36 (3)	20:59	
24	08:08	06:52	05:31	04:01		02:49	19:12 (3)	02:23	
	15:35	16:53	18:01	19:14		20:23	24 19:36 (3)	20:59	
25	08:06	06:50	05:28	03:59		02:47	19:13 (3)	02:23	
	15:37	16:55	18:03	19:17		20:25	23 19:36 (3)	20:59	
26	08:04	06:47	05:25	03:56		02:45	19:13 (3)	02:23	
	15:39	16:58	18:05	19:19		20:27	23 19:36 (3)	20:59	
27	08:02	06:44	05:23	03:53		02:44	19:14 (3)	02:24	
	15:42	17:00	18:08	19:21		20:29	22 19:36 (3)	20:59	
28	08:00	06:41	05:20	17:35 (5)	03:51	02:42	19:14 (3)	02:25	
	15:44	17:03	18:10	5 17:40 (5)	19:24	20:31	22 19:36 (3)	20:58	
29	07:57		05:17	17:32 (5)	03:48	02:40	19:14 (3)	02:25	
	15:47		18:12	10 17:42 (5)	19:26	20:33	21 19:35 (3)	20:58	
30	07:55		05:14	17:30 (5)	03:45	02:39	19:15 (3)	02:26	
	15:49		18:15	14 17:44 (5)	19:29	20:35	20 19:35 (3)	20:58	
31	07:53		05:11	17:29 (5)		02:37	19:16 (3)		
	15:52		18:17	17 17:46 (5)		20:37	19 19:35 (3)		
Potential sun hours	216	257	365	434	466	473	554	140	
Total, worst case			46	466	473	554	140		
Sun reduction			0.28	0.30	0.35			0.30	
Oper. time red.			0.93	0.93	0.93			0.93	
Wind dir. red.			0.62	0.63	0.73			0.74	
Total reduction			0.16	0.18	0.24			0.21	
Total, real			7	83	113			29	

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

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

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DM - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (321)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	19:30 (3) 03:22	19:14 (2) 04:33	17:25 (5) 05:42	06:56	08:07
	20:57	3 19:33 (3) 20:07	15 19:29 (2) 18:43	21 17:46 (5) 17:14	15:48	14:48
2	02:28	19:29 (3) 03:24	19:13 (2) 04:35	17:24 (5) 05:44	06:58	08:09
	20:56	6 19:35 (3) 20:04	14 19:27 (2) 18:40	24 17:48 (5) 17:12	15:45	14:47
3	02:29	19:28 (3) 03:26	19:13 (2) 04:38	17:23 (5) 05:46	07:01	08:10
	20:56	8 19:36 (3) 20:02	11 19:24 (2) 18:37	25 17:48 (5) 17:09	15:43	14:46
4	02:30	19:27 (3) 03:29	19:13 (2) 04:40	17:22 (5) 05:49	07:03	08:12
	20:55	10 19:37 (3) 20:00	9 19:22 (2) 18:34	26 17:48 (5) 17:06	15:40	14:45
5	02:32	19:26 (3) 03:31	19:13 (2) 04:42	17:21 (5) 05:51	07:06	08:14
	20:54	12 19:38 (3) 19:57	7 19:20 (2) 18:31	27 17:48 (5) 17:03	15:38	14:44
6	02:33	19:26 (3) 03:33	19:14 (2) 04:45	17:20 (5) 05:53	07:08	08:16
	20:53	13 19:39 (3) 19:55	4 19:18 (2) 18:29	28 17:48 (5) 17:00	15:36	14:43
7	02:34	19:26 (3) 03:35	19:14 (2) 04:47	17:20 (5) 05:56	07:11	08:18
	20:52	14 19:40 (3) 19:52	2 19:15 (2) 18:26	28 17:48 (5) 16:57	15:33	14:42
8	02:35	19:25 (3) 03:38	04:49	17:20 (5) 05:58	07:13	08:19
	20:51	16 19:41 (3) 19:50	18:23	28 17:48 (5) 16:54	15:31	14:41
9	02:37	19:25 (3) 03:40	04:51	17:19 (5) 06:00	07:16	08:21
	20:50	16 19:41 (3) 19:47	18:20	28 17:47 (5) 16:51	15:28	14:40
10	02:38	19:24 (3) 03:42	04:54	17:19 (5) 06:03	07:18	08:22
	20:48	17 19:41 (3) 19:44	18:17	25 17:44 (5) 16:48	15:26	14:40
11	02:40	19:24 (3) 03:45	04:56	17:19 (5) 06:05	07:21	08:24
	20:47	19 19:43 (3) 19:42	18:14	22 17:41 (5) 16:45	15:24	14:39
12	02:42	19:23 (3) 03:47	04:58	17:20 (5) 06:07	07:23	08:25
	20:46	20 19:43 (3) 19:39	18:11	18 17:38 (5) 16:42	15:22	14:39
13	02:43	19:24 (3) 03:49	05:01	17:21 (5) 06:10	07:26	08:26
	20:44	20 19:44 (3) 19:37	18:08	15 17:36 (5) 16:40	15:19	14:39
14	02:45	19:23 (3) 03:52	05:03	17:22 (5) 06:12	07:28	08:28
	20:43	21 19:44 (3) 19:34	18:05	11 17:33 (5) 16:37	15:17	14:38
15	02:47	19:23 (3) 03:54	05:05	17:24 (5) 06:14	07:30	08:29
	20:41	22 19:45 (3) 19:31	18:02	6 17:30 (5) 16:34	15:15	14:38
16	02:49	19:22 (3) 03:56	05:07	06:17	07:33	08:30
	20:40	23 19:45 (3) 19:28	17:59	16:31	15:13	14:38
17	02:50	19:23 (3) 03:59	05:10	06:19	07:35	08:31
	20:38	22 19:45 (3) 19:26	17:56	16:28	15:11	14:38
18	02:52	19:23 (3) 04:01	05:12	06:22	07:38	08:32
	20:36	23 19:46 (3) 19:23	17:53	16:25	15:09	14:38
19	02:54	19:22 (3) 04:03	05:14	06:24	07:40	08:33
	20:34	24 19:46 (3) 19:20	17:50	16:23	15:07	14:38
20	02:56	19:22 (3) 04:06	18:18 (4) 05:16	06:26	07:42	08:33
	20:32	24 19:46 (3) 19:17	6 18:24 (4) 17:47	16:20	15:05	14:39
21	02:58	19:23 (3) 04:08	18:15 (4) 05:19	06:29	07:45	08:34
	20:31	24 19:47 (3) 19:15	11 18:26 (4) 17:44	16:17	15:03	14:39
22	03:00	19:22 (3) 04:10	18:13 (4) 05:21	06:31	07:47	08:34
	20:29	24 19:46 (3) 19:12	15 18:28 (4) 17:41	16:14	15:02	14:39
23	03:02	19:22 (3) 04:12	18:12 (4) 05:23	06:34	07:49	08:35
	20:27	23 19:45 (3) 19:09	16 18:28 (4) 17:38	16:12	15:00	14:40
24	03:04	19:23 (3) 04:15	18:10 (4) 05:26	06:36	07:52	08:35
	20:25	21 19:44 (3) 19:06	18 18:28 (4) 17:35	16:09	14:58	14:41
25	03:06	19:20 (2) 04:17	18:10 (4) 05:28	06:39	07:54	08:36
	20:22	22 19:42 (3) 19:03	19 18:29 (4) 17:32	16:06	14:57	14:41
26	03:09	19:18 (2) 04:19	18:09 (4) 05:30	06:41	07:56	08:36
	20:20	22 19:40 (3) 19:00	18 18:27 (4) 17:29	16:04	14:55	14:42
27	03:11	19:17 (2) 04:22	18:09 (4) 05:32	06:43	07:58	08:36
	20:18	21 19:38 (3) 18:58	16 18:25 (4) 17:26	16:01	14:53	14:43
28	03:13	19:16 (2) 04:24	18:09 (4) 05:35	06:46	08:00	08:36
	20:16	21 19:37 (3) 18:55	13 18:22 (4) 17:23	15:58	14:52	14:44
29	03:15	19:15 (2) 04:26	17:33 (5) 05:37	06:48	08:02	08:36
	20:14	20 19:35 (3) 18:52	18 18:19 (4) 17:20	15:56	14:51	14:45
30	03:17	19:14 (2) 04:29	17:29 (5) 05:39	06:51	08:05	08:36
	20:11	19 19:33 (3) 18:49	22 18:16 (4) 17:17	15:53	14:49	14:46
31	03:19	19:14 (2) 04:31	17:27 (5)	06:53		08:36
	20:09	17 19:31 (2) 18:46	21 18:13 (4)	15:50		14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	567	255	332			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.74	0.67	0.62			
Total reduction	0.18	0.15	0.15			
Total, real	101	38	50			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DN - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (322)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December			
1	08:36	13:52 (3)	07:51	06:38	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07	13:38 (3)	
14:49	5	13:57 (3)	15:54	17:05	18:20	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48	16	13:54 (3)
2	08:35	13:52 (3)	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:09	13:38 (3)	
14:50	6	13:58 (3)	15:57	17:08	18:22	19:33	20:40	20:57	20:05	18:40	17:12	15:45	14:47	17	13:55 (3)
3	08:35	13:52 (3)	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:38 (3)	
14:52	8	14:00 (3)	15:59	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46	17	13:55 (3)
4	08:34	13:52 (3)	07:44	06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12	13:39 (3)	
14:53	10	14:02 (3)	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:44	16	13:55 (3)
5	08:33	13:53 (3)	07:42	06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14	13:39 (3)	
14:55	11	14:04 (3)	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:43	15	13:54 (3)
6	08:33	13:53 (3)	07:39	06:24	04:53	03:29	02:29	02:33	03:33	04:45	05:53	07:08	08:16	13:39 (3)	
14:56	13	14:06 (3)	16:07	17:17	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:35	14:43	13	13:52 (3)
7	08:32	13:54 (3)	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18	13:40 (3)	
14:58	14	14:08 (3)	16:10	17:20	18:34	19:45	20:48	20:52	19:52	18:26	16:57	15:33	14:42	11	13:51 (3)
8	08:31	13:54 (3)	07:35	06:18	04:47	03:24	02:27	02:35	03:38	04:49	05:58	07:13	08:19	13:40 (3)	
15:00	16	14:10 (3)	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41	10	13:50 (3)
9	08:30	13:54 (3)	07:32	06:16	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21	13:41 (3)	
15:02	18	14:12 (3)	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40	8	13:49 (3)
10	08:29	13:54 (3)	07:30	06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	08:22	13:41 (3)	
15:04	17	14:11 (3)	16:17	17:27	18:41	19:52	20:51	20:49	19:45	18:17	16:48	15:26	14:40	7	13:48 (3)
11	08:28	13:56 (3)	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24	13:42 (3)	
15:06	16	14:12 (3)	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39	5	13:47 (3)
12	08:27	13:56 (3)	07:25	06:07	04:35	03:15	02:24	02:41	03:47	04:58	06:07	07:23	08:25	13:43 (3)	
15:08	16	14:12 (3)	16:22	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39	4	13:47 (3)
13	08:25	13:56 (3)	07:22	06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	08:27	13:43 (3)	
15:10	16	14:12 (3)	16:25	17:34	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:19	14:38	3	13:46 (3)
14	08:24	13:58 (3)	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28	13:44 (3)	
15:12	15	14:13 (3)	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38	2	13:46 (3)
15	08:23	13:59 (3)	07:17	05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	08:29	13:44 (3)	
15:14	13	14:12 (3)	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38	2	13:45 (3)
16	08:21	14:00 (3)	07:14	05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	08:30	13:43 (3)	
15:16	12	14:12 (3)	16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38	13:43 (3)	
17	08:20	14:01 (3)	07:12	05:52	04:21	03:03	02:22	02:50	03:58	05:10	06:19	07:35	08:31	13:43 (3)	
15:18	10	14:11 (3)	16:35	17:44	18:58	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38	13:43 (3)	
18	08:18	14:03 (3)	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32	13:43 (3)	
15:20	7	14:10 (3)	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38	13:43 (3)	
19	08:17	14:06 (3)	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33	13:43 (3)	
15:23	2	14:08 (3)	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38	13:43 (3)	
20	08:15	14:03 (3)	07:03	05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:43	08:33	13:43 (3)	
15:25	16:43	17:51	19:05	20:15	20:59	20:33	19:17	17:47	16:20	15:05	13:48	13:48	13:48	13:48	
21	08:13	14:01 (3)	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34	13:43 (3)	
15:27	16:45	17:53	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	13:49	13:49	13:49	13:49	
22	08:11	14:01 (3)	07:01	05:41	04:11	02:55	02:22	03:00	04:10	05:21	06:31	07:47	08:35	13:43 (3)	
15:30	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	13:49	13:49	13:49	13:49	
23	08:10	14:01 (3)	07:00	05:40	04:10	02:55	02:22	03:02	04:12	05:23	06:34	07:49	08:35	13:42 (3)	
15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	2	13:44 (3)	13:44	13:44	
24	08:08	14:01 (3)	07:00	05:40	04:10	02:55	02:22	03:04	04:15	05:26	06:36	07:52	08:36	13:40 (3)	
15:34	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	7	13:47 (3)	13:47	13:47	
25	08:06	14:01 (3)	07:00	05:40	04:10	02:55	02:22	03:06	04:17	05:28	06:39	07:54	08:36	13:39 (3)	
15:37	16:55	18:03	19:17	20:25	20:59	20:23	19:03	17:32	16:06	14:56	10	13:49 (3)	13:49	13:49	
26	08:04	14:01 (3)	07:00	05:40	04:10	02:55	02:22	03:08	04:19	05:30	06:41	07:56	08:36	13:38 (3)	
15:39	16:58	18:05	19:19	20:27	20:59	20:20	19:01	17:29	16:04	14:55	12	13:50 (3)	13:50	13:50	
27	08:02	14:01 (3)	07:00	05:40	04:10	02:55	02:22	03:11	04:22	05:32	06:44	07:58	08:36	13:38 (3)	
15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:53	13	13:51 (3)	13:51	13:51	
28	08:00	14:01 (3)	07:00	05:40	04:10	02:55	02:22	03:13	04:24	05:35	06:46	08:01	08:36	13:37 (3)	
15:44	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:23	15:58	14:52	15	13:52 (3)	13:52	13:52	
29	07:58	14:01 (3)	07:00	05:40	04:10	02:55	02:22	03:15	04:26	05:37	06:48	08:03	08:36	13:37 (3)	
15:47	18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:50	13:45	16	13:53 (3)	13:53	13:53	
30	07:55	14:01 (3)	07:00	05:40	04:10	02:55	02:22	03:17	04:29	05:39	06:51	08:05	08:36	13:37 (3)	
15:49	18:15	19:29	20:35	20:58	20:12	18:49	17:17	15:53	14:49	13:44	16	13:53 (3)	13:53	13:53	
31	07:53	14:01 (3)	07:00	05:40	04:10	02:55	02:22	03:19	04:31	05:41	06:53	08:06	08:36	13:37 (3)	
15:52	18:17	19:31	20:37	20:58	20:09	18:46	17:14	15:50	14:45	13:40	16	13:53 (3)	13:53	13:53	
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	91	155	194	155
Total, worst case	225											91	155		155
Sun reduction	0.27											0.28	0.30		0.30
Oper. time red.	0.93											0.93	0.93		0.93
Wind dir. red.	0.56											0.56	0.56		0.56
Total reduction	0.14											0.15	0.16		0.16
Total, real	32											13	24		24

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:

Gismarvik

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Calculated:  
15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DO - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (323)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:35	07:51	06:38	05:08	03:43		02:36						
	14:49	15:54	17:05	18:19	19:31		20:38	18	19:21 (3)	02:27	19:34 (3)	03:22	
2	08:35	07:49	06:36	05:05	03:40		02:34						
	14:50	15:57	17:08	18:22	19:33		20:40	18	19:38 (3)	02:56	6	19:39 (3)	02:04
3	08:34	07:46	06:33	05:02	03:37		02:33						
	14:52	16:00	17:10	18:24	19:36		20:42	17	19:38 (3)	02:56	8	19:40 (3)	02:02
4	08:34	07:44	06:30	04:59	03:35		02:32						
	14:53	16:02	17:13	18:27	19:38		20:43	15	19:37 (3)	02:55	10	19:41 (3)	02:00
5	08:33	07:42	06:27	04:56	03:32		02:30						
	14:55	16:05	17:15	18:29	19:41		20:45	15	19:38 (3)	02:54	12	19:42 (3)	01:57
6	08:32	07:39	06:24	04:53	03:30		02:29						
	14:57	16:07	17:18	18:31	19:43		20:46	13	19:37 (3)	02:53	13	19:43 (3)	01:55
7	08:32	07:37	06:21	04:50	03:27		02:28						
	14:58	16:10	17:20	18:34	19:45	2	19:07 (2)	02:28					
8	08:31	07:35	06:18	04:47	03:25		02:27						
	15:00	16:12	17:22	18:36	19:48	4	19:10 (2)	02:49					
9	08:30	07:32	06:15	04:44	03:22		02:26						
	15:02	16:15	17:25	18:38	19:50	7	19:13 (2)	02:50					
10	08:29	07:30	06:13	04:41	03:20		02:26						
	15:04	16:17	17:27	18:41	19:52	9	19:15 (2)	02:51					
11	08:28	07:27	06:10	04:38	03:17		02:25						
	15:06	16:20	17:30	18:43	19:55	11	19:17 (2)	02:52					
12	08:27	07:25	06:07	04:36	03:15		02:24						
	15:08	16:23	17:32	18:46	19:57	12	19:18 (2)	02:53					
13	08:25	07:22	06:04	04:33	03:12		02:24						
	15:10	16:25	17:34	18:48	19:59	14	19:20 (2)	02:54					
14	08:24	07:19	06:01	04:30	03:10		02:23						
	15:12	16:28	17:37	18:50	20:02	16	19:22 (2)	02:55					
15	08:23	07:17	05:58	04:27	03:08		02:23						
	15:14	16:30	17:39	18:53	20:04	17	19:24 (3)	02:56					
16	08:21	07:14	05:55	04:24	03:06		02:22						
	15:16	16:33	17:42	18:55	20:06	18	19:26 (3)	02:57					
17	08:20	07:11	05:52	04:21	03:03		02:22						
	15:18	16:35	17:44	18:57	20:08	19	19:28 (3)	02:57					
18	08:18	07:09	05:49	04:18	03:01		02:22						
	15:21	16:38	17:46	19:00	20:11	20	19:31 (3)	02:58					
19	08:16	07:06	05:46	04:15	02:59		02:22						
	15:23	16:40	17:49	19:02	20:13	16	19:33 (3)	02:58					
20	08:15	07:03	05:43	04:13	02:57		02:22						
	15:25	16:43	17:51	19:05	20:15	17	19:34 (3)	02:59					
21	08:13	07:01	05:40	04:10	02:55		02:22						
	15:27	16:45	17:53	19:07	20:17	20	19:36 (3)	02:59					
22	08:11	06:58	05:37	04:07	02:53		02:22						
	15:30	16:48	17:56	19:09	20:19	21	19:38 (3)	02:59					
23	08:09	06:55	05:34	04:04	02:51		02:22						
	15:32	16:50	17:58	19:12	20:21	23	19:40 (3)	02:59					
24	08:08	06:52	05:31	04:01	02:49		02:23						
	15:35	16:53	18:01	19:14	20:23	24	19:40 (3)	02:59					
25	08:06	06:50	05:28	03:59	02:47		02:23						
	15:37	16:55	18:03	19:17	20:25	23	19:40 (3)	02:59					
26	08:04	06:47	05:25	03:56	02:45		02:23						
	15:39	16:58	18:05	19:19	20:27	23	19:40 (3)	02:59					
27	08:02	06:44	05:23	03:53	02:44		02:24						
	15:42	17:00	18:08	19:21	20:29	22	19:40 (3)	02:59					
28	08:00	06:41	05:20	03:51	02:42		02:25						
	15:44	17:03	18:10	19:24	20:31	21	19:40 (3)	02:58					
29	07:57		05:17	03:48	02:40		02:25						
	15:47		18:12	19:26	20:33	21	19:39 (3)	02:58					
30	07:55		05:14	03:45	02:39		02:26						
	15:49		18:15	19:29	20:35	20	19:39 (3)	02:58					
31	07:53		05:11		02:37		02:30						
	15:52		18:17		20:37	19	19:39 (3)						
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194	
Total, worst case							529						
Sun reduction						0.35	0.26						
Oper. time red.						0.93	0.93						
Wind dir. red.						0.74	0.74						
Total reduction						0.24	0.18						
Total, real						101	29		6				

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:  
**Gismarvik**

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15.08.2011 12:14 / 160

Licensed user:  
**Kjeller Vindteknikk AS**  
Gunnar Randres vei 12  
NO-2007 Kjeller  
(+47) 480 50 480  
Tove Risberg / tove.risberg@vindteknikk.no  
Calculated:  
15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

Calculation: Skyggekast Gismarvik Shadow receptor: DP - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (324)

**Assumptions for shadow calculations**

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:54	17:05	18:20	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:09
	14:50	15:57	17:08	18:22	19:33	20:40	20:57	20:05	18:40	17:12	15:45	14:47
3	08:35	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	15:59	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:44
5	08:33	07:42	06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44
6	08:33	07:39	06:24	04:53	03:29	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:56	16:07	17:17	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:45	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:18	04:47	03:24	02:27	02:35	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:16	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29	07:30	06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	08:22
	15:04	16:17	17:27	18:41	19:52	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:27	07:25	06:07	04:35	03:15	02:24	02:41	03:47	04:58	06:07	07:23	08:25
	15:08	16:22	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39
13	08:25	07:22	06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	08:27
	15:10	16:25	17:34	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:19	14:38
14	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	07:17	05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20	07:12	05:52	04:21	03:03	02:22	02:50	03:58	05:10	06:19	07:35	08:31
	15:18	16:35	17:44	18:58	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:20	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:17	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
20	08:15	07:03	05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:43	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:33	19:17	17:47	16:20	15:05	14:38
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27	16:45	17:53	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
22	08:11	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35
	15:30	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
23	08:10	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	08:35
	15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:53	05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	08:36
	15:34	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	14:40
25	08:06	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
	15:37	16:55	18:03	19:17	20:25	20:59	20:23	19:03	17:32	16:06	14:56	14:41
26	08:04	06:47	05:25	03:56	02:45	02:23	03:08	04:19	05:30	06:41	07:56	08:36
	15:39	16:58	18:05	19:19	20:27	20:59	20:20	19:01	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:44	07:58	08:36
	15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00	06:41	05:20	03:50	02:42	02:25	03:13	04:24	05:35	06:46	08:00	08:36
	15:44	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:23	15:58	14:52	14:44
29	07:58		05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	08:03	08:36
	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:50	14:45
30	07:55		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:49		18:15	19:29	20:35	20:58	20:12	18:49	17:17	15:53	14:49	14:46
31	07:53		05:11		02:37		03:19	04:31		06:53		08:36
	15:52		18:17		20:37		20:09	18:46		15:50		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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Licensed user:

Kjeller Vindteknikk AS

Gunnar Randres vei 12

NO-2007 Kjeller

(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DQ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (325)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	03:43 19:31	02:36 20:38	19:23 (3) 02:27	19:33 (3) 03:22	04:33 05:42	05:42 06:56	06:56 08:07	08:07 14:48
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:33	02:34 20:40	19:22 (3) 02:28	19:33 (3) 03:24	04:35 05:44	05:44 06:58	06:58 08:08	08:08 14:47
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	19:23 (3) 02:29	19:33 (3) 03:26	04:38 05:47	05:47 07:01	07:01 08:10	08:10 14:46
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	19:24 (3) 02:30	19:32 (3) 03:29	04:40 05:49	05:49 07:03	07:03 08:12	08:12 14:45
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:41	02:30 20:45	19:25 (3) 02:32	19:32 (3) 03:31	04:42 05:51	05:51 07:06	07:06 08:14	08:14 14:44
6	08:32 14:57	07:39 16:07	06:24 17:18	04:53 18:31	03:30 19:43	02:29 20:46	19:26 (3) 02:33	19:31 (3) 03:33	04:45 05:53	05:53 07:08	07:08 08:16	08:16 14:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:47	19:26 (3) 02:34	19:32 (3) 03:35	04:47 05:56	05:56 07:11	07:11 08:18	08:18 14:42
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	03:25 19:48	02:27 20:49	19:27 (3) 02:35	19:31 (3) 03:38	04:49 05:58	05:58 07:13	07:13 08:19	08:19 14:41
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	03:22 19:50	02:26 20:50	19:28 (3) 02:37	19:31 (3) 03:40	04:51 06:00	06:00 07:16	07:16 08:21	08:21 14:40
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:52	02:26 20:51	19:29 (3) 02:38	19:30 (3) 03:42	04:54 06:03	06:03 07:18	07:18 08:22	08:22 14:40
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:52	19:29 (3) 02:40	19:30 (3) 03:45	04:56 06:05	06:05 07:21	07:21 08:24	08:24 14:39
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	03:15 19:57	02:24 20:53	19:30 (3) 02:42	19:30 (3) 03:47	04:58 06:07	06:07 07:23	07:23 08:25	08:25 14:39
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	03:12 19:59	02:24 20:54	19:32 (3) 02:43	19:30 (3) 03:49	05:01 06:10	06:10 07:26	07:26 08:26	08:26 14:39
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	03:10 20:02	02:23 20:55	19:32 (3) 02:45	19:29 (3) 03:52	05:03 06:12	06:12 07:28	07:28 08:28	08:28 14:38
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:23 20:56	19:37 (3) 02:43	19:30 (3) 03:54	05:05 06:14	06:14 07:30	07:30 08:29	08:29 14:38
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	02:22 20:57	19:36 (3) 02:41	19:31 (3) 03:56	05:07 06:17	06:17 07:33	07:33 08:30	08:30 14:38
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	03:03 20:08	02:22 20:57	19:20 (3) 02:22	19:29 (3) 03:59	05:10 06:19	06:19 07:35	07:35 08:31	08:31 14:38
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	03:01 20:11	02:22 20:58	19:21 (3) 02:22	19:30 (3) 04:01	05:12 06:22	06:22 07:38	07:38 08:32	08:32 14:38
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	02:59 20:13	02:22 20:58	19:20 (3) 02:22	19:33 (3) 04:03	05:14 06:24	06:24 07:40	07:40 08:33	08:33 14:38
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	02:57 20:15	02:22 20:59	19:20 (3) 02:22	19:29 (3) 04:06	05:16 06:26	06:26 07:42	07:42 08:33	08:33 14:39
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	02:55 20:17	02:22 20:59	19:19 (3) 02:22	19:30 (3) 04:08	05:19 06:29	06:29 07:45	07:45 08:34	08:34 14:39
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	02:53 20:19	02:22 20:59	19:20 (3) 02:22	19:29 (3) 04:10	05:21 06:31	06:31 07:47	07:47 08:34	08:34 14:39
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	02:51 20:21	02:22 20:59	19:19 (3) 02:22	19:29 (3) 04:12	05:23 06:34	06:34 07:49	07:49 08:35	08:35 14:40
24	08:08 15:35	06:52 16:53	05:31 18:01	04:01 19:14	02:49 20:23	02:23 20:59	19:19 (3) 02:23	19:30 (3) 04:15	05:28 06:36	06:36 07:52	07:52 08:35	08:35 14:41
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	02:47 20:25	02:23 20:59	19:20 (3) 02:23	19:33 (3) 04:17	05:28 06:39	06:39 07:54	07:54 08:36	08:36 14:41
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 19:19	02:45 20:27	02:23 20:59	19:20 (3) 02:23	19:33 (3) 04:19	05:30 06:41	06:41 07:56	07:56 08:36	08:36 14:42
27	08:02 15:42	06:44 17:00	05:23 18:08	03:53 19:21	02:44 20:29	02:24 20:59	19:20 (3) 02:24	19:32 (3) 04:22	05:32 06:43	06:43 07:58	07:58 08:36	08:36 14:43
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	02:25 20:58	19:21 (3) 02:25	19:32 (3) 04:24	05:35 06:46	06:46 08:00	08:00 08:36	08:36 14:44
29	07:57 15:47	06:39 18:12	05:17 19:26	03:48 20:33	02:40 20:33	02:25 20:58	19:21 (3) 02:25	19:33 (3) 04:26	05:37 06:48	06:48 08:02	08:02 08:36	08:36 14:45
30	07:55 15:49	06:37 18:15	05:14 19:29	03:45 20:35	02:39 20:35	02:26 20:58	19:21 (3) 02:26	19:35 (3) 04:29	05:39 06:51	06:51 08:05	08:05 08:36	08:36 14:46
31	07:53 15:52	06:35 18:17	05:11 19:37	03:43 20:43	02:37 20:37	02:26 20:58	19:22 (3) 02:26	19:36 (3) 04:31	05:41 06:53	06:53 08:07	08:07 08:36	08:36 14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case					282	199						
Sun reduction					0.35	0.30						
Oper. time red.					0.93	0.93						
Wind dir. red.					0.74	0.74						
Total reduction					0.24	0.21						
Total, real					68	41						

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)



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Calculated:

15.08.2011 09:56/2.7.486



SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DR - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (326)

Assumptions for shadow calculations

Maximum distance for influence 1 500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for specific times of day (e.g., 08:35, 14:49, etc.), showing sun rise/set times and shadow reduction percentages.

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

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

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DS - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (327)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35	07:51	06:38	05:08	03:43	18:41 (2)   02:36
	14:49	15:54	17:05	18:19	19:31	18:55 (2)   20:38
2	08:35	07:49	06:36	05:05	17:49 (4)   03:40	18:42 (2)   02:34
	14:50	15:57	17:08	18:22	17:51 (4)   19:33	18:58 (2)   20:40
3	08:34	07:46	06:33	05:02	17:47 (4)   03:37	18:42 (2)   02:33
	14:52	16:00	17:10	18:24	17:53 (4)   19:36	19:00 (2)   20:42
4	08:34	07:44	06:30	04:59	17:46 (4)   03:35	18:42 (2)   02:32
	14:53	16:02	17:13	18:27	17:55 (4)   19:38	19:02 (3)   20:43
5	08:33	07:42	06:27	04:56	17:45 (4)   03:32	18:43 (2)   02:30
	14:55	16:05	17:15	18:29	17:57 (4)   19:41	19:04 (3)   20:45
6	08:33	07:39	06:24	04:53	17:45 (4)   03:30	18:44 (2)   02:29
	14:57	16:07	17:18	18:31	18:00 (4)   19:43	19:07 (3)   20:46
7	08:32	07:37	06:21	04:50	17:45 (4)   03:27	18:43 (3)   02:28
	14:58	16:10	17:20	18:34	18:03 (4)   19:45	19:08 (3)   20:47
8	08:31	07:35	06:18	04:47	17:44 (4)   03:25	18:43 (3)   02:27
	15:00	16:12	17:22	18:36	18:04 (4)   19:48	19:08 (3)   20:49
9	08:30	07:32	06:15	04:44	17:44 (4)   03:22	18:43 (3)   02:26
	15:02	16:15	17:25	18:38	18:03 (4)   19:50	19:09 (3)   20:50
10	08:29	07:30	06:13	04:41	17:45 (4)   03:20	18:43 (3)   02:26
	15:04	16:17	17:27	18:41	18:02 (4)   19:52	19:09 (3)   20:51
11	08:28	07:27	06:10	04:38	17:45 (4)   03:17	18:44 (3)   02:25
	15:06	16:20	17:30	18:43	18:00 (4)   19:55	19:08 (3)   20:52
12	08:27	07:25	06:07	04:36	17:48 (4)   03:15	18:43 (3)   02:24
	15:08	16:23	17:32	18:46	17:59 (4)   19:57	19:07 (3)   20:53
13	08:25	07:22	06:04	04:33	17:50 (4)   03:12	18:43 (3)   02:23
	15:10	16:25	17:34	18:48	17:55 (4)   19:59	19:07 (3)   20:54
14	08:24	07:19	06:01	17:06 (5)   04:30	03:10	18:44 (3)   02:23
	15:12	16:28	17:37	17:07 (5)   18:50	20:02	19:06 (3)   20:55
15	08:23	07:17	05:58	17:02 (5)   04:27	03:08	18:45 (3)   02:23
	15:14	16:30	17:39	17:09 (5)   18:53	20:04	19:06 (3)   20:56
16	08:21	07:14	05:55	17:00 (5)   04:24	03:06	18:45 (3)   02:22
	15:16	16:33	17:42	17:12 (5)   18:55	20:06	19:05 (3)   20:57
17	08:20	07:11	05:52	16:58 (5)   04:21	03:03	18:46 (3)   02:22
	15:18	16:35	17:44	16:14 (5)   18:57	20:08	19:04 (3)   20:57
18	08:18	07:09	05:49	16:57 (5)   04:18	03:01	18:48 (3)   02:22
	15:21	16:38	17:46	17:16 (5)   19:00	20:11	19:04 (3)   20:58
19	08:16	07:06	05:46	16:56 (5)   04:15	02:59	18:49 (3)   02:22
	15:23	16:40	17:49	17:19 (5)   19:02	20:13	19:03 (3)   20:58
20	08:15	07:03	05:43	16:55 (5)   04:13	02:57	18:51 (3)   02:22
	15:25	16:43	17:51	17:21 (5)   19:05	20:15	19:01 (3)   20:59
21	08:13	07:01	05:40	16:54 (5)   04:10	02:55	18:53 (3)   02:22
	15:27	16:45	17:53	17:21 (5)   19:07	20:17	18:58 (3)   20:59
22	08:11	06:58	05:37	16:54 (5)   04:07	02:53	02:22
	15:30	16:48	17:56	17:21 (5)   19:09	20:19	20:59
23	08:09	06:55	05:34	16:53 (5)   04:04	02:51	02:22
	15:32	16:50	17:58	17:21 (5)   19:12	20:21	20:59
24	08:08	06:52	05:31	16:53 (5)   04:01	02:49	02:22
	15:35	16:53	18:01	17:20 (5)   19:14	20:23	20:59
25	08:06	06:50	05:28	16:53 (5)   03:59	02:47	02:23
	15:37	16:55	18:03	17:20 (5)   19:17	20:25	20:59
26	08:04	06:47	05:25	16:53 (5)   03:56	02:45	02:23
	15:39	16:58	18:05	17:19 (5)   19:19	20:27	20:59
27	08:02	06:44	05:23	16:54 (5)   03:53	18:44 (2)   02:44	02:24
	15:42	17:00	18:08	17:17 (5)   19:21	3 18:47 (2)   20:29	20:59
28	08:00	06:41	05:20	16:55 (5)   03:51	18:43 (2)   02:42	02:25
	15:44	17:03	18:10	17:16 (5)   19:24	6 18:49 (2)   20:31	20:59
29	07:57		05:17	16:56 (5)   03:48	18:42 (2)   02:40	02:25
	15:47		18:12	17:14 (5)   19:26	9 18:51 (2)   20:33	20:58
30	07:55		05:14	16:58 (5)   03:45	18:42 (2)   02:39	02:26
	15:49		18:15	17:12 (5)   19:29	12 18:54 (2)   20:35	20:58
31	07:53		05:11	17:01 (5)	02:37	
	15:52		18:17	7 17:08 (5)	20:37	
Potential sun hours	216	257	365	434	526	554
Total, worst case			350	179	412	
Sun reduction			0.28	0.30	0.35	
Oper. time red.			0.93	0.93	0.93	
Wind dir. red.			0.56	0.65	0.71	
Total reduction			0.15	0.18	0.23	
Total, real			51	32	96	

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:

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DS - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (327)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	July	August	September	October	November	December
1	02:27 20:57	03:22 19:07	18:54 (3) 04:33	17:44 (4) 05:42	06:56 15:48	08:07 14:48
2	02:28 20:56	03:24 19:04	18:54 (3) 04:35	17:44 (4) 05:44	06:58 15:45	08:09 14:47
3	02:29 20:56	03:26 19:02	18:54 (3) 04:38	17:42 (4) 05:46	07:01 15:43	08:10 14:46
4	02:30 20:55	03:29 19:00	18:53 (3) 04:40	17:41 (4) 05:49	07:03 15:40	08:12 14:45
5	02:31 20:54	03:31 19:57	18:53 (3) 04:42	17:41 (4) 05:51	07:06 15:38	08:14 14:44
6	02:33 20:53	03:33 19:55	18:53 (3) 04:45	17:40 (4) 05:53	07:08 15:36	08:16 14:43
7	02:34 20:52	03:35 19:52	18:53 (2) 04:47	17:41 (4) 05:56	07:11 15:33	08:18 14:42
8	02:35 20:51	03:38 19:50	18:52 (2) 04:49	17:41 (4) 05:58	07:13 15:31	08:19 14:41
9	02:37 20:50	03:40 19:47	18:51 (2) 04:51	17:41 (4) 06:00	07:16 15:28	08:21 14:40
10	02:38 20:48	03:42 19:44	18:50 (2) 04:54	17:42 (4) 06:03	07:18 15:26	08:22 14:40
11	02:40 20:47	03:45 19:42	18:50 (2) 04:56	17:44 (4) 06:05	07:21 15:24	08:24 14:39
12	02:42 20:46	03:47 19:39	18:50 (2) 04:58	16:54 (5) 06:07	07:23 15:22	08:25 14:39
13	02:43 20:44	03:49 19:37	18:51 (2) 05:01	16:58 (5) 06:10	07:26 15:19	08:26 14:39
14	02:45 20:43	03:52 19:34	18:51 (2) 05:03	17:03 (5) 06:12	07:28 15:17	08:28 14:38
15	02:47 20:41	03:54 19:31	18:51 (2) 05:05	17:04 (5) 06:14	07:30 15:15	08:29 14:38
16	02:49 20:40	03:56 19:28	18:56 (2) 05:07	17:05 (5) 06:16	07:33 15:13	08:30 14:38
17	02:50 20:38	03:59 19:26	18:53 (2) 05:10	17:06 (5) 06:18	07:35 15:11	08:31 14:38
18	02:52 20:36	04:01 19:23	05:12 17:56	16:41 (5) 06:22	07:38 15:09	08:32 14:38
19	02:54 20:34	04:03 19:20	05:14 17:50	16:40 (5) 06:24	07:40 15:07	08:33 14:38
20	02:56 20:32	04:06 19:17	05:16 17:47	16:39 (5) 06:26	07:42 15:05	08:33 14:39
21	02:58 20:31	04:08 19:15	05:19 17:44	16:39 (5) 06:29	07:45 15:03	08:34 14:39
22	03:00 20:29	04:10 19:12	05:21 17:41	16:39 (5) 06:31	07:47 15:02	08:34 14:39
23	03:02 20:27	19:02 (3) 19:10 (3)	04:12 17:38	16:39 (5) 06:34	07:49 15:00	08:35 14:40
24	03:04 20:25	19:00 (3) 19:12 (3)	04:15 17:35	16:38 (5) 06:36	07:52 14:58	08:35 14:41
25	03:06 20:22	18:59 (3) 19:14 (3)	04:17 17:32	16:39 (5) 06:39	07:54 14:57	08:36 14:41
26	03:09 20:20	18:58 (3) 19:15 (3)	04:19 17:29	17:00 (5) 06:06	16:40 (5) 06:41	07:56 14:55
27	03:11 20:18	18:57 (3) 19:16 (3)	04:22 17:26	16:40 (5) 06:43	16:57 (5) 16:04	07:58 14:53
28	03:13 20:16	18:56 (3) 19:17 (3)	04:24 17:23	16:43 (5) 06:46	16:01 16:01	07:58 14:53
29	03:15 20:14	18:55 (3) 19:17 (3)	04:26 18:55 (3)	17:23 17:20	16:51 (5) 16:48 (5)	15:58 15:56
30	03:17 20:11	18:55 (3) 19:18 (3)	04:29 18:49	17:50 (4) 17:17	06:51 15:53	08:05 14:49
31	03:19 20:09	18:54 (3) 19:18 (3)	04:31 18:46	17:46 (4) 17:58 (4)	06:53 15:50	08:05 14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	161	303	487			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.71	0.71	0.58			
Total reduction	0.17	0.16	0.14			
Total, real	28	48	69			

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:

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DT - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (328)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June			
1	08:35	07:51	06:38	05:08	17:19 (5)	03:43	02:36	19:13 (3)	
	14:49	15:54	17:05	18:19	17:46 (5)	19:31	20:38	14 19:27 (3)	
2	08:35	07:49	06:36	05:05	17:18 (5)	03:40	02:34	19:13 (3)	
	14:50	15:57	17:08	18:22	17:46 (5)	19:33	20:40	12 19:25 (3)	
3	08:34	07:46	06:33	05:02	17:18 (5)	03:37	02:33	19:15 (3)	
	14:52	16:00	17:10	18:24	17:45 (5)	19:36	20:42	9 19:24 (3)	
4	08:34	07:44	06:30	04:59	17:18 (5)	03:35	19:00 (2)	02:32	19:16 (3)
	14:53	16:02	17:13	18:27	17:45 (5)	19:38	2 19:02 (2)	20:43	7 19:23 (3)
5	08:33	07:42	06:27	04:56	17:18 (5)	03:32	18:59 (2)	02:30	
	14:55	16:05	17:15	18:29	17:44 (5)	19:41	5 19:04 (2)	20:45	
6	08:32	07:39	06:24	04:53	17:19 (5)	03:30	18:59 (2)	02:29	
	14:57	16:07	17:18	18:31	17:44 (5)	19:43	8 19:07 (2)	20:46	
7	08:32	07:37	06:21	04:50	17:19 (5)	03:27	18:58 (2)	02:28	
	14:58	16:10	17:20	18:34	17:43 (5)	19:45	10 19:08 (2)	20:47	
8	08:31	07:35	06:18	04:47	17:20 (5)	03:25	18:58 (2)	02:27	
	15:00	16:12	17:22	18:36	17:41 (5)	19:48	12 19:10 (2)	20:49	
9	08:30	07:32	06:15	04:44	17:21 (5)	03:22	18:58 (2)	02:26	
	15:02	16:15	17:25	18:38	17:39 (5)	19:50	15 19:13 (2)	20:50	
10	08:29	07:30	06:13	04:41	17:23 (5)	03:20	18:59 (2)	02:26	
	15:04	16:17	17:27	18:41	18:09 (4)	19:52	16 19:15 (2)	20:51	
11	08:28	07:27	06:10	04:38	17:25 (5)	03:17	18:59 (2)	02:25	
	15:06	16:20	17:30	18:43	15 18:11 (4)	19:55	18 19:17 (3)	20:52	
12	08:27	07:25	06:07	04:36	18:04 (4)	03:15	18:59 (2)	02:24	
	15:08	16:23	17:32	18:46	10 18:14 (4)	19:57	19 19:18 (3)	20:53	
13	08:25	07:22	06:04	04:33	18:03 (4)	03:12	19:00 (2)	02:24	
	15:10	16:25	17:34	18:48	13 18:16 (4)	19:59	20 19:20 (3)	20:54	
14	08:24	07:19	06:01	04:30	18:02 (4)	03:10	19:01 (2)	02:23	
	15:12	16:28	17:37	18:50	16 18:18 (4)	20:02	21 19:22 (3)	20:55	
15	08:23	07:17	05:58	04:27	18:02 (4)	03:08	19:02 (2)	02:23	
	15:14	16:30	17:39	18:53	18 18:20 (4)	20:04	22 19:24 (3)	20:56	
16	08:21	07:14	05:55	04:24	18:02 (4)	03:06	19:04 (2)	02:22	
	15:16	16:33	17:42	18:55	19 18:21 (4)	20:06	22 19:26 (3)	20:57	
17	08:20	07:11	05:52	04:21	18:03 (4)	03:03	19:06 (3)	02:22	
	15:18	16:35	17:44	18:57	18 18:21 (4)	20:08	22 19:28 (3)	20:57	
18	08:18	07:09	05:49	04:18	18:03 (4)	03:01	19:06 (3)	02:22	
	15:21	16:38	17:46	19:00	16 18:19 (4)	20:11	24 19:30 (3)	20:58	
19	08:16	07:06	05:46	04:15	18:04 (4)	02:59	19:06 (3)	02:22	
	15:23	16:40	17:49	19:02	14 18:18 (4)	20:13	24 19:30 (3)	20:58	
20	08:15	07:03	05:43	04:13	18:06 (4)	02:57	19:06 (3)	02:22	
	15:25	16:43	17:51	19:05	10 18:16 (4)	20:15	24 19:30 (3)	20:59	
21	08:13	07:01	05:40	04:10	18:09 (4)	02:55	19:06 (3)	02:22	
	15:27	16:45	17:53	19:07	3 18:12 (4)	20:17	24 19:30 (3)	20:59	
22	08:11	06:58	05:37	04:07	02:53	19:07 (3)	02:22		
	15:30	16:48	17:56	19:09	20:19	23 19:30 (3)	20:59		
23	08:09	06:55	05:34	04:04	02:51	19:07 (3)	02:22		
	15:32	16:50	17:58	19:12	20:21	23 19:30 (3)	20:59		
24	08:08	06:52	05:31	04:01	02:49	19:07 (3)	02:23		
	15:35	16:53	18:01	19:14	20:23	22 19:29 (3)	20:59		
25	08:06	06:50	05:28	17:30 (5)	03:59	02:47	19:08 (3)	02:23	
	15:37	16:55	18:03	3 17:33 (5)	19:17	20:25	21 19:29 (3)	20:59	
26	08:04	06:47	05:25	17:27 (5)	03:56	02:45	19:08 (3)	02:23	
	15:39	16:58	18:05	8 17:35 (5)	19:19	20:27	21 19:29 (3)	20:59	
27	08:02	06:44	05:23	17:24 (5)	03:53	02:44	19:09 (3)	02:24	
	15:42	17:00	18:08	13 17:37 (5)	19:21	20:29	20 19:29 (3)	20:59	
28	08:00	06:41	05:20	17:23 (5)	03:51	02:42	19:10 (3)	02:25	
	15:44	17:03	18:10	17 17:40 (5)	19:24	20:31	19 19:29 (3)	20:58	
29	07:57	05:17	17:21 (5)	03:48	02:40	19:10 (3)	02:25		
	15:47	18:12	21 17:42 (5)	19:26	20:33	18 19:28 (3)	20:58		
30	07:55	05:14	17:20 (5)	03:45	02:39	19:11 (3)	02:26		
	15:49	18:15	24 17:44 (5)	19:29	20:35	16 19:27 (3)	20:58		
31	07:53	05:11	17:19 (5)	03:43	02:37	19:12 (3)			
	15:52	18:17	27 17:46 (5)	19:31	20:37	15 19:27 (3)			
Potential sun hours	216	257	365	434	526	554			
Total, worst case			113	392	506	42			
Sun reduction			0.28	0.30	0.35	0.30			
Oper. time red.			0.93	0.93	0.93	0.93			
Wind dir. red.			0.61	0.63	0.73	0.73			
Total reduction			0.16	0.18	0.24	0.20			
Total, real			18	69	121	9			

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

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

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DT - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (328)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27 20:57	03:22 20:07	19:10 (2) 18:43	04:33 17:24 (5)	05:42 18:10 (4)	06:56 15:48
2	02:28 20:56	03:24 20:04	19:09 (2) 19:27 (3)	04:35 18:40	05:44 17:12 (5)	06:58 15:45
3	02:29 20:56	03:26 20:02	19:09 (2) 19:24 (2)	04:38 18:37	05:46 17:37 (5)	07:01 15:43
4	02:30 20:55	03:29 20:00	19:09 (2) 19:22 (2)	04:40 18:34	05:49 17:38 (5)	07:03 15:40
5	02:32 20:54	03:31 19:57	19:08 (2) 19:20 (2)	04:42 18:31	05:51 17:39 (5)	07:06 15:38
6	02:33 20:53	03:33 19:55	19:08 (2) 19:18 (2)	04:45 18:29	05:53 17:39 (5)	07:08 15:36
7	02:34 20:52	03:35 19:52	19:09 (2) 19:15 (2)	04:47 18:26	05:56 17:40 (5)	07:11 15:33
8	02:35 20:51	03:38 19:25 (3) 19:50	19:09 (2) 19:29 (3)	04:49 18:23	05:58 17:13 (5)	07:13 15:31
9	02:37 20:50	03:40 19:23 (3) 19:47	19:09 (2) 19:10 (2)	04:51 18:20	06:00 17:12 (5)	07:16 15:28
10	02:38 20:48	03:42 19:21 (3) 19:44	19:09 (2) 19:21 (3)	04:54 18:17	06:03 17:11 (5)	07:18 15:26
11	02:40 20:47	03:45 19:21 (3) 19:42	19:09 (2) 19:21 (3)	04:56 18:14	06:05 17:38 (5)	07:21 15:24
12	02:42 20:46	03:47 19:20 (3) 19:39	19:09 (2) 19:34 (3)	04:58 18:11	06:07 17:38 (5)	07:23 15:22
13	02:43 20:44	03:49 19:20 (3) 19:37	19:09 (2) 19:36 (3)	05:01 18:08	06:10 17:36 (5)	07:26 15:19
14	02:45 20:43	03:52 19:19 (3) 19:34	19:09 (2) 19:36 (3)	05:03 18:05	06:12 17:33 (5)	07:28 15:17
15	02:47 20:41	03:54 19:19 (3) 19:31	19:09 (2) 19:37 (3)	05:05 18:02	06:14 17:30 (5)	07:30 15:15
16	02:49 20:40	03:56 19:18 (3) 19:28	19:09 (2) 19:37 (3)	05:07 17:59	06:17 17:13 (5)	07:33 15:13
17	02:50 20:38	03:59 19:18 (3) 19:26	19:09 (2) 19:38 (3)	05:10 17:56	06:19 17:15 (5)	07:35 15:11
18	02:52 20:36	04:01 19:18 (3) 19:23	19:09 (2) 19:38 (3)	05:12 17:53	06:22 17:17 (5)	07:38 15:09
19	02:54 20:34	04:03 19:17 (3) 19:20	19:09 (2) 19:39 (3)	05:14 17:50	06:24 16:23	07:40 15:07
20	02:56 20:32	04:06 19:17 (3) 19:17	19:09 (2) 19:40 (3)	05:16 17:47	06:26 16:20	07:42 15:05
21	02:58 20:31	04:08 19:17 (3) 19:15	19:09 (2) 19:40 (3)	05:19 17:44	06:29 16:17	07:45 15:03
22	03:00 20:29	04:10 19:16 (3) 19:12	19:09 (2) 19:40 (3)	05:21 18:13 (4) 17:41	06:31 16:14	07:47 15:02
23	03:02 20:27	04:12 19:16 (3) 19:09	19:09 (2) 19:40 (3)	05:23 18:09 (4) 17:38	06:34 16:12	07:49 15:00
24	03:04 20:25	04:15 19:16 (3) 19:06	19:09 (2) 19:40 (3)	05:26 18:07 (4) 17:35	06:36 16:09	07:52 14:58
25	03:06 20:22	04:17 19:16 (3) 19:03	19:09 (2) 19:41 (3)	05:28 18:06 (4) 17:32	06:39 16:06	07:54 14:57
26	03:09 20:20	04:19 19:17 (3) 19:00	19:09 (2) 19:40 (3)	05:30 18:04 (4) 17:29	06:41 16:04	07:56 14:55
27	03:11 20:18	04:22 19:17 (3) 18:58	19:09 (2) 19:38 (3)	05:32 18:04 (4) 17:26	06:43 16:01	07:58 14:53
28	03:13 20:16	04:24 19:14 (2) 18:55	19:09 (2) 19:37 (3)	05:35 18:04 (4) 17:23	06:46 15:58	08:00 14:52
29	03:15 20:14	04:26 19:12 (2) 18:52	19:09 (2) 19:35 (3)	05:37 18:03 (4) 17:20	06:48 15:56	08:02 14:51
30	03:17 20:11	04:29 19:11 (2) 18:49	19:09 (2) 19:33 (3)	05:39 18:03 (4) 17:17	06:51 15:53	08:05 14:49
31	03:19 20:09	04:31 19:10 (2) 18:46	19:09 (2) 19:31 (3)	05:41 18:03 (4) 17:14	06:53 15:50	08:06 14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	459	239	372			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.73	0.69	0.61			
Total reduction	0.18	0.15	0.15			
Total, real	81	37	55			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DU - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (329)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35	07:51	06:38	05:08	17:05 (5)	03:43
	14:49	15:54	17:05	18:19	17:29 (5)	19:31
2	08:35	07:49	06:36	05:05	17:06 (5)	03:40
	14:50	15:57	17:08	18:22	17:27 (5)	19:33
3	08:34	07:46	06:33	05:02	17:07 (5)	03:37
	14:52	16:00	17:10	18:24	17:25 (5)	19:36
4	08:34	07:44	06:30	04:59	17:09 (5)	03:35
	14:53	16:02	17:13	18:27	17:23 (5)	19:38
5	08:33	07:42	06:27	04:56	17:12 (5)	03:32
	14:55	16:05	17:15	18:29	17:19 (5)	19:41
6	08:33	07:39	06:24	04:53	17:56 (4)	03:30
	14:57	16:07	17:18	18:31	18:00 (4)	19:43
7	08:32	07:37	06:21	04:50	17:55 (4)	03:27
	14:58	16:10	17:20	18:34	18:03 (4)	19:45
8	08:31	07:35	06:18	04:47	17:54 (4)	03:25
	15:00	16:12	17:22	18:36	18:05 (4)	19:48
9	08:30	07:32	06:15	04:44	17:53 (4)	03:22
	15:02	16:15	17:25	18:38	18:07 (4)	19:50
10	08:29	07:30	06:13	04:41	17:52 (4)	03:20
	15:04	16:17	17:27	18:41	18:09 (4)	19:52
11	08:28	07:27	06:10	04:38	17:52 (4)	03:17
	15:06	16:20	17:30	18:43	18:11 (4)	19:55
12	08:27	07:25	06:07	04:36	17:53 (4)	03:15
	15:08	16:23	17:32	18:46	18:12 (4)	19:57
13	08:25	07:22	06:04	04:33	17:53 (4)	03:12
	15:10	16:25	17:34	18:48	18:11 (4)	19:59
14	08:24	07:19	06:01	04:30	17:53 (4)	03:10
	15:12	16:28	17:37	18:50	18:09 (4)	20:02
15	08:23	07:17	05:58	04:27	17:54 (4)	03:08
	15:14	16:30	17:39	18:53	18:08 (4)	20:04
16	08:21	07:14	05:55	04:24	17:56 (4)	03:06
	15:16	16:33	17:42	18:55	18:05 (4)	20:06
17	08:20	07:11	05:52	04:21	03:03	03:03
	15:18	16:35	17:44	18:57	20:08	23 19:17 (3)   20:57
18	08:18	07:09	05:49	04:18	03:01	23 19:18 (3)   20:58
	15:21	16:38	17:46	19:00	20:11	23 19:18 (3)   20:58
19	08:16	07:06	05:46	17:17 (5)   04:15	02:59	22 19:17 (3)   20:58
	15:23	16:40	17:49	17:19 (5)   04:13	20:13	22 19:17 (3)   20:58
20	08:15	07:03	05:43	17:14 (5)   04:13	02:57	20 19:16 (3)   20:59
	15:25	16:43	17:51	17:21 (5)   04:10	20:15	20 19:16 (3)   20:59
21	08:13	07:01	05:40	17:11 (5)   04:10	02:55	20 19:16 (3)   20:59
	15:27	16:45	17:53	12 17:23 (5)   04:07	20:17	20 19:16 (3)   20:59
22	08:11	06:58	05:37	17:10 (5)   04:07	02:53	18 19:16 (3)   20:59
	15:30	16:48	17:56	16 17:26 (5)   04:04	20:19	18 19:16 (3)   20:59
23	08:09	06:55	05:34	17:08 (5)   04:04	02:51	17 19:15 (3)   20:59
	15:32	16:50	17:58	20 17:28 (5)   04:01	20:21	17 19:15 (3)   20:59
24	08:08	06:52	05:31	17:07 (5)   04:01	02:49	14 19:13 (3)   20:59
	15:35	16:53	18:01	23 17:30 (5)   03:59	20:23	14 19:13 (3)   20:59
25	08:06	06:50	05:28	17:06 (5)   03:59	02:47	12 19:13 (3)   20:59
	15:37	16:55	18:03	27 17:33 (5)   03:56	20:25	12 19:13 (3)   20:59
26	08:04	06:47	05:25	17:06 (5)   03:56	02:45	9 19:11 (3)   20:59
	15:39	16:58	18:05	27 17:33 (5)   03:53	20:27	9 19:11 (3)   20:59
27	08:02	06:44	05:23	17:05 (5)   03:53	02:44	4 19:09 (3)   20:59
	15:42	17:00	18:08	28 17:33 (5)   03:51	20:29	4 19:09 (3)   20:59
28	08:00	06:41	05:20	17:05 (5)   03:51	02:42	20:58
	15:44	17:03	18:10	27 17:32 (5)   03:48	20:31	20:58
29	07:57		05:17	17:05 (5)   03:48	02:40	20:58
	15:47		18:12	27 17:32 (5)   03:45	20:33	20:58
30	07:55		05:14	17:05 (5)   03:45	18:52 (2)   20:35	20:58
	15:49		18:15	26 17:31 (5)   03:45	2 18:54 (2)   20:35	20:58
31	07:53		05:11	17:05 (5)   03:45	02:37	
	15:52		18:17	25 17:30 (5)   03:45	20:37	
Potential sun hours	216	257	365	434	526	554
Total, worst case			267	235		481
Sun reduction			0.28	0.30		0.35
Oper. time red.			0.93	0.93		0.93
Wind dir. red.			0.59	0.63		0.72
Total reduction			0.15	0.17		0.24
Total, real			41	41		113

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DU - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (329)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	03:22	19:05 (3) 04:33	17:51 (4) 05:42	06:56	08:07
	20:57	20:07	19:29 (3) 18:43	18:10 (4) 17:14	15:48	14:48
2	02:28	03:24	19:03 (2) 04:35	17:51 (4) 05:44	06:58	08:09
	20:56	20:04	19:27 (3) 18:40	18:08 (4) 17:12	15:45	14:47
3	02:29	03:26	19:02 (2) 04:38	17:51 (4) 05:46	07:01	08:10
	20:56	20:02	19:24 (3) 18:37	18:05 (4) 17:09	15:43	14:46
4	02:30	03:29	19:01 (2) 04:40	17:51 (4) 05:49	07:03	08:12
	20:55	20:00	19:22 (3) 18:34	18:02 (4) 17:06	15:40	14:45
5	02:31	03:31	19:00 (2) 04:42	17:51 (4) 05:51	07:06	08:14
	20:54	19:57	19:20 (3) 18:31	17:59 (4) 17:03	15:38	14:44
6	02:33	03:33	18:59 (2) 04:45	17:51 (4) 05:53	07:08	08:16
	20:53	19:55	19:18 (3) 18:29	17:56 (4) 17:00	15:36	14:43
7	02:34	03:35	18:59 (2) 04:47	17:09 (5) 05:56	07:11	08:18
	20:52	19:52	19:15 (2) 18:26	17:54 (4) 16:57	15:33	14:42
8	02:35	03:38	18:59 (2) 04:49	17:04 (5) 05:58	07:13	08:19
	20:51	19:50	19:13 (2) 18:23	17:18 (5) 16:54	15:31	14:41
9	02:37	03:40	18:58 (2) 04:51	17:02 (5) 06:00	07:16	08:21
	20:50	19:47	19:10 (2) 18:20	17:20 (5) 16:51	15:28	14:40
10	02:38	03:42	18:58 (2) 04:54	16:59 (5) 06:03	07:18	08:22
	20:48	19:44	19:08 (2) 18:17	17:20 (5) 16:48	15:26	14:40
11	02:40	03:45	18:58 (2) 04:56	16:58 (5) 06:05	07:21	08:24
	20:47	19:42	19:05 (2) 18:14	17:21 (5) 16:45	15:24	14:39
12	02:42	03:47	18:59 (2) 04:58	16:56 (5) 06:07	07:23	08:25
	20:46	19:39	19:03 (2) 18:11	17:21 (5) 16:42	15:22	14:39
13	02:43	03:49	19:00 (2) 05:01	16:56 (5) 06:10	07:26	08:26
	20:44	19:37	19:01 (2) 18:08	17:22 (5) 16:40	15:19	14:39
14	02:45	03:52	18:05	16:55 (5) 06:12	07:28	08:28
	20:43	19:34	18:05	17:22 (5) 16:37	15:17	14:38
15	02:47	03:54	18:05	16:54 (5) 06:14	07:30	08:29
	20:41	19:31	18:02	17:22 (5) 16:34	15:15	14:38
16	02:49	03:56	18:02	16:54 (5) 06:17	07:33	08:30
	20:40	19:28	17:59	17:21 (5) 16:31	15:13	14:38
17	02:50	19:13 (3) 03:59	18:02	16:54 (5) 06:19	07:35	08:31
	20:38	7 19:20 (3) 19:26	17:56	17:21 (5) 16:28	15:11	14:38
18	02:52	19:11 (3) 04:01	18:02	16:54 (5) 06:22	07:38	08:32
	20:36	11 19:22 (3) 19:23	17:53	17:21 (5) 16:25	15:09	14:38
19	02:54	19:09 (3) 04:03	18:02	16:54 (5) 06:24	07:40	08:33
	20:34	14 19:23 (3) 19:20	17:50	17:18 (5) 16:23	15:07	14:38
20	02:56	19:09 (3) 04:06	18:02	16:54 (5) 06:26	07:42	08:33
	20:32	15 19:24 (3) 19:17	17:47	17:14 (5) 16:20	15:05	14:39
21	02:58	19:08 (3) 04:08	18:02	16:55 (5) 06:29	07:45	08:34
	20:31	17 19:25 (3) 19:15	17:44	17:12 (5) 16:17	15:03	14:39
22	03:00	19:06 (3) 04:10	18:02	16:56 (5) 06:31	07:47	08:34
	20:29	19 19:25 (3) 19:12	17:41	17:09 (5) 16:14	15:02	14:39
23	03:02	19:06 (3) 04:12	18:02	16:57 (5) 06:34	07:49	08:35
	20:27	20 19:26 (3) 19:09	17:38	17:06 (5) 16:12	15:00	14:40
24	03:04	19:06 (3) 04:15	18:02	16:59 (5) 06:36	07:52	08:35
	20:25	21 19:27 (3) 19:06	17:35	17:02 (5) 16:09	14:58	14:41
25	03:06	19:05 (3) 04:17	18:02	16:59 (5) 06:39	07:54	08:36
	20:22	23 19:28 (3) 19:03	17:32	16:06	14:57	14:41
26	03:09	19:05 (3) 04:19	18:02	06:41	07:56	08:36
	20:20	23 19:28 (3) 19:00	17:29	16:04	14:55	14:42
27	03:11	19:05 (3) 04:22	17:59 (4) 05:32	06:43	07:58	08:36
	20:18	24 19:29 (3) 18:58	9 18:08 (4) 17:26	16:01	14:53	14:43
28	03:13	19:05 (3) 04:24	18:02	06:46	08:00	08:36
	20:16	24 19:29 (3) 18:55	14 18:10 (4) 17:23	15:58	14:52	14:44
29	03:15	19:05 (3) 04:26	18:02	06:48	08:02	08:36
	20:14	24 19:29 (3) 18:52	16 18:10 (4) 17:20	15:56	14:51	14:45
30	03:17	19:04 (3) 04:29	18:02	06:51	08:05	08:36
	20:11	25 19:29 (3) 18:49	18 18:11 (4) 17:17	15:53	14:49	14:46
31	03:19	19:04 (3) 04:31	18:02	06:53	08:06	08:36
	20:09	25 19:29 (3) 18:46	19 18:11 (4) 17:14	15:50	14:47	14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	292	271	431			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.72	0.70	0.60			
Total reduction	0.18	0.16	0.14			
Total, real	51	42	62			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DV - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (330)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:54	17:05	18:19	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:08
	14:50	15:57	17:08	18:22	19:33	20:40	20:56	20:04	18:40	17:12	15:45	14:47
3	08:34	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:10
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:03	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:45
5	08:33	07:42	06:27	04:56	03:32	02:30	02:32	03:31	04:42	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:31	17:03	15:38	14:44
6	08:32	07:39	06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:57	16:07	17:18	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:45	20:47	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:18	04:47	03:25	02:27	02:35	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:15	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29	07:30	06:13	04:41	03:20	02:26	02:38	03:42	04:54	06:03	07:18	08:22
	15:04	16:17	17:27	18:41	19:52	20:51	20:48	19:44	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:27	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
	15:08	16:23	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39
13	08:25	07:22	06:04	04:33	03:12	02:24	02:43	03:49	05:01	06:10	07:26	08:26
	15:10	16:25	17:34	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:19	14:39
14	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:14	07:30	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:07	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:28	17:59	16:31	15:13	14:38
17	08:20	07:11	05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31
	15:18	16:35	17:44	18:57	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:21	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:16	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
20	08:15	07:03	05:43	04:13	02:57	02:22	02:56	04:06	05:16	06:26	07:42	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:32	19:17	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27	16:45	17:53	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
22	08:11	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:34
	15:30	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
23	08:09	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	08:35
	15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:52	05:31	04:01	02:49	02:23	03:04	04:15	05:26	06:36	07:52	08:35
	15:35	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
	15:37	16:55	18:03	19:17	20:25	20:59	20:22	19:03	17:32	16:06	14:57	14:41
26	08:04	06:47	05:25	03:56	02:45	02:23	03:09	04:19	05:30	06:41	07:56	08:36
	15:39	16:58	18:05	19:19	20:27	20:59	20:20	19:00	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:43	07:58	08:36
	15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:00	08:36
	15:44	17:03	18:10	19:24	20:31	20:58	20:16	18:55	17:23	15:58	14:52	14:44
29	07:57		05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	08:02	08:36
	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45
30	07:55		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:49		18:15	19:29	20:35	20:58	20:11	18:49	17:17	15:53	14:49	14:46
31	07:53		05:11		02:37		03:19	04:31		06:53		08:36
	15:52		18:17		20:37		20:09	18:46		15:50		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DW - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (331)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum

813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June
1	08:35	07:51	06:38	16:00 (5)	05:08	03:42
	14:49	15:54	17:05	16:25 (5)	18:19	19:31
2	08:35	07:49	06:36	15:59 (5)	05:05	03:40
	14:50	15:57	17:08	16:25 (5)	18:22	19:33
3	08:34	07:46	06:33	15:59 (5)	05:02	03:37
	14:52	15:59	17:10	16:25 (5)	18:24	19:36
4	08:34	07:44	06:30	15:59 (5)	04:59	03:35
	14:53	16:02	17:13	16:24 (5)	18:27	19:38
5	08:33	07:42	06:27	15:59 (5)	04:56	03:32
	14:55	16:05	17:15	16:24 (5)	18:29	19:41
6	08:33	07:39	06:24	15:59 (5)	04:53	03:30
	14:56	16:07	17:18	16:23 (5)	18:31	19:43
7	08:32	07:37	06:21	16:00 (5)	04:50	03:27
	14:58	16:10	17:20	16:22 (5)	18:34	19:45
8	08:31	07:35	06:18	16:01 (5)	04:47	03:25
	15:00	16:12	17:22	16:21 (5)	18:36	19:48
9	08:30	07:32	06:16	16:02 (5)	04:44	18:00 (3)
	15:02	16:15	17:25	16:19 (5)	18:38	18:05 (3)
10	08:29	07:30	06:13	16:05 (5)	04:41	17:56 (3)
	15:04	16:17	17:27	16:18 (5)	18:41	18:09 (3)
11	08:28	07:27	06:10	16:10 (5)	04:38	17:53 (3)
	15:06	16:20	17:30	16:13 (5)	18:43	18:11 (2)
12	08:27	07:25	06:07	04:36	17:52 (3)	03:15
	15:08	16:23	17:32	18:46	18:14 (2)	19:57
13	08:25	07:22	06:04	04:33	17:51 (3)	03:12
	15:10	16:25	17:34	18:48	18:16 (2)	19:59
14	08:24	07:19	06:01	04:30	17:49 (3)	03:10
	15:12	16:28	17:37	18:50	18:18 (2)	20:02
15	08:23	07:17	05:58	04:27	17:48 (3)	03:08
	15:14	16:30	17:39	18:53	18:20 (2)	20:04
16	08:21	07:14	05:55	04:24	17:47 (3)	03:06
	15:16	16:33	17:42	18:55	18:21 (2)	20:06
17	08:20	07:12	05:52	17:10 (4)	04:21	17:47 (3)
	15:18	16:35	17:44	17:14 (4)	18:57	18:21 (2)
18	08:18	07:09	05:49	17:08 (4)	04:18	17:47 (3)
	15:20	16:38	17:46	17:16 (4)	19:00	18:21 (2)
19	08:16	07:06	05:46	17:06 (4)	04:15	17:46 (3)
	15:23	16:40	17:49	17:19 (4)	19:02	18:20 (2)
20	08:15	07:03	05:43	17:05 (4)	04:13	17:47 (3)
	15:25	16:43	17:51	17:21 (4)	19:05	18:20 (2)
21	08:13	07:01	05:40	17:04 (4)	04:10	17:47 (3)
	15:27	16:45	17:53	17:23 (4)	19:07	18:18 (2)
22	08:11	06:58	05:37	17:04 (4)	04:07	17:47 (3)
	15:30	16:48	17:56	17:23 (4)	19:09	18:16 (2)
23	08:09	06:55	16:09 (5)	17:03 (4)	04:04	17:48 (3)
	15:32	16:50	16:18 (5)	17:58	19:12	18:14 (2)
24	08:08	06:52	16:06 (5)	17:03 (4)	04:01	17:48 (3)
	15:35	16:53	16:20 (5)	18:01	19:14	18:10 (3)
25	08:06	06:50	16:04 (5)	17:03 (4)	03:59	17:49 (3)
	15:37	16:55	16:22 (5)	18:03	19:17	18:08 (3)
26	08:04	06:47	16:03 (5)	17:04 (4)	03:56	17:51 (3)
	15:39	16:58	16:24 (5)	18:05	19:19	18:07 (3)
27	08:02	06:44	16:01 (5)	17:05 (4)	03:53	17:52 (3)
	15:42	17:00	16:24 (5)	18:08	19:21	18:04 (3)
28	08:00	06:41	16:01 (5)	17:07 (4)	03:51	17:57 (3)
	15:44	17:03	16:25 (5)	18:10	19:24	18:00 (3)
29	07:57		05:17	03:48	02:40	02:25
	15:47		18:12	19:26	20:33	20:58
30	07:55		05:14	03:45	02:39	02:26
	15:49		18:15	19:29	20:35	20:58
31	07:53		05:11		02:37	
	15:52		18:17		20:37	
Potential sun hours	216	257	365	434	526	554
Total, worst case		109	401	471		
Sun reduction		0.29	0.28	0.30		
Oper. time red.		0.93	0.93	0.93		
Wind dir. red.		0.53	0.55	0.65		
Total reduction		0.14	0.14	0.18		
Total, real		16	57	86		

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DW - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (331)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December			
1	02:27	03:22	04:33	17:52 (3)	05:42	06:56	08:07		
	20:57	20:07	18:43	18:10 (2)	17:14	15:48	14:48		
2	02:28	03:24	04:35	17:55 (3)	05:44	06:58	08:09		
	20:56	20:04	18:40	18:08 (3)	17:12	15:45	14:47		
3	02:29	03:26	04:38	17:58 (3)	05:46	15:44 (5)	07:01	08:10	
	20:56	20:02	18:37	18:03 (3)	17:09	15:54 (5)	15:43	14:46	
4	02:30	03:28	04:40	17:59 (3)	05:49	15:41 (5)	07:03	08:12	
	20:55	20:00	18:34	18:03 (3)	17:06	15:56 (5)	15:40	14:45	
5	02:31	03:31	04:42	17:59 (3)	05:51	15:39 (5)	07:06	08:14	
	20:54	19:57	18:32	18:03 (3)	17:03	15:57 (5)	15:38	14:44	
6	02:33	03:33	04:45	17:59 (3)	05:53	15:37 (5)	07:08	08:16	
	20:53	19:55	18:29	18:03 (3)	17:00	15:58 (5)	15:36	14:43	
7	02:34	03:35	04:47	17:59 (3)	05:56	15:36 (5)	07:11	08:18	
	20:52	19:52	18:26	18:03 (3)	16:57	15:59 (5)	15:33	14:42	
8	02:35	03:38	04:49	17:59 (3)	05:58	15:35 (5)	07:13	08:19	
	20:51	19:50	18:23	18:03 (3)	16:54	15:59 (5)	15:31	14:41	
9	02:37	03:40	04:51	17:59 (3)	06:00	15:35 (5)	07:16	08:21	
	20:50	19:47	18:20	18:03 (3)	16:51	16:00 (5)	15:28	14:40	
10	02:38	03:42	04:54	17:59 (3)	06:03	15:34 (5)	07:18	08:22	
	20:48	19:44	18:17	18:03 (3)	16:48	15:59 (5)	15:26	14:40	
11	02:40	03:45	04:56	17:59 (3)	06:05	15:34 (5)	07:21	08:24	
	20:47	19:42	18:14	18:03 (3)	16:45	16:00 (5)	15:24	14:39	
12	02:42	03:47	04:58	17:59 (3)	06:07	15:33 (5)	07:23	08:25	
	20:46	19:39	18:11	18:03 (3)	16:42	15:59 (5)	15:22	14:39	
13	02:43	03:49	05:01	17:59 (3)	06:10	15:34 (5)	07:26	08:26	
	20:44	19:37	18:08	18:03 (3)	16:40	15:59 (5)	15:19	14:39	
14	02:45	03:52	05:03	17:59 (3)	06:12	15:34 (5)	07:28	08:28	
	20:43	19:34	18:05	18:03 (3)	16:37	15:57 (5)	15:17	14:38	
15	02:47	03:54	18:03 (3)	05:05	16:57 (4)	06:14	15:35 (5)	07:30	08:29
	20:41	19:31	18:09 (3)	18:02	17:05 (4)	16:34	15:57 (5)	15:15	14:38
16	02:49	03:56	17:59 (3)	05:07	16:54 (4)	06:17	15:35 (5)	07:33	08:30
	20:40	19:28	18:12 (3)	17:59	17:07 (4)	16:31	15:55 (5)	15:13	14:38
17	02:50	03:59	17:57 (3)	05:10	16:53 (4)	06:19	15:36 (5)	07:35	08:31
	20:38	19:26	18:14 (3)	17:56	17:09 (4)	16:28	15:54 (5)	15:11	14:38
18	02:52	04:01	17:55 (3)	05:12	16:51 (4)	06:22	15:38 (5)	07:38	08:32
	20:36	19:23	18:15 (3)	17:53	17:09 (4)	16:25	15:50 (5)	15:09	14:38
19	02:54	04:03	17:54 (3)	05:14	16:50 (4)	06:24	15:41 (5)	07:40	08:33
	20:34	19:20	18:15 (3)	17:50	17:09 (4)	16:23	15:48 (5)	15:07	14:38
20	02:56	04:05	17:53 (3)	05:16	16:49 (4)	06:26	15:39 (5)	07:42	08:33
	20:32	19:17	18:21 (2)	17:47	17:09 (4)	16:20	15:40 (5)	15:05	14:39
21	02:58	04:08	17:52 (3)	05:19	16:49 (4)	06:29	15:37 (5)	07:45	08:34
	20:31	19:15	18:22 (2)	17:44	17:09 (4)	16:17	15:38 (5)	15:03	14:39
22	03:00	04:10	17:51 (3)	05:21	16:49 (4)	06:31	15:35 (5)	07:47	08:35
	20:29	19:12	18:23 (2)	17:41	17:08 (4)	16:14	15:36 (5)	15:02	14:39
23	03:02	04:12	17:51 (3)	05:23	16:49 (4)	06:34	15:34 (5)	07:49	08:35
	20:27	19:09	18:23 (2)	17:38	17:06 (4)	16:12	15:35 (5)	15:00	14:40
24	03:04	04:15	17:50 (3)	05:26	16:49 (4)	06:36	15:33 (5)	07:52	08:35
	20:25	19:06	18:24 (2)	17:35	17:02 (4)	16:09	15:34 (5)	14:58	14:41
25	03:06	04:17	17:49 (3)	05:28	16:50 (4)	06:39	15:32 (5)	07:54	08:36
	20:23	19:03	18:24 (2)	17:32	17:00 (4)	16:06	15:33 (5)	14:57	14:41
26	03:09	04:19	17:49 (3)	05:30	16:51 (4)	06:41	15:31 (5)	07:56	08:36
	20:20	19:01	18:23 (2)	17:29	16:57 (4)	16:04	15:32 (5)	14:55	14:42
27	03:11	04:22	17:50 (3)	05:32	16:49 (4)	06:43	15:30 (5)	07:58	08:36
	20:18	18:58	18:24 (2)	17:26	17:00 (4)	16:01	15:31 (5)	14:53	14:43
28	03:13	04:24	17:50 (3)	05:35	16:49 (4)	06:46	15:29 (5)	08:00	08:36
	20:16	18:55	18:22 (2)	17:23	17:00 (4)	16:00	15:32 (5)	14:52	14:44
29	03:15	04:26	17:50 (3)	05:37	16:49 (4)	06:48	15:28 (5)	08:02	08:36
	20:14	18:52	18:19 (2)	17:20	17:00 (4)	16:00	15:33 (5)	14:51	14:45
30	03:17	04:29	17:50 (3)	05:39	16:49 (4)	06:51	15:27 (5)	08:05	08:36
	20:11	18:49	18:16 (2)	17:17	17:00 (4)	16:00	15:34 (5)	14:49	14:46
31	03:19	04:31	17:51 (3)	05:41	16:49 (4)	06:53	15:26 (5)	08:06	08:36
	20:09	18:46	18:13 (2)	17:14	17:00 (4)	16:00	15:35 (5)	14:47	14:47
Potential sun hours	551	481	387	318	232	194			
Total, worst case		445	215	340					
Sun reduction		0.24	0.26	0.28					
Oper. time red.		0.93	0.93	0.93					
Wind dir. red.		0.65	0.58	0.53					
Total reduction		0.15	0.14	0.14					
Total, real		65	31	47					

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DX - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (332)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:54	17:05	18:19	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:58	08:08
	14:50	15:57	17:08	18:22	19:33	20:40	20:56	20:04	18:40	17:12	15:45	14:47
3	08:34	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:10
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:03	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:45
5	08:33	07:42	06:27	04:56	03:32	02:30	02:32	03:31	04:42	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:31	17:03	15:38	14:44
6	08:32	07:39	06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:57	16:07	17:18	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:45	20:47	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:18	04:47	03:25	02:27	02:35	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:15	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29	07:30	06:13	04:41	03:20	02:26	02:38	03:42	04:54	06:03	07:18	08:22
	15:04	16:17	17:27	18:41	19:52	20:51	20:48	19:44	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:27	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
	15:08	16:23	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39
13	08:25	07:22	06:04	04:33	03:12	02:24	02:43	03:49	05:01	06:10	07:26	08:26
	15:10	16:25	17:34	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:19	14:39
14	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:14	07:30	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:07	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:28	17:59	16:31	15:13	14:38
17	08:20	07:11	05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31
	15:18	16:35	17:44	18:57	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:21	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:16	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
20	08:15	07:03	05:43	04:13	02:57	02:22	02:56	04:06	05:16	06:26	07:42	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:32	19:17	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27	16:45	17:53	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
22	08:11	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:34
	15:30	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
23	08:09	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	08:35
	15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:52	05:31	04:01	02:49	02:23	03:04	04:15	05:26	06:36	07:52	08:35
	15:35	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
	15:37	16:55	18:03	19:17	20:25	20:59	20:22	19:03	17:32	16:06	14:57	14:41
26	08:04	06:47	05:25	03:56	02:45	02:23	03:09	04:19	05:30	06:41	07:56	08:36
	15:39	16:58	18:05	19:19	20:27	20:59	20:20	19:00	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:43	07:58	08:36
	15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:00	08:36
	15:44	17:03	18:10	19:24	20:31	20:58	20:16	18:55	17:23	15:58	14:52	14:44
29	07:57		05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	08:02	08:36
	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45
30	07:55		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:49		18:15	19:29	20:35	20:58	20:11	18:49	17:17	15:53	14:49	14:46
31	07:53		05:11		02:37		03:19	04:31		06:53		08:36
	15:52		18:17		20:37		20:09	18:46		15:51		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DY - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (333)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:36 14:49	13:54 (3) 13:57 (3)	07:51 15:54	06:38 17:05	05:08 18:20	03:42 19:31	02:36 20:38	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	06:56 15:48
2	08:35 14:50	13:54 (3) 13:58 (3)	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:33	02:34 20:40	02:28 20:57	03:24 20:05	04:35 18:40	05:44 17:12	06:58 15:45
3	08:35 14:52	13:55 (3) 14:00 (3)	07:46 15:59	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43
4	08:34 14:53	13:55 (3) 14:02 (3)	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:28 20:00	04:40 18:34	05:49 17:06	07:03 15:40
5	08:33 14:55	13:55 (3) 14:04 (3)	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:41	02:30 20:45	02:31 20:54	03:31 19:57	04:42 18:32	05:51 17:03	07:06 15:38
6	08:33 14:56	13:56 (3) 14:06 (3)	07:39 16:07	06:24 17:17	04:53 18:31	03:29 19:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:35
7	08:32 14:58	13:56 (3) 14:08 (3)	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:48	02:34 20:52	03:35 19:52	04:47 18:26	05:56 16:57	07:11 15:33
8	08:31 15:00	13:56 (3) 14:10 (3)	07:35 16:12	06:18 17:22	04:47 18:36	03:24 19:48	02:27 20:49	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 15:31
9	08:30 15:02	13:57 (3) 14:13 (3)	07:32 16:15	06:16 17:25	04:44 18:38	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	07:16 15:28
10	08:29 15:04	13:57 (3) 14:14 (3)	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:52	02:25 20:51	02:38 20:49	03:42 19:45	04:54 18:17	06:03 16:48	07:18 15:26
11	08:28 15:06	13:58 (3) 14:15 (3)	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:52	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24
12	08:27 15:08	13:58 (3) 14:15 (3)	07:25 16:22	06:07 17:32	04:35 18:46	03:15 19:57	02:24 20:53	02:41 20:46	03:47 19:39	04:58 18:11	06:07 16:42	07:23 15:22
13	08:25 15:10	13:58 (3) 14:15 (3)	07:22 16:25	06:04 17:34	04:33 18:48	03:12 19:59	02:23 20:54	02:43 20:44	03:49 19:37	05:01 18:08	06:10 16:40	07:26 15:19
14	08:24 15:12	14:00 (3) 14:15 (3)	07:19 16:28	06:01 17:37	04:30 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:17
15	08:23 15:14	14:00 (3) 14:15 (3)	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:22 20:56	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	07:31 15:15
16	08:21 15:16	14:01 (3) 14:15 (3)	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	02:22 20:57	02:48 20:40	03:56 19:29	05:07 17:59	06:17 16:31	07:33 15:13
17	08:20 15:18	14:02 (3) 14:15 (3)	07:12 16:35	05:52 17:44	04:21 18:58	03:03 20:08	02:22 20:57	02:50 20:38	03:58 19:26	05:10 17:56	06:19 16:28	07:35 15:11
18	08:18 15:20	14:03 (3) 14:14 (3)	07:09 16:38	05:49 17:46	04:18 19:00	03:01 20:11	02:22 20:58	02:52 20:36	04:01 19:23	05:12 17:53	06:22 16:25	07:38 15:09
19	08:17 15:23	14:05 (3) 14:14 (3)	07:06 16:40	05:46 17:49	04:15 19:02	02:59 20:13	02:22 20:58	02:54 20:34	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:07
20	08:15 15:25	14:08 (3) 14:12 (3)	07:03 16:43	05:43 17:51	04:13 19:05	02:57 20:15	02:22 20:59	02:56 20:33	04:05 19:17	05:16 17:47	06:26 16:20	07:43 15:05
21	08:13 15:27	14:12 (3) 16:45	07:01 17:53	05:40 18:07	04:10 19:17	02:55 20:17	02:22 20:59	02:58 20:31	04:08 19:15	05:19 17:44	06:29 16:17	07:45 15:03
22	08:11 15:30	14:15 (3) 16:48	06:58 17:56	05:37 18:09	04:07 19:09	02:53 20:19	02:22 20:59	03:00 20:29	04:10 19:12	05:21 17:41	06:31 16:14	07:47 15:02
23	08:10 15:32	14:16 (3) 16:50	06:55 17:58	05:34 18:12	04:04 19:21	02:51 20:21	02:22 20:59	03:02 20:27	04:12 19:09	05:23 17:38	06:34 16:12	07:49 15:00
24	08:08 15:34	14:17 (3) 16:53	06:53 18:01	05:31 18:01	04:01 19:14	02:49 20:23	02:22 20:59	03:04 20:25	04:15 19:06	05:26 17:35	06:36 16:09	07:52 14:58
25	08:06 15:37	14:18 (3) 16:55	06:50 18:03	05:28 18:03	03:59 19:17	02:47 20:25	02:23 20:59	03:06 20:23	04:17 19:03	05:28 17:32	06:39 16:06	07:54 14:56
26	08:04 15:39	14:19 (3) 16:58	06:47 18:05	05:25 18:05	03:56 19:19	02:45 20:27	02:23 20:59	03:08 20:20	04:19 19:01	05:30 17:29	06:41 16:04	07:56 14:55
27	08:02 15:42	14:20 (3) 17:00	06:44 18:08	05:23 18:08	03:53 19:21	02:44 20:29	02:24 20:59	03:11 20:18	04:22 18:58	05:32 17:26	06:44 16:01	07:58 14:53
28	08:00 15:44	14:21 (3) 17:03	06:41 18:10	05:20 18:10	03:50 19:24	02:42 20:31	02:25 20:59	03:13 20:16	04:24 18:55	05:35 17:23	06:46 15:58	08:00 14:52
29	07:58 15:47	14:22 (3) 17:06	06:38 18:13	05:17 18:12	03:48 19:26	02:40 20:33	02:25 20:58	03:15 20:14	04:26 18:52	05:37 17:20	06:48 15:56	08:03 14:50
30	07:55 15:49	14:23 (3) 17:09	06:35 18:15	05:14 18:15	03:45 19:29	02:39 20:35	02:26 20:58	03:17 20:12	04:29 18:49	05:39 17:17	06:51 15:53	08:05 14:49
31	07:53 15:52	14:24 (3) 17:12	06:31 18:17	05:11 18:17	03:42 19:37	02:37 20:37	02:27 20:59	03:19 20:09	04:31 18:46	06:53 15:50	08:06 14:47	09:11 13:55 (3)
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194
Total, worst case	229										116	119
Sun reduction	0.27										0.28	0.30
Oper. time red.	0.93										0.93	0.93
Wind dir. red.	0.56										0.56	0.56
Total reduction	0.14										0.15	0.16
Total, real	32										17	19

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DZ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (334)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1281 1143 697 478 515 675 1091 8182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	17:03 (5) 17:17 (5)	03:43 19:31
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	17:07 (5) 17:12 (5)	03:40 19:33
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	17:52 (4) 17:53 (4)	03:37 19:36
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	17:51 (4) 17:55 (4)	03:35 19:38
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	17:49 (4) 17:57 (4)	03:32 19:41
6	08:33 14:57	07:39 16:07	06:24 17:18	04:53 18:31	17:49 (4) 18:00 (4)	03:30 19:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	17:48 (4) 18:03 (4)	03:27 19:45
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	17:48 (4) 18:05 (4)	03:25 19:48
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	17:48 (4) 18:07 (4)	03:22 19:50
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	17:47 (4) 18:06 (4)	03:20 19:52
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	17:48 (4) 18:05 (4)	03:17 19:55
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	17:49 (4) 18:04 (4)	03:15 19:57
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	17:50 (4) 18:03 (4)	03:12 19:59
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	17:52 (4) 18:00 (4)	03:10 20:02
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	18:48 (3) 19:10 (3)
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	18:48 (3) 19:09 (3)
17	08:20 15:18	07:11 16:35	05:52 17:44	17:08 (5) 17:14 (5)	04:21 18:57	03:03 20:08
18	08:18 15:21	07:09 16:38	05:49 17:46	17:05 (5) 17:16 (5)	04:18 19:00	03:01 20:11
19	08:16 15:23	07:06 16:40	05:46 17:49	17:04 (5) 17:19 (5)	04:15 19:02	02:59 20:13
20	08:15 15:25	07:03 16:43	05:43 17:51	17:02 (5) 17:21 (5)	04:13 19:05	02:57 20:15
21	08:13 15:27	07:01 16:45	05:40 17:53	17:01 (5) 17:23 (5)	04:10 19:07	02:55 20:17
22	08:11 15:30	06:58 16:48	05:37 17:56	17:00 (5) 17:26 (5)	04:07 19:09	02:53 20:19
23	08:09 15:32	06:55 16:50	05:34 17:58	16:59 (5) 17:26 (5)	04:04 19:12	02:51 20:21
24	08:08 15:35	06:52 16:53	05:31 18:01	16:59 (5) 17:26 (5)	04:01 19:14	02:49 20:23
25	08:06 15:37	06:50 16:55	05:28 18:03	16:59 (5) 17:26 (5)	03:59 19:17	02:47 20:25
26	08:04 15:39	06:47 16:58	05:25 18:05	16:58 (5) 17:25 (5)	03:56 19:19	02:45 20:27
27	08:02 15:42	06:44 17:00	05:23 18:08	16:58 (5) 17:25 (5)	03:53 19:21	02:44 20:29
28	08:00 15:44	06:41 17:03	05:20 18:10	16:59 (5) 17:24 (5)	03:51 19:24	02:42 20:31
29	07:57 15:47	06:38 17:05	05:17 18:12	16:59 (5) 17:22 (5)	03:48 19:26	02:40 20:33
30	07:55 15:49	06:35 17:02	05:14 18:15	17:00 (5) 17:21 (5)	03:45 19:29	02:39 20:35
31	07:53 15:52	06:32 17:00	05:11 18:17	17:01 (5) 17:19 (5)	03:42 19:31	02:37 20:37
Potential sun hours	216	257	365	434	526	554
Total, worst case			321	184	423	
Sun reduction			0.28	0.30	0.35	
Oper. time red.			0.93	0.93	0.93	
Wind dir. red.			0.57	0.64	0.72	
Total reduction			0.15	0.18	0.23	
Total, real			48	33	99	

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

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

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: DZ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (334)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum

813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	July	August	September	October	November	December
1	02:27 20:57	03:22 19:27 (3)	04:33 18:58 (3)	05:42 17:47 (4)	06:56 18:04 (4)	08:07 17:14
2	02:28 20:56	03:24 19:28 (3)	04:35 18:57 (3)	05:44 17:46 (4)	06:58 18:05 (4)	08:09 17:12
3	02:29 20:56	03:26 19:29 (3)	04:38 18:57 (3)	05:46 17:46 (4)	07:01 18:05 (4)	08:10 17:09
4	02:30 20:55	03:29 19:30 (3)	04:40 18:57 (3)	05:49 17:45 (4)	07:03 18:02 (4)	08:12 17:06
5	02:31 20:54	03:31 19:31 (3)	04:42 18:57 (2)	05:51 17:44 (4)	07:06 18:02 (4)	08:14 17:03
6	02:33 20:53	03:33 19:32 (3)	04:45 18:56 (2)	05:53 17:44 (4)	07:08 18:00 (4)	08:16 17:00
7	02:34 20:52	03:35 19:33 (3)	04:47 18:55 (2)	05:56 17:45 (4)	07:11 18:00 (4)	08:18 16:57
8	02:35 20:51	03:38 19:34 (3)	04:49 18:54 (2)	05:58 17:46 (4)	07:13 18:00 (4)	08:19 16:54
9	02:37 20:50	03:40 19:35 (3)	04:51 18:54 (2)	06:00 17:46 (4)	07:16 18:00 (4)	08:21 16:51
10	02:38 20:48	03:42 19:36 (3)	04:54 18:53 (2)	06:03 17:01 (5)	07:18 17:01 (5)	08:22 16:48
11	02:40 20:47	03:45 19:37 (3)	04:56 18:53 (2)	06:05 16:56 (5)	07:21 16:56 (5)	08:24 16:45
12	02:42 20:46	03:47 19:38 (3)	04:58 18:53 (2)	06:07 17:10 (5)	07:23 16:53 (5)	08:25 16:42
13	02:43 20:44	03:49 19:39 (3)	05:01 18:54 (2)	06:10 16:52 (5)	07:26 16:52 (5)	08:26 16:40
14	02:45 20:43	03:52 19:40 (3)	05:03 19:01 (2)	06:12 17:12 (5)	07:28 16:50 (5)	08:28 16:37
15	02:47 20:41	03:54 19:41 (3)	05:05 18:54 (2)	06:14 17:13 (5)	07:30 16:48 (5)	08:29 16:34
16	02:49 20:40	03:56 19:42 (3)	05:07 18:56 (2)	06:17 17:13 (5)	07:33 16:47 (5)	08:30 16:31
17	02:50 20:38	03:59 19:43 (3)	05:10 17:59	06:19 16:47 (5)	07:35 16:47 (5)	08:31 16:28
18	02:52 20:36	04:01 19:44 (3)	05:12 17:56	06:22 17:14 (5)	07:38 16:46 (5)	08:32 16:22
19	02:54 20:34	04:03 19:45 (3)	05:14 17:53	06:24 17:13 (5)	07:40 16:46 (5)	08:33 16:25
20	02:56 20:32	04:06 19:46 (3)	05:16 17:50	06:26 17:13 (5)	07:42 16:46 (5)	08:33 16:23
21	02:58 20:31	04:08 19:47 (3)	05:19 17:47	06:29 17:12 (5)	07:45 16:45 (5)	08:34 16:20
22	03:00 20:29	04:10 19:48 (3)	05:21 17:44	06:31 17:12 (5)	07:47 16:46 (5)	08:34 16:17
23	03:02 20:27	04:12 19:49 (3)	05:23 17:41	06:34 17:09 (5)	07:49 16:46 (5)	08:35 16:14
24	03:04 20:25	04:15 19:50 (3)	05:26 17:38	06:36 16:46 (5)	07:52 16:46 (5)	08:35 16:12
25	03:06 20:22	04:17 19:51 (3)	05:28 17:35	06:39 17:02 (5)	07:54 16:48 (5)	08:36 16:09
26	03:09 20:20	04:19 19:52 (3)	05:30 17:32	06:41 17:00 (5)	07:56 16:48 (5)	08:36 16:06
27	03:11 20:18	04:22 19:53 (3)	05:32 17:29	06:43 16:49 (5)	07:58 16:57 (5)	08:36 16:04
28	03:13 20:16	04:24 19:54 (3)	05:35 17:26	06:46 16:51 (5)	08:00 16:51 (5)	08:36 16:43
29	03:15 20:14	04:26 19:55 (3)	05:37 17:23	06:48 15:58	08:02 15:58	08:36 14:52
30	03:17 20:11	04:29 19:56 (3)	05:39 18:01 (4)	06:51 17:50 (4)	08:05 15:56	08:36 14:51
31	03:19 20:09	04:31 19:57 (3)	05:41 18:03 (4)	06:53 17:48 (4)	08:07 15:53	08:36 14:49
Potential sun hours	551	481	387	318	232	194
Total, worst case	192	286	457			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.72	0.71	0.59			
Total reduction	0.17	0.16	0.14			
Total, real	33	45	65			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EA - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (335)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum

813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June
1	08:35	07:51	06:38	16:07 (5) 05:08	03:42	02:36
	14:49	15:54	17:05	23 16:30 (5) 18:19	19:31	20:38
2	08:35	07:49	06:36	16:07 (5) 05:05	03:40	02:34
	14:50	15:57	17:08	24 16:31 (5) 18:22	19:33	20:40
3	08:34	07:46	06:33	16:06 (5) 05:02	03:37	02:33
	14:52	15:59	17:10	25 16:31 (5) 18:24	19:36	20:42
4	08:34	07:44	06:30	16:05 (5) 04:59	03:35	02:32
	14:53	16:02	17:13	26 16:31 (5) 18:27	19:38	20:43
5	08:33	07:42	06:27	16:05 (5) 04:56	03:32	02:30
	14:55	16:05	17:15	26 16:31 (5) 18:29	19:41	20:45
6	08:33	07:39	06:24	16:05 (5) 04:53	03:30	02:29
	14:56	16:07	17:18	25 16:30 (5) 18:31	19:43	20:46
7	08:32	07:37	06:21	16:05 (5) 04:50	03:27	02:28
	14:58	16:10	17:20	25 16:30 (5) 18:34	19:45	20:47
8	08:31	07:35	06:18	16:05 (5) 04:47	03:25	02:27
	15:00	16:12	17:22	24 16:29 (5) 18:36	19:48	20:49
9	08:30	07:32	06:15	16:06 (5) 04:44	03:22	02:26
	15:02	16:15	17:25	22 16:28 (5) 18:38	19:50	20:50
10	08:29	07:30	06:13	16:08 (5) 04:41	03:20	02:26
	15:04	16:17	17:27	20 16:28 (5) 18:41	19:52	20:51
11	08:28	07:27	06:10	16:09 (5) 04:38	18:07 (3) 03:17	02:25
	15:06	16:20	17:30	17 16:26 (5) 18:43	2 18:09 (3) 19:55	20:52
12	08:27	07:25	06:07	16:11 (5) 04:36	18:02 (3) 03:15	02:24
	15:08	16:23	17:32	13 16:24 (5) 18:46	12 18:14 (3) 19:57	20:53
13	08:25	07:22	06:04	16:15 (5) 04:33	18:00 (3) 03:12	02:23
	15:10	16:25	17:34	5 16:20 (5) 18:48	16 18:16 (2) 19:59	20:54
14	08:24	07:19	06:01	04:30	17:58 (3) 03:10	02:23
	15:12	16:28	17:37	20 18:50	20 18:18 (2) 20:02	20:55
15	08:23	07:17	05:58	04:27	17:56 (3) 03:08	02:23
	15:14	16:30	17:39	18:53	24 18:20 (2) 20:04	20:56
16	08:21	07:14	05:55	04:24	17:55 (3) 03:06	02:22
	15:16	16:33	17:42	18:55	27 18:22 (2) 20:06	20:57
17	08:20	07:12	05:52	04:21	17:55 (3) 03:03	02:22
	15:18	16:35	17:44	18:57	30 18:25 (2) 20:08	20:57
18	08:18	07:09	05:49	04:18	17:54 (3) 03:01	02:22
	15:20	16:38	17:46	19:00	31 18:25 (2) 20:11	20:58
19	08:16	07:06	05:46	17:14 (4) 04:15	17:53 (3) 02:59	02:22
	15:23	16:40	17:49	5 17:19 (4) 19:02	32 18:25 (2) 20:13	20:58
20	08:15	07:03	05:43	17:12 (4) 04:13	17:53 (3) 02:57	02:22
	15:25	16:43	17:51	9 17:21 (4) 19:05	32 18:25 (2) 20:15	20:59
21	08:13	07:01	05:40	17:10 (4) 04:10	17:53 (3) 02:55	02:22
	15:27	16:45	17:53	13 17:23 (4) 19:07	31 18:24 (2) 20:17	20:59
22	08:11	06:58	05:37	17:09 (4) 04:07	17:52 (3) 02:53	02:22
	15:30	16:48	17:56	17 17:26 (4) 19:09	30 18:22 (2) 20:19	20:59
23	08:09	06:55	05:34	17:08 (4) 04:04	17:53 (3) 02:51	02:22
	15:32	16:50	17:58	20 17:28 (4) 19:12	29 18:22 (2) 20:21	20:59
24	08:08	06:52	05:31	17:08 (4) 04:01	17:53 (3) 02:49	02:22
	15:35	16:53	18:01	20 17:28 (4) 19:14	27 18:20 (2) 20:23	20:59
25	08:06	06:50	16:15 (5) 05:28	17:08 (4) 03:59	17:53 (3) 02:47	02:23
	15:37	16:55	8 16:23 (5) 18:03	19 17:27 (4) 19:17	23 18:16 (2) 20:25	20:59
26	08:04	06:47	16:12 (5) 05:25	17:08 (4) 03:56	17:54 (3) 02:45	02:23
	15:39	16:58	13 16:25 (5) 18:05	18 17:26 (4) 19:19	22 18:16 (3) 20:27	20:59
27	08:02	06:44	16:10 (5) 05:23	17:08 (4) 03:53	17:55 (3) 02:44	02:24
	15:42	17:00	18 16:28 (5) 18:08	17 17:25 (4) 19:21	19 18:14 (3) 20:29	20:59
28	08:00	06:41	16:09 (5) 05:20	17:09 (4) 03:51	17:57 (3) 02:42	02:25
	15:44	17:03	20 16:29 (5) 18:10	15 17:24 (4) 19:24	16 18:13 (3) 20:31	20:59
29	07:57		05:17	17:10 (4) 03:48	17:58 (3) 02:40	02:25
	15:47		18:12	12 17:22 (4) 19:26	13 18:11 (3) 20:33	20:58
30	07:55		05:14	17:12 (4) 03:45	18:02 (3) 02:39	02:26
	15:49		18:15	7 17:19 (4) 19:29	6 18:08 (3) 20:35	20:58
31	07:53		05:11			02:37
	15:52		18:17			20:37
Potential sun hours	216	257	365	434	526	554
Total, worst case		59	447	442		
Sun reduction		0.29	0.28	0.30		
Oper. time red.		0.93	0.93	0.93		
Wind dir. red.		0.53	0.55	0.66		
Total reduction		0.14	0.14	0.18		
Total, real		8	64	82		

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EA - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (335)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1281 1143 697 478 515 675 1091 8182  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December		
1	02:27	03:22	04:33	18:06 (3)	05:42	15:51 (5)	06:56	08:07
	20:57	20:07	18:43	18:08 (3)	17:14	16:02 (5)	15:48	14:48
2	02:28	03:24	04:35		05:44	15:48 (5)	06:58	08:09
	20:56	20:04	18:40		17:12	16:04 (5)	15:45	14:47
3	02:29	03:26	04:38		05:46	15:45 (5)	07:01	08:10
	20:56	20:02	18:37		17:09	16:05 (5)	15:43	14:46
4	02:30	03:28	04:40		05:49	15:44 (5)	07:03	08:12
	20:55	20:00	18:34		17:06	16:06 (5)	15:40	14:45
5	02:31	03:31	04:42		05:51	15:43 (5)	07:06	08:14
	20:54	19:57	18:32		17:03	16:06 (5)	15:38	14:44
6	02:33	03:33	04:45		05:53	15:41 (5)	07:08	08:16
	20:53	19:55	18:29		17:00	16:06 (5)	15:36	14:43
7	02:34	03:35	04:47		05:56	15:41 (5)	07:11	08:18
	20:52	19:52	18:26		16:57	16:07 (5)	15:33	14:42
8	02:35	03:38	04:49		05:58	15:40 (5)	07:13	08:19
	20:51	19:50	18:23		16:54	16:06 (5)	15:31	14:41
9	02:37	03:40	04:51		06:00	15:41 (5)	07:16	08:21
	20:50	19:47	18:20		16:51	16:07 (5)	15:28	14:40
10	02:38	03:42	04:54		06:03	15:40 (5)	07:18	08:22
	20:48	19:44	18:17		16:48	16:06 (5)	15:26	14:40
11	02:40	03:45	04:56		06:05	15:41 (5)	07:21	08:24
	20:47	19:42	18:14		16:45	16:06 (5)	15:24	14:39
12	02:42	03:47	04:58		06:07	15:41 (5)	07:23	08:25
	20:46	19:39	18:11		16:42	16:04 (5)	15:22	14:39
13	02:43	03:49	18:09 (3)	05:01	17:05 (4)	15:42 (5)	07:26	08:26
	20:44	19:37	18:17 (3)	18:08	17:10 (4)	16:04 (5)	15:19	14:39
14	02:45	03:52	18:06 (3)	05:03	17:01 (4)	15:42 (5)	07:28	08:28
	20:43	19:34	18:20 (3)	18:05	17:12 (4)	16:02 (5)	15:17	14:38
15	02:47	03:54	18:04 (3)	05:05	16:58 (4)	15:44 (5)	07:30	08:29
	20:41	19:31	18:21 (3)	18:02	17:13 (4)	16:00 (5)	15:15	14:38
16	02:49	03:56	18:02 (3)	05:07	16:57 (4)	15:45 (5)	07:33	08:30
	20:40	19:28	18:22 (3)	17:59	17:14 (4)	16:31	15:13	14:38
17	02:50	03:59	18:01 (3)	05:10	16:56 (4)	15:49 (5)	07:35	08:31
	20:38	19:26	18:23 (3)	17:56	17:15 (4)	16:28	15:11	14:38
18	02:52	04:01	17:59 (3)	05:12	16:55 (4)	16:22	15:09	14:38
	20:36	19:23	18:23 (2)	17:53	17:15 (4)	16:25	15:07	14:38
19	02:54	04:03	17:58 (3)	05:14	16:55 (4)	16:24	15:07	14:38
	20:34	19:20	18:26 (2)	17:50	17:14 (4)	16:23	15:05	14:39
20	02:56	04:05	17:58 (3)	05:16	16:54 (4)	16:26	15:05	14:39
	20:32	19:17	18:28 (2)	17:47	17:14 (4)	16:20	15:03	14:39
21	02:58	04:08	17:58 (3)	05:19	16:55 (4)	16:29	15:03	14:39
	20:31	19:15	18:28 (2)	17:44	17:12 (4)	16:17	15:03	14:39
22	03:00	04:10	17:57 (3)	05:21	16:55 (4)	16:31	15:03	14:39
	20:29	19:12	18:29 (2)	17:41	17:09 (4)	16:14	15:02	14:39
23	03:02	04:12	17:57 (3)	05:23	16:55 (4)	16:34	15:02	14:39
	20:27	19:09	18:29 (2)	17:38	17:06 (4)	16:12	15:00	14:40
24	03:04	04:15	17:56 (3)	05:26	16:56 (4)	16:36	15:00	14:40
	20:25	19:06	18:28 (2)	17:35	17:02 (4)	16:09	14:58	14:41
25	03:06	04:17	17:56 (3)	05:28	16:59 (4)	16:39	14:58	14:41
	20:23	19:03	18:28 (2)	17:32	17:00 (4)	16:06	14:57	14:41
26	03:09	04:19	17:56 (3)	05:30		16:41	14:56	14:42
	20:20	19:01	18:27 (2)	17:29		16:04	14:55	14:42
27	03:11	04:22	17:58 (3)	05:32		16:43	14:55	14:43
	20:18	18:58	18:25 (2)	17:26		16:01	14:53	14:43
28	03:13	04:24	17:58 (3)	05:35		16:46	14:52	14:44
	20:16	18:55	18:22 (2)	17:23		16:04	14:52	14:44
29	03:15	04:26	17:59 (3)	05:37		16:48	14:51	14:45
	20:14	18:52	18:19 (2)	17:20		16:06	14:51	14:45
30	03:17	04:29	18:00 (3)	05:39		16:51	14:50	14:46
	20:11	18:49	18:16 (2)	17:17		16:03	14:49	14:46
31	03:19	04:31	18:01 (3)			16:53	14:49	14:46
	20:09	18:46	18:13 (3)			16:05	14:48	14:47
Potential sun hours	551	481	387		318		232	194
Total, worst case		451	178	343				
Sun reduction		0.24	0.26	0.28				
Oper. time red.		0.93	0.93	0.93				
Wind dir. red.		0.66	0.58	0.53				
Total reduction		0.15	0.14	0.14				
Total, real		67	25	47				

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:

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EB - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (336)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	17:26 (5) 17:49 (5)	03:43 19:31
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	17:25 (5) 17:51 (5)	03:40 19:33
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	17:24 (5) 17:51 (5)	03:37 19:36
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	17:23 (5) 17:51 (5)	03:35 19:38
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	17:23 (5) 17:50 (5)	03:32 19:41
6	08:32 14:57	07:39 16:07	06:24 17:18	04:53 18:31	17:24 (5) 17:51 (5)	03:30 19:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	17:24 (5) 17:50 (5)	03:27 19:45
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	17:24 (5) 17:49 (5)	03:25 19:48
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	17:24 (5) 17:48 (5)	03:22 19:50
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	17:25 (5) 17:46 (5)	03:20 19:52
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	17:26 (5) 18:11 (4)	03:17 19:55
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	17:29 (5) 18:14 (4)	03:15 19:57
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	17:31 (5) 18:16 (4)	03:12 19:59
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	18:07 (4) 18:18 (4)	03:10 20:02
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	18:06 (4) 18:20 (4)	03:08 20:04
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	18:05 (4) 18:22 (4)	03:06 20:06
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	18:06 (4) 18:25 (4)	03:03 20:08
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	18:06 (4) 18:24 (4)	03:01 20:11
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	18:06 (4) 18:23 (4)	02:59 20:13
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	18:08 (4) 18:22 (4)	02:57 20:15
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	18:09 (4) 18:20 (4)	02:55 20:17
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	18:11 (4) 18:17 (4)	02:53 20:19
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	02:51 20:21	20:19
24	08:08 15:35	06:52 16:53	05:31 18:01	04:01 19:14	02:49 20:23	23 19:33 (3)   20:59
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	02:47 20:25	22 19:33 (3)   20:59
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 19:19	02:45 20:27	21 19:11 (3)   20:23
27	08:02 15:42	06:44 17:00	05:23 18:08	17:36 (5)   03:53 17:37 (5)   19:21	02:44 20:29	21 19:12 (3)   20:24
28	08:00 15:44	06:41 17:03	05:20 18:10	17:32 (5)   03:51 17:40 (5)   19:24	02:42 20:31	20 19:13 (3)   20:25
29	07:57 15:47	06:38 17:05	05:17 18:12	17:30 (5)   03:48 17:42 (5)   19:26	02:40 20:33	20 19:12 (3)   20:25
30	07:55 15:49	06:35 17:02	05:14 18:15	17:28 (5)   03:45 17:44 (5)   19:29	02:39 20:35	19 19:13 (3)   20:26
31	07:53 15:52	06:32 17:00	05:11 18:17	17:27 (5)   03:42 17:46 (5)   19:26	02:37 20:37	17 19:14 (3)   20:27
Potential sun hours	216	257	365	434	526	554
Total, worst case			57	436	485	74
Sun reduction			0.28	0.30	0.35	0.30
Oper. time red.			0.93	0.93	0.93	0.93
Wind dir. red.			0.62	0.63	0.73	0.74
Total reduction			0.16	0.18	0.24	0.21
Total, real			9	77	116	15

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EB - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (336)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December		
1	02:27 20:57	03:22 20:07	19:12 (2) 19:29 (2)	04:33 18:43	17:25 (5) 18:10 (4)	05:42 17:14	06:56 15:48	08:07 14:48
2	02:28 20:56	03:24 20:04	19:12 (2) 19:27 (2)	04:35 18:40	17:24 (5) 17:45 (5)	05:44 17:12	06:58 15:45	08:09 14:47
3	02:29 20:56	03:26 20:02	19:11 (2) 19:24 (2)	04:38 18:37	17:22 (5) 17:46 (5)	05:46 17:09	07:01 15:43	08:10 14:46
4	02:30 20:55	03:29 20:00	19:11 (2) 19:22 (2)	04:40 18:34	17:21 (5) 17:46 (5)	05:49 17:06	07:03 15:40	08:12 14:45
5	02:32 20:54	03:31 19:57	19:11 (2) 19:20 (2)	04:42 18:31	17:20 (5) 17:46 (5)	05:51 17:03	07:06 15:38	08:14 14:44
6	02:33 20:53	19:27 (3) 19:32 (3)	03:33 19:55	19:11 (2) 19:18 (2)	04:45 18:29	05:53 17:00	07:08 15:36	08:16 14:43
7	02:34 20:52	19:26 (3) 19:35 (3)	03:35 19:52	19:12 (2) 19:15 (2)	04:47 18:26	05:56 16:57	07:11 15:33	08:18 14:42
8	02:35 20:51	19:25 (3) 19:36 (3)	03:38 19:50	19:12 (2) 19:13 (2)	04:49 18:23	05:58 16:54	07:13 15:31	08:19 14:41
9	02:37 20:50	19:24 (3) 19:36 (3)	03:40 19:47	04:51 18:20	17:18 (5) 17:45 (5)	06:00 16:51	07:16 15:28	08:21 14:40
10	02:38 20:48	19:23 (3) 19:37 (3)	03:42 19:44	04:54 18:17	17:18 (5) 17:44 (5)	06:03 16:48	07:18 15:26	08:22 14:40
11	02:40 20:47	19:23 (3) 19:38 (3)	03:45 19:42	04:56 18:14	17:18 (5) 17:41 (5)	06:05 16:45	07:21 15:24	08:24 14:39
12	02:42 20:46	19:22 (3) 19:39 (3)	03:47 19:39	04:58 18:11	17:18 (5) 17:38 (5)	06:07 16:42	07:23 15:22	08:25 14:39
13	02:43 20:44	19:22 (3) 19:40 (3)	03:49 19:37	05:01 18:08	17:19 (5) 17:36 (5)	06:10 16:40	07:26 15:19	08:26 14:39
14	02:45 20:43	19:21 (3) 19:40 (3)	03:52 19:34	05:03 18:05	17:20 (5) 17:33 (5)	06:12 16:37	07:28 15:17	08:28 14:38
15	02:47 20:41	19:21 (3) 19:41 (3)	03:54 19:31	05:05 18:02	17:21 (5) 17:30 (5)	06:14 16:34	07:30 15:15	08:29 14:38
16	02:49 20:40	19:21 (3) 19:41 (3)	03:56 19:28	05:07 17:59	17:23 (5) 17:26 (5)	06:17 16:31	07:33 15:13	08:30 14:38
17	02:50 20:38	19:21 (3) 19:42 (3)	03:59 19:26	05:10 17:56	05:10 16:28	06:19 15:11	07:35 15:11	08:31 14:38
18	02:52 20:36	19:21 (3) 19:43 (3)	04:01 19:23	05:12 17:53	05:12 16:25	06:22 15:09	07:38 15:09	08:32 14:38
19	02:54 20:34	19:20 (3) 19:42 (3)	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:07	08:33 15:07	08:33 14:38
20	02:56 20:32	19:20 (3) 19:43 (3)	04:06 19:17	05:16 17:47	06:26 16:20	07:42 15:05	08:33 15:05	08:33 14:39
21	02:58 20:31	19:20 (3) 19:44 (3)	04:08 19:15	05:19 18:16 (4)	06:29 16:17	07:45 15:03	08:34 15:03	08:34 14:39
22	03:00 20:29	19:19 (3) 19:43 (3)	04:10 19:12	05:21 18:25 (4)	06:31 16:14	07:47 15:02	08:34 15:02	08:34 14:39
23	03:02 20:27	19:20 (3) 19:43 (3)	04:12 19:09	05:23 18:26 (4)	06:34 16:12	07:49 15:00	08:35 15:00	08:35 14:40
24	03:04 20:25	19:20 (3) 19:43 (3)	04:15 19:06	05:26 18:26 (4)	06:36 16:09	07:52 14:58	08:35 14:58	08:35 14:41
25	03:06 20:22	19:20 (3) 19:42 (3)	04:17 19:03	05:28 18:27 (4)	06:39 16:06	07:54 14:57	08:36 14:57	08:36 14:41
26	03:09 20:20	19:20 (3) 19:40 (3)	04:19 19:00	05:30 18:27 (4)	06:41 16:04	07:56 14:55	08:36 14:55	08:36 14:42
27	03:11 20:18	19:17 (2) 19:38 (3)	04:22 18:58	05:32 18:25 (4)	06:43 16:01	07:58 14:53	08:36 14:53	08:36 14:43
28	03:13 20:16	19:15 (2) 19:37 (3)	04:24 18:55	05:35 18:22 (4)	06:46 15:58	08:00 14:52	08:36 14:52	08:36 14:44
29	03:15 20:14	19:14 (2) 19:35 (3)	04:26 18:52	05:37 18:19 (4)	06:48 15:56	08:02 14:51	08:36 14:51	08:36 14:45
30	03:17 20:11	19:13 (2) 19:33 (3)	04:29 18:49	05:39 18:16 (4)	06:51 15:53	08:05 14:49	08:36 14:49	08:36 14:46
31	03:19 20:09	19:13 (2) 19:31 (3)	04:31 18:46	17:27 (5) 18:13 (4)	06:53 15:50	08:36 14:47	08:36 14:47	08:36 14:47
Potential sun hours	551	481	387	318	232	194		
Total, worst case	486	244	335					
Sun reduction	0.26	0.24	0.26					
Oper. time red.	0.93	0.93	0.93					
Wind dir. red.	0.73	0.68	0.62					
Total reduction	0.18	0.15	0.15					
Total, real	86	37	50					

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EC - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (337)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35	07:51	06:38	05:08	17:10 (5)	03:43
	14:49	15:54	17:05	18:19	17:36 (5)	19:31
2	08:35	07:49	06:36	05:05	17:10 (5)	03:40
	14:50	15:57	17:08	18:22	17:35 (5)	19:33
3	08:34	07:46	06:33	05:02	17:11 (5)	03:37
	14:52	16:00	17:10	18:24	17:34 (5)	19:36
4	08:34	07:44	06:30	04:59	17:11 (5)	03:35
	14:53	16:02	17:13	18:27	17:32 (5)	19:38
5	08:33	07:42	06:27	04:56	17:12 (5)	03:32
	14:55	16:05	17:15	18:29	17:31 (5)	19:41
6	08:32	07:39	06:24	04:53	17:15 (5)	03:30
	14:57	16:07	17:18	18:31	17:29 (5)	19:43
7	08:32	07:37	06:21	04:50	17:18 (5)	03:27
	14:58	16:10	17:20	18:34	18:03 (4)	19:45
8	08:31	07:35	06:18	04:47	17:59 (4)	03:25
	15:00	16:12	17:22	18:36	18:05 (4)	19:48
9	08:30	07:32	06:15	04:44	17:58 (4)	03:22
	15:02	16:15	17:25	18:38	18:07 (4)	19:50
10	08:29	07:30	06:13	04:41	17:57 (4)	03:20
	15:04	16:17	17:27	18:41	18:09 (4)	19:52
11	08:28	07:27	06:10	04:38	17:56 (4)	03:17
	15:06	16:20	17:30	18:43	18:11 (4)	19:55
12	08:27	07:25	06:07	04:36	17:57 (4)	03:15
	15:08	16:23	17:32	18:46	18:14 (4)	19:57
13	08:25	07:22	06:04	04:33	17:56 (4)	03:12
	15:10	16:25	17:34	18:48	18:15 (4)	19:59
14	08:24	07:19	06:01	04:30	17:56 (4)	03:10
	15:12	16:28	17:37	18:50	18:14 (4)	20:02
15	08:23	07:17	05:58	04:27	17:57 (4)	03:08
	15:14	16:30	17:39	18:53	18:13 (4)	20:04
16	08:21	07:14	05:55	04:24	17:57 (4)	03:06
	15:16	16:33	17:42	18:55	18:11 (4)	20:06
17	08:20	07:11	05:52	04:21	18:00 (4)	03:03
	15:18	16:35	17:44	18:57	18:10 (4)	20:08
18	08:18	07:09	05:49	04:18	18:02 (4)	03:01
	15:21	16:38	17:46	19:00	18:06 (4)	20:11
19	08:16	07:06	05:46	04:15	02:59	18:58 (3)
	15:23	16:40	17:49	19:02	20:13	19:21 (3)
20	08:15	07:03	05:43	04:13	02:57	18:59 (3)
	15:25	16:43	17:51	19:05	20:15	19:21 (3)
21	08:13	07:01	05:40	04:10	02:55	18:59 (3)
	15:27	16:45	17:53	19:07	20:17	19:20 (3)
22	08:11	06:58	05:37	17:20 (5)	04:07	02:53
	15:30	16:48	17:56	6 17:26 (5)	19:09	20:19
23	08:09	06:55	05:34	17:17 (5)	04:04	02:51
	15:32	16:50	17:58	11 17:28 (5)	19:12	20:21
24	08:08	06:52	05:31	17:15 (5)	04:01	02:49
	15:35	16:53	18:01	15 17:30 (5)	19:14	20:23
25	08:06	06:50	05:28	17:14 (5)	03:59	02:47
	15:37	16:55	18:03	19 17:33 (5)	19:17	20:25
26	08:04	06:47	05:25	17:13 (5)	03:56	02:45
	15:39	16:58	18:05	22 17:35 (5)	19:19	20:27
27	08:02	06:44	05:23	17:12 (5)	03:53	02:44
	15:42	17:00	18:08	25 17:37 (5)	19:21	20:29
28	08:00	06:41	05:20	17:11 (5)	03:51	02:42
	15:44	17:03	18:10	27 17:38 (5)	19:24	20:31
29	07:57	06:37	05:17	17:11 (5)	03:48	02:40
	15:47	06:47	18:12	27 17:38 (5)	19:26	20:33
30	07:55	06:35	05:14	17:10 (5)	03:45	02:39
	15:49	06:47	18:15	27 17:37 (5)	19:29	20:35
31	07:53	06:33	05:11	17:10 (5)	03:43	02:37
	15:52	06:49	18:17	27 17:37 (5)	19:31	20:37
Potential sun hours	216	257	365	434	526	554
Total, worst case			206	279	481	
Sun reduction			0.28	0.30	0.35	
Oper. time red.			0.93	0.93	0.93	
Wind dir. red.			0.60	0.63	0.73	
Total reduction			0.16	0.17	0.24	
Total, real			32	49	114	

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

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

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EC - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (337)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December			
1	02:27 20:57	03:22 20:07	19:06 (2) 18:43	04:33 15	17:55 (4) 18:10 (4)	05:42 17:14	06:56 15:48	08:07 14:48	
2	02:28 20:56	03:24 20:04	19:05 (2) 19:27 (3)	04:35 18:40	17:56 (4) 18:08 (4)	05:44 17:12	06:58 15:45	08:09 14:47	
3	02:29 20:56	03:26 20:02	19:04 (2) 19:24 (3)	04:38 18:37	17:56 (4) 18:05 (4)	05:46 17:09	07:01 15:43	08:10 14:46	
4	02:30 20:55	03:29 20:00	19:03 (2) 19:22 (3)	04:40 18:34	17:56 (4) 18:02 (4)	05:49 17:06	07:03 15:40	08:12 14:45	
5	02:31 20:54	03:31 19:57	19:02 (2) 19:20 (3)	04:42 18:31	17:14 (5) 17:59 (4)	05:51 17:03	07:06 15:38	08:14 14:44	
6	02:33 20:53	03:33 19:55	19:02 (2) 19:18 (2)	04:45 18:29	17:10 (5) 17:24 (5)	05:53 17:00	07:08 15:36	08:16 14:43	
7	02:34 20:52	03:35 19:52	19:02 (2) 19:15 (2)	04:47 18:26	17:09 (5) 17:27 (5)	05:56 16:57	07:11 15:33	08:18 14:42	
8	02:35 20:51	03:38 19:50	19:02 (2) 19:13 (2)	04:49 18:23	17:07 (5) 17:28 (5)	05:58 16:54	07:13 15:31	08:19 14:41	
9	02:37 20:50	03:40 19:47	19:01 (2) 19:10 (2)	04:51 18:20	17:05 (5) 17:28 (5)	06:00 16:51	07:16 15:28	08:21 14:40	
10	02:38 20:48	03:42 19:44	19:02 (2) 19:08 (2)	04:54 18:17	17:04 (5) 17:28 (5)	06:03 16:48	07:18 15:26	08:22 14:40	
11	02:40 20:47	03:45 19:42	19:02 (2) 19:05 (2)	04:56 18:14	17:02 (5) 17:28 (5)	06:05 16:45	07:21 15:24	08:24 14:39	
12	02:42 20:46	03:47 19:39	19:02 (2) 19:03 (2)	04:58 18:11	17:01 (5) 17:28 (5)	06:07 16:42	07:23 15:22	08:25 14:39	
13	02:43 20:44	03:49 19:37	05:01 18:08	27	17:02 (5) 17:29 (5)	06:10 16:40	07:26 15:19	08:26 14:39	
14	02:45 20:43	03:52 19:34	05:03 18:05	27	17:01 (5) 17:28 (5)	06:12 16:37	07:28 15:17	08:28 14:38	
15	02:47 20:41	19:17 (3) 19:22 (3)	03:54 19:31	05:05 18:02	27	17:01 (5) 17:28 (5)	06:14 16:34	07:30 15:15	08:29 14:38
16	02:49 20:40	5 19:22 (3) 9 19:24 (3)	03:56 19:28	05:07 17:59	26	17:00 (5) 17:26 (5)	06:17 16:31	07:33 15:13	08:30 14:38
17	02:50 20:38	12 19:14 (3) 12 19:26 (3)	03:59 19:26	05:10 17:56	23	17:01 (5) 17:24 (5)	06:19 16:28	07:35 15:11	08:31 14:38
18	02:52 20:36	14 19:13 (3) 14 19:27 (3)	04:01 19:23	05:12 17:53	20	17:01 (5) 17:21 (5)	06:22 16:25	07:38 15:09	08:32 14:38
19	02:54 20:34	17 19:11 (3) 17 19:28 (3)	04:03 19:20	05:14 17:50	16	17:02 (5) 17:18 (5)	06:24 16:23	07:40 15:07	08:33 14:38
20	02:56 20:32	18 19:11 (3) 18 19:29 (3)	04:06 19:17	05:16 17:47	12	17:02 (5) 17:14 (5)	06:26 16:20	07:42 15:05	08:33 14:39
21	02:58 20:31	19 19:11 (3) 19 19:30 (3)	04:08 19:15	05:19 17:44	7	17:05 (5) 17:12 (5)	06:29 16:17	07:45 15:03	08:34 14:39
22	03:00 20:29	19 19:09 (3) 20 19:29 (3)	04:10 19:12	05:21 17:41	2	17:07 (5) 17:09 (5)	06:31 16:14	07:47 15:02	08:34 14:39
23	03:02 20:27	21 19:09 (3) 21 19:30 (3)	04:12 19:09	05:23 17:38			06:34 16:12	07:49 15:00	08:35 14:40
24	03:04 20:25	22 19:09 (3) 22 19:31 (3)	04:15 19:06	05:26 17:35			06:36 16:09	07:52 14:58	08:35 14:41
25	03:06 20:22	22 19:09 (3) 22 19:31 (3)	04:17 19:03	18:04 (4) 18:10 (4)	6	05:28 17:32	06:39 16:06	07:54 14:57	08:36 14:41
26	03:09 20:20	24 19:08 (3) 24 19:32 (3)	04:19 19:00	18:01 (4) 18:12 (4)	11	05:30 17:29	06:41 16:04	07:56 14:55	08:36 14:42
27	03:11 20:18	24 19:08 (3) 24 19:32 (3)	04:22 18:58	18:00 (4) 18:14 (4)	14	05:32 17:26	06:43 16:01	07:58 14:53	08:36 14:43
28	03:13 20:16	24 19:08 (3) 24 19:32 (3)	04:24 18:55	17:58 (4) 18:15 (4)	17	05:35 17:23	06:46 15:58	08:00 14:52	08:36 14:44
29	03:15 20:14	24 19:08 (3) 24 19:32 (3)	04:26 18:52	17:57 (4) 18:15 (4)	18	05:37 17:20	06:48 15:56	08:02 14:51	08:36 14:45
30	03:17 20:11	24 19:08 (3) 24 19:32 (3)	04:29 18:49	17:56 (4) 18:15 (4)	19	05:39 17:17	06:51 15:53	08:05 14:49	08:36 14:46
31	03:19 20:09	23 19:08 (2) 23 19:31 (3)	04:31 18:46	17:55 (4) 18:13 (4)			06:53 15:50	08:06 14:47	08:36 14:47
Potential sun hours	551	481	387	392	318	232	194		
Total, worst case		322	265	392					
Sun reduction		0.26	0.24	0.26					
Oper. time red.		0.93	0.93	0.93					
Wind dir. red.		0.73	0.69	0.60					
Total reduction		0.18	0.16	0.15					
Total, real		57	41	57					

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: ED - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (338)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	17:17 (5) 17:44 (5)	03:43 19:31	19:14 (3)
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	17:17 (5) 17:44 (5)	03:40 19:33	6 19:20 (3)
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	17:17 (5) 17:43 (5)	03:37 19:36	18:59 (2) 19:00 (2)
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	17:17 (5) 17:43 (5)	03:35 19:38	18:57 (2) 19:02 (2)
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	17:17 (5) 17:42 (5)	03:32 19:41	18:57 (2) 19:04 (2)
6	08:32 14:57	07:39 16:07	06:24 17:18	04:53 18:31	17:18 (5) 17:41 (5)	03:30 19:43	18:57 (2) 19:07 (2)
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	17:19 (5) 17:40 (5)	03:27 19:45	18:56 (2) 19:08 (2)
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	17:20 (5) 17:38 (5)	03:25 19:48	18:56 (2) 19:10 (2)
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	17:22 (5) 18:07 (4)	03:22 19:50	18:57 (2) 19:13 (2)
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	17:25 (5) 18:09 (4)	03:20 19:52	18:57 (2) 19:15 (3)
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	18:02 (4) 18:11 (4)	03:17 19:55	18:58 (2) 19:17 (3)
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	18:02 (4) 18:14 (4)	03:15 19:57	18:58 (2) 19:18 (3)
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	18:01 (4) 18:16 (4)	03:12 19:59	18:59 (2) 19:20 (3)
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	18:01 (4) 18:18 (4)	03:10 20:02	19:00 (2) 19:22 (3)
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	18:01 (4) 18:19 (4)	03:08 20:04	19:03 (2) 19:24 (3)
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	18:01 (4) 18:18 (4)	03:06 20:06	19:03 (3) 19:26 (3)
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	18:02 (4) 18:18 (4)	03:03 20:08	19:03 (3) 19:27 (3)
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	18:02 (4) 18:17 (4)	03:01 20:11	19:04 (3) 19:28 (3)
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	18:04 (4) 18:15 (4)	02:59 20:13	19:04 (3) 19:27 (3)
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	18:07 (4) 18:12 (4)	02:57 20:15	19:04 (3) 19:27 (3)
21	08:15 15:27	07:01 16:45	05:40 17:53	04:10 19:07	18:12 (4) 19:07	02:55 20:17	19:04 (3) 19:27 (3)
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	19:07 20:19	02:53 20:19	19:05 (3) 19:27 (3)
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	20:19 20:21	02:51 20:21	19:05 (3) 19:26 (3)
24	08:08 15:35	06:52 16:53	05:31 18:01	04:01 19:14	20:21 20:23	02:49 20:23	19:05 (3) 19:26 (3)
25	08:06 15:37	06:50 16:55	05:28 18:03	17:26 (5) 17:33 (5)	03:59 19:17	02:47 20:25	19:06 (3) 19:26 (3)
26	08:04 15:39	06:47 16:58	05:25 18:05	17:24 (5) 17:35 (5)	03:56 19:19	02:45 20:27	19:06 (3) 19:25 (3)
27	08:02 15:42	06:44 17:00	05:23 18:08	17:22 (5) 17:37 (5)	03:53 19:21	02:44 20:29	19:08 (3) 19:25 (3)
28	08:00 15:44	06:41 17:03	05:20 18:10	17:21 (5) 17:40 (5)	03:51 19:24	02:42 20:31	19:09 (3) 19:24 (3)
29	07:57 15:47	06:38 17:05	05:17 18:12	17:19 (5) 17:42 (5)	03:48 19:26	02:40 20:33	19:09 (3) 19:23 (3)
30	07:55 15:49	06:35 17:02	05:14 18:15	17:18 (5) 17:44 (5)	03:45 19:29	02:39 20:35	19:11 (3) 19:23 (3)
31	07:53 15:52	06:32 17:00	05:11 18:17	17:18 (5) 17:45 (5)	03:43 19:31	02:37 20:37	19:12 (3) 19:22 (3)
Potential sun hours	216	257	365	434	526	554	
Total, worst case			128	357	498	6	
Sun reduction			0.28	0.30	0.35	0.30	
Oper. time red.			0.93	0.93	0.93	0.93	
Wind dir. red.			0.61	0.63	0.73	0.73	
Total reduction			0.16	0.18	0.24	0.20	
Total, real			20	63	118	1	

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

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

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: ED - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (338)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27 20:57	03:22 20:07	19:09 (2) 18:43	04:33 18:01 (4)	05:42 17:14	06:56 15:48
2	02:28 20:56	03:24 20:04	19:08 (2) 19:27 (3)	04:35 18:40	05:44 17:24 (5)	06:58 15:45
3	02:29 20:56	03:26 20:02	19:07 (2) 19:24 (2)	04:38 18:37	05:46 17:20 (5)	07:01 15:43
4	02:30 20:55	03:29 20:00	19:07 (2) 19:22 (2)	04:40 18:34	05:49 17:35 (5)	07:03 15:40
5	02:31 20:54	03:31 19:57	19:07 (2) 19:20 (2)	04:42 18:31	05:51 17:36 (5)	07:06 15:38
6	02:33 20:53	03:33 19:55	19:06 (2) 19:18 (2)	04:45 18:29	05:53 17:36 (5)	07:08 15:36
7	02:34 20:52	03:35 19:52	19:06 (2) 19:15 (2)	04:47 18:26	05:56 17:38 (5)	07:11 15:33
8	02:35 20:51	03:38 19:50	19:06 (2) 19:13 (2)	04:49 18:23	05:58 17:38 (5)	07:13 15:31
9	02:37 20:50	03:40 19:47	19:07 (2) 19:10 (2)	04:51 18:20	06:00 17:38 (5)	07:16 15:28
10	02:38 20:48	03:42 19:44	19:07 (2) 19:08 (2)	04:54 18:17	06:03 17:37 (5)	07:18 15:26
11	02:40 20:47	19:23 (3) 19:27 (3)	03:45 19:21 (3)	04:56 18:14	06:05 17:37 (5)	07:21 15:24
12	02:42 20:46	19:21 (3) 19:29 (3)	03:47 19:19 (3)	04:58 18:11	06:07 17:36 (5)	07:23 15:22
13	02:43 20:44	19:20 (3) 19:31 (3)	03:49 19:17 (3)	05:01 18:08	06:10 17:36 (5)	07:26 15:19
14	02:45 20:43	19:18 (3) 19:31 (3)	03:52 19:16 (3)	05:03 18:05	06:12 17:33 (5)	07:28 15:17
15	02:47 20:41	19:18 (3) 19:33 (3)	03:54 19:13 (3)	05:05 18:02	06:14 17:30 (5)	07:30 15:15
16	02:49 20:40	19:17 (3) 19:33 (3)	03:56 19:11 (3)	05:07 17:59	06:17 17:26 (5)	07:33 15:13
17	02:50 20:38	19:16 (3) 19:34 (3)	03:59 19:09 (3)	05:10 17:56	06:19 17:24 (5)	07:35 15:11
18	02:52 20:36	19:16 (3) 19:35 (3)	04:01 19:07 (3)	05:12 17:53	06:22 17:21 (5)	07:38 15:09
19	02:54 20:34	19:15 (3) 19:35 (3)	04:03 19:05 (3)	05:14 17:50	06:24 17:18 (5)	07:40 15:07
20	02:56 20:32	19:15 (3) 19:36 (3)	04:06 19:03 (3)	05:16 17:47	06:26 16:20	07:42 15:05
21	02:58 20:31	19:15 (3) 19:37 (3)	04:08 19:01 (3)	05:19 17:44	06:29 16:17	07:45 15:03
22	03:00 20:29	19:14 (3) 19:36 (3)	04:10 19:00 (3)	05:21 17:41	06:31 16:14	07:47 15:02
23	03:02 20:27	19:14 (3) 19:37 (3)	04:12 19:00 (3)	05:23 18:10 (4)	06:34 16:12	07:49 15:00
24	03:04 20:25	19:14 (3) 19:37 (3)	04:15 19:00 (3)	05:26 18:07 (4)	06:36 16:09	07:52 14:58
25	03:06 20:22	19:14 (3) 19:38 (3)	04:17 19:00 (3)	05:28 18:05 (4)	06:39 16:06	07:54 14:57
26	03:09 20:20	19:14 (3) 19:38 (3)	04:19 19:00 (3)	05:30 18:20 (4)	06:41 16:04	07:56 14:55
27	03:11 20:18	19:14 (3) 19:38 (3)	04:22 18:58 (3)	05:32 18:03 (4)	06:43 16:01	07:58 14:53
28	03:13 20:16	19:14 (3) 19:37 (3)	04:24 18:55 (3)	05:35 18:02 (4)	06:46 15:58	08:00 14:52
29	03:15 20:14	19:13 (2) 19:35 (3)	04:26 18:52 (3)	05:37 18:02 (4)	06:48 15:56	08:02 14:51
30	03:17 20:11	19:11 (2) 19:33 (3)	04:29 18:49 (3)	05:39 18:01 (4)	06:51 15:53	08:05 14:49
31	03:19 20:09	19:09 (2) 19:31 (3)	04:31 18:46 (3)	05:41 18:13 (4)	06:53 15:50	08:06 14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	396	245	368			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.73	0.69	0.61			
Total reduction	0.18	0.15	0.15			
Total, real	70	38	54			

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:

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## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EE - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (339)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	17:12 (5) 17:39 (5)	03:43 19:31
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	17:12 (5) 17:38 (5)	03:40 19:33
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	17:12 (5) 17:37 (5)	03:37 19:36
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	17:13 (5) 17:36 (5)	03:35 19:38
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	17:14 (5) 17:34 (5)	03:32 19:41
6	08:32 14:57	07:39 16:07	06:24 17:18	04:53 18:31	17:16 (5) 17:34 (5)	03:30 19:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	17:17 (5) 17:31 (5)	03:27 19:45
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	17:21 (5) 18:05 (4)	03:25 19:48
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	18:00 (4) 18:07 (4)	03:22 19:50
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	17:59 (4) 18:09 (4)	03:20 19:52
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	17:58 (4) 18:11 (4)	03:17 19:55
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	17:58 (4) 18:14 (4)	03:15 19:57
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	17:58 (4) 18:16 (4)	03:12 19:59
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	17:58 (4) 18:16 (4)	03:10 20:02
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	17:58 (4) 18:15 (4)	03:08 20:04
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	17:58 (4) 18:14 (4)	03:06 20:06
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	18:00 (4) 18:13 (4)	03:03 20:08
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	18:02 (4) 18:10 (4)	03:01 20:11
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	02:59 20:13	23 02:22 19:23 (3)
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	02:57 20:15	22 02:22 19:22 (3)
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	02:55 20:17	22 02:22 19:22 (3)
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	02:53 20:19	20 02:22 19:22 (3)
23	08:09 15:32	06:55 16:50	05:34 17:58	17:22 (5) 17:28 (5)	04:04 19:12	19 02:22 19:21 (3)
24	08:08 15:35	06:52 16:53	05:31 18:01	17:19 (5) 17:30 (5)	04:01 19:14	18 02:22 19:20 (3)
25	08:06 15:37	06:50 16:55	05:28 18:03	17:18 (5) 17:33 (5)	03:59 19:17	16 02:23 19:20 (3)
26	08:04 15:39	06:47 16:58	05:25 18:05	17:16 (5) 17:35 (5)	03:56 19:19	15 02:23 19:19 (3)
27	08:02 15:42	06:44 17:00	05:23 18:08	17:15 (5) 17:37 (5)	03:53 19:21	12 02:24 19:18 (3)
28	08:00 15:44	06:41 17:03	05:20 18:10	17:14 (5) 17:40 (5)	03:51 19:24	10 02:25 19:18 (3)
29	07:57 15:47	06:38 17:05	05:17 18:12	17:13 (5) 17:40 (5)	03:48 19:26	6 02:25 19:15 (3)
30	07:55 15:49	06:35 17:07	05:14 18:15	17:12 (5) 17:40 (5)	03:45 19:29	02:26 20:58
31	07:53 15:52	06:32 17:09	05:11 18:17	17:11 (5) 17:40 (5)	03:42 19:32	02:26 20:58
Potential sun hours	216	257	365	434	526	554
Total, worst case			181	299	475	
Sun reduction			0.28	0.30	0.35	
Oper. time red.			0.93	0.93	0.93	
Wind dir. red.			0.60	0.63	0.73	
Total reduction			0.16	0.17	0.24	
Total, real			28	52	112	

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EE - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (339)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum

813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	July	August	September	October	November	December
1	02:27	03:22	19:07 (2) 04:33	17:57 (4) 05:42	06:56	08:07
	20:57	20:07	22 19:29 (3) 18:43	18:10 (4) 17:14	15:48	14:48
2	02:28	03:24	19:06 (2) 04:35	17:58 (4) 05:44	06:58	08:09
	20:56	20:04	21 19:27 (3) 18:40	18:08 (4) 17:12	15:45	14:47
3	02:29	03:26	19:05 (2) 04:38	17:58 (4) 05:46	07:01	08:10
	20:56	20:02	19 19:24 (3) 18:37	7 18:05 (4) 17:09	15:43	14:46
4	02:30	03:29	19:04 (2) 04:40	17:18 (5) 05:49	07:03	08:12
	20:55	20:00	18 19:22 (3) 18:34	10 18:02 (4) 17:06	15:40	14:45
5	02:31	03:31	19:04 (2) 04:42	17:14 (5) 05:51	07:06	08:14
	20:54	19:57	16 19:20 (2) 18:31	13 17:27 (5) 17:03	15:38	14:44
6	02:33	03:33	19:03 (2) 04:45	17:11 (5) 05:53	07:08	08:16
	20:53	19:55	15 19:18 (2) 18:29	18 17:29 (5) 17:00	15:36	14:43
7	02:34	03:35	19:03 (2) 04:47	17:10 (5) 05:56	07:11	08:18
	20:52	19:52	12 19:15 (2) 18:26	21 17:31 (5) 16:57	15:33	14:42
8	02:35	03:38	19:03 (2) 04:49	17:08 (5) 05:58	07:13	08:19
	20:51	19:50	10 19:13 (2) 18:23	23 17:31 (5) 16:54	15:31	14:41
9	02:37	03:40	19:03 (2) 04:51	17:07 (5) 06:00	07:16	08:21
	20:50	19:47	7 19:10 (2) 18:20	24 17:31 (5) 16:51	15:28	14:40
10	02:38	03:42	19:03 (2) 04:54	17:06 (5) 06:03	07:18	08:22
	20:48	19:44	5 19:08 (2) 18:17	25 17:31 (5) 16:48	15:26	14:40
11	02:40	03:45	19:04 (2) 04:56	17:05 (5) 06:05	07:21	08:24
	20:47	19:42	2 19:05 (2) 18:14	26 17:31 (5) 16:45	15:24	14:39
12	02:42	03:47	04:58	17:04 (5) 06:07	07:23	08:25
	20:46	19:39	27 18:11	17:31 (5) 16:42	15:22	14:39
13	02:43	03:49	05:01	17:04 (5) 06:10	07:26	08:26
	20:44	19:37	27 18:08	17:31 (5) 16:40	15:19	14:39
14	02:45	03:52	05:03	17:04 (5) 06:12	07:28	08:28
	20:43	4 19:19 (3) 19:34	27 18:05	17:31 (5) 16:37	15:17	14:38
15	02:47	03:54	05:05	17:03 (5) 06:14	07:30	08:29
	20:41	9 19:26 (3) 19:31	27 18:02	17:30 (5) 16:34	15:15	14:38
16	02:49	03:56	05:07	17:03 (5) 06:17	07:33	08:30
	20:40	12 19:27 (3) 19:28	23 17:59	17:26 (5) 16:31	15:13	14:38
17	02:50	03:59	05:10	17:04 (5) 06:19	07:35	08:31
	20:38	14 19:28 (3) 19:26	20 17:56	17:24 (5) 16:28	15:11	14:38
18	02:52	04:01	05:12	17:05 (5) 06:22	07:38	08:32
	20:36	16 19:30 (3) 19:23	16 17:53	17:21 (5) 16:25	15:09	14:38
19	02:54	04:03	05:14	17:06 (5) 06:24	07:40	08:33
	20:34	18 19:30 (3) 19:20	12 17:50	17:18 (5) 16:23	15:07	14:38
20	02:56	04:06	05:16	17:07 (5) 06:26	07:42	08:33
	20:32	19 19:31 (3) 19:17	7 17:47	17:14 (5) 16:20	15:05	14:39
21	02:58	04:08	05:19	17:10 (5) 06:29	07:45	08:34
	20:31	20 19:32 (3) 19:15	2 17:44	17:12 (5) 16:17	15:03	14:39
22	03:00	04:10	05:21	06:31	07:47	08:34
	20:29	21 19:31 (3) 19:12	17:41	16:14	15:02	14:39
23	03:02	04:12	05:23	06:34	07:49	08:35
	20:27	22 19:32 (3) 19:09	17:38	16:12	15:00	14:40
24	03:04	04:15	05:26	06:36	07:52	08:35
	20:25	23 19:33 (3) 19:06	17:35	16:09	14:58	14:41
25	03:06	04:17	05:28	06:39	07:54	08:36
	20:22	23 19:33 (3) 19:03	9 18:13 (4) 17:32	16:06	14:57	14:41
26	03:09	04:19	05:30	06:41	07:56	08:36
	20:20	24 19:34 (3) 19:00	13 18:15 (4) 17:29	16:04	14:55	14:42
27	03:11	04:22	05:32	06:43	07:58	08:36
	20:18	24 19:34 (3) 18:58	16 18:17 (4) 17:26	16:01	14:53	14:43
28	03:13	04:24	05:35	06:46	08:00	08:36
	20:16	24 19:34 (3) 18:55	17 18:17 (4) 17:23	15:58	14:52	14:44
29	03:15	04:26	05:37	06:48	08:02	08:36
	20:14	24 19:34 (3) 18:52	19 18:17 (4) 17:20	15:56	14:51	14:45
30	03:17	04:29	05:39	06:51	08:05	08:36
	20:11	23 19:33 (3) 18:49	18 18:16 (4) 17:17	15:53	14:49	14:46
31	03:19	04:31	17:57 (4)	06:53	08:36	08:36
	20:09	23 19:31 (3) 18:46	16 18:13 (4)	15:50	14:47	14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	343	255	378			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.73	0.69	0.61			
Total reduction	0.18	0.15	0.15			
Total, real	60	39	55			

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)	Minutes with flicker	Last time (hh:mm) with flicker
			(WTG causing flicker last time)

Project:

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EF - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (340)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:43	02:36	16 19:16 (3) 02:27	03:22	16 19:13 (2) 04:33	05:42	06:56	08:07
2	14:49	15:54	17:05	18:19	19:31	20:38	16 19:32 (3) 02:57	20:07	16 19:29 (2) 04:43	07:14	08:48	10:08
3	08:35	07:49	06:36	05:05	03:40	02:34	15 19:16 (3) 02:28	03:24	14 19:13 (2) 04:35	05:44	06:58	08:08
4	14:50	15:57	17:08	18:22	19:33	20:40	15 19:31 (3) 02:56	20:04	14 19:27 (2) 04:40	07:12	08:46	10:06
5	08:34	07:46	06:33	05:02	03:37	02:33	13 19:17 (3) 02:29	03:26	12 19:12 (2) 04:38	05:46	07:01	08:10
6	14:52	16:00	17:10	18:24	19:36	20:42	13 19:30 (3) 02:56	20:02	12 19:24 (2) 04:37	05:49	07:03	08:12
7	08:34	07:44	06:30	04:59	03:35	02:32	12 19:18 (3) 02:30	03:29	10 19:12 (2) 04:40	05:49	07:03	08:12
8	14:53	16:02	17:13	18:27	19:38	20:43	12 19:30 (3) 02:55	20:00	10 19:22 (2) 04:38	05:46	07:00	08:10
9	08:33	07:42	06:27	04:56	03:32	02:30	10 19:20 (3) 02:32	19:29 (3) 03:31	8 19:12 (2) 04:42	05:51	07:06	08:14
10	14:55	16:05	17:15	18:29	19:41	20:45	10 19:30 (3) 02:54	3 19:32 (3) 03:33	8 19:20 (2) 04:41	05:53	07:08	08:16
11	08:32	07:39	06:24	04:53	03:30	02:29	8 19:21 (3) 02:33	19:27 (3) 03:33	5 19:18 (2) 04:45	05:53	07:08	08:16
12	14:57	16:07	17:18	18:31	19:43	4 19:07 (2) 02:46	8 19:29 (3) 02:53	7 19:34 (3) 03:35	5 19:18 (2) 04:47	05:56	07:11	08:18
13	08:32	07:37	06:21	04:50	03:27	02:28	4 19:27 (3) 02:34	19:23 (3) 03:35	2 19:15 (2) 04:47	05:56	07:11	08:18
14	14:58	16:10	17:20	18:34	19:45	6 19:08 (2) 02:47	4 19:27 (3) 02:52	9 19:36 (3) 03:38	2 19:15 (2) 04:49	05:58	07:13	08:21
15	08:31	07:35	06:18	04:47	03:25	02:27	20:51	11 19:37 (3) 03:40	18:23	16:54	15:31	14:41
16	15:00	16:12	17:22	18:36	19:48	8 19:10 (2) 02:49	02:37	11 19:37 (3) 03:40	18:23	16:54	15:31	14:41
17	08:30	07:32	06:15	04:44	03:22	02:26	20:51	11 19:37 (3) 03:40	18:23	16:54	15:31	14:41
18	15:02	16:15	17:25	18:38	19:50	11 19:13 (2) 02:50	02:38	11 19:37 (3) 03:40	18:23	16:54	15:31	14:41
19	08:29	07:30	06:13	04:41	03:20	02:26	10 19:24 (3) 03:42	18:20	16:51	15:28	14:40	
20	15:04	16:17	17:27	18:41	19:52	13 19:15 (2) 02:51	02:40	13 19:38 (3) 03:42	18:20	16:51	15:28	14:40
21	08:28	07:27	06:10	04:38	03:17	02:25	14 19:24 (3) 03:45	18:17	16:48	15:26	14:40	
22	15:06	16:20	17:30	18:43	19:55	15 19:17 (2) 02:52	02:40	14 19:38 (3) 03:45	18:17	16:48	15:26	14:40
23	08:27	07:25	06:07	04:36	03:15	02:24	16 19:40 (3) 03:47	18:14	16:45	15:24	14:39	
24	15:08	16:23	17:32	18:46	3 18:14 (4) 19:57	16 19:18 (2) 02:53	02:42	16 19:40 (3) 03:47	18:14	16:45	15:24	14:39
25	08:25	07:22	06:04	04:33	03:12	02:24	17 19:23 (3) 03:49	18:11	16:42	15:22	14:39	
26	15:10	16:25	17:34	18:48	7 18:16 (4) 19:59	18 19:20 (3) 02:54	02:43	17 19:40 (3) 03:49	18:11	16:42	15:22	14:39
27	08:24	07:19	06:01	04:30	03:10	02:23	18 19:41 (3) 03:52	18:08	16:40	15:19	14:39	
28	15:12	16:28	17:37	18:50	10 18:18 (4) 20:02	19 19:22 (3) 02:55	02:45	18 19:41 (3) 03:52	18:08	16:40	15:19	14:39
29	08:23	07:17	05:58	04:27	03:08	02:23	19 19:22 (3) 02:55	18:05	16:37	15:17	14:38	
30	15:14	16:30	17:39	18:53	13 18:20 (4) 20:04	20 19:24 (3) 02:56	02:47	19 19:22 (3) 02:55	18:05	16:37	15:17	14:38
31	08:21	07:14	05:55	04:24	03:06	02:22	20 19:24 (3) 02:56	18:02	16:34	15:15	14:38	
32	15:16	16:33	17:42	18:55	15 18:22 (4) 20:06	21 19:26 (3) 02:57	02:49	20 19:22 (3) 02:56	18:02	16:34	15:15	14:38
33	08:20	07:11	05:52	04:21	03:03	02:22	20 19:26 (3) 02:57	17:59	16:31	15:13	14:38	
34	15:18	16:35	17:44	18:57	18 18:25 (4) 20:08	21 19:28 (3) 02:57	02:50	20 19:22 (3) 02:56	17:59	16:31	15:13	14:38
35	08:18	07:09	05:49	04:18	03:01	02:22	21 19:28 (3) 02:57	17:56	16:28	15:11	14:38	
36	15:21	16:38	17:46	19:00	18 18:25 (4) 20:11	20 19:31 (3) 02:58	02:52	21 19:28 (3) 02:57	17:56	16:28	15:11	14:38
37	08:16	07:06	05:46	04:15	03:00	02:22	22 19:44 (3) 03:59	17:53	16:25	15:09	14:38	
38	15:23	16:40	17:49	19:02	17 18:24 (4) 20:13	22 19:33 (3) 02:58	02:54	22 19:44 (3) 03:59	17:53	16:25	15:09	14:38
39	08:15	07:03	05:43	04:13	03:00	02:22	22 19:44 (3) 03:59	17:53	16:25	15:09	14:38	
40	15:25	16:43	17:51	19:05	16 18:24 (4) 20:15	23 19:34 (3) 02:59	02:54	22 19:44 (3) 03:59	17:53	16:25	15:09	14:38
41	08:13	07:01	05:40	04:10	03:00	02:22	23 19:34 (3) 02:59	17:53	16:25	15:09	14:38	
42	15:27	16:45	17:53	19:07	13 18:22 (4) 20:17	23 19:34 (3) 02:59	02:58	23 19:44 (3) 03:59	17:53	16:25	15:09	14:38
43	08:11	06:58	05:37	04:07	03:00	02:22	24 19:45 (3) 03:59	17:53	16:25	15:09	14:38	
44	15:30	16:48	17:56	19:09	9 18:20 (4) 20:19	24 19:35 (3) 02:59	03:00	24 19:45 (3) 03:59	17:53	16:25	15:09	14:38
45	08:09	06:55	05:34	04:04	02:51	02:22	25 19:45 (3) 03:59	17:53	16:25	15:09	14:38	
46	15:32	16:50	17:58	19:12	20 19:34 (3) 02:59	25 19:45 (3) 03:59	03:02	25 19:45 (3) 03:59	17:53	16:25	15:09	14:38
47	08:08	06:52	05:31	04:01	02:49	02:23	26 19:45 (3) 03:59	17:53	16:25	15:09	14:38	
48	15:35	16:53	18:01	19:14	20 19:34 (3) 02:59	26 19:45 (3) 03:59	03:04	26 19:45 (3) 03:59	17:53	16:25	15:09	14:38
49	08:06	06:50	05:28	03:59	02:47	02:23	27 19:45 (3) 03:59	17:53	16:25	15:09	14:38	
50	15:37	16:55	18:03	19:17	20 19:34 (3) 02:59	27 19:45 (3) 03:59	03:06	27 19:45 (3) 03:59	17:53	16:25	15:09	14:38
51	08:04	06:47	05:25	03:56	02:45	02:23	28 19:45 (3) 03:59	17:53	16:25	15:09	14:38	
52	15:39	16:58	18:05	19:19	20 19:33 (3) 02:59	28 19:45 (3) 03:59	03:09	28 19:45 (3) 03:59	17:53	16:25	15:09	14:38
53	08:02	06:44	05:23	03:53	02:44	02:24	29 19:45 (3) 03:59	17:53	16:25	15:09	14:38	
54	15:42	17:00	18:08	19:21	20 19:34 (3) 02:59	29 19:45 (3) 03:59	03:11	29 19:45 (3) 03:59	17:53	16:25	15:09	14:38
55	08:00	06:41	05:20	03:51	02:42	02:25	30 19:45 (3) 03:59	17:53	16:25	15:09	14:38	
56	15:44	17:03	18:10	19:24	20 19:34 (3) 02:58	30 19:45 (3) 03:59	03:13	30 19:45 (3) 03:59	17:53	16:25	15:09	14:38
57	07:57	06:37	05:17	03:48	02:40	02:25	31 19:45 (3) 03:59	17:53	16:25	15:09	14:38	
58	15:47	17:06	18:12	19:26	20 19:33 (3) 02:58	31 19:45 (3) 03:59	03:15	31 19:45 (3) 03:59	17:53	16:25	15:09	14:38
59	07:55	06:35	05:14	03:45	02:39	02:26	32 19:45 (3) 03:59	17:53	16:25	15:09	14:38	
60	15:49	17:08	18:15	19:29	20 19:33 (3) 02:58	32 19:45 (3) 03:59	03:17	32 19:45 (3) 03:59	17:53	16:25	15:09	14:38
61	07:53	06:33	05:11	03:42	02:37	02:26	33 19:45 (3) 03:59	17:53	16:25	15:09	14:38	
62	15:52	17:11	18:17	19:31	20 19:33 (3) 02:58	33 19:45 (3) 03:59	03:19	33 19:45 (3) 03:59	17:53	16:25	15:09	14:38
63	Potential sun hours	216	257	365	434	526	551	551	387	318	232	194
64	Total, worst case				139	471	78	489	209			
65	Sun reduction				0.30	0.35	0.30	0.29	0.24			
66	Oper. time red.				0.93	0.93	0.93	0.93	0.93			
67	Wind dir. red.				0.66	0.73	0.74	0.74	0.68			
68	Total reduction				0.19	0.24	0.21	0.18	0.15			
69	Total, real				26	113	16	87	32			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EG - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (341)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June		
1	08:35	07:51	06:38	05:08	17:15 (5)	03:43		
	14:49	15:54	17:05	18:19	17:42 (5)	19:31		
2	08:35	07:49	06:36	05:05	17:15 (5)	03:40		
	14:50	15:57	17:08	18:22	17:41 (5)	19:33		
3	08:34	07:46	06:33	05:02	17:15 (5)	03:37		
	14:52	16:00	17:10	18:24	17:40 (5)	19:36		
4	08:34	07:44	06:30	04:59	17:15 (5)	03:35		
	14:53	16:02	17:13	18:27	17:39 (5)	19:38		
5	08:33	07:42	06:27	04:56	17:15 (5)	03:32		
	14:55	16:05	17:15	18:29	17:38 (5)	19:41		
6	08:32	07:39	06:24	04:53	17:17 (5)	03:30		
	14:57	16:07	17:18	18:31	17:38 (5)	19:43		
7	08:32	07:37	06:21	04:50	17:18 (5)	03:27		
	14:58	16:10	17:20	18:34	17:36 (5)	19:45		
8	08:31	07:35	06:18	04:47	17:20 (5)	03:25		
	15:00	16:12	17:22	18:36	18:05 (4)	19:48		
9	08:30	07:32	06:15	04:44	17:23 (5)	03:22		
	15:02	16:15	17:25	18:38	18:07 (4)	19:50		
10	08:29	07:30	06:13	04:41	18:01 (4)	03:20		
	15:04	16:17	17:27	18:41	8 18:09 (4)	19:52		
11	08:28	07:27	06:10	04:38	18:00 (4)	03:17		
	15:06	16:20	17:30	18:43	11 18:11 (4)	19:55		
12	08:27	07:25	06:07	04:36	18:00 (4)	03:15		
	15:08	16:23	17:32	18:46	14 18:14 (4)	19:57		
13	08:25	07:22	06:04	04:33	18:00 (4)	03:12		
	15:10	16:25	17:34	18:48	16 18:16 (4)	19:59		
14	08:24	07:19	06:01	04:30	17:59 (4)	03:10		
	15:12	16:28	17:37	18:50	19 18:18 (4)	20:02		
15	08:23	07:17	05:58	04:27	17:59 (4)	03:08		
	15:14	16:30	17:39	18:53	18 18:17 (4)	20:04		
16	08:21	07:14	05:55	04:24	17:59 (4)	03:06		
	15:16	16:33	17:42	18:55	17 18:16 (4)	20:06		
17	08:20	07:11	05:52	04:21	18:01 (4)	03:03		
	15:18	16:35	17:44	18:57	15 18:16 (4)	20:08		
18	08:18	07:09	05:49	04:18	18:02 (4)	03:01		
	15:21	16:38	17:46	19:00	12 18:14 (4)	20:11		
19	08:16	07:06	05:46	04:15	18:04 (4)	02:59		
	15:23	16:40	17:49	19:02	7 18:11 (4)	20:13		
20	08:15	07:03	05:43	04:13	02:57	19:02 (3)	20:22	
	15:25	16:43	17:51	19:05	20:15	22 19:24 (3)	20:59	
21	08:13	07:01	05:40	04:10	02:55	19:02 (3)	20:22	
	15:27	16:45	17:53	19:07	20:17	22 19:24 (3)	20:59	
22	08:11	06:58	05:37	04:07	02:53	19:03 (3)	20:22	
	15:30	16:48	17:56	19:09	20:19	21 19:24 (3)	20:59	
23	08:09	06:55	05:34	04:04	02:51	19:03 (3)	20:22	
	15:32	16:50	17:58	19:12	20:21	21 19:24 (3)	20:59	
24	08:08	06:52	05:31	17:24 (5)	04:01	02:49	19:03 (3)	20:22
	15:35	16:53	18:01	6 17:30 (5)	19:14	20:23	20 19:23 (3)	20:59
25	08:06	06:50	05:28	17:22 (5)	03:59	02:47	19:05 (3)	20:23
	15:37	16:55	18:03	11 17:33 (5)	19:17	20:25	18 19:23 (3)	20:59
26	08:04	06:47	05:25	17:20 (5)	03:56	02:45	19:05 (3)	20:23
	15:39	16:58	18:05	15 17:35 (5)	19:19	20:27	17 19:22 (3)	20:59
27	08:02	06:44	05:23	17:19 (5)	03:53	02:44	19:07 (3)	20:24
	15:42	17:00	18:08	18 17:37 (5)	19:21	20:29	14 19:21 (3)	20:59
28	08:00	06:41	05:20	17:17 (5)	03:51	02:42	19:08 (3)	20:25
	15:44	17:03	18:10	23 17:40 (5)	19:24	20:31	13 19:21 (3)	20:58
29	07:57		05:17	17:16 (5)	03:48	02:40	19:09 (3)	20:25
	15:47		18:12	26 17:42 (5)	19:26	20:33	10 19:19 (3)	20:58
30	07:55		05:14	17:16 (5)	03:45	02:39	19:11 (3)	20:26
	15:49		18:15	27 17:43 (5)	19:29	20:35	7 19:18 (3)	20:58
31	07:53		05:11	17:15 (5)		02:37		
	15:52		18:17	27 17:42 (5)		20:37		
Potential sun hours	216	257	365	434	526		554	
Total, worst case			153	327	485			
Sun reduction			0.28	0.30	0.35			
Oper. time red.			0.93	0.93	0.93			
Wind dir. red.			0.60	0.63	0.73			
Total reduction			0.16	0.18	0.24			
Total, real			24	57	115			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EG - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (341)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December	
1	02:27 20:57	03:22 20:07	19:08 (2) 18:43	04:33 18:10 (4)	17:59 (4) 17:14	06:56 15:48	08:07 14:48
2	02:28 20:56	03:24 20:04	19:07 (2) 19:27 (3)	04:35 18:40	18:00 (4) 17:12 (5)	06:58 15:45	08:09 14:47
3	02:29 20:56	03:26 20:02	19:06 (2) 19:24 (3)	04:38 18:37	17:21 (5) 18:05 (4)	07:01 15:43	08:10 14:46
4	02:30 20:55	03:29 20:00	19:05 (2) 19:22 (2)	04:40 18:34	17:17 (5) 18:02 (4)	07:03 15:40	08:12 14:45
5	02:31 20:54	03:31 19:57	19:05 (2) 19:20 (2)	04:42 18:31	17:14 (5) 17:32 (5)	07:06 15:38	08:14 14:44
6	02:33 20:53	03:33 19:55	19:05 (2) 19:18 (2)	04:45 18:29	17:12 (5) 17:33 (5)	07:08 15:36	08:16 14:43
7	02:34 20:52	03:35 19:52	19:05 (2) 19:15 (2)	04:47 18:26	17:11 (5) 17:34 (5)	07:11 15:33	08:18 14:42
8	02:35 20:51	03:38 19:50	19:05 (2) 19:13 (2)	04:49 18:23	17:10 (5) 17:35 (5)	07:13 15:31	08:19 14:41
9	02:37 20:50	03:40 19:47	19:05 (2) 19:10 (2)	04:51 18:20	17:09 (5) 17:35 (5)	06:00 15:28	08:21 14:40
10	02:38 20:48	03:42 19:44	19:05 (2) 19:08 (2)	04:54 18:17	17:08 (5) 17:35 (5)	06:03 16:48	08:22 14:40
11	02:40 20:47	03:45 19:42	04:56 18:14	17:07 (5) 17:34 (5)	06:05 16:45	07:21 15:24	08:24 14:39
12	02:42 20:46	03:47 19:39	04:58 18:11	17:06 (5) 17:34 (5)	06:07 16:42	07:23 15:22	08:25 14:39
13	02:43 20:44	19:21 (3) 19:25 (3)	03:49 19:37	05:01 18:08	17:07 (5) 17:34 (5)	06:10 16:40	08:26 15:19
14	02:45 20:43	19:18 (3) 19:27 (3)	03:52 19:34	05:03 18:05	17:07 (5) 17:33 (5)	06:12 16:37	08:28 15:17
15	02:47 20:41	19:17 (3) 19:29 (3)	03:54 19:31	05:05 18:02	17:07 (5) 17:30 (5)	06:14 16:34	08:29 15:15
16	02:49 20:40	19:29 (3) 19:30 (3)	19:31 19:28	18:02 17:59	17:30 (5) 17:26 (5)	16:34 16:31	15:13 14:38
17	02:50 20:38	19:30 (3) 19:31 (3)	03:59 19:26	05:10 17:56	17:08 (5) 17:24 (5)	06:19 16:28	07:35 15:11
18	02:52 20:36	19:31 (3) 19:32 (3)	04:01 19:23	05:12 17:53	17:09 (5) 17:21 (5)	06:22 16:25	07:38 15:09
19	02:54 20:34	19:32 (3) 19:32 (3)	04:03 19:20	05:14 17:50	17:10 (5) 17:18 (5)	06:24 16:23	07:40 15:07
20	02:56 20:32	19:33 (3) 19:33 (3)	04:06 19:17	05:16 17:47	17:12 (5) 17:14 (5)	06:26 16:20	07:42 15:05
21	02:58 20:31	19:34 (3) 19:34 (3)	04:08 19:15	05:19 17:44	17:14 (5) 16:17	06:29 15:03	07:45 14:39
22	03:00 20:29	19:34 (3) 19:34 (3)	04:10 19:12	05:21 17:41	16:17 16:14	15:03 15:02	14:39 14:39
23	03:02 20:27	19:34 (3) 19:34 (3)	04:12 19:09	05:23 17:38	16:14 16:12	15:02 15:00	14:39 14:40
24	03:04 20:25	19:34 (3) 19:35 (3)	04:15 19:06	05:26 18:07 (4) 18:15 (4)	16:12 16:09	15:00 14:58	14:40 14:41
25	03:06 20:22	19:35 (3) 19:35 (3)	04:17 19:03	05:28 18:04 (4) 18:17 (4)	16:09 16:06	14:58 14:57	14:41 14:41
26	03:09 20:20	19:35 (3) 19:35 (3)	04:19 19:00	05:30 18:02 (4) 18:17 (4)	16:06 16:04	14:57 14:55	14:41 14:42
27	03:11 20:18	19:36 (3) 19:36 (3)	04:22 18:58	05:32 18:02 (4) 18:19 (4)	16:04 16:01	14:55 14:53	14:42 14:43
28	03:13 20:16	19:36 (3) 19:36 (3)	04:24 18:55	05:35 18:01 (4) 18:19 (4)	16:03 15:58	14:53 14:52	14:43 14:44
29	03:15 20:14	19:37 (3) 19:37 (3)	04:26 18:52	05:37 18:00 (4) 18:19 (4)	16:02 16:00	14:52 14:51	14:44 14:45
30	03:17 20:11	19:38 (3) 19:38 (3)	04:29 18:49	05:39 17:59 (4) 18:16 (4)	16:01 15:53	14:51 14:49	14:45 14:46
31	03:19 20:09	19:39 (2) 19:39 (2)	04:31 18:46	17:59 (4) 18:13 (4)	15:53 15:50	14:49 14:47	14:46 14:47
Potential sun hours	551	481	387	318	232	194	
Total, worst case	359	251	373				
Sun reduction	0.26	0.24	0.26				
Oper. time red.	0.93	0.93	0.93				
Wind dir. red.	0.73	0.69	0.61				
Total reduction	0.18	0.15	0.15				
Total, real	63	39	55				

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EH - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (342)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June	
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	17:21 (5) 17:48 (5)	03:43 19:31	19:14 (3) 20:38
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	17:20 (5) 17:48 (5)	03:40 19:33	19:15 (3) 20:40
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	17:20 (5) 17:47 (5)	03:37 19:36	19:22 (3) 20:42
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	17:20 (5) 17:47 (5)	03:35 19:38	02:32 20:43
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	17:20 (5) 17:46 (5)	03:32 19:41	02:30 20:45
6	08:32 14:57	07:39 16:07	06:24 17:18	04:53 18:31	17:21 (5) 17:46 (5)	03:30 19:43	02:29 20:46
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	17:21 (5) 17:45 (5)	03:27 19:45	02:28 20:47
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	17:22 (5) 17:43 (5)	03:25 19:48	02:27 20:49
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	17:23 (5) 17:42 (5)	03:22 19:50	02:26 20:50
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	17:24 (5) 18:09 (4)	03:20 19:52	02:26 20:51
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	17:27 (5) 18:11 (4)	03:17 19:55	02:25 20:52
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	18:05 (4) 18:14 (4)	03:15 19:57	02:24 20:53
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	18:04 (4) 18:16 (4)	03:12 19:59	02:24 20:54
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	18:03 (4) 18:18 (4)	03:10 20:02	02:23 20:55
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	18:03 (4) 18:20 (4)	03:08 20:04	02:23 20:56
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	18:03 (4) 18:21 (4)	03:06 20:06	02:22 20:57
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	18:04 (4) 18:21 (4)	03:03 20:08	02:22 20:57
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	18:04 (4) 18:20 (4)	03:01 20:11	02:22 20:58
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	18:05 (4) 18:18 (4)	02:59 20:13	02:22 20:58
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	18:07 (4) 18:17 (4)	02:57 20:15	02:22 20:59
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	18:10 (4) 18:13 (4)	02:55 20:17	02:22 20:59
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	18:13 (4) 18:20 (4)	02:53 20:19	02:22 20:59
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	18:20 (4) 18:27 (4)	02:51 20:21	02:22 20:59
24	08:08 15:35	06:52 16:53	05:31 18:01	04:01 19:14	18:28 (4) 18:35 (4)	02:49 20:23	02:23 20:59
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	18:42 (4) 18:49 (4)	02:47 20:25	02:23 20:59
26	08:04 15:39	06:47 16:58	05:25 18:05	17:30 (5) 18:05	18:56 (4) 19:02 (4)	03:56 20:27	02:23 20:59
27	08:02 15:42	06:44 17:00	05:23 18:08	17:28 (5) 17:37 (5)	19:09 (4) 19:16 (4)	03:53 20:29	02:24 20:59
28	08:00 15:44	06:41 17:03	05:20 18:10	17:26 (5) 17:40 (5)	19:24 (4) 19:31 (4)	03:51 20:31	02:25 20:58
29	07:57 15:47	06:38 17:05	05:17 18:12	17:24 (5) 17:42 (5)	19:38 (4) 19:45 (4)	03:48 20:33	02:25 20:58
30	07:55 15:49	06:35 17:02	05:14 18:15	17:23 (5) 17:44 (5)	19:52 (4) 19:59 (4)	03:45 20:35	02:26 20:58
31	07:53 15:52	06:32 17:00	05:11 18:17	17:22 (5) 17:46 (5)	20:07 (4) 20:14 (4)	03:43 20:37	02:26 20:58
Potential sun hours	216	257	365	434	526	554	
Total, worst case			91	386	487	19	
Sun reduction			0.28	0.30	0.35	0.30	
Oper. time red.			0.93	0.93	0.93	0.93	
Wind dir. red.			0.61	0.63	0.73	0.73	
Total reduction			0.16	0.18	0.24	0.20	
Total, real			15	68	116	4	

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

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

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EH - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (342)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27 20:57	03:22 20:07	19:10 (2) 18:43	04:33 17:25 (5)	05:42 18:10 (4)	06:56 15:48
2	02:28 20:56	03:24 20:04	19:09 (2) 19:27 (3)	04:35 18:40	05:44 17:23 (5)	06:58 15:45
3	02:29 20:56	03:26 20:02	19:09 (2) 19:24 (2)	04:38 18:37	05:46 17:21 (5)	07:01 15:43
4	02:30 20:55	03:29 20:00	19:08 (2) 19:22 (2)	04:40 18:34	05:49 17:40 (5)	07:03 15:40
5	02:31 20:54	03:31 19:57	19:08 (2) 19:20 (2)	04:42 18:31	05:51 17:17 (5)	07:06 15:38
6	02:33 20:53	03:33 19:55	19:08 (2) 19:18 (2)	04:45 18:29	05:53 17:41 (5)	07:08 15:36
7	02:34 20:52	03:35 19:52	19:08 (2) 19:15 (2)	04:47 18:26	05:56 17:16 (5)	07:11 15:33
8	02:35 20:51	03:38 19:50	19:09 (2) 19:13 (2)	04:49 18:23	05:58 17:42 (5)	07:13 15:31
9	02:37 20:50	03:40 19:47	19:09 (2) 19:10 (2)	04:51 18:20	06:00 17:14 (5)	07:16 15:28
10	02:38 20:48	19:23 (3) 19:29 (3)	03:42 19:44	04:54 18:17	06:03 17:14 (5)	07:18 15:26
11	02:40 20:47	19:23 (3) 19:31 (3)	03:45 19:42	04:56 18:14	06:05 17:13 (5)	07:21 15:24
12	02:42 20:46	19:21 (3) 19:32 (3)	03:47 19:39	04:58 18:11	06:07 17:38 (5)	07:23 15:22
13	02:43 20:44	19:21 (3) 19:34 (3)	03:49 19:37	05:01 18:08	06:10 17:14 (5)	07:26 15:19
14	02:45 20:43	19:19 (3) 19:34 (3)	03:52 19:34	05:03 18:05	06:12 17:33 (5)	07:28 15:17
15	02:47 20:41	19:19 (3) 19:36 (3)	03:54 19:31	05:05 18:02	06:14 17:15 (5)	07:30 15:15
16	02:49 20:40	19:18 (3) 19:36 (3)	03:56 19:28	05:07 17:59	06:17 17:16 (5)	07:33 15:13
17	02:50 20:38	19:18 (3) 19:37 (3)	03:59 19:26	05:10 17:56	06:19 17:18 (5)	07:35 15:11
18	02:52 20:36	19:18 (3) 19:38 (3)	04:01 19:23	05:12 17:53	06:22 16:22	07:38 15:09
19	02:54 20:34	19:17 (3) 19:38 (3)	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:07
20	02:56 20:32	19:17 (3) 19:38 (3)	04:06 19:17	05:16 17:47	06:26 16:20	07:42 15:05
21	02:58 20:31	19:17 (3) 19:39 (3)	04:08 19:15	05:19 17:44	06:29 16:17	07:45 15:03
22	03:00 20:29	19:16 (3) 19:39 (3)	04:10 19:12	18:14 (4) 18:18 (4)	05:21 17:41	06:31 15:02
23	03:02 20:27	19:16 (3) 19:39 (3)	04:12 19:09	18:10 (4) 18:21 (4)	05:23 17:38	06:34 15:00
24	03:04 20:25	19:16 (3) 19:39 (3)	04:15 19:06	18:08 (4) 18:22 (4)	05:26 17:35	06:36 14:58
25	03:06 20:22	19:16 (3) 19:40 (3)	04:17 19:03	18:06 (4) 18:23 (4)	05:28 17:32	06:39 16:06
26	03:09 20:20	19:16 (3) 19:40 (3)	04:19 19:00	18:05 (4) 18:23 (4)	05:30 17:29	06:41 16:04
27	03:11 20:18	19:17 (3) 19:38 (3)	04:22 18:58	18:05 (4) 18:24 (4)	05:32 17:26	06:43 16:01
28	03:13 20:16	19:15 (2) 19:37 (3)	04:24 18:55	18:05 (4) 18:22 (4)	05:35 17:23	06:46 15:58
29	03:15 20:14	19:13 (2) 19:35 (3)	04:26 18:52	18:04 (4) 18:19 (4)	05:37 17:20	06:48 15:56
30	03:17 20:11	19:12 (2) 19:33 (3)	04:29 18:49	18:04 (4) 18:16 (4)	05:39 17:17	06:51 15:53
31	03:19 20:09	19:11 (2) 19:31 (3)	04:31 18:46	18:04 (4) 18:13 (4)	05:41 17:15	06:53 15:50
Potential sun hours	551	481	387	318	232	194
Total, worst case	414	237	353			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.73	0.69	0.62			
Total reduction	0.18	0.15	0.15			
Total, real	73	36	53			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EI - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (343)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:54	17:05	18:19	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:09
	14:50	15:57	17:08	18:22	19:33	20:40	20:57	20:05	18:40	17:12	15:45	14:47
3	08:35	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11
	14:52	15:59	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:44
5	08:33	07:42	06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:44
6	08:33	07:39	06:24	04:53	03:29	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:56	16:07	17:17	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:45	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:18	04:47	03:24	02:27	02:35	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:16	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29	07:30	06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	08:22
	15:04	16:17	17:27	18:41	19:52	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:27	07:25	06:07	04:35	03:15	02:24	02:41	03:47	04:58	06:07	07:23	08:25
	15:08	16:22	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39
13	08:25	07:22	06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	08:27
	15:10	16:25	17:34	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:19	14:38
14	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	07:17	05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20	07:12	05:52	04:21	03:03	02:22	02:50	03:58	05:10	06:19	07:35	08:31
	15:18	16:35	17:44	18:58	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:20	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:17	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
20	08:15	07:03	05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:43	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:33	19:17	17:47	16:20	15:05	14:38
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27	16:45	17:53	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
22	08:11	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:35
	15:30	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
23	08:10	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	08:35
	15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:53	05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	08:36
	15:34	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	14:40
25	08:06	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
	15:37	16:55	18:03	19:17	20:25	20:59	20:23	19:03	17:32	16:06	14:56	14:41
26	08:04	06:47	05:25	03:56	02:45	02:23	03:08	04:19	05:30	06:41	07:56	08:36
	15:39	16:58	18:05	19:19	20:27	20:59	20:20	19:01	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:44	07:58	08:36
	15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00	06:41	05:20	03:50	02:42	02:25	03:13	04:24	05:35	06:46	08:00	08:36
	15:44	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:23	15:58	14:52	14:44
29	07:58		05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	08:03	08:36
	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:50	14:45
30	07:55		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:49		18:15	19:29	20:35	20:58	20:12	18:49	17:17	15:53	14:49	14:46
31	07:53		05:11		02:37		03:19	04:31		06:53		08:36
	15:52		18:17		20:37		20:09	18:46		15:50		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EJ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (344)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	03:43 19:31	02:36 20:38	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	06:56 15:48	08:07 14:48
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:33	02:34 20:40	02:28 20:56	03:24 20:04	04:35 18:40	05:44 17:12	06:58 15:45	08:08 14:47
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	08:10 14:46
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:29 20:00	04:40 18:34	05:49 17:06	07:03 15:40	08:12 14:45
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:41	02:30 20:45	02:32 20:54	03:31 19:57	04:42 18:31	05:51 17:03	07:06 15:38	08:14 14:44
6	08:32 14:57	07:39 16:07	06:24 17:18	04:53 18:31	03:30 19:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36	08:16 14:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:47	02:34 20:52	03:35 19:52	04:47 18:26	05:56 16:57	07:11 15:33	08:18 14:42
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	03:25 19:48	02:27 20:49	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 15:31	08:19 14:41
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	07:16 15:28	08:21 14:40
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:52	02:26 20:51	02:38 20:48	03:42 19:44	04:54 18:17	06:03 16:48	07:18 15:26	08:22 14:40
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:52	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24	08:24 14:39
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	03:15 19:57	02:24 20:53	02:42 20:46	03:47 19:39	04:58 18:11	06:07 16:42	07:23 15:22	08:25 14:39
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	03:12 19:59	02:24 20:54	02:43 20:44	03:49 19:37	05:01 18:08	06:10 16:40	07:26 15:19	08:26 14:39
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:17	08:28 14:38
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:23 20:56	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	07:30 15:15	08:29 14:38
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	02:22 20:57	02:49 20:40	03:56 19:28	05:07 17:59	06:17 16:31	07:33 15:13	08:30 14:38
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	03:03 20:08	02:22 20:57	02:50 20:38	03:59 19:26	05:10 17:56	06:19 16:28	07:35 15:11	08:31 14:38
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	03:01 20:11	02:22 20:58	02:52 20:36	04:01 19:23	05:12 17:53	06:22 16:25	07:38 15:09	08:32 14:38
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	02:59 20:13	02:22 20:58	02:54 20:34	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:07	08:33 14:38
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	02:57 20:15	02:22 20:59	02:56 20:32	04:06 19:17	05:16 17:47	06:26 16:20	07:42 15:05	08:33 14:39
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	02:55 20:17	02:22 20:59	02:58 20:31	04:08 19:15	05:19 17:44	06:29 16:17	07:45 15:03	08:34 14:39
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	02:53 20:19	02:22 20:59	03:00 20:29	04:10 19:12	05:21 17:41	06:31 16:14	07:47 15:02	08:34 14:39
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	02:51 20:21	02:22 20:59	03:02 20:27	04:12 19:09	05:23 17:38	06:34 16:12	07:49 15:00	08:35 14:40
24	08:08 15:35	06:52 16:53	05:31 18:01	04:01 19:14	02:49 20:23	02:23 20:59	03:04 20:25	04:15 19:06	05:26 17:35	06:36 16:09	07:52 14:58	08:35 14:41
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	02:47 20:25	02:23 20:59	03:06 20:22	04:17 19:03	05:28 17:32	06:39 16:06	07:54 14:57	08:36 14:41
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 19:19	02:45 20:27	02:23 20:59	03:09 20:20	04:19 19:00	05:30 17:29	06:41 16:04	07:56 14:55	08:36 14:42
27	08:02 15:42	06:44 17:00	05:23 18:08	03:53 19:21	02:44 20:29	02:24 20:59	03:11 20:18	04:22 18:58	05:32 17:26	06:43 16:01	07:58 14:53	08:36 14:43
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	02:25 20:58	03:13 20:16	04:24 18:55	05:35 17:23	06:46 15:58	08:00 14:52	08:36 14:44
29	07:57 15:47		05:17 18:12	03:48 19:26	02:40 20:33	02:25 20:58	03:15 20:14	04:26 18:52	05:37 17:20	06:48 15:56	08:02 14:51	08:36 14:45
30	07:55 15:49		05:14 18:15	03:45 19:29	02:39 20:35	02:26 20:58	03:17 20:11	04:29 18:49	05:39 17:17	06:51 15:53	08:05 14:49	08:36 14:46
31	07:53 15:52		05:11 18:17		02:37 20:37		03:19 20:09	04:31 18:46		06:53 15:50		08:36 14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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)

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SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EK - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (345)

Assumptions for shadow calculations

Maximum distance for influence: 1 500 m
Minimum sun height over horizon for influence: 3 °
Day step for calculation: 1 days
Time step for calculation: 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for each day of the month, showing sun rise and set times in hh:mm format.

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

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

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SHADOW - Calendar

Calculation: Skyggekast GismarvikShadow receptor: EL - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (346)

Assumptions for shadow calculations

Maximum distance for influence: 1 500 m
Minimum sun height over horizon for influence: 3 °
Day step for calculation: 1 days
Time step for calculation: 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30
Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182
Idle start wind speed: Cut in wind speed from power curve

Table with 12 columns (Jan-Dec) and 31 rows of sun rise/set times and shadow calculations. Includes summary rows for Potential sun hours and Total, worst case.

Table layout: For each day in each month the following matrix apply
Day in month Sun rise (hh:mm) Sun set (hh:mm) Minutes with flicker
First time (hh:mm) with flicker Last time (hh:mm) with flicker
(WTG causing flicker first time) (WTG causing flicker last time)

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SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EM - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (347)

Assumptions for shadow calculations

Maximum distance for influence 1 500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1281 1143 697 478 515 675 1091 8182
Idle start wind speed: Cut in wind speed from power curve

Table with 12 columns for months (January-December) and rows for each day of the month, showing sun rise and set times in hh:mm format. Includes summary rows for Potential sun hours, Total, worst case, and various reductions.

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

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

Project:

Gismarvik

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Calculated:

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### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EN - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (348)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	03:43 19:31	02:36 20:38	19:54 (5) 02:27	19:56 (5) 02:57	03:22 04:33	05:42 07:14	06:56 08:06	08:06 14:48
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:33	02:34 20:40	19:53 (5) 02:28	19:57 (5) 03:24	03:36 04:46	05:44 07:01	06:58 08:10	08:08 14:47
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	19:52 (5) 02:29	19:57 (5) 03:26	03:36 04:48	05:46 07:07	07:01 08:14	14:40 14:46
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	19:52 (5) 02:30	19:57 (5) 03:29	03:40 04:50	05:49 07:03	07:03 08:12	14:42 14:45
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:41	02:31 20:45	19:53 (5) 02:32	19:58 (5) 03:31	03:31 04:42	05:51 07:06	07:06 08:14	14:41 14:44
6	08:32 14:57	07:39 16:07	06:24 17:18	04:53 18:31	03:30 19:43	02:29 20:46	19:53 (5) 02:33	19:58 (5) 03:33	03:45 05:53	07:08 08:16	08:16 14:43	14:43 14:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:47	19:52 (5) 02:34	19:59 (5) 03:35	03:47 05:55	07:11 08:17	08:17 14:42	14:42 14:42
8	08:31 15:00	07:34 16:12	06:18 17:22	04:47 18:36	03:25 19:48	02:27 20:49	19:52 (5) 02:36	19:59 (5) 03:38	03:49 05:58	07:13 08:19	08:19 14:41	14:41 14:41
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	03:22 19:50	02:26 20:50	19:53 (5) 02:37	20:00 (5) 03:40	03:40 04:51	06:00 07:16	07:16 08:21	14:40 14:40
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:52	02:26 20:51	19:53 (5) 02:38	20:00 (5) 03:42	03:42 04:54	06:03 07:18	07:18 08:22	14:40 14:40
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:52	19:52 (5) 02:40	20:01 (5) 03:45	03:45 04:56	06:05 07:21	07:21 08:24	14:39 14:39
12	08:26 15:08	07:24 16:23	06:07 17:32	04:36 18:46	03:15 19:57	02:24 20:53	19:53 (5) 02:42	20:03 (5) 03:47	03:47 04:58	06:07 07:23	07:23 08:25	14:39 14:39
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	03:13 19:59	02:24 20:54	19:53 (5) 02:43	20:04 (5) 03:48	03:49 05:01	06:10 07:26	07:26 08:26	14:39 14:39
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	03:10 20:02	02:23 20:55	19:53 (5) 02:45	20:05 (5) 03:49	03:52 05:03	06:12 07:28	07:28 08:28	14:38 14:38
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:23 20:56	19:53 (5) 02:47	20:06 (5) 03:51	03:54 05:05	06:14 07:30	07:30 08:29	14:38 14:38
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	02:22 20:57	19:54 (5) 02:49	20:09 (5) 03:39	03:56 05:07	06:17 07:33	07:33 08:30	14:38 14:38
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	03:03 20:08	02:22 20:57	19:54 (5) 02:50	20:10 (5) 03:38	03:59 05:10	06:19 07:35	07:35 08:31	14:38 14:38
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	03:01 20:10	02:22 20:58	19:54 (5) 02:52	20:11 (5) 03:36	04:01 05:12	06:22 07:38	07:38 08:32	14:38 14:38
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	02:59 20:13	02:22 20:58	19:54 (5) 02:54	20:11 (5) 03:34	04:03 05:14	06:24 07:40	07:40 08:32	14:38 14:38
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	02:57 20:15	02:22 20:59	19:54 (5) 02:56	20:11 (5) 03:32	04:06 05:16	06:26 07:42	07:42 08:33	14:39 14:39
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	02:55 20:17	02:22 20:59	19:55 (5) 02:58	20:11 (5) 03:30	04:08 05:19	06:29 07:45	07:45 08:34	14:39 14:39
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	02:53 20:19	02:22 20:59	19:54 (5) 03:00	20:11 (5) 03:29	04:10 05:21	06:31 07:47	07:47 08:34	14:39 14:39
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	02:51 20:21	02:22 20:59	19:55 (5) 03:02	20:12 (5) 03:27	04:12 05:23	06:34 07:49	07:49 08:35	14:40 14:40
24	08:07 15:35	06:52 16:53	05:31 18:01	04:01 19:14	02:49 20:23	02:23 20:59	19:55 (5) 03:04	20:12 (5) 03:25	04:15 05:26	06:36 07:52	07:52 08:35	14:41 14:41
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	02:47 20:25	02:23 20:59	19:55 (5) 03:06	20:11 (5) 03:22	04:17 05:28	06:39 07:54	07:54 08:36	14:41 14:41
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 19:19	02:45 20:27	02:23 20:59	19:56 (5) 03:09	20:12 (5) 03:20	04:19 05:30	06:41 07:56	07:56 08:36	14:42 14:42
27	08:02 15:42	06:44 17:00	05:23 18:08	03:53 19:21	02:44 20:29	02:24 20:59	19:56 (5) 03:11	20:12 (5) 03:18	04:22 05:32	06:43 07:58	07:58 08:36	14:43 14:43
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	02:25 20:58	19:56 (5) 03:13	20:11 (5) 03:16	04:24 05:35	06:46 08:00	08:00 08:36	14:44 14:44
29	07:57 15:47	06:40 17:03	05:17 18:12	03:48 19:26	02:40 20:33	02:25 20:58	19:57 (5) 03:15	20:11 (5) 03:15	04:26 05:37	06:48 08:02	08:02 08:36	14:44 14:44
30	07:55 15:49	06:39 17:05	05:14 18:15	03:45 19:29	02:39 20:35	02:26 20:58	19:57 (5) 03:17	20:11 (5) 03:11	04:29 05:39	06:51 08:04	08:04 08:36	14:46 14:46
31	07:53 15:52	06:37 17:08	05:11 18:17	03:43 19:34	02:37 20:37	02:27 20:58	19:58 (5) 03:18	20:11 (5) 03:20	04:31 05:41	06:53 08:06	08:06 08:36	14:47 14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case							387		92			
Sun reduction							0.30		0.26			
Oper. time red.							0.93		0.93			
Wind dir. red.							0.75		0.75			
Total reduction							0.21		0.18			
Total, real							81		17			

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

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



Project:

Gismarvik

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15.08.2011 12:14 / 197

Licensed user:

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Gunnar Randres vei 12  
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(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EO - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (349)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:54	17:05	18:19	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:08
	14:50	15:57	17:08	18:22	19:33	20:40	20:56	20:04	18:40	17:12	15:45	14:47
3	08:34	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:10
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:03	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:45
5	08:33	07:42	06:27	04:56	03:32	02:30	02:32	03:31	04:42	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:31	17:03	15:38	14:44
6	08:32	07:39	06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:57	16:07	17:18	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:45	20:47	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:18	04:47	03:25	02:27	02:35	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:15	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29	07:30	06:13	04:41	03:20	02:26	02:38	03:42	04:54	06:03	07:18	08:22
	15:04	16:17	17:27	18:41	19:52	20:51	20:48	19:44	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:27	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
	15:08	16:23	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39
13	08:25	07:22	06:04	04:33	03:12	02:24	02:43	03:49	05:01	06:10	07:26	08:26
	15:10	16:25	17:34	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:19	14:39
14	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:14	07:30	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:07	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:28	17:59	16:31	15:13	14:38
17	08:20	07:11	05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31
	15:18	16:35	17:44	18:57	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:21	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:16	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
20	08:15	07:03	05:43	04:13	02:57	02:22	02:56	04:06	05:16	06:26	07:42	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:32	19:17	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27	16:45	17:53	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
22	08:11	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:34
	15:30	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
23	08:09	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	08:35
	15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:52	05:31	04:01	02:49	02:23	03:04	04:15	05:26	06:36	07:52	08:35
	15:35	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
	15:37	16:55	18:03	19:17	20:25	20:59	20:22	19:03	17:32	16:06	14:57	14:41
26	08:04	06:47	05:25	03:56	02:45	02:23	03:09	04:19	05:30	06:41	07:56	08:36
	15:39	16:58	18:05	19:19	20:27	20:59	20:20	19:00	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:43	07:58	08:36
	15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:00	08:36
	15:44	17:03	18:10	19:24	20:31	20:58	20:16	18:55	17:23	15:58	14:52	14:44
29	07:57		05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	08:02	08:36
	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45
30	07:55		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:49		18:15	19:29	20:35	20:58	20:11	18:49	17:17	15:53	14:49	14:46
31	07:53		05:11		02:37		03:19	04:31		06:53		08:36
	15:52		18:17		20:37		20:09	18:46		15:50		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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15.08.2011 12:14 / 199

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Calculated:

15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

Calculation: Skyggekast Gismarvik Shadow receptor: EQ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (351)

**Assumptions for shadow calculations**

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:35	07:51	06:38	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07	13:48 (3)
	14:49	15:54	17:05	18:19	19:31	20:38	20:57	20:27	18:43	17:14	15:48	14:48	12 14:00 (3)
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:09	13:49 (3)
	14:50	15:57	17:08	18:22	19:33	20:40	20:57	20:05	18:40	17:12	15:45	14:47	9 13:58 (3)
3	08:35	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:11	13:49 (3)
	14:52	15:59	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46	7 13:56 (3)
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12	13:51 (3)
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:44	4 13:55 (3)
5	08:33	07:42	06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14	13:51 (3)
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	14:43	3 13:54 (3)
6	08:33	07:39	06:24	04:53	03:29	02:29	02:33	03:33	04:45	05:53	07:08	08:16	13:54 (3)
	14:56	16:07	17:17	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:35	14:43	
7	08:32	14:06 (3)	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
	14:58	14:08 (3)	16:10	17:20	18:34	19:45	20:48	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	14:06 (3)	07:35	06:18	04:47	03:24	02:27	02:35	03:38	04:49	05:58	07:13	08:19
	15:00	4 14:10 (3)	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	14:06 (3)	07:32	06:16	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
	15:02	7 14:13 (3)	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29	14:06 (3)	07:30	06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	08:22
	15:04	9 14:15 (3)	16:17	17:27	18:41	19:52	20:51	20:49	19:45	18:17	16:48	15:26	14:40
11	08:28	14:06 (3)	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	11 14:17 (3)	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:27	14:06 (3)	07:25	06:07	04:35	03:15	02:24	02:41	03:47	04:58	06:07	07:23	08:25
	15:08	14 14:20 (3)	16:22	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39
13	08:25	14:06 (3)	07:22	06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	08:27
	15:10	16 14:22 (3)	16:25	17:34	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:19	14:38
14	08:24	14:07 (3)	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	17 14:24 (3)	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	14:07 (3)	07:17	05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	08:29
	15:14	17 14:24 (3)	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	14:08 (3)	07:14	05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	08:30
	15:16	17 14:25 (3)	16:33	17:42	18:55	20:06	20:57	20:40	19:29	17:59	16:31	15:13	14:38
17	08:20	14:08 (3)	07:12	05:52	04:21	03:03	02:22	02:50	03:58	05:10	06:19	07:35	08:31
	15:18	17 14:25 (3)	16:35	17:44	18:58	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	14:08 (3)	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:20	17 14:25 (3)	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	6 13:50 (3) 14:38
19	08:17	14:09 (3)	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	13:47 (3) 08:33
	15:23	16 14:25 (3)	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	10 13:57 (3) 14:38
20	08:15	14:10 (3)	07:03	05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:43	13:46 (3) 08:33
	15:25	15 14:25 (3)	16:43	17:51	19:05	20:15	20:59	20:33	19:17	17:47	16:20	15:05	13 13:59 (3) 14:38
21	08:13	14:10 (3)	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	13:46 (3) 08:34
	15:27	14 14:24 (3)	16:45	17:53	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14 14:00 (3) 14:39
22	08:11	14:11 (3)	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	13:46 (3) 08:35
	15:30	13 14:24 (3)	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	15 14:01 (3) 14:39
23	08:10	14:13 (3)	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	13:45 (3) 08:35
	15:32	10 14:23 (3)	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	16 14:01 (3) 14:40
24	08:08	14:16 (3)	06:53	05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	13:46 (3) 08:36
	15:34	6 14:22 (3)	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	16 14:02 (3) 14:40
25	08:06	14:16 (3)	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	13:46 (3) 08:36
	15:37	16:55	18:03	19:17	20:25	20:59	20:23	19:03	17:32	16:06	14:56	17 14:03 (3) 14:41	
26	08:04	14:15 (3)	06:47	05:25	03:56	02:45	02:23	03:08	04:19	05:30	06:41	07:56	13:46 (3) 08:36
	15:39	16:58	18:05	19:19	20:27	20:59	20:20	19:01	17:29	16:04	14:55	17 14:03 (3) 14:42	
27	08:02	14:14 (3)	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:44	07:58	13:46 (3) 08:36
	15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:53	18 14:04 (3) 14:43	
28	08:00	14:13 (3)	06:41	05:20	03:50	02:42	02:25	03:13	04:24	05:35	06:46	08:00	13:46 (3) 08:36
	15:44	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:23	15:58	14:52	17 14:03 (3) 14:44	
29	07:58	14:12 (3)	06:38	05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	08:03	13:47 (3) 08:36
	15:47	18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:50	16 14:03 (3) 14:45		
30	07:55	14:11 (3)	06:35	05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	13:47 (3) 08:36
	15:49	18:15	19:29	20:35	20:58	20:12	18:49	17:17	15:53	14:49	14 14:01 (3) 14:46		
31	07:53	14:10 (3)	06:32	05:11	03:44	02:37	02:26	03:19	04:31	05:41	06:53	08:06	13:47 (3) 08:36
	15:52	18:17	19:31	20:37	20:59	20:09	18:46	17:14	15:50	14:45	13 14:01 (3) 14:46		
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194	
Total, worst case		222									189		35
Sun reduction		0.27									0.28		0.30
Oper. time red.		0.93									0.93		0.93
Wind dir. red.		0.55									0.55		0.55
Total reduction		0.14									0.14		0.15
Total, real		31									27		5

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:

Gismarvik

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15.08.2011 12:14 / 200

Licensed user:

Kjeller Vindteknikk AS  
Gunnar Randres vei 12  
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(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: ER - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (352)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:54	17:05	18:19	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:08
	14:50	15:57	17:08	18:22	19:33	20:40	20:56	20:04	18:40	17:12	15:45	14:47
3	08:34	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:10
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:03	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:45
5	08:33	07:42	06:27	04:56	03:32	02:30	02:32	03:31	04:42	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:31	17:03	15:38	14:44
6	08:32	07:39	06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:57	16:07	17:18	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:45	20:47	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:18	04:47	03:25	02:27	02:35	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:15	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29	07:30	06:13	04:41	03:20	02:26	02:38	03:42	04:54	06:03	07:18	08:22
	15:04	16:17	17:27	18:41	19:52	20:51	20:48	19:44	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:27	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
	15:08	16:23	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39
13	08:25	07:22	06:04	04:33	03:12	02:24	02:43	03:49	05:01	06:10	07:26	08:26
	15:10	16:25	17:34	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:19	14:39
14	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:14	07:30	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:07	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:28	17:59	16:31	15:13	14:38
17	08:20	07:11	05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31
	15:18	16:35	17:44	18:57	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:21	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:16	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
20	08:15	07:03	05:43	04:13	02:57	02:22	02:56	04:06	05:16	06:26	07:42	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:32	19:17	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27	16:45	17:53	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
22	08:11	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:34
	15:30	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
23	08:09	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	08:35
	15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:52	05:31	04:01	02:49	02:23	03:04	04:15	05:26	06:36	07:52	08:35
	15:35	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
	15:37	16:55	18:03	19:17	20:25	20:59	20:22	19:03	17:32	16:06	14:57	14:41
26	08:04	06:47	05:25	03:56	02:45	02:23	03:09	04:19	05:30	06:41	07:56	08:36
	15:39	16:58	18:05	19:19	20:27	20:59	20:20	19:00	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:43	07:58	08:36
	15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:00	08:36
	15:44	17:03	18:10	19:24	20:31	20:58	20:16	18:55	17:23	15:58	14:52	14:44
29	07:57		05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	08:02	08:36
	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45
30	07:55		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:49		18:15	19:29	20:35	20:58	20:11	18:49	17:17	15:53	14:49	14:46
31	07:53		05:11		02:37		03:19	04:31		06:53		08:36
	15:52		18:17		20:37		20:09	18:46		15:50		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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15.08.2011 12:14 / 201

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Calculated:

15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

Calculation: Skyggekast Gismarvik Shadow receptor: ES - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (353)

**Assumptions for shadow calculations**

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	14:47 (3)   06:38	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:54	20 15:07 (3)   17:05	18:19	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	14:47 (3)   06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:09
	14:50	15:57	20 15:07 (3)   17:08	18:22	19:33	20:40	20:57	20:05	18:40	17:12	15:45	14:47
3	08:35	07:46	14:48 (3)   06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	14:22 (3)   08:11
	14:52	15:59	19 15:07 (3)   17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	10 14:32 (3)   14:46
4	08:34	07:44	14:48 (3)   06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	14:20 (3)   08:12
	14:53	16:02	18 15:06 (3)   17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14 14:34 (3)   14:45
5	08:33	07:42	14:49 (3)   06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	14:19 (3)   08:14
	14:55	16:05	18 15:07 (3)   17:15	18:29	19:41	20:45	20:54	19:57	18:32	17:03	15:38	16 14:35 (3)   14:44
6	08:33	07:39	14:50 (3)   06:24	04:53	03:29	02:29	02:33	03:33	04:45	05:53	07:08	14:19 (3)   08:16
	14:56	16:07	16 15:06 (3)   17:17	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	17 14:36 (3)   14:43
7	08:32	07:37	14:51 (3)   06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	14:19 (3)   08:18
	14:58	16:10	13 15:04 (3)   17:20	18:34	19:45	20:48	20:52	19:52	18:26	16:57	15:33	18 14:37 (3)   14:42
8	08:31	07:35	14:53 (3)   06:18	04:47	03:24	02:27	02:35	03:38	04:49	05:58	07:13	14:17 (3)   08:19
	15:00	16:12	9 15:02 (3)   17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	20 14:37 (3)   14:41
9	08:30	07:32	14:54 (3)   06:16	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	14:17 (3)   08:21
	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	20 14:37 (3)   14:40
10	08:29	07:30	14:55 (3)   06:13	04:41	03:20	02:25	02:38	03:42	04:54	06:03	07:18	14:18 (3)   08:22
	15:04	16:17	17:27	18:41	19:52	20:51	20:49	19:44	18:17	16:48	15:26	20 14:38 (3)   14:40
11	08:28	07:27	15:41 (2)   06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	14:18 (3)   08:24
	15:06	16:20	3 15:44 (2)   17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	20 14:38 (3)   14:39
12	08:27	07:25	15:40 (2)   06:07	04:35	03:15	02:24	02:41	03:47	04:58	06:07	07:23	14:19 (3)   08:25
	15:08	16:22	7 15:47 (2)   17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	19 14:38 (3)   14:39
13	08:25	07:22	15:40 (2)   06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	14:19 (3)   08:26
	15:10	16:25	10 15:50 (2)   17:34	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:19	19 14:38 (3)   14:38
14	08:24	07:19	15:39 (2)   06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	14:19 (3)   08:28
	15:12	16:28	14 15:53 (2)   17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	16 14:35 (3)   14:38
15	08:23	07:17	15:39 (2)   05:58	04:27	03:08	02:22	02:47	03:54	05:05	06:14	07:31	14:20 (3)   08:29
	15:14	16:30	17 15:56 (2)   17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	13 14:33 (3)   14:38
16	08:21	07:14	15:39 (2)   05:55	04:24	03:06	02:22	02:48	03:56	05:07	06:17	07:33	14:21 (3)   08:30
	15:16	16:33	17 15:56 (2)   17:42	18:55	20:06	20:57	20:40	19:28	17:59	16:31	15:13	10 14:31 (3)   14:38
17	08:20	07:12	15:39 (2)   05:52	04:21	03:03	02:22	02:50	03:58	05:10	06:19	07:35	14:23 (3)   08:31
	15:18	16:35	16 15:55 (2)   17:44	18:58	20:08	20:57	20:38	19:26	17:56	16:28	15:11	6 14:29 (3)   14:38
18	08:18	07:09	15:39 (2)   05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	14:24 (3)   08:32
	15:20	16:38	16 15:55 (2)   17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	2 14:26 (3)   14:38
19	08:17	07:06	15:41 (2)   05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	13 15:54 (2)   17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
20	08:15	07:03	15:42 (2)   05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:43	08:33
	15:25	16:43	11 15:53 (2)   17:51	19:05	20:15	20:59	20:33	19:17	17:47	16:20	15:05	14:38
21	08:13	07:01	15:45 (2)   05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27	16:45	5 15:50 (2)   17:53	19:07	20:17	20:59	20:31	19:15	17:44	16:17	7 15:14 (2)   15:03	14:39
22	08:11	06:58	15:46 (2)   05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	15:12 (2)   07:47	08:35
	15:30	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	12 15:24 (2)   15:02	14:39
23	08:10	06:55	15:47 (2)   05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	15:10 (2)   07:49	08:35
	15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	14 15:24 (2)   15:00	14:40
24	08:08	14:50 (3)   06:53	05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	15:09 (2)   07:52	08:35
	15:34	2 14:52 (3)   16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	16 15:25 (2)   14:58	14:40
25	08:06	14:49 (3)   06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	15:09 (2)   07:54	08:36
	15:37	6 14:55 (3)   16:55	18:03	19:17	20:25	20:59	20:23	19:03	17:32	16:06	17 15:26 (2)   14:56	14:41
26	08:04	14:48 (3)   06:47	05:25	03:56	02:45	02:23	03:08	04:19	05:30	06:41	15:08 (2)   07:56	08:36
	15:39	10 14:58 (3)   16:58	18:05	19:19	20:27	20:59	20:20	19:01	17:29	16:04	17 15:25 (2)   14:55	14:42
27	08:02	14:48 (3)   06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:44	15:08 (2)   07:58	08:36
	15:42	13 15:01 (3)   17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	16 15:24 (2)   14:53	14:43
28	08:00	14:47 (3)   06:41	05:20	03:50	02:42	02:25	03:13	04:24	05:35	06:46	15:09 (2)   08:00	08:36
	15:44	17 15:04 (3)   17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:23	15:58	13 15:22 (2)   14:52	14:44
29	07:58	14:47 (3)   06:38	05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	15:10 (2)   08:03	08:36
	15:47	19 15:06 (3)   17:05	18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	9 15:19 (2)   14:51	14:45
30	07:55	14:47 (3)   06:35	05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	15:10 (2)   08:05	08:36
	15:49	19 15:06 (3)   17:05	18:15	19:29	20:35	20:58	20:12	18:49	17:17	15:53	5 15:15 (2)   14:49	14:46
31	07:53	14:47 (3)   06:32	05:11	03:43	02:37	02:26	03:19	04:31	05:41	06:53	15:11 (2)   08:06	08:36
	15:52	20 15:07 (3)   17:06	18:17	19:31	20:37	20:59	20:09	18:46	17:14	15:50	2 15:13 (2)   14:47	14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	317	232	194
Total, worst case	106	262	365	434	526	554	551	481	387	317	232	194
Sun reduction	0.27	0.29	0.28	0.30	0.35	0.30	0.26	0.24	0.26	0.28	0.28	0.30
Oper. time red.	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Wind dir. red.	0.50	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.50
Total reduction	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13
Total, real	13	36	365	434	526	554	551	481	387	317	232	194

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: ET - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (354)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	17:11 (5) 17:35 (5)	03:43 19:31
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	17:11 (5) 17:34 (5)	03:40 19:33
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	17:12 (5) 17:33 (5)	03:37 19:36
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	17:13 (5) 17:31 (5)	03:35 19:38
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	17:15 (5) 17:29 (5)	03:32 19:41
6	08:32 14:57	07:39 16:07	06:24 17:18	04:53 18:31	17:19 (5) 17:26 (5)	03:30 19:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	17:59 (4) 18:03 (4)	03:27 19:45
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	17:57 (4) 18:05 (4)	03:25 19:48
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	17:56 (4) 18:07 (4)	03:22 19:50
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	17:56 (4) 18:09 (4)	03:20 19:52
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	17:55 (4) 18:11 (4)	03:17 19:55
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	17:56 (4) 18:14 (4)	03:15 19:57
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	17:56 (4) 18:13 (4)	03:12 19:59
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	17:56 (4) 18:12 (4)	03:10 20:02
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	17:57 (4) 18:10 (4)	03:08 20:04
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	17:58 (4) 18:08 (4)	03:06 20:06
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	18:02 (4) 18:05 (4)	03:03 20:08
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	03:01 20:11	20:08
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	02:59 20:13	20:08
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	02:57 20:15	20:06
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	02:55 20:17	20:04
22	08:11 15:30	06:58 16:48	05:37 17:56	17:19 (5) 17:26 (5)	04:07 19:09	20:02
23	08:09 15:32	06:55 16:50	05:34 17:58	17:17 (5) 17:28 (5)	04:04 19:12	20:00
24	08:08 15:35	06:52 16:53	05:31 18:01	17:16 (5) 17:30 (5)	04:01 19:14	19:58
25	08:06 15:37	06:50 16:55	05:28 18:03	17:14 (5) 17:33 (5)	03:59 19:17	19:56
26	08:04 15:39	06:47 16:58	05:25 18:05	17:13 (5) 17:35 (5)	03:56 19:19	19:54
27	08:02 15:42	06:44 17:00	05:23 18:08	17:12 (5) 17:37 (5)	03:53 19:21	19:52
28	08:00 15:44	06:41 17:03	05:20 18:10	17:12 (5) 17:38 (5)	03:51 19:24	19:50
29	07:57 15:47	06:38 17:06	05:17 18:12	17:11 (5) 17:37 (5)	03:48 19:26	19:48
30	07:55 15:49	06:35 17:09	05:14 18:15	17:11 (5) 17:37 (5)	03:45 19:29	19:46
31	07:53 15:52	06:32 17:12	05:11 18:17	17:11 (5) 17:36 (5)	03:42 19:32	19:44
Potential sun hours	216	257	365	434	526	554
Total, worst case			201	238	403	
Sun reduction			0.28	0.30	0.35	
Oper. time red.			0.93	0.93	0.93	
Wind dir. red.			0.60	0.63	0.72	
Total reduction			0.16	0.17	0.24	
Total, real			31	42	95	

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

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

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: ET - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (354)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27 20:57	03:22 20:07	19:05 (3) 18:43	04:33 18:10 (4)	05:42 17:14	06:56 15:48
2	02:28 20:56	03:24 20:04	19:05 (2) 19:27 (3)	04:35 18:40	05:44 17:12	06:58 15:47
3	02:29 20:56	03:26 20:02	19:03 (2) 19:24 (3)	04:38 18:37	05:46 17:09	07:01 15:46
4	02:30 20:55	03:29 20:00	19:02 (2) 19:22 (3)	04:40 18:34	05:49 17:06	07:03 15:45
5	02:31 20:54	03:31 19:57	19:01 (2) 19:20 (3)	04:42 18:31	05:51 17:03	07:06 15:38
6	02:33 20:53	03:33 19:55	19:00 (2) 19:18 (3)	04:45 18:29	05:53 17:00	07:08 15:36
7	02:34 20:52	03:35 19:52	19:00 (2) 19:15 (2)	04:47 18:26	05:56 17:00	07:11 15:33
8	02:35 20:51	03:38 19:50	18:59 (2) 19:13 (2)	04:49 18:23	05:58 17:00	07:13 15:31
9	02:37 20:50	03:40 19:47	18:59 (2) 19:10 (2)	04:51 18:20	06:00 17:00	07:16 15:28
10	02:38 20:48	03:42 19:44	18:59 (2) 19:08 (2)	04:54 18:17	06:03 17:00	07:18 15:26
11	02:40 20:47	03:45 19:42	18:59 (2) 19:05 (2)	04:56 18:14	06:05 17:00	07:21 15:24
12	02:42 20:46	03:47 19:39	18:59 (2) 19:03 (2)	04:58 18:11	06:07 17:00	07:23 15:22
13	02:43 20:44	03:49 19:37	19:00 (2) 19:01 (2)	05:01 18:08	06:10 17:00	07:26 15:19
14	02:45 20:43	03:52 19:34	05:03 18:05	06:12 17:00	07:28 16:59	08:28 15:17
15	02:47 20:41	03:54 19:31	05:05 18:02	06:14 17:00	07:30 16:57	08:29 15:15
16	02:49 20:40	03:56 19:28	05:07 17:59	06:17 17:00	07:33 16:55	08:30 15:13
17	02:50 20:38	03:59 19:26	05:10 17:56	06:19 17:24 (5)	07:35 16:28	08:31 15:11
18	02:52 20:36	04:01 19:23	05:12 17:53	06:22 17:21 (5)	07:38 16:25	08:32 15:09
19	02:54 20:34	04:03 19:14 (3) 19:17 (3)	05:14 17:50	06:24 17:18 (5)	07:40 16:23	08:33 15:07
20	02:56 20:32	04:06 19:12 (3) 19:21 (3)	05:16 17:47	06:26 17:14 (5)	07:42 16:20	08:33 15:05
21	02:58 20:31	04:08 19:10 (3) 19:22 (3)	05:19 17:44	06:29 17:04 (5)	07:45 16:17	08:34 15:03
22	03:00 20:29	04:10 19:08 (3) 19:23 (3)	05:21 17:41	06:31 17:09 (5)	07:47 16:14	08:34 15:02
23	03:02 20:27	04:12 19:08 (3) 19:24 (3)	05:23 17:38	06:34 16:12	07:49 15:00	08:35 14:40
24	03:04 20:25	04:15 19:07 (3) 19:25 (3)	05:26 17:35	06:36 16:09	07:52 14:58	08:35 14:41
25	03:06 20:22	04:17 19:06 (3) 19:26 (3)	05:28 17:32	06:39 16:06	07:54 14:57	08:36 14:41
26	03:09 20:20	04:19 19:06 (3) 19:27 (3)	05:30 18:03 (4) 18:08 (4)	06:41 16:04	07:56 14:55	08:36 14:42
27	03:11 20:18	04:22 19:06 (3) 19:27 (3)	05:32 18:01 (4) 18:11 (4)	06:43 16:01	07:58 14:53	08:36 14:43
28	03:13 20:16	04:24 19:05 (3) 19:28 (3)	05:35 17:58 (4) 18:12 (4)	06:46 15:58	08:00 14:52	08:36 14:44
29	03:15 20:14	04:26 19:05 (3) 19:28 (3)	05:37 17:57 (4) 18:13 (4)	06:48 15:56	08:02 14:51	08:36 14:45
30	03:17 20:11	04:29 19:05 (3) 19:28 (3)	05:39 17:56 (4) 18:13 (4)	06:51 15:53	08:05 14:49	08:36 14:46
31	03:19 20:09	04:31 19:05 (3) 19:28 (3)	05:41 17:55 (4) 18:13 (4)	06:53 15:50	08:06 14:47	08:36 14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	227	264	371			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.72	0.70	0.60			
Total reduction	0.17	0.16	0.15			
Total, real	40	41	54			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EU - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (355)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June		
1	08:35	07:51	06:38	05:08	17:17 (5)	03:43		
	14:49	15:54	17:05	18:19	26 17:43 (5)	19:31		
2	08:35	07:49	06:36	05:05	17:16 (5)	03:40		
	14:50	15:57	17:08	18:22	26 17:42 (5)	19:33		
3	08:34	07:46	06:33	05:02	17:16 (5)	03:37		
	14:52	16:00	17:10	18:24	25 17:41 (5)	19:36		
4	08:34	07:44	06:30	04:59	17:17 (5)	03:35		
	14:53	16:02	17:13	18:27	23 17:40 (5)	19:38		
5	08:33	07:42	06:27	04:56	17:17 (5)	03:32		
	14:55	16:05	17:15	18:29	22 17:39 (5)	19:41		
6	08:32	07:39	06:24	04:53	17:19 (5)	03:30		
	14:57	16:07	17:18	18:31	19 17:38 (5)	19:43		
7	08:32	07:37	06:21	04:50	17:20 (5)	03:27		
	14:58	16:10	17:20	18:34	16 17:36 (5)	19:45		
8	08:31	07:35	06:18	04:47	17:22 (5)	03:25		
	15:00	16:12	17:22	18:36	14 18:05 (4)	19:48		
9	08:30	07:32	06:15	04:44	18:02 (4)	03:22		
	15:02	16:15	17:25	18:38	5 18:07 (4)	19:50		
10	08:29	07:30	06:13	04:41	18:01 (4)	03:20		
	15:04	16:17	17:27	18:41	8 18:09 (4)	19:52		
11	08:28	07:27	06:10	04:38	18:00 (4)	03:17		
	15:06	16:20	17:30	18:43	11 18:11 (4)	19:55		
12	08:27	07:25	06:07	04:36	18:00 (4)	03:15		
	15:08	16:23	17:32	18:46	14 18:14 (4)	19:57		
13	08:25	07:22	06:04	04:33	18:00 (4)	03:12		
	15:10	16:25	17:34	18:48	16 18:16 (4)	19:59		
14	08:24	07:19	06:01	04:30	17:59 (4)	03:10		
	15:12	16:28	17:37	18:50	19 18:18 (4)	20:02		
15	08:23	07:17	05:58	04:27	18:00 (4)	03:08		
	15:14	16:30	17:39	18:53	17 18:17 (4)	20:04		
16	08:21	07:14	05:55	04:24	18:00 (4)	03:06		
	15:16	16:33	17:42	18:55	15 18:15 (4)	20:06		
17	08:20	07:11	05:52	04:21	18:02 (4)	03:03		
	15:18	16:35	17:44	18:57	13 18:15 (4)	20:08		
18	08:18	07:09	05:49	04:18	18:03 (4)	03:01		
	15:21	16:38	17:46	19:00	9 18:12 (4)	20:11		
19	08:16	07:06	05:46	04:15	02:59	19:00 (3)	02:22	
	15:23	16:40	17:49	19:02	20:13	21 19:21 (3)	20:58	
20	08:15	07:03	05:43	04:13	02:57	19:01 (3)	02:22	
	15:25	16:43	17:51	19:05	20:15	20 19:21 (3)	20:59	
21	08:13	07:01	05:40	04:10	02:55	19:01 (3)	02:22	
	15:27	16:45	17:53	19:07	20:17	19 19:20 (3)	20:59	
22	08:11	06:58	05:37	04:07	02:53	19:02 (3)	02:22	
	15:30	16:48	17:56	19:09	20:19	18 19:20 (3)	20:59	
23	08:09	06:55	05:34	04:04	02:51	19:03 (3)	02:22	
	15:32	16:50	17:58	19:12	20:21	16 19:19 (3)	20:59	
24	08:08	06:52	05:31	17:26 (5)	04:01	02:49	19:03 (3)	02:22
	15:35	16:53	18:01	4 17:30 (5)	19:14	20:23	15 19:18 (3)	20:59
25	08:06	06:50	05:28	17:24 (5)	03:59	02:47	19:05 (3)	02:23
	15:37	16:55	18:03	9 17:33 (5)	19:17	20:25	13 19:18 (3)	20:59
26	08:04	06:47	05:25	17:22 (5)	03:56	02:45	19:06 (3)	02:23
	15:39	16:58	18:05	13 17:35 (5)	19:19	20:27	10 19:16 (3)	20:59
27	08:02	06:44	05:23	17:20 (5)	03:53	02:44	19:09 (3)	02:24
	15:42	17:00	18:08	17 17:37 (5)	19:21	20:29	5 19:14 (3)	20:59
28	08:00	06:41	05:20	17:19 (5)	03:51	02:42	19:07 (3)	02:25
	15:44	17:03	18:10	21 17:40 (5)	19:24	20:31	19:08 (3)	20:58
29	07:57	06:38	05:17	17:18 (5)	03:48	02:40	19:05 (3)	02:25
	15:47	17:05	18:12	24 17:42 (5)	19:26	20:33	19:06 (3)	20:58
30	07:55	06:36	05:14	17:18 (5)	03:45	02:39	19:03 (3)	02:26
	15:49	17:06	18:15	25 17:43 (5)	19:29	20:35	19:09 (3)	20:58
31	07:53	06:34	05:11	17:17 (5)	03:43	02:37	19:04 (3)	02:26
	15:52	17:08	18:17	26 17:43 (5)	19:31	20:37	19:11 (3)	20:58
Potential sun hours	216	257	365	434	526	554		
Total, worst case			139	298	420			
Sun reduction			0.28	0.30	0.35			
Oper. time red.			0.93	0.93	0.93			
Wind dir. red.			0.61	0.63	0.73			
Total reduction			0.16	0.18	0.24			
Total, real			22	52	99			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EU - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (355)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	03:22	19:08 (2) 04:33	17:59 (4) 05:42	06:56	08:07
	20:57	20:07	21 19:29 (3) 18:43	11 18:10 (4) 17:14	15:48	14:48
2	02:28	03:24	19:06 (2) 04:35	18:00 (4) 05:44	06:58	08:09
	20:56	20:04	21 19:27 (3) 18:40	8 18:08 (4) 17:12	15:45	14:47
3	02:29	03:26	19:05 (2) 04:38	18:00 (4) 05:46	07:01	08:10
	20:56	20:02	19 19:24 (3) 18:37	5 18:05 (4) 17:09	15:43	14:46
4	02:30	03:29	19:05 (2) 04:40	17:19 (5) 05:49	07:03	08:12
	20:55	20:00	17 19:22 (3) 18:34	14 18:02 (4) 17:06	15:40	14:45
5	02:31	03:31	19:04 (2) 04:42	17:16 (5) 05:51	07:06	08:14
	20:54	19:57	16 19:20 (2) 18:31	16 17:32 (5) 17:03	15:38	14:44
6	02:33	03:33	19:03 (2) 04:45	17:14 (5) 05:53	07:08	08:16
	20:53	19:55	15 19:18 (2) 18:29	19 17:33 (5) 17:00	15:36	14:43
7	02:34	03:35	19:03 (2) 04:47	17:13 (5) 05:56	07:11	08:18
	20:52	19:52	12 19:15 (2) 18:26	22 17:35 (5) 16:57	15:33	14:42
8	02:35	03:38	19:03 (2) 04:49	17:12 (5) 05:58	07:13	08:19
	20:51	19:50	10 19:13 (2) 18:23	23 17:35 (5) 16:54	15:31	14:41
9	02:37	03:40	19:03 (2) 04:51	17:11 (5) 06:00	07:16	08:21
	20:50	19:47	7 19:10 (2) 18:20	25 17:36 (5) 16:51	15:28	14:40
10	02:38	03:42	19:03 (2) 04:54	17:10 (5) 06:03	07:18	08:22
	20:48	19:44	5 19:08 (2) 18:17	25 17:35 (5) 16:48	15:26	14:40
11	02:40	03:45	19:03 (2) 04:56	17:09 (5) 06:05	07:21	08:24
	20:47	19:42	2 19:05 (2) 18:14	26 17:35 (5) 16:45	15:24	14:39
12	02:42	03:47	04:58	17:08 (5) 06:07	07:23	08:25
	20:46	19:39	27 18:11	17:35 (5) 16:42	15:22	14:39
13	02:43	03:49	05:01	17:09 (5) 06:10	07:26	08:26
	20:44	19:37	26 18:08	17:35 (5) 16:40	15:19	14:39
14	02:45	03:52	05:03	17:09 (5) 06:12	07:28	08:28
	20:43	19:34	24 18:05	17:33 (5) 16:37	15:17	14:38
15	02:47	03:54	05:05	17:09 (5) 06:14	07:30	08:29
	20:41	19:31	21 18:02	17:30 (5) 16:34	15:15	14:38
16	02:49	19:20 (3) 03:56	05:07	17:09 (5) 06:17	07:33	08:30
	20:40	2 19:21 (3) 19:28	17 17:59	17 17:26 (5) 16:31	15:13	14:38
17	02:50	19:17 (3) 03:59	05:10	17:10 (5) 06:19	07:35	08:31
	20:38	8 19:25 (3) 19:26	14 17:56	14 17:24 (5) 16:28	15:11	14:38
18	02:52	19:16 (3) 04:01	05:12	17:11 (5) 06:22	07:38	08:32
	20:36	11 19:27 (3) 19:23	10 17:53	10 17:21 (5) 16:25	15:09	14:38
19	02:54	19:14 (3) 04:03	05:14	17:12 (5) 06:24	07:40	08:33
	20:34	13 19:27 (3) 19:20	6 17:50	6 17:18 (5) 16:23	15:07	14:38
20	02:56	19:13 (3) 04:06	05:16	06:26	07:42	08:33
	20:32	16 19:29 (3) 19:17	17 17:47	16:20	15:05	14:39
21	02:58	19:13 (3) 04:08	05:19	06:29	07:45	08:34
	20:31	17 19:30 (3) 19:15	17 17:44	16:17	15:03	14:39
22	03:00	19:11 (3) 04:10	05:21	06:31	07:47	08:34
	20:29	19 19:30 (3) 19:12	17 17:41	16:14	15:02	14:39
23	03:02	19:11 (3) 04:12	05:23	06:34	07:49	08:35
	20:27	20 19:31 (3) 19:09	17 17:38	16:12	15:00	14:40
24	03:04	19:11 (3) 04:15	05:26	06:36	07:52	08:35
	20:25	20 19:31 (3) 19:06	17 17:35	16:09	14:58	14:41
25	03:06	19:10 (3) 04:17	18:06 (4) 05:28	06:39	07:54	08:36
	20:22	22 19:32 (3) 19:03	9 18:15 (4) 17:32	16:06	14:57	14:41
26	03:09	19:10 (3) 04:19	18:03 (4) 05:30	06:41	07:56	08:36
	20:20	22 19:32 (3) 19:00	14 18:17 (4) 17:29	16:04	14:55	14:42
27	03:11	19:10 (3) 04:22	18:03 (4) 05:32	06:43	07:58	08:36
	20:18	23 19:33 (3) 18:58	15 18:18 (4) 17:26	16:01	14:53	14:43
28	03:13	19:10 (3) 04:24	18:01 (4) 05:35	06:46	08:00	08:36
	20:16	23 19:33 (3) 18:55	18 18:19 (4) 17:23	15:58	14:52	14:44
29	03:15	19:10 (3) 04:26	18:00 (4) 05:37	06:48	08:02	08:36
	20:14	23 19:33 (3) 18:52	19 18:19 (4) 17:20	15:56	14:51	14:45
30	03:17	19:10 (3) 04:29	18:00 (4) 05:39	06:51	08:05	08:36
	20:11	23 19:33 (3) 18:49	16 18:16 (4) 17:17	15:53	14:49	14:46
31	03:19	19:10 (2) 04:31	17:59 (4)	06:53	08:36	08:36
	20:09	21 19:31 (3) 18:46	14 18:13 (4)	15:50	14:47	14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	283	250	339			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.73	0.69	0.61			
Total reduction	0.18	0.16	0.15			
Total, real	50	39	50			

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:

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EV - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (356)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.27	0.29	0.28	0.30	0.35	0.30	0.26	0.24	0.26	0.28	0.28	0.30

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
813	231	221	428	610	1 281	1 143	697	478	515	675	1 091	8 182

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

	January	February	March	April	May	June
1	08:35	07:51	06:38	05:08	17:38 (5)	03:43
	14:49	15:54	17:05	18:19	17:49 (5)	19:31
2	08:35	07:49	06:36	05:05	17:36 (5)	03:40
	14:50	15:57	17:08	18:22	17:51 (5)	19:33
3	08:34	07:46	06:33	05:02	17:35 (5)	03:37
	14:52	16:00	17:10	18:24	17:53 (5)	19:36
4	08:34	07:44	06:30	04:59	17:34 (5)	03:35
	14:53	16:02	17:13	18:27	17:55 (5)	19:38
5	08:33	07:42	06:27	04:56	17:33 (5)	03:32
	14:55	16:05	17:15	18:29	17:57 (5)	19:41
6	08:32	07:39	06:24	04:53	17:33 (5)	03:30
	14:57	16:07	17:18	18:31	17:59 (5)	19:43
7	08:32	07:37	06:21	04:50	17:33 (5)	03:27
	14:58	16:10	17:20	18:34	17:59 (5)	19:45
8	08:31	07:35	06:18	04:47	17:32 (5)	03:25
	15:00	16:12	17:22	18:36	17:58 (5)	19:48
9	08:30	07:32	06:15	04:44	17:32 (5)	03:22
	15:02	16:15	17:25	18:38	17:57 (5)	19:50
10	08:29	07:30	06:13	04:41	17:32 (5)	03:20
	15:04	16:17	17:27	18:41	17:56 (5)	19:52
11	08:28	07:27	06:10	04:38	17:33 (5)	03:17
	15:06	16:20	17:30	18:43	17:55 (5)	19:55
12	08:27	07:25	06:07	04:36	17:34 (5)	03:15
	15:08	16:23	17:32	18:46	17:55 (5)	19:57
13	08:25	07:22	06:04	04:33	17:35 (5)	03:12
	15:10	16:25	17:34	18:48	17:53 (5)	19:59
14	08:24	07:19	06:01	04:30	17:36 (5)	03:10
	15:12	16:28	17:37	18:50	17:51 (5)	20:02
15	08:23	07:17	05:58	04:27	17:39 (5)	03:08
	15:14	16:30	17:39	18:53	17:48 (5)	20:04
16	08:21	07:14	05:55	04:24	03:06	19:07 (2)
	15:16	16:33	17:42	18:55	20:06	19:26 (3)
17	08:20	07:11	05:52	04:21	03:03	19:08 (2)
	15:18	16:35	17:44	18:57	20:08	19:28 (3)
18	08:18	07:09	05:49	04:18	03:01	19:13 (3)
	15:21	16:38	17:46	19:00	20:11	19:31 (3)
19	08:16	07:06	05:46	04:15	02:59	19:12 (3)
	15:23	16:40	17:49	19:02	20:13	19:33 (3)
20	08:15	07:03	05:43	04:13	02:57	19:12 (3)
	15:25	16:43	17:51	19:05	20:15	19:34 (3)
21	08:13	07:01	05:40	04:10	02:55	19:12 (3)
	15:27	16:45	17:53	19:07	20:17	19:34 (3)
22	08:11	06:58	05:37	04:07	02:53	19:13 (3)
	15:30	16:48	17:56	19:09	20:19	19:35 (3)
23	08:09	06:55	05:34	04:04	02:51	19:13 (3)
	15:32	16:50	17:58	19:12	20:21	19:34 (3)
24	08:08	06:52	05:31	04:01	02:49	19:13 (3)
	15:35	16:53	18:01	19:14	20:23	19:34 (3)
25	08:06	06:50	05:28	03:59	02:47	19:13 (3)
	15:37	16:55	18:03	19:17	20:25	19:34 (3)
26	08:04	06:47	05:25	03:56	02:45	19:13 (3)
	15:39	16:58	18:05	19:19	20:27	19:33 (3)
27	08:02	06:44	05:23	03:53	02:44	19:14 (3)
	15:42	17:00	18:08	19:21	20:29	19:33 (3)
28	08:00	06:41	05:20	03:51	02:42	19:15 (3)
	15:44	17:03	18:10	19:24	20:31	19:33 (3)
29	07:57		05:17	03:48	02:40	19:15 (3)
	15:47		18:12	19:26	20:33	19:32 (3)
30	07:55		05:14	17:43 (5)	03:45	02:39
	15:49		18:15	2	17:44 (5)	19:29
31	07:53		05:11	17:40 (5)	03:42	02:37
	15:52		18:17	6	17:46 (5)	19:32 (3)
Potential sun hours	216	257	365	434	526	554
Total, worst case			8	301	429	43
Sun reduction			0.28	0.30	0.35	0.30
Oper. time red.			0.93	0.93	0.93	0.93
Wind dir. red.			0.63	0.63	0.73	0.74
Total reduction			0.16	0.18	0.24	0.21
Total, real			1	53	103	9

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EV - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (356)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1281 1143 697 478 515 675 1091 8182  
 Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	03:22	19:14 (2) 04:33	17:32 (5) 05:42	06:56	08:07
	20:57	20:07	15 19:29 (2) 18:43	22 17:54 (5) 17:14	15:48	14:48
2	02:28	03:24	19:14 (2) 04:35	17:31 (5) 05:44	06:58	08:08
	20:56	20:04	13 19:27 (2) 18:40	24 17:55 (5) 17:12	15:45	14:47
3	02:29	03:26	19:14 (2) 04:38	17:30 (5) 05:46	07:01	08:10
	20:56	20:02	10 19:24 (2) 18:37	25 17:55 (5) 17:09	15:43	14:46
4	02:30	03:29	19:14 (2) 04:40	17:29 (5) 05:49	07:03	08:12
	20:55	20:00	8 19:22 (2) 18:34	26 17:55 (5) 17:06	15:40	14:45
5	02:32	03:31	19:14 (2) 04:42	17:29 (5) 05:51	07:06	08:14
	20:54	19:57	6 19:20 (2) 18:31	26 17:55 (5) 17:03	15:38	14:44
6	02:33	03:33	19:14 (2) 04:45	17:28 (5) 05:53	07:08	08:16
	20:53	19:55	4 19:18 (2) 18:29	26 17:54 (5) 17:00	15:36	14:43
7	02:34	03:35	19:14 (2) 04:47	17:29 (5) 05:56	07:11	08:18
	20:52	19:52	2 19:15 (2) 18:26	25 17:54 (5) 16:57	15:33	14:42
8	02:35	19:30 (3) 03:38	04:49	17:29 (5) 05:58	07:13	08:19
	20:51	5 19:35 (3) 19:50	18:23	22 17:51 (5) 16:54	15:31	14:41
9	02:37	19:28 (3) 03:40	04:51	17:29 (5) 06:00	07:16	08:21
	20:50	8 19:36 (3) 19:47	18:20	18 17:47 (5) 16:51	15:28	14:40
10	02:38	19:27 (3) 03:42	04:54	17:29 (5) 06:03	07:18	08:22
	20:48	10 19:37 (3) 19:44	18:17	15 17:44 (5) 16:48	15:26	14:40
11	02:40	19:26 (3) 03:45	04:56	17:30 (5) 06:05	07:21	08:24
	20:47	13 19:39 (3) 19:42	18:14	11 17:41 (5) 16:45	15:24	14:39
12	02:42	19:25 (3) 03:47	04:58	17:31 (5) 06:07	07:23	08:25
	20:46	14 19:39 (3) 19:39	18:11	7 17:38 (5) 16:42	15:22	14:39
13	02:43	19:25 (3) 03:49	05:01	17:34 (5) 06:10	07:26	08:26
	20:44	16 19:41 (3) 19:37	18:08	2 17:36 (5) 16:40	15:19	14:39
14	02:45	19:24 (3) 03:52	05:03	06:12	07:28	08:28
	20:43	17 19:41 (3) 19:34	18:05	16:37	15:17	14:38
15	02:47	19:24 (3) 03:54	05:05	06:14	07:30	08:29
	20:41	18 19:42 (3) 19:31	18:02	16:34	15:15	14:38
16	02:49	19:23 (3) 03:56	05:07	06:17	07:33	08:30
	20:40	19 19:42 (3) 19:28	17:59	16:31	15:13	14:38
17	02:50	19:23 (3) 03:59	05:10	06:19	07:35	08:31
	20:38	20 19:43 (3) 19:26	17:56	16:28	15:11	14:38
18	02:52	19:23 (3) 04:01	05:12	06:22	07:38	08:32
	20:36	21 19:44 (3) 19:23	17:53	16:25	15:09	14:38
19	02:54	19:23 (3) 04:03	05:14	06:24	07:40	08:33
	20:34	20 19:43 (3) 19:20	17:50	16:23	15:07	14:38
20	02:56	19:23 (3) 04:06	05:16	06:26	07:42	08:33
	20:32	21 19:44 (3) 19:17	17:47	16:20	15:05	14:39
21	02:58	19:23 (3) 04:08	05:19	06:29	07:45	08:34
	20:31	22 19:45 (3) 19:15	17:44	16:17	15:03	14:39
22	03:00	19:22 (3) 04:10	05:21	06:31	07:47	08:34
	20:29	22 19:44 (3) 19:12	17:41	16:14	15:02	14:39
23	03:02	19:22 (3) 04:12	05:23	06:34	07:49	08:35
	20:27	22 19:44 (3) 19:09	17:38	16:12	15:00	14:40
24	03:04	19:22 (3) 04:15	05:26	06:36	07:52	08:35
	20:25	22 19:44 (3) 19:06	17:35	16:09	14:58	14:41
25	03:06	19:23 (3) 04:17	05:28	06:39	07:54	08:36
	20:22	19 19:42 (3) 19:03	17:32	16:06	14:57	14:41
26	03:09	19:23 (3) 04:19	05:30	06:41	07:56	08:36
	20:20	17 19:40 (3) 19:00	17:29	16:04	14:55	14:42
27	03:11	19:19 (2) 04:22	05:32	06:43	07:58	08:36
	20:18	19 19:38 (3) 18:58	17:26	16:01	14:53	14:43
28	03:13	19:17 (2) 04:24	17:40 (5) 05:35	06:46	08:00	08:36
	20:16	20 19:37 (3) 18:55	17:50 (5) 17:23	15:58	14:52	14:44
29	03:15	19:16 (2) 04:26	17:37 (5) 05:37	06:48	08:02	08:36
	20:14	19 19:35 (3) 18:52	15 17:52 (5) 17:20	15:56	14:51	14:45
30	03:17	19:15 (2) 04:29	17:35 (5) 05:39	06:51	08:05	08:36
	20:11	18 19:33 (3) 18:49	18 17:53 (5) 17:17	15:53	14:49	14:46
31	03:19	19:15 (2) 04:31	17:33 (5) 17:17	06:53	14:49	08:36
	20:09	16 19:31 (3) 18:46	21 17:54 (5) 17:17	15:50	14:47	14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	418	122	249			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.74	0.68	0.63			
Total reduction	0.18	0.15	0.15			
Total, real	74	18	38			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EW - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (357)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June		
1	08:35 14:49	07:51 15:54	14:42 (5) 17:05	06:38 17:05	15:58 (3) 16:21 (3)	05:08 18:19	03:42 19:31	02:36 20:38
2	08:35 14:50	07:49 15:57	14:44 (5) 17:08	06:36 17:08	15:58 (3) 16:20 (3)	05:05 18:22	03:40 19:33	02:34 20:40
3	08:35 14:52	07:46 15:59	14:50 (5) 17:10	06:33 17:10	15:59 (3) 16:19 (3)	05:02 18:24	03:37 19:36	02:33 20:42
4	08:34 14:53	07:44 16:02	14:53 (5) 17:13	06:30 17:13	16:00 (3) 16:17 (3)	04:59 18:27	03:35 19:38	02:32 20:43
5	08:33 14:55	07:42 16:05	14:56 (5) 17:15	06:27 17:15	16:01 (3) 16:15 (3)	04:56 18:29	03:32 19:41	02:30 20:45
6	08:33 14:56	07:39 16:07	14:59 (5) 17:17	06:24 17:17	16:04 (3) 16:46 (2)	04:53 18:31	03:30 19:43	02:29 20:46
7	08:32 14:58	07:37 16:10	15:02 (5) 17:20	06:21 17:20	16:41 (2) 16:48 (2)	04:50 18:34	03:27 19:45	02:28 20:48
8	08:31 15:00	07:35 16:12	15:05 (5) 17:22	06:18 17:22	16:40 (2) 16:51 (2)	04:47 18:36	03:24 19:48	02:27 20:49
9	08:30 15:02	07:32 16:15	15:08 (5) 17:25	06:16 17:25	16:40 (2) 16:54 (2)	04:44 18:38	03:22 19:50	02:26 20:50
10	08:29 15:04	07:30 16:17	15:11 (5) 17:27	06:13 17:27	16:40 (2) 16:57 (2)	04:41 18:41	03:20 19:52	02:25 20:51
11	08:28 15:06	07:27 16:20	15:14 (5) 17:30	06:10 17:30	16:40 (2) 16:58 (2)	04:38 18:43	03:17 19:55	02:25 20:52
12	08:27 15:08	07:25 16:22	15:17 (5) 17:32	06:07 17:32	16:40 (2) 16:57 (2)	04:36 18:46	03:15 19:57	02:24 20:53
13	08:25 15:10	07:22 16:25	15:20 (5) 17:34	06:04 17:34	16:40 (2) 16:56 (2)	04:33 18:48	03:12 19:59	02:23 20:54
14	08:24 15:12	07:19 16:28	15:23 (5) 17:37	06:01 17:37	16:41 (2) 16:55 (2)	04:30 18:50	03:10 20:02	02:23 20:55
15	08:23 15:14	07:17 16:30	15:26 (5) 17:39	05:58 17:39	16:43 (2) 16:52 (2)	04:27 18:53	03:08 20:04	02:22 20:56
16	08:21 15:16	07:14 16:33	15:29 (5) 17:42	05:55 17:42	16:52 (2) 18:55	04:24 20:06	03:06 20:06	02:22 20:57
17	08:20 15:18	07:12 16:35	15:32 (5) 17:44	05:52 17:44	18:57	04:21 20:08	03:03 20:08	02:22 20:57
18	08:18 15:20	07:09 16:38	15:35 (5) 17:46	05:49 17:46	18:57	04:18 20:11	03:01 20:11	02:22 20:58
19	08:17 15:23	14:37 (5) 07:06	15:38 (5) 17:49	05:46 17:49	19:00	04:15 20:13	02:59 20:13	02:22 20:58
20	08:15 15:25	14:36 (5) 07:03	15:41 (5) 17:51	05:43 17:51	19:02	04:13 20:15	02:57 20:15	02:22 20:59
21	08:13 15:27	14:35 (5) 07:01	15:44 (5) 17:53	05:40 17:53	19:05	04:10 20:17	02:55 20:17	02:22 20:59
22	08:11 15:30	14:43 (5) 06:58	15:47 (5) 17:56	05:37 17:56	19:07	04:07 20:19	02:53 20:19	02:22 20:59
23	08:09 15:32	14:46 (5) 06:48	15:50 (5) 17:59	05:34 17:59	19:09	04:04 20:21	02:51 20:21	02:22 20:59
24	08:08 15:35	14:49 (5) 06:50	15:53 (5) 18:01	05:31 18:01	19:12	04:01 20:23	02:49 20:23	02:22 20:59
25	08:06 15:37	14:36 (5) 06:50	15:56 (5) 18:03	05:28 18:03	19:17	03:59 20:25	02:23 20:25	02:23 20:59
26	08:04 15:39	14:36 (5) 06:47	15:59 (5) 18:05	05:25 18:05	19:19	03:56 20:27	02:23 20:27	02:23 20:59
27	08:02 15:42	14:55 (5) 16:58	16:22 (3) 18:05	05:23 18:05	19:21	03:53 20:29	02:44 20:29	02:24 20:59
28	08:00 15:44	14:36 (5) 06:44	15:58 (3) 18:08	05:23 18:08	19:21	03:53 20:29	02:44 20:29	02:24 20:59
29	07:58 15:47	14:55 (5) 17:00	16:22 (3) 18:08	05:20 18:08	19:24	03:50 20:31	02:42 20:31	02:25 20:59
30	07:55 15:49	14:38 (5) 05:17	16:21 (3) 18:10	05:17 18:10	19:24	03:48 20:33	02:40 20:33	02:25 20:58
31	07:53 15:52	14:39 (5) 05:14	16:22 (3) 18:05	05:14 18:05	19:29	03:45 20:35	02:39 20:35	02:26 20:58
Potential sun hours	216	257	365	434	526	554		
Total, worst case	176	289	231					
Sun reduction	0.27	0.29	0.28					
Oper. time red.	0.93	0.93	0.93					
Wind dir. red.	0.52	0.52	0.53					
Total reduction	0.13	0.14	0.14					
Total, real	23	41	32					

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EW - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (357)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	16:19 (2) 16:36 (2)	06:56 15:48
2	02:28 20:56	03:24 20:04	04:35 18:40	05:44 17:12	16:18 (2) 16:36 (2)	06:58 15:45
3	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	16:17 (2) 16:35 (2)	07:01 15:43
4	02:30 20:55	03:28 20:00	04:40 18:34	05:49 17:06	16:17 (2) 16:33 (2)	07:03 15:40
5	02:31 20:54	03:31 19:57	04:42 18:32	05:51 17:03	16:17 (2) 16:29 (2)	07:06 15:38
6	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	16:17 (2) 16:26 (2)	07:08 15:36
7	02:34 20:52	03:35 19:52	04:47 18:26	05:56 16:57	16:18 (2) 16:24 (2)	07:11 15:33
8	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	15:38 (3) 16:20 (2)	07:13 15:31
9	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	15:36 (3) 15:52 (3)	07:16 15:28
10	02:38 20:49	03:42 19:44	04:54 18:17	06:03 16:48	15:34 (3) 15:53 (3)	07:18 15:26
11	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	15:33 (3) 15:54 (3)	07:21 15:24
12	02:42 20:46	03:47 19:39	04:58 18:11	06:07 16:42	15:32 (3) 15:54 (3)	07:23 15:22
13	02:43 20:44	03:49 19:37	05:01 18:08	06:10 16:40	15:31 (3) 15:55 (3)	07:26 15:19
14	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	15:30 (3) 15:54 (3)	07:28 15:17
15	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	15:30 (3) 15:55 (3)	07:31 15:15
16	02:48 20:40	03:56 19:28	05:07 17:59	06:17 16:31	15:30 (3) 15:54 (3)	07:33 15:13
17	02:50 20:38	03:59 19:26	05:10 17:56	06:19 16:28	15:30 (3) 15:54 (3)	07:35 15:11
18	02:52 20:36	04:01 19:23	05:12 17:53	06:22 16:25	15:30 (3) 15:50 (3)	07:38 15:09
19	02:54 20:34	04:03 19:20	05:14 17:50	06:24 16:23	15:31 (3) 15:48 (3)	07:40 15:07
20	02:56 20:33	04:05 19:17	05:16 17:47	06:26 16:20	15:22 (4) 15:45 (3)	07:42 15:05
21	02:58 20:31	04:08 19:15	05:19 17:44	06:29 16:17	15:19 (4) 15:42 (3)	07:45 15:03
22	03:00 20:29	04:10 19:12	05:21 17:41	06:31 16:14	15:18 (4) 15:39 (3)	07:47 15:02
23	03:02 20:27	04:12 19:09	05:23 17:38	06:34 16:12	15:16 (4) 15:32 (4)	07:49 15:00
24	03:04 20:25	04:15 19:06	05:26 17:35	06:36 16:09	15:16 (4) 15:33 (4)	07:52 14:58
25	03:06 20:23	04:17 19:03	05:28 17:32	06:39 16:06	15:16 (4) 15:30 (4)	07:54 14:56
26	03:08 20:20	04:19 19:01	05:30 17:29	06:41 16:04	15:16 (4) 15:27 (4)	07:56 14:55
27	03:11 20:18	04:22 18:58	05:32 17:26	06:44 16:01	15:16 (4) 15:24 (4)	07:58 14:53
28	03:13 20:16	04:24 18:55	05:35 17:23	16:25 (2) 16:32 (2)	06:46 15:58	08:00 14:52
29	03:15 20:14	04:26 18:52	05:37 17:20	16:22 (2) 16:34 (2)	06:48 15:56	08:03 14:51
30	03:17 20:12	04:29 18:49	05:39 17:17	16:20 (2) 16:35 (2)	06:51 15:53	08:05 14:49
31	03:19 20:09	04:31 18:46		06:53 15:50		08:06 14:47
Potential sun hours	551	481	387	317	232	194
Total, worst case			34	478		194
Sun reduction			0.26	0.28		0.28
Oper. time red.			0.93	0.93		0.93
Wind dir. red.			0.53	0.52		0.52
Total reduction			0.13	0.14		0.13
Total, real			4	65		26

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EX - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (358)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June
1	08:35	07:51	06:38	05:08	17:15 (5)	03:43
	14:49	15:54	17:05	18:19	17:40 (5)	19:31
2	08:35	07:49	06:36	05:05	17:15 (5)	03:40
	14:50	15:57	17:08	18:22	17:39 (5)	19:33
3	08:34	07:46	06:33	05:02	17:15 (5)	03:37
	14:52	16:00	17:10	18:24	17:38 (5)	19:36
4	08:34	07:44	06:30	04:59	17:15 (5)	03:35
	14:53	16:02	17:13	18:27	17:36 (5)	19:38
5	08:33	07:42	06:27	04:56	17:16 (5)	03:32
	14:55	16:05	17:15	18:29	17:35 (5)	19:41
6	08:32	07:39	06:24	04:53	17:19 (5)	03:30
	14:57	16:07	17:18	18:31	17:34 (5)	19:43
7	08:32	07:37	06:21	04:50	17:21 (5)	03:27
	14:58	16:10	17:20	18:34	18:03 (4)	19:45
8	08:31	07:35	06:18	04:47	18:00 (4)	03:25
	15:00	16:12	17:22	18:36	18:05 (4)	19:48
9	08:30	07:32	06:15	04:44	17:59 (4)	03:22
	15:02	16:15	17:25	18:38	18:07 (4)	19:50
10	08:29	07:30	06:13	04:41	17:58 (4)	03:20
	15:04	16:17	17:27	18:41	18:09 (4)	19:52
11	08:28	07:27	06:10	04:38	17:58 (4)	03:17
	15:06	16:20	17:30	18:43	18:11 (4)	19:55
12	08:27	07:25	06:07	04:36	17:58 (4)	03:15
	15:08	16:23	17:32	18:46	18:14 (4)	19:57
13	08:25	07:22	06:04	04:33	17:58 (4)	03:12
	15:10	16:25	17:34	18:48	18:16 (4)	19:59
14	08:24	07:19	06:01	04:30	17:58 (4)	03:10
	15:12	16:28	17:37	18:50	18:15 (4)	20:02
15	08:23	07:17	05:58	04:27	17:58 (4)	03:08
	15:14	16:30	17:39	18:53	18:14 (4)	20:04
16	08:21	07:14	05:55	04:24	17:59 (4)	03:06
	15:16	16:33	17:42	18:55	18:12 (4)	20:06
17	08:20	07:11	05:52	04:21	18:02 (4)	03:03
	15:18	16:35	17:44	18:57	18:11 (4)	20:08
18	08:18	07:09	05:49	04:18	03:01	18:58 (3)
	15:21	16:38	17:46	19:00	20:11	20:58
19	08:16	07:06	05:46	04:15	02:59	18:58 (3)
	15:23	16:40	17:49	19:02	20:13	20:58
20	08:15	07:03	05:43	04:13	02:57	18:59 (3)
	15:25	16:43	17:51	19:05	20:15	20:59
21	08:13	07:01	05:40	04:10	02:55	18:59 (3)
	15:27	16:45	17:53	19:07	20:17	20:59
22	08:11	06:58	05:37	04:07	02:53	19:01 (3)
	15:30	16:48	17:56	19:09	20:19	20:59
23	08:09	06:55	05:34	17:24 (5)	04:04	02:51
	15:32	16:50	17:58	4	17:28 (5)	19:12
24	08:08	06:52	05:31	17:22 (5)	04:01	02:49
	15:35	16:53	18:01	8	17:30 (5)	19:14
25	08:06	06:50	05:28	17:20 (5)	03:59	02:47
	15:37	16:55	18:03	13	17:33 (5)	19:17
26	08:04	06:47	05:25	17:18 (5)	03:56	02:45
	15:39	16:58	18:05	17	17:35 (5)	19:19
27	08:02	06:44	05:23	17:17 (5)	03:53	02:44
	15:42	17:00	18:08	20	17:37 (5)	19:21
28	08:00	06:41	05:20	17:16 (5)	03:51	02:42
	15:44	17:03	18:10	24	17:40 (5)	19:24
29	07:57		05:17	17:15 (5)	03:48	02:40
	15:47		18:12	26	17:41 (5)	19:26
30	07:55		05:14	17:15 (5)	03:45	02:39
	15:49		18:15	26	17:41 (5)	19:29
31	07:53		05:11	17:15 (5)	03:43	02:37
	15:52		18:17	25	17:40 (5)	19:27
Potential sun hours	216	257	365	434	526	554
Total, worst case			163	265	398	
Sun reduction			0.28	0.30	0.35	
Oper. time red.			0.93	0.93	0.93	
Wind dir. red.			0.60	0.63	0.72	
Total reduction			0.16	0.17	0.24	
Total, real			26	46	94	

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EX - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (358)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum

813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	July	August	September	October	November	December
1	02:27 20:57	03:22 19:27 (3)	04:33 18:43	17:56 (4) 18:10 (4)	05:42 17:14	06:56 15:48
2	02:28 20:56	03:24 19:27 (3)	04:35 18:40	17:57 (4) 18:08 (4)	05:44 17:12	06:58 15:47
3	02:29 20:56	03:26 19:24 (3)	04:38 18:37	17:57 (4) 18:05 (4)	05:46 17:09	07:01 15:43
4	02:30 20:55	03:29 19:22 (3)	04:40 18:34	17:57 (4) 18:02 (4)	05:49 17:06	07:03 15:40
5	02:31 20:54	03:31 19:20 (3)	04:42 18:31	17:17 (5) 17:59 (4)	05:51 17:03	07:06 15:38
6	02:33 20:53	03:33 19:18 (2)	04:45 18:29	17:14 (5) 17:29 (5)	05:53 17:00	07:08 15:36
7	02:34 20:52	03:35 19:15 (2)	04:47 18:26	17:13 (5) 17:31 (5)	05:56 16:57	07:11 15:33
8	02:35 20:51	03:38 19:13 (2)	04:49 18:23	17:11 (5) 17:32 (5)	05:58 16:54	07:13 15:31
9	02:37 20:50	03:40 19:10 (2)	04:51 18:20	17:09 (5) 17:32 (5)	06:00 16:51	07:16 15:28
10	02:38 20:48	03:42 19:08 (2)	04:54 18:17	17:08 (5) 17:32 (5)	06:03 16:48	07:18 15:26
11	02:40 20:47	03:45 19:05 (2)	04:56 18:14	17:07 (5) 17:32 (5)	06:05 16:45	07:21 15:24
12	02:42 20:46	03:47 19:03 (2)	04:58 18:11	17:06 (5) 17:32 (5)	06:07 16:42	07:23 15:22
13	02:43 20:44	03:49 19:37	05:01 18:08	17:06 (5) 17:32 (5)	06:10 16:40	07:26 15:19
14	02:45 20:43	03:52 19:34	05:03 18:05	17:06 (5) 17:32 (5)	06:12 16:37	07:28 15:17
15	02:47 20:41	03:54 19:31	05:05 18:02	17:06 (5) 17:30 (5)	06:14 16:34	07:30 15:15
16	02:49 20:40	03:56 19:28	05:07 17:59	17:06 (5) 17:26 (5)	06:17 16:31	07:33 15:13
17	02:50 20:38	03:59 19:26	05:10 17:56	17:07 (5) 17:24 (5)	06:19 16:28	07:35 15:11
18	02:52 20:36	04:01 19:23	05:12 17:53	17:07 (5) 17:21 (5)	06:22 16:25	07:38 15:09
19	02:54 20:34	19:14 (3) 19:21 (3)	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:07
20	02:56 20:32	19:13 (3) 19:23 (3)	04:06 19:17	05:16 17:47	06:26 16:20	07:42 15:05
21	02:58 20:31	19:12 (3) 19:25 (3)	04:08 19:15	05:19 17:44	06:29 16:17	07:45 15:03
22	03:00 20:29	19:10 (3) 19:25 (3)	04:10 19:12	05:21 17:41	06:31 16:14	07:47 15:02
23	03:02 20:27	19:09 (3) 19:26 (3)	04:12 19:09	05:23 17:38	06:34 16:12	07:49 15:00
24	03:04 20:25	19:09 (3) 19:27 (3)	04:15 19:06	05:26 17:35	06:36 16:09	07:52 14:58
25	03:06 20:22	19:08 (3) 19:28 (3)	04:17 19:03	05:28 17:32	06:39 16:06	07:54 14:57
26	03:09 20:20	19:08 (3) 19:28 (3)	04:19 19:00	18:03 (4) 18:13 (4)	05:30 17:29	06:41 16:04
27	03:11 20:18	19:07 (3) 19:29 (3)	04:22 18:58	18:02 (4) 18:15 (4)	05:32 17:26	06:43 16:01
28	03:13 20:16	19:07 (3) 19:29 (3)	04:24 18:55	18:00 (4) 18:15 (4)	05:35 17:23	06:46 15:58
29	03:15 20:14	19:07 (3) 19:30 (3)	04:26 18:52	17:59 (4) 18:16 (4)	05:37 17:20	06:48 15:56
30	03:17 20:11	19:07 (3) 19:30 (3)	04:29 18:49	17:58 (4) 18:16 (4)	05:39 17:17	06:51 15:53
31	03:19 20:09	19:07 (3) 19:30 (3)	04:31 18:46	17:57 (4) 18:13 (4)	05:41 15:50	06:53 15:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	233	255	343			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.72	0.70	0.61			
Total reduction	0.18	0.16	0.15			
Total, real	41	40	50			

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:

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EY - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (359)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35	07:51	06:38	05:08	17:10 (5)	03:43
	14:49	15:54	17:05	18:19	17:33 (5)	19:31
2	08:35	07:49	06:36	05:05	17:11 (5)	03:40
	14:50	15:57	17:08	18:22	17:32 (5)	19:33
3	08:34	07:46	06:33	05:02	17:12 (5)	03:37
	14:52	16:00	17:10	18:24	17:30 (5)	19:36
4	08:34	07:44	06:30	04:59	17:14 (5)	03:35
	14:53	16:02	17:13	18:27	17:28 (5)	19:38
5	08:33	07:42	06:27	04:56	17:16 (5)	03:32
	14:55	16:05	17:15	18:29	17:25 (5)	19:41
6	08:32	07:39	06:24	04:53	17:58 (4)	03:30
	14:57	16:07	17:18	18:31	18:00 (4)	19:43
7	08:32	07:37	06:21	04:50	17:57 (4)	03:27
	14:58	16:10	17:20	18:34	18:03 (4)	19:45
8	08:31	07:35	06:18	04:47	17:55 (4)	03:25
	15:00	16:12	17:22	18:36	18:05 (4)	19:48
9	08:30	07:32	06:15	04:44	17:55 (4)	03:22
	15:02	16:15	17:25	18:38	18:07 (4)	19:50
10	08:29	07:30	06:13	04:41	17:54 (4)	03:20
	15:04	16:17	17:27	18:41	18:09 (4)	19:52
11	08:28	07:27	06:10	04:38	17:54 (4)	03:17
	15:06	16:20	17:30	18:43	18:11 (4)	19:55
12	08:27	07:25	06:07	04:36	17:54 (4)	03:15
	15:08	16:23	17:32	18:46	18:11 (4)	19:57
13	08:25	07:22	06:04	04:33	17:55 (4)	03:12
	15:10	16:25	17:34	18:48	18:11 (4)	19:59
14	08:24	07:19	06:01	04:30	17:55 (4)	03:10
	15:12	16:28	17:37	18:50	18:10 (4)	20:02
15	08:23	07:17	05:58	04:27	17:57 (4)	03:08
	15:14	16:30	17:39	18:53	18:08 (4)	20:04
16	08:21	07:14	05:55	04:24	17:59 (4)	03:06
	15:16	16:33	17:42	18:55	18:04 (4)	20:06
17	08:20	07:11	05:52	04:21	03:03	18:53 (3)
	15:18	16:35	17:44	18:57	20:08	19:12 (3)
18	08:18	07:09	05:49	04:18	03:01	18:55 (3)
	15:21	16:38	17:46	19:00	20:11	19:12 (3)
19	08:16	07:06	05:46	04:15	02:59	18:56 (3)
	15:23	16:40	17:49	19:02	20:13	19:11 (3)
20	08:15	07:03	05:43	04:13	02:57	18:57 (3)
	15:25	16:43	17:51	19:05	20:15	19:10 (3)
21	08:13	07:01	05:40	17:19 (5)	04:10	02:55
	15:27	16:45	17:53	4 17:23 (5)	19:07	20:17
22	08:11	06:58	05:37	17:17 (5)	04:07	02:53
	15:30	16:48	17:56	9 17:26 (5)	19:09	20:19
23	08:09	06:55	05:34	17:15 (5)	04:04	02:51
	15:32	16:50	17:58	13 17:28 (5)	19:12	20:21
24	08:08	06:52	05:31	17:14 (5)	04:01	02:49
	15:35	16:53	18:01	16 17:30 (5)	19:14	20:23
25	08:06	06:50	05:28	17:12 (5)	03:59	02:47
	15:37	16:55	18:03	21 17:33 (5)	19:17	20:25
26	08:04	06:47	05:25	17:12 (5)	03:56	02:45
	15:39	16:58	18:05	23 17:35 (5)	19:19	20:27
27	08:02	06:44	05:23	17:11 (5)	03:53	02:44
	15:42	17:00	18:08	26 17:37 (5)	19:21	20:29
28	08:00	06:41	05:20	17:10 (5)	03:51	02:42
	15:44	17:03	18:10	26 17:36 (5)	19:24	20:31
29	07:57	06:38	05:17	17:10 (5)	03:48	18:50 (2)
	15:47	17:05	18:12	26 17:36 (5)	19:26	2 18:51 (2)
30	07:55	06:35	05:14	17:10 (5)	03:45	18:49 (2)
	15:49	17:06	18:15	25 17:35 (5)	19:29	5 18:54 (2)
31	07:53	06:33	05:11	17:10 (5)	03:43	02:37
	15:52	17:08	18:17	24 17:34 (5)	19:27	20:37
Potential sun hours	216	257	365	434	526	554
Total, worst case			213	218	372	
Sun reduction			0.28	0.30	0.35	
Oper. time red.			0.93	0.93	0.93	
Wind dir. red.			0.59	0.63	0.72	
Total reduction			0.15	0.18	0.23	
Total, real			33	38	87	

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EY - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (359)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27 20:57	03:22 19:07 (3)	04:33 18:43 (3)	17:53 (4) 18:10 (4)	05:42 17:14	06:56 15:48
2	02:28 20:56	03:24 19:04 (3)	04:35 18:40 (3)	17:53 (4) 18:08 (4)	05:44 17:12	06:58 15:47
3	02:29 20:56	03:26 19:02 (3)	04:38 18:37 (3)	17:53 (4) 18:05 (4)	05:46 17:09	07:01 15:43
4	02:30 20:55	03:29 19:01 (2)	04:40 18:34 (3)	17:53 (4) 18:02 (4)	05:49 17:06	07:03 15:40
5	02:31 20:54	03:31 18:59 (2)	04:42 18:31 (3)	17:53 (4) 17:59 (4)	05:51 17:03	07:06 15:38
6	02:33 20:53	03:33 19:18 (3)	04:45 18:29 (3)	17:53 (4) 17:56 (4)	05:53 17:00	07:08 15:36
7	02:34 20:52	03:35 19:15 (3)	04:47 18:26 (3)	17:13 (5) 17:20 (5)	05:56 16:57	07:11 15:33
8	02:35 20:51	03:38 19:13 (2)	04:49 18:23 (3)	17:09 (5) 17:23 (5)	05:58 16:54	07:13 15:31
9	02:37 20:50	03:40 19:47	04:51 18:20 (2)	17:06 (5) 17:24 (5)	06:00 16:51	07:16 15:28
10	02:38 20:48	03:42 19:44	04:54 18:17 (2)	17:04 (5) 17:25 (5)	06:03 16:48	07:18 15:26
11	02:40 20:47	03:45 19:42	04:56 18:14 (2)	17:03 (5) 17:25 (5)	06:05 16:45	07:21 15:24
12	02:42 20:46	03:47 19:39	04:58 18:11 (2)	17:02 (5) 17:26 (5)	06:07 16:42	07:23 15:22
13	02:43 20:44	03:49 19:37	05:01 18:08 (2)	17:01 (5) 17:26 (5)	06:10 16:40	07:26 15:19
14	02:45 20:43	03:52 19:34	05:03 18:05 (2)	17:01 (5) 17:26 (5)	06:12 16:37	07:28 15:17
15	02:47 20:41	03:54 19:31	05:05 18:02	17:00 (5) 17:26 (5)	06:14 16:34	07:30 15:15
16	02:49 20:40	03:56 19:28	05:07 17:59	16:59 (5) 17:25 (5)	06:17 16:31	07:33 15:13
17	02:50 20:38	03:59 19:26	05:10 17:56	17:00 (5) 17:24 (5)	06:19 16:28	07:35 15:11
18	02:52 20:36	04:01 19:23	05:12 17:53	17:00 (5) 17:21 (5)	06:22 16:25	07:38 15:09
19	02:54 20:34	04:03 19:20	05:14 17:50	17:00 (5) 17:18 (5)	06:24 16:23	07:40 15:07
20	02:56 20:32	04:05 19:17	05:16 17:47	17:00 (5) 17:14 (5)	06:26 16:20	07:42 15:05
21	02:58 20:31	19:13 (3) 19:15 (3)	04:08 19:15 (3)	05:19 17:44	06:29 16:17	07:45 15:03
22	03:00 20:29	19:09 (3) 19:18 (3)	04:10 19:12 (3)	05:21 17:41	06:31 16:14	07:47 15:02
23	03:02 20:27	19:07 (3) 19:19 (3)	04:12 19:09 (3)	05:23 17:38	06:34 16:12	07:49 15:00
24	03:04 20:25	19:06 (3) 19:21 (3)	04:15 19:06 (3)	05:26 17:35	06:36 16:09	07:52 14:58
25	03:06 20:22	19:05 (3) 19:22 (3)	04:17 19:03 (3)	05:28 17:32	06:39 16:06	07:54 14:57
26	03:09 20:20	19:05 (3) 19:23 (3)	04:19 19:00 (3)	05:30 17:29	06:41 16:04	07:56 14:55
27	03:11 20:18	19:04 (3) 19:24 (3)	04:22 18:58 (4)	05:32 18:01 (4)	06:43 16:01	07:58 14:53
28	03:13 20:16	19:04 (3) 19:24 (3)	04:24 18:55 (4)	05:35 18:10 (4)	06:46 15:58	08:00 14:52
29	03:15 20:14	19:03 (3) 19:25 (3)	04:26 18:52 (4)	05:37 18:11 (4)	06:48 15:56	08:02 14:51
30	03:17 20:11	19:03 (3) 19:25 (3)	04:29 18:49 (4)	05:39 18:11 (4)	06:51 15:53	08:05 14:49
31	03:19 20:09	19:03 (3) 19:25 (3)	04:31 18:46 (4)	17:54 (4) 18:11 (4)	06:53 15:50	08:06 14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	179	270	363			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.72	0.70	0.60			
Total reduction	0.17	0.16	0.15			
Total, real	31	42	53			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: EZ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (360)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.27	0.29	0.28	0.30	0.35	0.30	0.26	0.24	0.26	0.28	0.28	0.30

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
813	231	221	428	610	1 281	1 143	697	478	515	675	1 091	8 182

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

	January	February	March	April	May	June	July	August	September	October	November	December		
1	08:35	07:51	06:38	05:08	03:43	02:36	19:38 (5)	02:27	19:44 (5)	03:22	04:33	05:42	06:56	08:06
	14:49	15:54	17:05	18:19	19:31	20:38	17	19:55 (5)	20:07	18:43	17:14	15:48	14:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	19:38 (5)	02:28	19:44 (5)	03:24	04:36	05:44	06:58	08:08
	14:50	15:57	17:08	18:22	19:33	20:40	17	19:55 (5)	20:56	20:04	18:40	17:12	15:45	14:47
3	08:34	07:46	06:33	05:02	03:37	02:33	19:38 (5)	02:29	19:45 (5)	03:26	04:38	05:46	07:01	08:10
	14:52	16:00	17:10	18:24	19:36	20:42	18	19:56 (5)	20:56	20:04	18:37	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	19:38 (5)	02:30	19:45 (5)	03:29	04:40	05:49	07:03	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20	19:58 (5)	20:55	20:04	18:34	17:06	15:40	14:45
5	08:33	07:42	06:27	04:56	03:32	02:31	19:39 (5)	02:32	19:45 (5)	03:31	04:42	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20	19:59 (5)	20:54	20:05	18:31	17:03	15:38	14:44
6	08:32	07:39	06:24	04:53	03:30	02:29	19:39 (5)	02:33	19:45 (5)	03:33	04:45	05:53	07:08	08:16
	14:57	16:07	17:18	18:31	19:43	20:46	20	19:59 (5)	20:53	20:05	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	19:39 (5)	02:34	19:46 (5)	03:35	04:47	05:55	07:11	08:17
	14:58	16:10	17:20	18:34	19:45	20:47	20	19:59 (5)	20:52	20:06	18:26	16:57	15:33	14:42
8	08:31	07:34	06:18	04:47	03:25	02:27	19:39 (5)	02:36	19:45 (5)	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:22	18:36	19:48	20:49	20	19:59 (5)	20:51	20:06	18:23	16:54	15:31	14:41
9	08:30	07:32	06:15	04:44	03:22	02:26	19:40 (5)	02:37	19:45 (5)	03:40	04:51	06:00	07:16	08:21
	15:02	16:15	17:25	18:38	19:50	20:50	20	20:00 (5)	20:50	19:45 (5)	18:20	16:51	15:29	14:40
10	08:29	07:30	06:13	04:41	03:20	02:26	19:40 (5)	02:38	19:45 (5)	03:42	04:54	06:03	07:18	08:22
	15:04	16:17	17:27	18:41	19:52	20:51	19	19:59 (5)	20:48	19:45 (5)	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:38	03:17	02:25	19:40 (5)	02:40	19:46 (5)	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	19	19:59 (5)	20:47	19:46 (5)	18:14	16:45	15:24	14:39
12	08:26	07:24	06:07	04:36	03:15	02:24	19:41 (5)	02:42	19:46 (5)	03:47	04:58	06:07	07:23	08:25
	15:08	16:23	17:32	18:46	19:57	20:53	18	19:59 (5)	20:46	19:45 (5)	18:11	16:42	15:22	14:39
13	08:25	07:22	06:04	04:33	03:13	02:24	19:41 (5)	02:43	19:46 (5)	03:49	05:01	06:10	07:26	08:26
	15:10	16:25	17:34	18:48	19:59	20:54	19	20:00 (5)	20:44	19:46 (5)	18:08	16:40	15:20	14:39
14	08:24	07:19	06:01	04:30	03:10	02:23	19:41 (5)	02:45	19:46 (5)	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:50	20:02	20:55	18	19:59 (5)	20:43	19:45 (5)	18:05	16:37	15:17	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	19:42 (5)	02:47	19:47 (5)	03:54	05:05	06:14	07:30	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	18	20:00 (5)	20:41	19:46 (5)	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	19:42 (5)	02:49	19:47 (5)	03:56	05:07	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	18	20:00 (5)	20:39	19:45 (5)	18:05	16:31	15:13	14:38
17	08:20	07:11	05:52	04:21	03:03	02:22	19:42 (5)	02:50	19:48 (5)	03:59	05:10	06:19	07:35	08:31
	15:18	16:35	17:44	18:57	20:08	20:57	18	20:00 (5)	20:38	19:45 (5)	18:02	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	19:43 (5)	02:52	19:48 (5)	04:01	05:12	06:22	07:38	08:32
	15:21	16:38	17:46	19:00	20:10	20:58	17	20:00 (5)	20:36	19:45 (5)	18:03	16:25	15:09	14:38
19	08:16	07:06	05:46	04:15	02:59	02:22	19:43 (5)	02:54	19:48 (5)	04:03	05:14	06:24	07:40	08:32
	15:23	16:40	17:49	19:02	20:13	20:58	18	20:01 (5)	20:34	19:45 (5)	18:05	16:23	15:07	14:38
20	08:15	07:03	05:43	04:13	02:57	02:22	19:43 (5)	02:56	19:49 (5)	04:06	05:16	06:26	07:42	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	18	20:01 (5)	20:32	19:45 (5)	18:07	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	19:43 (5)	02:58	19:45 (5)	04:08	05:19	06:29	07:45	08:34
	15:27	16:45	17:53	19:07	20:17	20:59	18	20:01 (5)	20:30	19:45 (5)	18:09	16:17	15:03	14:39
22	08:11	06:58	05:37	04:07	02:53	02:22	19:43 (5)	03:00	19:45 (5)	04:10	05:21	06:31	07:47	08:34
	15:30	16:48	17:56	19:09	20:19	20:59	18	20:01 (5)	20:29	19:45 (5)	18:12	16:14	15:02	14:39
23	08:09	06:55	05:34	04:04	02:51	02:22	19:44 (5)	03:02	19:45 (5)	04:12	05:23	06:34	07:49	08:35
	15:32	16:50	17:58	19:12	20:21	20:59	18	20:02 (5)	20:27	19:45 (5)	18:13	16:12	15:00	14:40
24	08:07	06:52	05:31	04:01	02:49	19:39 (5)	18	19:44 (5)	20:23	19:44 (5)	05:26	06:36	07:52	08:35
	15:35	16:53	18:01	19:14	20:23	2 19:41 (5)	18	20:02 (5)	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:28	03:59	02:47	19:39 (5)	17	19:44 (5)	20:23	19:44 (5)	05:28	06:39	07:54	08:36
	15:37	16:55	18:03	19:17	20:25	4 19:43 (5)	17	20:01 (5)	20:22	19:03	17:32	16:06	14:57	14:41
26	08:04	06:47	05:25	03:56	02:45	19:38 (5)	18	19:44 (5)	20:23	19:44 (5)	05:29	06:41	07:56	08:36
	15:39	16:58	18:05	19:19	20:27	6 19:44 (5)	18	20:02 (5)	20:20	19:00	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	19:38 (5)	18	19:45 (5)	20:24	19:45 (5)	05:32	06:43	07:58	08:36
	15:42	17:00	18:08	19:21	20:29	9 19:47 (5)	18	20:03 (5)	20:18	18:58	17:26	16:01	14:54	14:43
28	08:00	06:41	05:20	03:51	02:42	19:38 (5)	19	19:44 (5)	20:25	19:44 (5)	05:35	06:46	08:00	08:36
	15:44	17:03	18:10	19:24	20:31	11 19:49 (5)	19	20:03 (5)	20:16	18:55	17:23	15:58	14:52	14:44
29	07:57		05:17	03:48	02:40	19:38 (5)	18	19:45 (5)	20:25	19:45 (5)	05:37	06:48	08:02	08:36
	15:47		18:12	19:26	20:33	11 19:49 (5)	18	20:03 (5)	20:14	18:52	17:20	15:56	14:51	14:45
30	07:55		05:14	03:45	02:39	19:38 (5)	19	19:45 (5)	20:26	19:45 (5)	05:39	06:51	08:04	08:36
	15:49		18:15	19:29	20:35	13 19:51 (5)	19	20:04 (5)	20:11	18:49	17:17	15:53	14:49	14:46
31	07:53		05:11	03:37	02:37	19:38 (5)			20:20	19:44 (5)	05:41	06:53	08:06	08:36
	15:52		18:17	19:31	20:37	15 19:53 (5)			20:09	18:46		15:51	14:47	14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194		
Total, worst case					71	553	294							
Sun reduction					0.35	0.30	0.26							
Oper. time red.					0.93	0.93	0.93							
Wind dir. red.					0.75	0.75	0.75							
Total reduction					0.24	0.21	0.18							
Total, real					17	116	53							

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)	Last time (hh:mm) with flicker (WTG causing flicker last time)
	Sun set (hh:mm)			

Project:

Gismarvik

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Licensed user:

Kjeller Vindteknikk AS

Gunnar Randres vei 12

NO-2007 Kjeller

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Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FA - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (361)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June		
1	08:35	07:51	06:38	05:08	17:29 (5)	03:43		
	14:49	15:54	17:05	18:19	20 17:49 (5)	19:31		
2	08:35	07:49	06:36	05:05	17:28 (5)	03:40		
	14:50	15:57	17:08	18:22	23 17:51 (5)	19:33		
3	08:34	07:46	06:33	05:02	17:27 (5)	03:37		
	14:52	16:00	17:10	18:24	25 17:52 (5)	19:36		
4	08:34	07:44	06:30	04:59	17:27 (5)	03:35		
	14:53	16:02	17:13	18:27	25 17:52 (5)	19:38		
5	08:33	07:42	06:27	04:56	17:26 (5)	03:32		
	14:55	16:05	17:15	18:29	26 17:52 (5)	19:41		
6	08:32	07:39	06:24	04:53	17:27 (5)	03:30		
	14:57	16:07	17:17	18:31	25 17:52 (5)	19:43		
7	08:32	07:37	06:21	04:50	17:27 (5)	03:27		
	14:58	16:10	17:20	18:34	24 17:51 (5)	19:45		
8	08:31	07:35	06:18	04:47	17:27 (5)	03:25		
	15:00	16:12	17:22	18:36	23 17:50 (5)	19:48		
9	08:30	07:32	06:15	04:44	17:28 (5)	03:22		
	15:02	16:15	17:25	18:38	20 17:48 (5)	19:50		
10	08:29	07:30	06:13	04:41	17:29 (5)	03:20		
	15:04	16:17	17:27	18:41	18 17:47 (5)	19:52		
11	08:28	07:27	06:10	04:38	17:30 (5)	03:17		
	15:06	16:20	17:30	18:43	16 18:11 (4)	19:55		
12	08:27	07:25	06:07	04:36	17:33 (5)	03:15		
	15:08	16:23	17:32	18:46	14 18:13 (4)	19:57		
13	08:25	07:22	06:04	04:33	18:07 (4)	03:12		
	15:10	16:25	17:34	18:48	9 18:16 (4)	19:59		
14	08:24	07:19	06:01	04:30	18:06 (4)	03:10		
	15:12	16:28	17:37	18:50	12 18:18 (4)	20:02		
15	08:23	07:17	05:58	04:27	18:06 (4)	03:08		
	15:14	16:30	17:39	18:53	14 18:20 (4)	20:04		
16	08:21	07:14	05:55	04:24	18:05 (4)	03:06		
	15:16	16:33	17:42	18:55	17 18:22 (4)	20:06		
17	08:20	07:11	05:52	04:21	18:06 (4)	03:03		
	15:18	16:35	17:44	18:57	17 18:23 (4)	20:08		
18	08:18	07:09	05:49	04:18	18:07 (4)	03:01		
	15:21	16:38	17:46	19:00	15 18:22 (4)	20:11		
19	08:16	07:06	05:46	04:15	18:07 (4)	02:59		
	15:23	16:40	17:49	19:02	14 18:21 (4)	20:13		
20	08:15	07:03	05:43	04:13	18:09 (4)	02:57		
	15:25	16:43	17:51	19:05	11 18:20 (4)	20:15		
21	08:13	07:01	05:40	04:10	18:12 (4)	02:55		
	15:27	16:45	17:53	19:07	4 18:16 (4)	20:17		
22	08:11	06:58	05:37	04:07	02:53	19:07 (3)	02:22	
	15:30	16:48	17:56	19:09	20 19:27 (3)	20:59		
23	08:09	06:55	05:34	04:04	02:51	19:08 (3)	02:22	
	15:32	16:50	17:58	19:12	18 19:26 (3)	20:59		
24	08:08	06:52	05:31	04:01	02:49	19:08 (3)	02:23	
	15:35	16:53	18:01	19:14	17 19:25 (3)	20:59		
25	08:06	06:50	05:28	03:59	02:47	19:09 (3)	02:23	
	15:37	16:55	18:03	19:17	16 19:25 (3)	20:59		
26	08:04	06:47	05:25	03:56	02:45	19:09 (3)	02:23	
	15:39	16:58	18:05	19:19	15 19:24 (3)	20:59		
27	08:02	06:44	05:23	03:53	02:44	19:11 (3)	02:24	
	15:42	17:00	18:08	19:21	13 19:24 (3)	20:59		
28	08:00	06:41	05:20	17:35 (5)	03:51	19:13 (3)	02:25	
	15:44	17:03	18:10	5 17:40 (5)	19:24	10 19:23 (3)	20:58	
29	07:57	06:38	05:17	17:33 (5)	03:48	02:40	19:14 (3)	02:25
	15:47	06:38	18:12	9 17:42 (5)	19:26	7 19:21 (3)	20:58	
30	07:55	06:36	05:14	17:31 (5)	03:45	02:39	02:26	
	15:49	06:36	18:15	13 17:44 (5)	19:29	20:35	20:58	
31	07:53	06:34	05:11	17:30 (5)	03:43	02:37		
	15:52	06:34	18:17	16 17:46 (5)	19:31	20:37		
Potential sun hours	216	257	365	434	526	554		
Total, worst case			43	372	405			
Sun reduction			0.28	0.30	0.35			
Oper. time red.			0.93	0.93	0.93			
Wind dir. red.			0.62	0.63	0.73			
Total reduction			0.16	0.18	0.24			
Total, real			7	66	96			

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

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

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FA - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (361)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum

813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	July	August	September	October	November	December
1	02:27 20:57	03:22 19:07	19:11 (2) 04:33	17:29 (5) 05:42	06:56 08:07	08:07 14:48
2	02:28 20:56	03:24 19:04	19:10 (2) 04:35	17:28 (5) 05:44	06:58 08:08	08:08 14:47
3	02:29 20:56	03:26 19:02	19:09 (2) 04:38	17:26 (5) 05:46	07:01 08:10	08:10 14:46
4	02:30 20:55	03:29 19:00	19:09 (2) 04:40	17:25 (5) 05:49	07:03 08:12	08:12 14:45
5	02:31 20:54	03:31 19:57	19:08 (2) 04:42	17:23 (5) 05:51	07:06 08:14	08:14 14:44
6	02:33 20:53	03:33 19:55	19:08 (2) 04:45	17:22 (5) 05:53	07:08 08:16	08:16 14:43
7	02:34 20:52	03:35 19:52	19:08 (2) 04:47	17:22 (5) 05:56	07:11 08:18	08:18 14:42
8	02:35 20:51	03:38 19:50	19:15 (2) 04:49	17:48 (5) 05:58	07:13 08:19	08:19 14:41
9	02:37 20:50	03:40 19:47	19:13 (2) 04:51	17:47 (5) 06:00	07:16 08:21	08:21 14:40
10	02:38 20:48	03:42 19:44	19:10 (2) 04:54	17:47 (5) 06:03	07:18 08:22	08:22 14:40
11	02:40 20:47	03:45 19:42	18:17 04:56	17:44 (5) 06:05	07:21 08:24	08:24 14:39
12	02:42 20:46	03:47 19:39	18:14 04:58	17:41 (5) 06:07	07:23 08:25	08:25 14:39
13	02:43 20:44	03:49 19:37	18:11 05:01	17:38 (5) 06:10	07:26 08:26	08:26 14:39
14	02:45 20:43	19:23 (3) 03:52	18:08 05:03	17:36 (5) 06:12	07:28 08:28	08:28 14:38
15	02:47 20:41	19:29 (3) 03:54	18:05 05:05	17:33 (5) 06:14	07:28 08:29	08:29 14:38
16	02:49 20:40	19:31 (3) 03:56	18:02 05:07	17:30 (5) 06:17	07:30 08:30	08:30 14:38
17	02:50 20:38	19:32 (3) 03:58	17:59 05:10	16:31 06:19	07:33 08:31	08:31 14:38
18	02:52 20:36	19:33 (3) 04:01	17:56 05:12	16:28 06:22	07:35 08:32	08:32 14:38
19	02:54 20:34	19:35 (3) 04:03	17:53 05:14	16:25 06:24	07:38 08:33	08:33 14:38
20	02:56 20:32	19:36 (3) 04:06	17:50 05:16	16:23 06:26	07:40 08:33	08:33 14:39
21	02:58 20:31	19:37 (3) 04:08	17:47 05:19	16:20 06:29	07:42 08:34	08:34 14:39
22	03:00 20:29	19:37 (3) 04:10	17:44 05:21	16:17 06:31	07:44 08:34	08:34 14:39
23	03:02 20:27	19:36 (3) 04:12	18:16 (4) 05:21	16:14 06:34	07:47 08:35	08:35 14:40
24	03:04 20:25	19:36 (3) 04:15	18:21 (4) 05:23	16:12 06:36	07:49 08:35	08:35 14:41
25	03:06 20:22	19:37 (3) 04:17	18:23 (4) 05:26	16:11 06:39	07:52 08:36	08:36 14:41
26	03:09 20:20	19:37 (3) 04:19	18:24 (4) 05:28	16:09 06:39	07:54 08:36	08:36 14:41
27	03:11 20:18	19:38 (3) 04:22	18:25 (4) 05:32	16:06 06:41	07:57 08:36	08:36 14:42
28	03:13 20:16	19:38 (3) 04:24	18:25 (4) 05:32	16:04 06:43	07:59 08:36	08:36 14:43
29	03:15 20:14	19:38 (3) 04:26	18:08 (4) 05:32	16:01 06:43	07:58 08:36	08:36 14:44
30	03:17 20:11	19:37 (3) 04:29	18:22 (4) 05:37	15:58 06:48	08:00 08:36	08:36 14:44
31	03:19 20:09	19:35 (3) 04:31	18:19 (4) 05:39	15:56 06:51	08:02 08:36	08:36 14:45
Potential sun hours	551	481	387	318	232	194
Total, worst case	318	226	290			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.73	0.69	0.62			
Total reduction	0.18	0.15	0.15			
Total, real	56	35	44			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FB - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (362)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June		
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	17:11 (5) 17:32 (5)	03:42 19:31	18:47 (2) 18:55 (2)	02:36 20:38
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	17:11 (5) 17:31 (5)	03:40 19:33	18:47 (2) 18:58 (2)	02:34 20:40
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	17:13 (5) 17:29 (5)	03:37 19:36	18:47 (2) 19:00 (2)	02:33 20:42
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	17:15 (5) 17:26 (5)	03:35 19:38	18:47 (2) 19:02 (2)	02:32 20:43
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	04:56 18:29	03:32 19:41	18:48 (2) 19:04 (3)	02:30 20:45
6	08:32 14:57	07:39 16:07	06:24 17:17	04:53 18:31	17:57 (4) 18:00 (4)	03:30 19:43	18:48 (2) 19:07 (3)	02:29 20:46
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	17:56 (4) 18:03 (4)	03:27 19:45	18:49 (2) 19:08 (3)	02:28 20:47
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	17:55 (4) 18:05 (4)	03:25 19:48	18:50 (2) 19:10 (3)	02:27 20:49
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	17:54 (4) 18:07 (4)	03:22 19:50	18:50 (3) 19:13 (3)	02:26 20:50
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	17:53 (4) 18:09 (4)	03:20 19:52	18:50 (3) 19:13 (3)	02:26 20:51
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	17:53 (4) 18:11 (4)	03:17 19:55	18:50 (3) 19:13 (3)	02:25 20:52
12	08:27 15:08	07:25 16:23	06:07 17:32	04:36 18:46	17:53 (4) 18:10 (4)	03:15 19:57	18:50 (3) 19:12 (3)	02:24 20:53
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	17:55 (4) 18:10 (4)	03:12 19:59	18:50 (3) 19:12 (3)	02:23 20:54
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	17:55 (4) 18:08 (4)	03:10 20:02	18:51 (3) 19:11 (3)	02:23 20:55
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	17:57 (4) 18:06 (4)	03:08 20:04	18:51 (3) 19:11 (3)	02:23 20:56
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	04:24 20:06	03:06 20:06	18:52 (3) 19:10 (3)	02:22 20:57
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	04:21 20:08	03:03 20:08	18:53 (3) 19:09 (3)	02:22 20:57
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	04:18 20:11	03:01 20:11	18:54 (3) 19:09 (3)	02:22 20:58
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	04:15 20:13	02:59 20:13	18:56 (3) 19:08 (3)	02:22 20:58
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	04:13 20:15	02:57 20:15	18:57 (3) 19:06 (3)	02:22 20:59
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 17:18 (5)	04:10 17:23 (5)	02:55 19:07	19:01 (3) 19:02 (3)	02:22 20:59
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 17:26 (5)	04:07 17:26 (5)	02:53 19:09	19:02 (3) 19:09 (3)	02:22 20:59
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 17:28 (5)	04:04 17:28 (5)	02:51 19:12	19:02 (3) 19:09 (3)	02:22 20:59
24	08:08 15:35	06:52 16:53	05:31 18:01	04:01 17:30 (5)	04:01 17:30 (5)	02:49 19:14	19:02 (3) 19:09 (3)	02:22 20:59
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 17:33 (5)	03:59 17:33 (5)	02:47 19:17	19:02 (3) 19:09 (3)	02:23 20:59
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 17:35 (5)	03:56 17:35 (5)	02:45 19:19	19:02 (3) 19:09 (3)	02:23 20:59
27	08:02 15:42	06:44 17:00	05:23 18:08	03:53 17:36 (5)	03:53 17:36 (5)	02:44 19:21	19:02 (3) 19:09 (3)	02:24 20:59
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 17:36 (5)	03:51 17:36 (5)	02:42 19:24	19:02 (3) 19:09 (3)	02:25 20:58
29	07:57 15:47	06:38 17:05	05:17 18:12	03:48 17:35 (5)	03:48 17:35 (5)	02:40 19:26	19:02 (3) 19:09 (3)	02:25 20:58
30	07:55 15:49	06:35 17:02	05:14 18:15	03:45 17:34 (5)	03:45 17:34 (5)	02:39 19:29	19:02 (3) 19:09 (3)	02:26 20:58
31	07:53 15:52	06:32 17:00	05:11 18:17	03:42 17:33 (5)	03:42 17:33 (5)	02:37 19:31	19:02 (3) 19:09 (3)	02:26 20:58
Potential sun hours	216	257	365	434	526	554		
Total, worst case			214	198	346			
Sun reduction			0.28	0.30	0.35			
Oper. time red.			0.93	0.93	0.93			
Wind dir. red.			0.59	0.63	0.72			
Total reduction			0.15	0.18	0.23			
Total, real			33	35	81			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FB - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (362)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum

813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	July	August	September	October	November	December	
1	02:27 20:57	03:22 20:07	19:01 (3) 18:43	04:33 18:10 (4)	17:52 (4) 17:14	06:56 15:48	08:07 14:48
2	02:28 20:56	03:24 20:04	19:01 (3) 19:23 (3)	04:35 18:40	17:52 (4) 17:12	06:58 15:45	08:09 14:47
3	02:29 20:56	03:26 20:02	19:00 (3) 19:23 (3)	04:38 18:37	17:52 (4) 18:05 (4)	05:46 17:09	07:01 15:43
4	02:30 20:55	03:29 20:00	19:00 (3) 19:22 (3)	04:40 18:34	17:52 (4) 18:02 (4)	05:49 17:06	07:03 15:40
5	02:31 20:54	03:31 19:57	19:00 (2) 19:20 (3)	04:42 18:31	17:52 (4) 17:59 (4)	05:51 17:03	07:06 15:38
6	02:33 20:53	03:33 19:55	18:58 (2) 19:18 (3)	04:45 18:29	17:52 (4) 17:56 (4)	05:53 17:00	07:08 15:36
7	02:34 20:52	03:35 19:52	18:57 (2) 19:15 (3)	04:47 18:26	05:56 16:57	07:11 15:33	08:18 14:42
8	02:35 20:51	03:38 19:50	18:57 (2) 19:13 (2)	04:49 18:23	17:10 (5) 17:21 (5)	05:58 16:54	07:13 15:31
9	02:37 20:50	03:40 19:47	18:56 (2) 19:10 (2)	04:51 18:20	17:07 (5) 17:23 (5)	06:00 16:51	07:16 15:28
10	02:38 20:48	03:42 19:44	18:56 (2) 19:08 (2)	04:54 18:17	17:05 (5) 17:24 (5)	06:03 16:48	07:18 15:26
11	02:40 20:47	03:45 19:42	18:55 (2) 19:05 (2)	04:56 18:14	17:03 (5) 17:24 (5)	06:05 16:45	07:21 15:24
12	02:42 20:46	03:47 19:39	18:55 (2) 19:03 (2)	04:58 18:11	17:02 (5) 17:25 (5)	06:07 16:42	07:23 15:22
13	02:43 20:44	03:49 19:37	18:56 (2) 19:01 (2)	05:01 18:08	17:01 (5) 17:26 (5)	06:10 16:40	07:26 15:19
14	02:45 20:43	03:52 19:34	18:57 (2) 18:59 (2)	05:03 18:05	17:00 (5) 17:25 (5)	06:12 16:37	07:28 15:17
15	02:47 20:41	03:54 19:31	05:05 18:02	05:05 17:25 (5)	17:00 (5) 16:34	06:14 15:15	07:30 14:38
16	02:49 20:40	03:56 19:28	05:07 17:59	05:07 17:24 (5)	16:59 (5) 16:31	06:17 15:13	07:33 14:38
17	02:50 20:38	03:59 19:26	05:10 17:56	05:10 17:24 (5)	17:00 (5) 16:28	06:19 15:11	07:35 14:38
18	02:52 20:36	04:01 19:23	05:12 17:53	05:12 17:21 (5)	16:59 (5) 16:25	06:22 15:09	07:38 14:38
19	02:54 20:34	04:03 19:20	05:14 17:50	05:14 17:18 (5)	16:59 (5) 16:23	06:24 15:07	07:40 14:38
20	02:56 20:32	04:05 19:17	05:16 17:47	05:16 17:14 (5)	17:00 (5) 16:20	06:26 15:05	07:42 14:39
21	02:58 20:31	04:08 19:15	05:19 17:44	05:19 17:12 (5)	17:01 (5) 16:17	06:29 15:03	07:45 14:39
22	03:00 20:29	04:10 19:12	05:21 17:41	05:21 17:02 (5)	17:12 (5) 16:14	16:17 15:02	15:03 14:39
23	03:02 20:27	19:09 (3) 19:15 (3)	04:12 19:09	05:23 17:38	17:04 (5) 17:06 (5)	06:34 16:12	07:49 15:00
24	03:04 20:25	19:07 (3) 19:17 (3)	04:15 19:06	05:26 17:35	16:12 16:09	15:00 14:58	14:40 14:41
25	03:06 20:22	19:05 (3) 19:19 (3)	04:17 19:03	05:28 17:32	06:39 16:06	07:54 14:57	08:36 14:41
26	03:09 20:20	19:04 (3) 19:20 (3)	04:19 19:00	05:30 17:29	06:41 16:04	07:56 14:55	08:36 14:42
27	03:11 20:18	19:03 (3) 19:21 (3)	04:22 18:58	05:32 17:26	06:43 16:01	07:58 14:53	08:36 14:43
28	03:13 20:16	19:03 (3) 19:22 (3)	04:24 18:55	17:59 (4) 18:08 (4)	05:35 17:23	06:46 15:58	08:00 14:52
29	03:15 20:14	19:02 (3) 19:22 (3)	04:26 18:52	17:56 (4) 18:09 (4)	05:37 17:20	06:48 15:56	08:02 14:51
30	03:17 20:11	19:02 (3) 19:23 (3)	04:29 18:49	17:54 (4) 18:10 (4)	05:39 17:17	06:51 15:53	08:05 14:49
31	03:19 20:09	19:01 (3) 19:23 (3)	04:31 18:46	17:53 (4) 18:10 (4)	05:41 15:50	06:53 15:50	08:06 14:47
Potential sun hours	551	481	387	318	232	194	
Total, worst case	146	269	357				
Sun reduction	0.26	0.24	0.26				
Oper. time red.	0.93	0.93	0.93				
Wind dir. red.	0.72	0.70	0.60				
Total reduction	0.17	0.16	0.15				
Total, real	25	42	52				

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FC - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (363)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	
1	08:35	07:51	06:38	05:08	17:36 (5)	03:43	02:36
	14:49	15:54	17:05	18:19	17:49 (5)	19:31	19:19 (3)
2	08:35	07:49	06:36	05:05	17:35 (5)	03:40	20:38
	14:50	15:57	17:08	18:22	17:51 (5)	19:33	6 19:25 (3)
3	08:34	07:46	06:33	05:02	17:33 (5)	03:37	02:34
	14:52	16:00	17:10	18:24	17:53 (5)	19:36	02:33
4	08:34	07:44	06:30	04:59	17:33 (5)	03:35	02:42
	14:53	16:02	17:13	18:27	17:55 (5)	19:38	02:32
5	08:33	07:42	06:27	04:56	17:32 (5)	03:32	20:43
	14:55	16:05	17:15	18:29	17:57 (5)	19:41	19:03 (2)
6	08:32	07:39	06:24	04:53	17:32 (5)	03:30	02:30
	14:57	16:07	17:18	18:31	17:58 (5)	19:43	2 19:04 (2)
7	08:32	07:37	06:21	04:50	17:32 (5)	03:27	19:02 (2)
	14:58	16:10	17:20	18:34	17:57 (5)	19:45	5 19:07 (2)
8	08:31	07:35	06:18	04:47	17:32 (5)	03:25	19:01 (2)
	15:00	16:12	17:22	18:36	17:56 (5)	19:48	7 19:08 (2)
9	08:30	07:32	06:15	04:44	17:32 (5)	03:22	19:01 (2)
	15:02	16:15	17:25	18:38	17:56 (5)	19:50	9 19:10 (2)
10	08:29	07:30	06:13	04:41	17:32 (5)	03:20	19:02 (2)
	15:04	16:17	17:27	18:41	17:54 (5)	19:52	11 19:13 (2)
11	08:28	07:27	06:10	04:38	17:32 (5)	03:17	19:02 (2)
	15:06	16:20	17:30	18:43	17:53 (5)	19:55	13 19:15 (2)
12	08:27	07:25	06:07	04:36	17:34 (5)	03:15	19:02 (2)
	15:08	16:23	17:32	18:46	18:14 (4)	19:57	15 19:17 (2)
13	08:25	07:22	06:04	04:33	17:36 (5)	03:12	16 19:08 (3)
	15:10	16:25	17:34	18:48	18:16 (4)	19:59	18 19:20 (3)
14	08:24	07:19	06:01	04:30	17:38 (5)	03:10	17 19:03 (2)
	15:12	16:28	17:37	18:50	18:18 (4)	20:02	19 19:20 (3)
15	08:23	07:17	05:58	04:27	18:10 (4)	03:08	18 19:04 (2)
	15:14	16:30	17:39	18:53	18:20 (4)	20:04	19 19:05 (2)
16	08:21	07:14	05:55	04:24	18:09 (4)	03:06	19 19:24 (3)
	15:16	16:33	17:42	18:55	18:22 (4)	20:06	19 19:08 (2)
17	08:20	07:11	05:52	04:21	18:10 (4)	03:03	20 19:26 (3)
	15:18	16:35	17:44	18:57	18:25 (4)	20:08	18 19:09 (3)
18	08:18	07:09	05:49	04:18	18:09 (4)	03:01	19 19:22 (3)
	15:21	16:38	17:46	19:00	18:27 (4)	20:11	19 19:28 (3)
19	08:16	07:06	05:46	04:15	18:09 (4)	02:59	21 19:10 (3)
	15:23	16:40	17:49	19:02	18:26 (4)	20:13	22 19:31 (3)
20	08:15	07:03	05:43	04:13	18:11 (4)	02:57	22 19:32 (3)
	15:25	16:43	17:51	19:05	18:25 (4)	20:15	21 19:10 (3)
21	08:13	07:01	05:40	04:10	18:12 (4)	02:55	21 19:31 (3)
	15:27	16:45	17:53	19:07	18:24 (4)	20:17	21 19:31 (3)
22	08:11	06:58	05:37	04:07	18:13 (4)	02:53	21 19:11 (3)
	15:30	16:48	17:56	19:09	18:21 (4)	20:19	21 19:32 (3)
23	08:09	06:55	05:34	04:04	18:14 (4)	02:51	21 19:11 (3)
	15:32	16:50	17:58	19:12	18:22 (4)	20:21	21 19:31 (3)
24	08:08	06:52	05:31	04:01	18:11 (4)	02:49	20 19:11 (3)
	15:35	16:53	18:01	19:14	18:23 (4)	20:23	20 19:31 (3)
25	08:06	06:50	05:28	03:59	18:12 (4)	02:47	19 19:30 (3)
	15:37	16:55	18:03	19:17	18:24 (4)	20:25	19 19:12 (3)
26	08:04	06:47	05:25	03:56	18:13 (4)	02:45	18 19:30 (3)
	15:39	16:58	18:05	19:19	18:25 (4)	20:27	18 19:12 (3)
27	08:02	06:44	05:23	03:53	18:14 (4)	02:44	18 19:30 (3)
	15:42	17:00	18:08	19:21	18:26 (4)	20:29	16 19:13 (3)
28	08:00	06:41	05:20	03:51	18:15 (4)	02:42	16 19:29 (3)
	15:44	17:03	18:10	19:24	18:27 (4)	20:31	15 19:14 (3)
29	07:57	06:38	05:17	03:48	18:16 (4)	02:40	15 19:29 (3)
	15:47	17:06	18:12	19:26	18:28 (4)	20:33	15 19:15 (3)
30	07:55	06:35	05:14	03:45	18:17 (4)	02:39	13 19:28 (3)
	15:49	17:08	18:15	19:29	18:29 (4)	20:35	13 19:16 (3)
31	07:53	06:33	05:11	03:43	18:18 (4)	02:37	11 19:27 (3)
	15:52	17:11	18:17	19:31	18:30 (4)	20:37	9 19:18 (3)
Potential sun hours	216	257	365	434	526	554	9 19:27 (3)
Total, worst case			12	399	414	6	
Sun reduction			0.28	0.30	0.35	0.30	
Oper. time red.			0.93	0.93	0.93	0.93	
Wind dir. red.			0.63	0.64	0.73	0.73	
Total reduction			0.16	0.18	0.24	0.21	
Total, real			2	71	99	1	

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

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

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FC - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (363)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27 20:57	03:22 20:07	19:13 (2) 18:43	04:33 17:31 (5)	05:42 17:14	06:56 15:48
2	02:28 20:56	03:24 20:04	19:12 (2) 19:27 (2)	04:35 18:40	05:44 17:12	06:58 15:45
3	02:29 20:56	03:26 20:02	19:12 (2) 19:24 (2)	04:38 18:37	05:46 17:09	07:01 15:43
4	02:30 20:55	03:29 20:00	19:12 (2) 19:22 (2)	04:40 18:34	05:49 17:06	07:03 15:40
5	02:32 20:54	03:31 19:57	19:12 (2) 19:20 (2)	04:42 18:31	05:51 17:03	07:06 15:38
6	02:33 20:53	03:33 19:55	19:12 (2) 19:18 (2)	04:45 18:29	05:53 17:00	07:08 15:36
7	02:34 20:52	03:35 19:52	19:12 (2) 19:15 (2)	04:47 18:26	05:56 16:57	07:11 15:33
8	02:35 20:51	03:38 19:50	19:12 (2) 19:13 (2)	04:49 18:23	05:58 16:54	07:13 15:31
9	02:37 20:50	03:40 19:47	04:51 18:20	06:00 17:47 (5)	06:00 16:51	07:16 15:28
10	02:38 20:48	03:42 19:44	04:54 18:17	06:03 17:44 (5)	06:03 16:48	07:18 15:26
11	02:40 20:47	19:28 (3) 19:32 (3)	03:45 19:42	04:56 18:14	06:05 17:41 (5)	07:21 15:24
12	02:42 20:46	19:26 (3) 19:34 (3)	03:47 19:39	04:58 18:11	06:07 17:38 (5)	07:23 15:22
13	02:43 20:44	19:25 (3) 19:36 (3)	03:49 19:37	05:01 18:08	06:10 17:31 (5)	07:26 15:19
14	02:45 20:43	19:24 (3) 19:36 (3)	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:17
15	02:47 20:41	19:23 (3) 19:38 (3)	03:54 19:31	05:05 18:02	06:14 16:34	07:30 15:15
16	02:49 20:40	19:22 (3) 19:38 (3)	03:56 19:28	05:07 17:59	06:17 16:31	07:33 15:13
17	02:50 20:38	19:22 (3) 19:39 (3)	03:59 19:26	05:10 17:56	06:19 16:28	07:35 15:11
18	02:52 20:36	19:22 (3) 19:40 (3)	04:01 19:23	05:12 17:53	06:22 16:25	07:38 15:09
19	02:54 20:34	19:21 (3) 19:40 (3)	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:07
20	02:56 20:32	19:21 (3) 19:41 (3)	04:06 19:17	05:16 17:47	06:26 16:20	07:42 15:05
21	02:58 20:31	19:21 (3) 19:41 (3)	04:08 19:15	05:19 18:18 (4)	06:29 16:17	07:45 15:03
22	03:00 20:29	19:20 (3) 19:41 (3)	04:10 19:12	05:21 18:16 (4)	06:31 16:14	07:47 15:02
23	03:02 20:27	19:20 (3) 19:41 (3)	04:12 19:09	05:23 18:14 (4)	06:34 16:12	07:49 15:00
24	03:04 20:25	19:20 (3) 19:42 (3)	04:15 19:06	05:26 18:13 (4)	06:36 16:09	07:52 14:58
25	03:06 20:22	19:20 (3) 19:42 (3)	04:17 19:03	05:28 18:12 (4)	06:39 16:06	07:54 14:57
26	03:09 20:20	19:20 (3) 19:40 (3)	04:19 19:00	05:30 18:11 (4)	06:41 16:04	07:56 14:55
27	03:11 20:18	19:20 (3) 19:38 (3)	04:22 18:58	05:32 18:12 (4)	06:43 16:01	07:58 14:53
28	03:13 20:16	19:17 (2) 19:37 (3)	04:24 18:55	05:35 18:12 (4)	06:46 15:58	08:00 14:52
29	03:15 20:14	19:16 (2) 19:35 (3)	04:26 18:52	05:37 18:19 (4)	06:48 15:56	08:02 14:51
30	03:17 20:11	19:14 (2) 19:33 (3)	04:29 18:49	05:39 18:16 (4)	06:51 15:53	08:05 14:49
31	03:19 20:09	19:14 (2) 19:31 (3)	04:31 18:46	05:41 18:13 (4)	06:53 15:50	08:06 14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	359	236	252			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.73	0.68	0.63			
Total reduction	0.18	0.15	0.15			
Total, real	64	36	38			

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)

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FD - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (364)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June
1	08:35	07:51	06:38	05:08	17:16 (5)	03:42
	14:49	15:54	17:05	18:19	17:41 (5)	19:31
2	08:35	07:49	06:36	05:05	17:16 (5)	03:40
	14:50	15:57	17:08	18:22	17:40 (5)	19:33
3	08:34	07:46	06:33	05:02	17:17 (5)	03:37
	14:52	16:00	17:10	18:24	17:39 (5)	19:36
4	08:34	07:44	06:30	04:59	17:17 (5)	03:35
	14:53	16:02	17:13	18:27	17:38 (5)	19:38
5	08:33	07:42	06:27	04:56	17:18 (5)	03:32
	14:55	16:05	17:15	18:29	17:36 (5)	19:41
6	08:32	07:39	06:24	04:53	17:20 (5)	03:30
	14:57	16:07	17:17	18:31	17:35 (5)	19:43
7	08:32	07:37	06:21	04:50	17:23 (5)	03:27
	14:58	16:10	17:20	18:34	17:32 (5)	19:45
8	08:31	07:35	06:18	04:47	18:01 (4)	03:25
	15:00	16:12	17:22	18:36	18:05 (4)	19:48
9	08:30	07:32	06:15	04:44	18:00 (4)	03:22
	15:02	16:15	17:25	18:38	18:07 (4)	19:50
10	08:29	07:30	06:13	04:41	17:59 (4)	03:20
	15:04	16:17	17:27	18:41	18:09 (4)	19:52
11	08:28	07:27	06:10	04:38	17:58 (4)	03:17
	15:06	16:20	17:30	18:43	18:11 (4)	19:55
12	08:27	07:25	06:07	04:36	17:58 (4)	03:15
	15:08	16:23	17:32	18:46	18:13 (4)	19:57
13	08:25	07:22	06:04	04:33	17:58 (4)	03:12
	15:10	16:25	17:34	18:48	18:16 (4)	19:59
14	08:24	07:19	06:01	04:30	17:59 (4)	03:10
	15:12	16:28	17:37	18:50	18:15 (4)	20:02
15	08:23	07:17	05:58	04:27	17:59 (4)	03:08
	15:14	16:30	17:39	18:53	18:14 (4)	20:04
16	08:21	07:14	05:55	04:24	18:00 (4)	03:06
	15:16	16:33	17:42	18:55	18:12 (4)	20:06
17	08:20	07:11	05:52	04:21	18:02 (4)	03:03
	15:18	16:35	17:44	18:57	18:11 (4)	20:08
18	08:18	07:09	05:49	04:18	03:01	03:01
	15:21	16:38	17:46	19:00	20:11	19:17 (3)
19	08:16	07:06	05:46	04:15	02:59	18:58 (3)
	15:23	16:40	17:49	19:02	20:13	19:16 (3)
20	08:15	07:03	05:43	04:13	02:57	18:59 (3)
	15:25	16:43	17:51	19:05	20:15	19:15 (3)
21	08:13	07:01	05:40	04:10	02:55	19:00 (3)
	15:27	16:45	17:53	19:07	20:17	19:14 (3)
22	08:11	06:58	05:37	04:07	02:53	19:02 (3)
	15:30	16:48	17:56	19:09	20:19	19:13 (3)
23	08:09	06:55	05:34	17:27 (5)	04:04	02:51
	15:32	16:50	17:58	2	17:28 (5)	19:12
24	08:08	06:52	05:31	17:24 (5)	04:01	02:49
	15:35	16:53	18:01	6	17:30 (5)	19:14
25	08:06	06:50	05:28	17:22 (5)	03:59	02:47
	15:37	16:55	18:03	11	17:33 (5)	19:17
26	08:04	06:47	05:25	17:20 (5)	03:56	02:45
	15:39	16:58	18:05	15	17:35 (5)	19:19
27	08:02	06:44	05:23	17:19 (5)	03:53	02:44
	15:42	17:00	18:08	18	17:37 (5)	19:21
28	08:00	06:41	05:20	17:18 (5)	03:51	02:42
	15:44	17:03	18:10	22	17:40 (5)	19:24
29	07:57		05:17	17:17 (5)	03:48	02:40
	15:47		18:12	25	17:42 (5)	19:26
30	07:55		05:14	17:17 (5)	03:45	18:53 (2)
	15:49		18:15	25	17:42 (5)	19:29
31	07:53		05:11	17:16 (5)	03:42	18:54 (2)
	15:52		18:17	26	17:42 (5)	19:31
Potential sun hours	216	257	365	434	526	554
Total, worst case			150	255	367	
Sun reduction			0.28	0.30	0.35	
Oper. time red.			0.93	0.93	0.93	
Wind dir. red.			0.60	0.63	0.72	
Total reduction			0.16	0.18	0.24	
Total, real			24	45	86	

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)



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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FD - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (364)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	July	August	September	October	November	December
1	02:27	03:22	19:06 (3) 04:33	17:57 (4) 05:42	06:56	08:07
	20:57	20:07	19:29 (3) 18:43	18:10 (4) 17:14	15:48	14:48
2	02:28	03:24	19:06 (3) 04:35	17:58 (4) 05:44	06:58	08:08
	20:56	20:04	19:27 (3) 18:40	18:08 (4) 17:12	15:45	14:47
3	02:29	03:26	19:05 (2) 04:38	17:58 (4) 05:46	07:01	08:10
	20:56	20:02	19:24 (3) 18:37	18:05 (4) 17:09	15:43	14:46
4	02:30	03:29	19:03 (2) 04:40	17:58 (4) 05:49	07:03	08:12
	20:55	20:00	19:22 (3) 18:34	18:02 (4) 17:06	15:40	14:45
5	02:31	03:31	19:02 (2) 04:42	17:19 (5) 05:51	07:06	08:14
	20:54	19:57	18:20 (3) 18:31	17:28 (5) 17:03	15:38	14:44
6	02:33	03:33	19:01 (2) 04:45	17:15 (5) 05:53	07:08	08:16
	20:53	19:55	17:18 (3) 18:29	17:30 (5) 17:00	15:36	14:43
7	02:34	03:35	19:01 (2) 04:47	17:14 (5) 05:56	07:11	08:18
	20:52	19:52	14:19 (2) 18:26	17:32 (5) 16:57	15:33	14:42
8	02:35	03:38	19:00 (2) 04:49	17:12 (5) 05:58	07:13	08:19
	20:51	19:50	13:19 (2) 18:23	17:33 (5) 16:54	15:31	14:41
9	02:37	03:40	19:00 (2) 04:51	17:11 (5) 06:00	07:16	08:21
	20:50	19:47	10:19 (2) 18:20	17:33 (5) 16:51	15:28	14:40
10	02:38	03:42	19:00 (2) 04:54	17:10 (5) 06:03	07:18	08:22
	20:48	19:44	8:19 (2) 18:17	17:34 (5) 16:48	15:26	14:40
11	02:40	03:45	19:00 (2) 04:56	17:09 (5) 06:05	07:21	08:24
	20:47	19:42	5:19 (2) 18:14	17:33 (5) 16:45	15:24	14:39
12	02:42	03:47	19:00 (2) 04:58	17:08 (5) 06:07	07:23	08:25
	20:46	19:39	3:19 (2) 18:11	17:33 (5) 16:42	15:22	14:39
13	02:43	03:49	18:08	17:08 (5) 06:10	07:26	08:26
	20:44	19:37	18:08	17:34 (5) 16:40	15:19	14:39
14	02:45	03:52	18:05	17:08 (5) 06:12	07:28	08:28
	20:43	19:34	18:05	17:33 (5) 16:37	15:17	14:38
15	02:47	03:54	18:02	17:08 (5) 06:14	07:30	08:29
	20:41	19:31	18:02	17:30 (5) 16:34	15:15	14:38
16	02:49	03:56	18:00	17:08 (5) 06:17	07:33	08:30
	20:40	19:28	17:59	17:26 (5) 16:31	15:13	14:38
17	02:50	03:59	17:56	17:09 (5) 06:19	07:35	08:31
	20:38	19:26	17:56	17:24 (5) 16:28	15:11	14:38
18	02:52	04:01	17:53	17:09 (5) 06:22	07:38	08:32
	20:36	19:23	17:53	17:21 (5) 16:25	15:09	14:38
19	02:54	04:03	17:50	17:10 (5) 06:24	07:40	08:33
	20:34	19:20	17:50	17:18 (5) 16:23	15:07	14:38
20	02:56	19:15 (3) 04:05	17:47	17:12 (5) 06:26	07:42	08:33
	20:32	19:19 (3) 19:17	17:47	17:14 (5) 16:20	15:05	14:39
21	02:58	19:13 (3) 04:08	17:44	16:29	07:45	08:34
	20:31	9:19 (2) 19:15	17:44	16:17	15:03	14:39
22	03:00	19:11 (3) 04:10	17:41	06:31	07:47	08:34
	20:29	12:19 (2) 19:12	17:41	16:14	15:02	14:39
23	03:02	19:10 (3) 04:12	17:38	06:34	07:49	08:35
	20:27	14:19 (2) 19:09	17:38	16:12	15:00	14:40
24	03:04	19:09 (3) 04:15	17:35	06:36	07:52	08:35
	20:25	16:19 (2) 19:06	17:35	16:09	14:58	14:41
25	03:06	19:08 (3) 04:17	17:32	06:39	07:54	08:36
	20:22	18:19 (2) 19:03	17:32	16:06	14:57	14:41
26	03:09	19:08 (3) 04:19	18:04 (4) 05:30	06:41	07:56	08:36
	20:20	19:19 (3) 19:00	18:13 (4) 17:29	16:04	14:55	14:42
27	03:11	19:07 (3) 04:22	18:02 (4) 05:32	06:43	07:58	08:36
	20:18	21:19 (2) 18:58	18:15 (4) 17:26	16:01	14:53	14:43
28	03:13	19:07 (3) 04:24	18:01 (4) 05:35	06:46	08:00	08:36
	20:16	21:18 (2) 18:55	18:16 (4) 17:23	15:58	14:52	14:44
29	03:15	19:07 (3) 04:26	17:59 (4) 05:37	06:48	08:02	08:36
	20:14	22:19 (2) 18:52	18:16 (4) 17:20	15:56	14:51	14:45
30	03:17	19:07 (3) 04:29	17:58 (4) 05:39	06:51	08:05	08:36
	20:11	22:19 (2) 18:49	18:16 (4) 17:17	15:53	14:49	14:46
31	03:19	19:06 (3) 04:31	17:58 (4) 17:17	06:53	14:49	08:36
	20:09	23:19 (2) 18:46	18:13 (4) 17:17	15:50	14:47	14:47
Potential sun hours	551	481	387	318	232	194
Total, worst case	201	257	320			
Sun reduction	0.26	0.24	0.26			
Oper. time red.	0.93	0.93	0.93			
Wind dir. red.	0.72	0.70	0.61			
Total reduction	0.18	0.16	0.15			
Total, real	35	40	47			

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FE - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (365)

Assumptions for shadow calculations

Maximum distance for influence 1 500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1281 1143 697 478 515 675 1091 8182
Idle start wind speed: Cut in wind speed from power curve

Table with 12 columns (months) and rows for each day (1-31) showing sunrise, sunset, and shadow data. Includes summary rows for 'Potential sun hours' and 'Total, real'.

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

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





Project:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FH - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (368)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:54	17:05	18:19	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:09
	14:50	15:57	17:08	18:22	19:33	20:40	20:56	20:04	18:40	17:12	15:45	14:47
3	08:34	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:10
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:03	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:45
5	08:33	07:42	06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:31	17:03	15:38	14:44
6	08:32	07:39	06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:56	16:07	17:17	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:45	20:47	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:18	04:47	03:25	02:27	02:35	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:15	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29	07:30	06:13	04:41	03:20	02:26	02:38	03:42	04:54	06:03	07:18	08:22
	15:04	16:17	17:27	18:41	19:52	20:51	20:48	19:44	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:27	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
	15:08	16:23	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39
13	08:25	07:22	06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	08:26
	15:10	16:25	17:34	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:19	14:39
14	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:14	07:30	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:07	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:28	17:59	16:31	15:13	14:38
17	08:20	07:11	05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31
	15:18	16:35	17:44	18:57	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:20	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:16	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
20	08:15	07:03	05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:42	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:32	19:17	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27	16:45	17:53	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
22	08:11	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:34
	15:30	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
23	08:09	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	08:35
	15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:52	05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	08:35
	15:35	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
	15:37	16:55	18:03	19:17	20:25	20:59	20:22	19:03	17:32	16:06	14:57	14:41
26	08:04	06:47	05:25	03:56	02:45	02:23	03:09	04:19	05:30	06:41	07:56	08:36
	15:39	16:58	18:05	19:19	20:27	20:59	20:20	19:00	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:43	07:58	08:36
	15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:00	08:36
	15:44	17:03	18:10	19:24	20:31	20:58	20:16	18:55	17:23	15:58	14:52	14:44
29	07:57		05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	08:02	08:36
	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45
30	07:55		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:49		18:15	19:29	20:35	20:58	20:11	18:49	17:17	15:53	14:49	14:46
31	07:53		05:11		02:37		03:19	04:31		06:53		08:36
	15:52		18:17		20:37		20:09	18:46		15:50		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FI - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (369)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:54	17:05	18:19	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:09
	14:50	15:57	17:08	18:22	19:33	20:40	20:56	20:04	18:40	17:12	15:45	14:47
3	08:34	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:10
	14:52	15:59	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:03	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:45
5	08:33	07:42	06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:31	17:03	15:38	14:44
6	08:33	07:39	06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:56	16:07	17:17	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:45	20:47	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:18	04:47	03:25	02:27	02:35	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:15	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29	07:30	06:13	04:41	03:20	02:26	02:38	03:42	04:54	06:03	07:18	08:22
	15:04	16:17	17:27	18:41	19:52	20:51	20:48	19:44	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:27	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
	15:08	16:23	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39
13	08:25	07:22	06:04	04:33	03:12	02:23	02:43	03:49	05:01	06:10	07:26	08:26
	15:10	16:25	17:34	18:48	19:59	20:54	20:44	19:37	18:08	16:40	15:19	14:39
14	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:14	07:30	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:07	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:28	17:59	16:31	15:13	14:38
17	08:20	07:11	05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31
	15:18	16:35	17:44	18:57	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:20	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:16	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
20	08:15	07:03	05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:42	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:32	19:17	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27	16:45	17:53	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
22	08:11	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:34
	15:30	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
23	08:09	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	08:35
	15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:52	05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	08:35
	15:35	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
	15:37	16:55	18:03	19:17	20:25	20:59	20:22	19:03	17:32	16:06	14:57	14:41
26	08:04	06:47	05:25	03:56	02:45	02:23	03:09	04:19	05:30	06:41	07:56	08:36
	15:39	16:58	18:05	19:19	20:27	20:59	20:20	19:00	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:43	07:58	08:36
	15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:00	08:36
	15:44	17:03	18:10	19:24	20:31	20:58	20:16	18:55	17:23	15:58	14:52	14:44
29	07:57		05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	08:02	08:36
	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45
30	07:55		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:49		18:15	19:29	20:35	20:58	20:11	18:49	17:17	15:53	14:49	14:46
31	07:53		05:11		02:37		03:19	04:31		06:53		08:36
	15:52		18:17		20:37		20:09	18:46		15:50		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FJ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (370)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:54	17:05	18:19	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:09
	14:50	15:57	17:08	18:22	19:33	20:40	20:56	20:04	18:40	17:12	15:45	14:47
3	08:34	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:10
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	14:56	16:07	17:17	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
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	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
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14	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:14	07:30	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
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	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:28	17:59	16:31	15:13	14:38
17	08:20	07:11	05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31
	15:18	16:35	17:44	18:57	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:20	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:16	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
20	08:15	07:03	05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:42	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:32	19:17	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27	16:45	17:53	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
22	08:11	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:34
	15:30	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
23	08:09	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	08:35
	15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:52	05:31	04:01	02:49	02:22	03:04	04:15	05:26	06:36	07:52	08:35
	15:35	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
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26	08:04	06:47	05:25	03:56	02:45	02:23	03:09	04:19	05:30	06:41	07:56	08:36
	15:39	16:58	18:05	19:19	20:27	20:59	20:20	19:00	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:43	07:58	08:36
	15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:00	08:36
	15:44	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:23	15:58	14:52	14:44
29	07:57		05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	08:02	08:36
	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45
30	07:55		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:49		18:15	19:29	20:35	20:58	20:11	18:49	17:17	15:53	14:49	14:46
31	07:53		05:11		02:37		03:19	04:31		06:53		08:36
	15:52		18:17		20:37		20:09	18:46		15:50		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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15.08.2011 12:14 / 229

Licensed user:

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NO-2007 Kjeller  
(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

Calculation: Skyggekast Gismarvik Shadow receptor: FK - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (371)

**Assumptions for shadow calculations**

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:54	17:05	18:19	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:09
	14:50	15:57	17:08	18:22	19:33	20:40	20:56	20:04	18:40	17:12	15:45	14:47
3	08:34	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:10
	14:52	15:59	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:49	07:03	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:45
5	08:33	07:42	06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:31	17:03	15:38	14:44
6	08:33	07:39	06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:56	16:07	17:17	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:56	07:11	08:18
	14:58	16:10	17:20	18:34	19:45	20:47	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:18	04:47	03:25	02:27	02:35	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:15	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29	07:30	06:13	04:41	03:20	02:26	02:38	03:42	04:54	06:03	07:18	08:22
	15:04	16:17	17:27	18:41	19:52	20:51	20:48	19:44	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:27	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
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	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:14	07:30	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:07	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:28	17:59	16:31	15:13	14:38
17	08:20	07:11	05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31
	15:18	16:35	17:44	18:57	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:20	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:16	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:33
	15:23	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
20	08:15	07:03	05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:42	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:32	19:17	17:47	16:20	15:05	14:39
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	15:27	16:45	17:53	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
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	15:30	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
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	15:35	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
	15:37	16:55	18:03	19:17	20:25	20:59	20:22	19:03	17:32	16:06	14:57	14:41
26	08:04	06:47	05:25	03:56	02:45	02:23	03:09	04:19	05:30	06:41	07:56	08:36
	15:39	16:58	18:05	19:19	20:27	20:59	20:20	19:00	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:43	07:58	08:36
	15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:00	08:36
	15:44	17:03	18:10	19:24	20:31	20:59	20:16	18:55	17:23	15:58	14:52	14:44
29	07:57		05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	08:02	08:36
	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45
30	07:55		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:49		18:15	19:29	20:35	20:58	20:11	18:49	17:17	15:53	14:49	14:46
31	07:53		05:11		02:37		03:19	04:31		06:53		08:36
	15:52		18:17		20:37		20:09	18:46		15:50		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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15.08.2011 12:14 / 230

Licensed user:

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(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FL - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (372)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:54	17:05	18:19	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:08
	14:50	15:57	17:08	18:22	19:33	20:40	20:56	20:04	18:40	17:12	15:45	14:47
3	08:34	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:10
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:03	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:45
5	08:33	07:42	06:27	04:56	03:32	02:30	02:32	03:31	04:42	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:31	17:03	15:38	14:44
6	08:32	07:39	06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:57	16:07	17:17	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:55	07:11	08:18
	14:58	16:10	17:20	18:34	19:45	20:47	20:52	19:52	18:26	16:57	15:33	14:42
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	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29	07:30	06:13	04:41	03:20	02:26	02:38	03:42	04:54	06:03	07:18	08:22
	15:04	16:17	17:27	18:41	19:52	20:51	20:48	19:44	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:26	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
	15:08	16:23	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39
13	08:25	07:22	06:04	04:33	03:12	02:24	02:43	03:49	05:01	06:10	07:26	08:26
	15:10	16:25	17:34	18:48	19:59	20:54	20:44	19:36	18:08	16:40	15:19	14:39
14	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:14	07:30	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:07	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:28	17:59	16:31	15:13	14:38
17	08:20	07:11	05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31
	15:18	16:35	17:44	18:57	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:21	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:16	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:32
	15:23	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
20	08:15	07:03	05:43	04:13	02:57	02:22	02:56	04:06	05:16	06:26	07:42	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:32	19:17	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27	16:45	17:53	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
22	08:11	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:34
	15:30	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
23	08:09	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	08:35
	15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:52	05:31	04:01	02:49	02:23	03:04	04:15	05:26	06:36	07:52	08:35
	15:35	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
	15:37	16:55	18:03	19:17	20:25	20:59	20:22	19:03	17:32	16:06	14:57	14:41
26	08:04	06:47	05:25	03:56	02:45	02:23	03:09	04:19	05:30	06:41	07:56	08:36
	15:39	16:58	18:05	19:19	20:27	20:59	20:20	19:00	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:43	07:58	08:36
	15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:00	08:36
	15:44	17:03	18:10	19:24	20:31	20:58	20:16	18:55	17:23	15:58	14:52	14:44
29	07:57		05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	08:02	08:36
	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45
30	07:55		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:49		18:15	19:29	20:35	20:58	20:11	18:49	17:17	15:53	14:49	14:46
31	07:53		05:11		02:37		03:19	04:31		06:53		08:36
	15:52		18:17		20:37		20:09	18:46		15:50		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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15.08.2011 12:14 / 231

Licensed user:

Kjeller Vindteknikk AS  
Gunnar Randres vei 12  
NO-2007 Kjeller  
(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FM - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (373)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07
	14:49	15:54	17:05	18:19	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:08
	14:50	15:57	17:08	18:22	19:33	20:40	20:56	20:04	18:40	17:12	15:45	14:47
3	08:34	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:10
	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:03	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:45
5	08:33	07:42	06:27	04:56	03:32	02:30	02:32	03:31	04:42	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:31	17:03	15:38	14:44
6	08:32	07:39	06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:57	16:07	17:17	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:55	07:11	08:18
	14:58	16:10	17:20	18:34	19:45	20:47	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:35	06:18	04:47	03:25	02:27	02:35	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:15	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
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	15:04	16:17	17:27	18:41	19:52	20:51	20:48	19:44	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:26	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
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13	08:25	07:22	06:04	04:33	03:12	02:24	02:43	03:49	05:01	06:10	07:26	08:26
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14	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:14	07:30	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:07	06:17	07:33	08:30
	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:28	17:59	16:31	15:13	14:38
17	08:20	07:11	05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31
	15:18	16:35	17:44	18:57	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
18	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
	15:21	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
19	08:16	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:32
	15:23	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
20	08:15	07:03	05:43	04:13	02:57	02:22	02:56	04:06	05:16	06:26	07:42	08:33
	15:25	16:43	17:51	19:05	20:15	20:59	20:32	19:17	17:47	16:20	15:05	14:39
21	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
	15:27	16:45	17:53	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
22	08:11	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:34
	15:30	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
23	08:09	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	08:35
	15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
24	08:08	06:52	05:31	04:01	02:49	02:23	03:04	04:15	05:26	06:36	07:52	08:35
	15:35	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	14:41
25	08:06	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
	15:37	16:55	18:03	19:17	20:25	20:59	20:22	19:03	17:32	16:06	14:57	14:41
26	08:04	06:47	05:25	03:56	02:45	02:23	03:09	04:19	05:30	06:41	07:56	08:36
	15:39	16:58	18:05	19:19	20:27	20:59	20:20	19:00	17:29	16:04	14:55	14:42
27	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:43	07:58	08:36
	15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:00	08:36
	15:44	17:03	18:10	19:24	20:31	20:58	20:16	18:55	17:23	15:58	14:52	14:44
29	07:57		05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	08:02	08:36
	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45
30	07:55		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
	15:49		18:15	19:29	20:35	20:58	20:11	18:49	17:17	15:53	14:49	14:46
31	07:53		05:11		02:37		03:19	04:31		06:53		08:36
	15:52		18:17		20:37		20:09	18:46		15:50		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:  
Gismarvik

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15.08.2011 12:14 / 232

Licensed user:  
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Gunnar Randres vei 12  
NO-2007 Kjeller  
(+47) 480 50 480  
Tove Risberg / tove.risberg@vindteknikk.no  
Calculated:  
15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

Calculation: Skyggekast Gismarvik Shadow receptor: FN - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (374)

**Assumptions for shadow calculations**

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	03:43 19:31	02:36 20:38	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	06:56 15:48	08:07 14:48
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:33	02:34 20:40	02:28 20:56	03:24 20:04	04:35 18:40	05:44 17:12	06:58 15:45	08:08 14:47
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	08:10 14:46
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:29 20:00	04:40 18:34	05:49 17:06	07:03 15:40	08:12 14:45
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:41	02:30 20:45	02:31 20:54	03:31 19:57	04:42 18:31	05:51 17:03	07:06 15:38	08:14 14:44
6	08:32 14:57	07:39 16:07	06:24 17:17	04:53 18:31	03:30 19:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36	08:16 14:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:47	02:34 20:52	03:35 19:52	04:47 18:26	05:55 16:57	07:11 15:33	08:18 14:42
8	08:31 15:00	07:35 16:12	06:18 17:22	04:47 18:36	03:25 19:48	02:27 20:49	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 15:31	08:19 14:41
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	07:16 15:28	08:21 14:40
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:52	02:26 20:51	02:38 20:48	03:42 19:44	04:54 18:17	06:03 16:48	07:18 15:26	08:22 14:40
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:52	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24	08:24 14:39
12	08:26 15:08	07:25 16:23	06:07 17:32	04:36 18:46	03:15 19:57	02:24 20:53	02:42 20:46	03:47 19:39	04:58 18:11	06:07 16:42	07:23 15:22	08:25 14:39
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	03:12 19:59	02:24 20:54	02:43 20:44	03:49 19:36	05:01 18:08	06:10 16:40	07:26 15:19	08:26 14:39
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15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:23 20:56	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	07:30 15:15	08:29 14:38
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	02:22 20:57	02:49 20:40	03:56 19:28	05:07 17:59	06:17 16:31	07:33 15:13	08:30 14:38
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	03:03 20:08	02:22 20:57	02:50 20:38	03:59 19:26	05:10 17:56	06:19 16:28	07:35 15:11	08:31 14:38
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	03:01 20:11	02:22 20:58	02:52 20:36	04:01 19:23	05:12 17:53	06:22 16:25	07:38 15:09	08:32 14:38
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	02:59 20:13	02:22 20:58	02:54 20:34	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:07	08:32 14:38
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	02:57 20:15	02:22 20:59	02:56 20:32	04:05 19:17	05:16 17:47	06:26 16:20	07:42 15:05	08:33 14:39
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	02:55 20:17	02:22 20:59	02:58 20:31	04:08 19:15	05:19 17:44	06:29 16:17	07:45 15:03	08:34 14:39
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	02:53 20:19	02:22 20:59	03:00 20:29	04:10 19:12	05:21 17:41	06:31 16:14	07:47 15:02	08:34 14:39
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	02:51 20:21	02:22 20:59	03:02 20:27	04:12 19:09	05:23 17:38	06:34 16:12	07:49 15:00	08:35 14:40
24	08:08 15:35	06:52 16:53	05:31 18:01	04:01 19:14	02:49 20:23	02:23 20:59	03:04 20:25	04:15 19:06	05:26 17:35	06:36 16:09	07:52 14:58	08:35 14:41
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	02:47 20:25	02:23 20:59	03:06 20:22	04:17 19:03	05:28 17:32	06:39 16:06	07:54 14:57	08:36 14:41
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 19:19	02:45 20:27	02:23 20:59	03:09 20:20	04:19 19:00	05:30 17:29	06:41 16:04	07:56 14:55	08:36 14:42
27	08:02 15:42	06:44 17:00	05:23 18:08	03:53 19:21	02:44 20:29	02:24 20:59	03:11 20:18	04:22 18:58	05:32 17:26	06:43 16:01	07:58 14:53	08:36 14:43
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	02:25 20:58	03:13 20:16	04:24 18:55	05:35 17:23	06:46 15:58	08:00 14:52	08:36 14:44
29	07:57 15:47		05:17 18:12	03:48 19:26	02:40 20:33	02:25 20:58	03:15 20:14	04:26 18:52	05:37 17:20	06:48 15:56	08:02 14:51	08:36 14:45
30	07:55 15:49		05:14 18:15	03:45 19:29	02:39 20:35	02:26 20:58	03:17 20:11	04:29 18:49	05:39 17:17	06:51 15:53	08:05 14:49	08:36 14:46
31	07:53 15:52		05:11 18:17		02:37 20:37		03:19 20:09	04:31 18:46		06:53 15:50		08:36 14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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: Gismarvik

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SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FO - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (375)

Assumptions for shadow calculations

Maximum distance for influence: 1 500 m
Minimum sun height over horizon for influence: 3 °
Day step for calculation: 1 days
Time step for calculation: 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30
Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1281 1143 697 478 515 675 1091 8182
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for days (1 to 31). Each cell contains two time values (hh:mm) representing sunrise and sunset. Summary rows include Potential sun hours, Total, worst case, Sun reduction, Oper. time red., Wind dir. red., Total reduction, and Total, real.

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

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

Project:

Gismarvik

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 Calculated:  
 15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

Calculation: Skyggekast Gismarvik Shadow receptor: FP - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (376)

**Assumptions for shadow calculations**

Maximum distance for influence

1 500 m

Minimum sun height over horizon for influence

3 °

Day step for calculation

1 days

Time step for calculation

1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.27	0.29	0.28	0.30	0.35	0.30	0.26	0.24	0.26	0.28	0.28	0.30

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
813	231	221	428	610	1 281	1 143	697	478	515	675	1 091	8 182

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:43							
2	08:35	07:49	06:36	05:05	03:40							
3	08:34	07:46	06:33	05:02	03:37							
4	08:34	07:44	06:30	04:59	03:35							
5	08:33	07:42	06:27	04:56	03:32							
6	08:32	07:39	06:24	04:53	03:30							
7	08:32	07:37	06:21	04:50	03:27							
8	08:31	07:34	06:18	04:47	03:25							
9	08:30	07:32	06:15	04:44	03:22							
10	08:29	07:30	06:13	04:41	03:20							
11	08:28	07:27	06:10	04:38	03:17							
12	08:26	07:24	06:07	04:36	03:15							
13	08:25	07:22	06:04	04:33	03:13							
14	08:24	07:19	06:01	04:30	03:10							
15	08:23	07:17	05:58	04:27	03:08							
16	08:21	07:14	05:55	04:24	03:06							
17	08:20	07:11	05:52	04:21	03:03							
18	08:18	07:09	05:49	04:18	03:01							
19	08:16	07:06	05:46	04:15	02:59							
20	08:15	07:03	05:43	04:13	02:57							
21	08:13	07:01	05:40	04:10	02:55							
22	08:11	06:58	05:37	04:07	02:53							
23	08:09	06:55	05:34	04:04	02:51							
24	08:07	06:52	05:31	04:01	02:49							
25	08:06	06:50	05:28	03:59	02:47							
26	08:04	06:47	05:25	03:56	02:45							
27	08:02	06:44	05:23	03:53	02:44							
28	08:00	06:41	05:20	03:51	02:42							
29	07:57	06:38	05:17	03:48	02:40							
30	07:55	06:36	05:15	03:46	02:38							
31	07:53	06:34	05:13	03:44	02:36							
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case					193		99					
Sun reduction					0.35		0.30					
Oper. time red.					0.93		0.93					
Wind dir. red.					0.74		0.74					
Total reduction					0.24		0.21					
Total, real					47		21					

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:

Gismarvik

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Calculated:

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### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FQ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (377)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:07
2	14:49	15:54	17:05	18:19	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
3	08:34	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:10
4	14:52	16:00	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
5	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:03	08:12
6	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:45
7	08:33	07:42	06:27	04:56	03:32	02:30	02:32	03:31	04:42	05:51	07:06	08:14
8	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:31	17:03	15:38	14:44
9	08:32	07:39	06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16
10	14:57	16:07	17:17	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
11	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:55	07:11	08:18
12	14:58	16:10	17:20	18:34	19:45	20:47	20:52	19:52	18:26	16:57	15:33	14:42
13	08:31	07:35	06:18	04:47	03:25	02:27	02:35	03:38	04:49	05:58	07:13	08:19
14	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
15	08:30	07:32	06:15	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
16	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
17	08:29	07:30	06:13	04:41	03:20	02:26	02:38	03:42	04:54	06:03	07:18	08:22
18	15:04	16:17	17:27	18:41	19:52	20:51	20:48	19:44	18:17	16:48	15:26	14:40
19	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
20	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
21	08:26	07:25	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
22	15:08	16:23	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39
23	08:25	07:22	06:04	04:33	03:12	02:24	02:43	03:49	05:01	06:10	07:26	08:26
24	15:10	16:25	17:34	18:48	19:59	20:54	20:44	19:36	18:08	16:40	15:19	14:39
25	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
26	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
27	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:14	07:30	08:29
28	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
29	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:07	06:17	07:33	08:30
30	15:16	16:33	17:42	18:55	20:06	20:57	20:40	19:28	17:59	16:31	15:13	14:38
31	08:20	07:11	05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31
1	15:18	16:35	17:44	18:57	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
2	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
3	15:21	16:38	17:46	19:00	20:11	20:58	20:36	19:23	17:53	16:25	15:09	14:38
4	08:16	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:32
5	15:23	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
6	08:15	07:03	05:43	04:13	02:57	02:22	02:56	04:05	05:16	06:26	07:42	08:33
7	15:25	16:43	17:51	19:05	20:15	20:59	20:32	19:17	17:47	16:20	15:05	14:39
8	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
9	15:27	16:45	17:53	19:07	20:17	20:59	20:31	19:15	17:44	16:17	15:03	14:39
10	08:11	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:34
11	15:30	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
12	08:09	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	08:35
13	15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
14	08:08	06:52	05:31	04:01	02:49	02:23	03:04	04:15	05:26	06:36	07:52	08:35
15	15:35	16:53	18:01	19:14	20:23	20:59	20:25	19:06	17:35	16:09	14:58	14:41
16	08:06	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
17	15:37	16:55	18:03	19:17	20:25	20:59	20:22	19:03	17:32	16:06	14:57	14:41
18	08:04	06:47	05:25	03:56	02:45	02:23	03:09	04:19	05:30	06:41	07:56	08:36
19	15:39	16:58	18:05	19:19	20:27	20:59	20:20	19:00	17:29	16:04	14:55	14:42
20	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:43	07:58	08:36
21	15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
22	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:00	08:36
23	15:44	17:03	18:10	19:24	20:31	20:58	20:16	18:55	17:23	15:58	14:52	14:44
24	07:57		05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	08:02	08:36
25	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45
26	07:55		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:05	08:36
27	15:49		18:15	19:29	20:35	20:58	20:11	18:49	17:17	15:53	14:49	14:46
28	07:53		05:11		02:37		03:19	04:31		06:53		08:36
29	15:52		18:17		20:37		20:09	18:46		15:50		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FR - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (378)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:43	02:36	02:27	03:22	04:33	05:42	06:56	08:06
2	14:49	15:54	17:05	18:19	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
3	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:36	05:44	06:58	08:08
4	14:50	15:57	17:08	18:22	19:33	20:40	20:56	20:04	18:40	17:12	15:45	14:47
5	08:34	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:10
6	14:52	16:00	17:10	18:24	19:36	20:41	20:56	20:02	18:37	17:09	15:43	14:46
7	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:49	07:03	08:12
8	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:45
9	08:33	07:42	06:27	04:56	03:32	02:31	02:32	03:31	04:42	05:51	07:06	08:14
10	14:55	16:05	17:15	18:29	19:40	20:45	20:54	19:57	18:31	17:03	15:38	14:44
11	08:32	07:39	06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16
12	14:57	16:07	17:17	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
13	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:55	07:11	08:17
14	14:58	16:10	17:20	18:34	19:45	20:47	20:52	19:52	18:26	16:57	15:33	14:42
15	08:31	07:34	06:18	04:47	03:25	02:27	02:36	03:38	04:49	05:58	07:13	08:19
16	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
17	08:30	07:32	06:15	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
18	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:29	14:40
19	08:29	07:30	06:13	04:41	03:20	02:26	02:38	03:42	04:54	06:03	07:18	08:22
20	15:04	16:17	17:27	18:41	19:52	20:51	20:48	19:44	18:17	16:48	15:26	14:40
21	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
22	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
23	08:26	07:24	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
24	15:08	16:23	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39
25	08:25	07:22	06:04	04:33	03:13	02:24	02:43	03:49	05:01	06:10	07:26	08:26
26	15:10	16:25	17:34	18:48	19:59	20:54	20:44	19:36	18:08	16:40	15:20	14:39
27	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:27
28	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
29	08:22	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:14	07:30	08:29
30	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
31	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	05:07	06:17	07:33	08:30
32	15:16	16:33	17:42	18:55	20:06	20:57	20:39	19:28	17:59	16:31	15:13	14:38
33	08:20	07:11	05:52	04:21	03:03	02:22	02:50	03:59	05:10	06:19	07:35	08:31
34	15:18	16:35	17:44	18:57	20:08	20:57	20:38	19:26	17:56	16:28	15:11	14:38
35	08:18	07:09	05:49	04:18	03:01	02:22	02:52	04:01	05:12	06:22	07:38	08:32
36	15:21	16:38	17:46	19:00	20:10	20:58	20:36	19:23	17:53	16:25	15:09	14:38
37	08:16	07:06	05:46	04:15	02:59	02:22	02:54	04:03	05:14	06:24	07:40	08:32
38	15:23	16:40	17:49	19:02	20:13	20:58	20:34	19:20	17:50	16:23	15:07	14:38
39	08:15	07:03	05:43	04:13	02:57	02:22	02:56	04:06	05:16	06:26	07:42	08:33
40	15:25	16:43	17:51	19:05	20:15	20:59	20:32	19:17	17:47	16:20	15:05	14:39
41	08:13	07:01	05:40	04:10	02:55	02:22	02:58	04:08	05:19	06:29	07:45	08:34
42	15:27	16:45	17:53	19:07	20:17	20:59	20:30	19:15	17:44	16:17	15:03	14:39
43	08:11	06:58	05:37	04:07	02:53	02:22	03:00	04:10	05:21	06:31	07:47	08:34
44	15:30	16:48	17:56	19:09	20:19	20:59	20:29	19:12	17:41	16:14	15:02	14:39
45	08:09	06:55	05:34	04:04	02:51	02:22	03:02	04:12	05:23	06:34	07:49	08:35
46	15:32	16:50	17:58	19:12	20:21	20:59	20:27	19:09	17:38	16:12	15:00	14:40
47	08:07	06:52	05:31	04:01	02:49	02:23	03:04	04:15	05:26	06:36	07:52	08:35
48	15:35	16:53	18:01	19:14	20:23	20:59	20:24	19:06	17:35	16:09	14:58	14:41
49	08:06	06:50	05:28	03:59	02:47	02:23	03:06	04:17	05:28	06:39	07:54	08:36
50	15:37	16:55	18:03	19:17	20:25	20:59	20:22	19:03	17:32	16:06	14:57	14:41
51	08:04	06:47	05:25	03:56	02:45	02:23	03:09	04:19	05:30	06:41	07:56	08:36
52	15:39	16:58	18:05	19:19	20:27	20:59	20:20	19:00	17:29	16:04	14:55	14:42
53	08:02	06:44	05:23	03:53	02:44	02:24	03:11	04:22	05:32	06:43	07:58	08:36
54	15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:54	14:43
55	08:00	06:41	05:20	03:51	02:42	02:25	03:13	04:24	05:35	06:46	08:00	08:36
56	15:44	17:03	18:10	19:24	20:31	20:58	20:16	18:55	17:23	15:58	14:52	14:44
57	07:57		05:17	03:48	02:40	02:25	03:15	04:26	05:37	06:48	08:02	08:36
58	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45
59	07:55		05:14	03:45	02:39	02:26	03:17	04:29	05:39	06:51	08:04	08:36
60	15:49		18:15	19:29	20:35	20:58	20:11	18:49	17:17	15:53	14:49	14:46
61	07:53		05:11		02:37		03:20	04:31		06:53		08:36
62	15:52		18:17		20:36		20:09	18:46		15:51		14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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15.08.2011 12:14 / 237

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Calculated:

15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

**Calculation:** Skyggekast Gismarvik Shadow receptor: FS - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (379)

**Assumptions for shadow calculations**

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []  
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30  
 Operational time  
 N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	03:43 19:31	02:36 20:38	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	06:56 15:48	08:06 14:48
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:33	02:34 20:40	02:28 20:56	03:24 20:04	04:35 18:40	05:44 17:11	06:58 15:45	08:08 14:47
3	08:34 14:52	07:46 16:00	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	08:10 14:46
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:29 20:00	04:40 18:34	05:49 17:06	07:03 15:40	08:12 14:45
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:40	02:31 20:45	02:32 20:54	03:31 19:57	04:42 18:31	05:51 17:03	07:06 15:38	08:14 14:44
6	08:32 14:57	07:39 16:07	06:24 17:17	04:53 18:31	03:30 19:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36	08:16 14:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:47	02:34 20:52	03:35 19:52	04:47 18:26	05:55 16:57	07:11 15:33	08:17 14:42
8	08:31 15:00	07:34 16:12	06:18 17:22	04:47 18:36	03:25 19:48	02:27 20:49	02:36 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 15:31	08:19 14:41
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	07:16 15:29	08:21 14:40
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:52	02:26 20:51	02:38 20:48	03:42 19:44	04:54 18:17	06:03 16:48	07:18 15:26	08:22 14:40
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:52	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24	08:24 14:39
12	08:26 15:08	07:24 16:23	06:07 17:32	04:36 18:46	03:15 19:57	02:24 20:53	02:42 20:46	03:47 19:39	04:58 18:11	06:07 16:42	07:23 15:22	08:25 14:39
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	03:13 19:59	02:24 20:54	02:43 20:44	03:49 19:36	05:01 18:08	06:10 16:40	07:26 15:20	08:26 14:39
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:17	08:28 14:38
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:23 20:56	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	07:30 15:15	08:29 14:38
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	02:22 20:57	02:49 20:39	03:56 19:28	05:07 17:59	06:17 16:31	07:33 15:13	08:30 14:38
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	03:03 20:08	02:22 20:57	02:50 20:38	03:59 19:26	05:10 17:56	06:19 16:28	07:35 15:11	08:31 14:38
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	03:01 20:10	02:22 20:58	02:52 20:36	04:01 19:23	05:12 17:53	06:22 16:25	07:38 15:09	08:32 14:38
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	02:59 20:13	02:22 20:58	02:54 20:34	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:07	08:32 14:38
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	02:57 20:15	02:22 20:59	02:56 20:32	04:06 19:17	05:16 17:47	06:26 16:20	07:42 15:05	08:33 14:39
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	02:55 20:17	02:22 20:59	02:58 20:30	04:08 19:15	05:19 17:44	06:29 16:17	07:45 15:03	08:34 14:39
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	02:53 20:19	02:22 20:59	03:00 20:29	04:10 19:12	05:21 17:41	06:31 16:14	07:47 15:02	08:34 14:39
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	02:51 20:21	02:22 20:59	03:02 20:27	04:12 19:09	05:23 17:38	06:34 16:12	07:49 15:00	08:35 14:40
24	08:07 15:35	06:52 16:53	05:31 18:01	04:01 19:14	02:49 20:23	02:23 20:59	03:04 20:24	04:15 19:06	05:26 17:35	06:36 16:09	07:52 14:58	08:35 14:41
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	02:47 20:25	02:23 20:59	03:06 20:22	04:17 19:03	05:28 17:32	06:39 16:06	07:54 14:57	08:36 14:41
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 19:19	02:45 20:27	02:23 20:59	03:09 20:20	04:19 19:00	05:30 17:29	06:41 16:04	07:56 14:55	08:36 14:42
27	08:02 15:42	06:44 17:00	05:23 18:08	03:53 19:21	02:44 20:29	02:24 20:59	03:11 20:18	04:22 18:58	05:32 17:26	06:43 16:01	07:58 14:53	08:36 14:43
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	02:25 20:58	03:13 20:16	04:24 18:55	05:35 17:23	06:46 15:58	08:00 14:52	08:36 14:44
29	07:57 15:47		05:17 18:12	03:48 19:26	02:40 20:33	02:25 20:58	03:15 20:14	04:26 18:52	05:37 17:20	06:48 15:56	08:02 14:51	08:36 14:45
30	07:55 15:49		05:14 18:15	03:45 19:29	02:39 20:35	02:26 20:58	03:17 20:11	04:29 18:49	05:39 17:17	06:51 15:53	08:04 14:49	08:36 14:46
31	07:53 15:52		05:11 18:17		02:37 20:37		03:20 20:09	04:31 18:46		06:53 15:51		08:36 14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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:

Gismarvik

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Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



### SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FT - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (380)

#### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for shadow calculation data including sun rise/set times, potential sun hours, and various reduction factors.

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

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

Project:  
**Gismarvik**

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Calculated:  
15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

Calculation: Skyggekast Gismarvik Shadow receptor: FU - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (381)

**Assumptions for shadow calculations**

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []  
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30  
**Operational time**  
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:06
2	14:49	15:54	17:05	18:19	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
3	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:08
4	14:50	15:57	17:08	18:22	19:33	20:40	20:56	20:04	18:40	17:11	15:45	14:47
5	08:34	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:10
6	14:52	15:59	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
7	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:29	04:40	05:48	07:03	08:12
8	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:45
9	08:33	07:42	06:27	04:56	03:32	02:30	02:32	03:31	04:42	05:51	07:06	08:14
10	14:55	16:05	17:15	18:29	19:41	20:45	20:54	19:57	18:31	17:03	15:38	14:44
11	08:32	07:39	06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16
12	14:57	16:07	17:17	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
13	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:55	07:11	08:17
14	14:58	16:10	17:20	18:34	19:45	20:47	20:52	19:52	18:26	16:57	15:33	14:42
15	08:31	07:34	06:18	04:47	03:25	02:27	02:35	03:38	04:49	05:58	07:13	08:19
16	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
17	08:30	07:32	06:15	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
18	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
19	08:29	07:30	06:13	04:41	03:20	02:26	02:38	03:42	04:54	06:03	07:18	08:22
20	15:04	16:17	17:27	18:41	19:52	20:51	20:48	19:44	18:17	16:48	15:26	14:40
21	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
22	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
23	08:26	07:24	06:07	04:36	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
24	15:08	16:23	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39
25	08:25	07:22	06:04	04:33	03:12	02:24	02:43	03:49	05:01	06:10	07:26	08:26
26	15:10	16:25	17:34	18:48	19:59	20:54	20:44	19:36	18:08	16:40	15:19	14:39
27	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
28	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
29	08:23	07:17	05:58	04:27	18:18 (5)	03:08	02:23	02:47	03:54	05:05	06:14	07:30
30	15:14	16:30	17:39	18:53	2	18:20 (5)	03:04	02:56	04:01	18:02	16:34	15:15
31	08:21	07:14	05:55	04:24	18:16 (5)	03:06	02:22	02:49	03:56	05:07	06:17	07:33
32	15:16	16:33	17:42	18:55	6	18:22 (5)	03:06	02:57	04:03	17:59	16:31	15:13
33	08:20	07:11	05:52	04:21	18:16 (5)	03:03	02:22	02:50	03:59	05:10	06:19	07:35
34	15:18	16:35	17:44	18:57	9	18:25 (5)	03:08	02:57	04:04	17:56	16:28	15:11
35	08:18	07:09	05:49	04:18	18:15 (5)	03:01	02:22	02:52	04:01	18:25 (5)	05:12	06:22
36	15:21	16:38	17:46	19:00	12	18:27 (5)	03:10	02:58	04:03	18:33 (5)	17:53	16:25
37	08:16	07:06	05:46	04:15	18:15 (5)	02:59	02:22	02:54	04:03	18:22 (5)	05:14	06:24
38	15:23	16:40	17:49	19:02	14	18:29 (5)	03:13	02:58	04:04	18:34 (5)	17:50	16:23
39	08:15	07:03	05:43	04:13	18:15 (5)	02:57	02:22	02:56	04:05	18:21 (5)	05:16	06:26
40	15:25	16:43	17:51	19:05	17	18:32 (5)	03:15	02:59	04:04	18:35 (5)	17:47	16:20
41	08:13	07:01	05:40	04:10	18:15 (5)	02:55	02:22	02:58	04:08	18:20 (5)	05:19	06:29
42	15:27	16:45	17:53	19:07	17	18:32 (5)	03:17	02:59	04:08	18:37 (5)	17:44	16:17
43	08:11	06:58	05:37	04:07	18:15 (5)	02:53	02:22	03:00	04:10	18:19 (5)	05:21	06:31
44	15:30	16:48	17:56	19:09	16	18:31 (5)	03:19	02:59	04:09	18:37 (5)	17:41	16:14
45	08:09	06:55	05:34	04:04	18:16 (5)	02:51	02:22	03:02	04:12	18:19 (5)	05:23	06:34
46	15:32	16:50	17:58	19:12	14	18:30 (5)	03:21	02:59	04:09	18:35 (5)	17:38	16:12
47	08:07	06:52	05:31	04:01	18:17 (5)	02:49	02:23	03:04	04:15	18:18 (5)	05:26	06:36
48	15:35	16:53	18:01	19:14	11	18:28 (5)	03:23	02:59	04:06	18:32 (5)	17:35	16:09
49	08:06	06:50	05:28	03:59	18:19 (5)	02:47	02:23	03:06	04:17	18:18 (5)	05:28	06:39
50	15:37	16:55	18:03	19:17	6	18:25 (5)	03:25	02:59	04:03	18:29 (5)	17:32	16:06
51	08:04	06:47	05:25	03:56	20:45	02:23	03:09	04:19	04:19	18:18 (5)	05:30	06:41
52	15:39	16:58	18:05	19:19	20:27	02:59	02:20	03:09	04:19	18:27 (5)	17:29	16:04
53	08:02	06:44	05:22	03:53	20:24	02:24	03:11	04:22	04:22	18:19 (5)	05:32	06:43
54	15:42	17:00	18:08	19:21	20:29	02:59	02:18	03:09	04:19	18:25 (5)	17:26	16:01
55	08:00	06:41	05:20	03:51	20:22	02:25	03:13	04:24	04:24	18:19 (5)	05:35	06:46
56	15:44	17:03	18:10	19:24	20:31	02:58	02:16	03:09	04:19	18:22 (5)	17:23	16:01
57	07:57	06:44	05:17	03:48	20:24	02:25	03:15	04:26	04:26	18:22 (5)	17:23	16:01
58	15:47	17:06	18:12	19:26	20:33	02:58	02:14	03:09	04:19	18:22 (5)	17:23	16:01
59	07:55	06:42	05:14	03:45	20:29	02:26	03:17	04:29	04:29	18:22 (5)	17:23	16:01
60	15:49	17:08	18:15	19:29	20:35	02:58	02:11	03:09	04:19	18:22 (5)	17:23	16:01
61	07:53	06:40	05:11	03:44	20:37	02:37	03:19	04:31	04:31	18:22 (5)	17:23	16:01
62	15:52	17:11	18:17	19:31	20:37	02:37	03:19	04:31	04:31	18:22 (5)	17:23	16:01
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case				124				128				
Sun reduction				0.30				0.24				
Oper. time red.				0.93				0.93				
Wind dir. red.				0.67				0.67				
Total reduction				0.19				0.15				
Total, real				23				19				

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) Minutes with flicker Last time (hh:mm) with flicker (WTG causing flicker last time)

Project: Gismarvik

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SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FV - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (382)

Assumptions for shadow calculations

Maximum distance for influence: 1 500 m
Minimum sun height over horizon for influence: 3 °
Day step for calculation: 1 days
Time step for calculation: 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182
Idle start wind speed: Cut in wind speed from power curve

Table with 12 columns (January to December) and 31 rows of data. Each row contains time intervals (Sun rise to Sun set) for each month. Summary rows at the bottom show potential sun hours, sun reduction, and total reduction for each month.

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

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

Project:

Gismarvik

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Licensed user:

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Gunnar Randres vei 12

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(+47) 480 50 480

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FW - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (383)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
 Minimum sun height over horizon for influence 3 °  
 Day step for calculation 1 days  
 Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	03:42 19:31	02:36 20:38	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	06:56 15:48	08:06 14:48
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:33	02:34 20:40	02:28 20:56	03:24 20:04	04:35 18:40	05:44 17:11	06:58 15:45	08:08 14:47
3	08:34 14:52	07:46 15:59	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	08:10 14:46
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:29 20:00	04:40 18:34	05:48 17:06	07:03 15:40	08:12 14:45
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:41	02:30 20:45	02:31 20:54	03:31 19:57	04:42 18:31	05:51 17:03	07:06 15:38	08:14 14:44
6	08:32 14:57	07:39 16:07	06:24 17:17	04:53 18:31	03:30 19:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36	08:16 14:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:47	02:34 20:52	03:35 19:52	04:47 18:26	05:55 16:57	07:11 15:33	08:17 14:42
8	08:31 15:00	07:34 16:12	06:18 17:22	04:47 18:36	03:25 19:48	02:27 20:49	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 15:31	08:19 14:41
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	07:16 15:28	08:21 14:40
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:52	02:26 20:51	02:38 20:48	03:42 19:44	04:54 18:17	06:02 16:48	07:18 15:26	08:22 14:40
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:52	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24	08:24 14:39
12	08:26 15:08	07:24 16:22	06:07 17:32	04:36 18:46	03:15 19:57	02:24 20:53	02:42 20:46	03:47 19:39	04:58 18:11	06:07 16:42	07:23 15:22	08:25 14:39
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	03:12 19:59	02:24 20:54	02:43 20:44	03:49 19:36	05:01 18:08	06:10 16:40	07:26 15:19	08:26 14:39
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	03:10 19:58	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:17	08:28 14:38
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	03:08 19:59	02:23 20:56	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	07:30 15:15	08:29 14:38
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	03:06 19:59	02:22 20:57	02:49 20:39	03:56 19:28	05:07 17:59	06:17 16:31	07:33 15:13	08:30 14:38
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	03:03 19:58	02:22 20:57	02:50 20:38	03:59 19:26	05:10 17:56	06:19 16:28	07:35 15:11	08:31 14:38
18	08:18 15:20	07:09 16:38	05:49 17:46	04:18 19:00	03:01 19:58	02:22 20:58	02:52 20:36	04:01 19:23	05:12 17:53	06:22 16:25	07:38 15:09	08:32 14:38
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	03:00 19:58	02:22 20:58	02:54 20:34	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:07	08:32 14:38
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	03:00 19:58	02:22 20:59	02:56 20:32	04:05 19:17	05:16 18:22 (5)	06:26 17:47	07:42 15:05	08:33 14:39
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	03:00 19:58	02:22 20:59	02:58 20:30	04:08 19:15	05:19 18:32 (5)	06:29 17:44	07:45 15:03	08:34 14:39
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	03:00 19:58	02:22 20:59	03:00 20:29	04:10 19:12	05:21 18:33 (5)	06:31 17:41	07:47 15:02	08:34 14:39
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	03:00 19:58	02:22 20:59	03:02 20:27	04:12 19:09	05:23 18:17 (5)	06:34 17:38	07:49 15:00	08:35 14:40
24	08:07 15:35	06:52 16:53	05:31 18:01	04:01 19:14	03:00 19:58	02:23 20:59	03:04 20:25	04:15 19:06	05:26 18:32 (5)	06:36 17:35	07:52 16:09	08:35 14:41
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	03:00 19:58	02:23 20:59	03:06 20:22	04:17 19:03	05:28 18:16 (5)	06:39 17:32	07:54 16:06	08:36 14:41
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 19:19	03:00 19:58	02:23 20:59	03:09 20:20	04:19 19:00	05:30 18:15 (5)	06:41 17:29	07:56 16:04	08:36 14:42
27	08:02 15:42	06:44 17:00	05:22 18:08	03:53 19:21	03:00 19:58	02:24 20:59	03:11 20:18	04:22 18:58	05:32 18:16 (5)	06:43 17:26	07:58 16:01	08:36 14:43
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24	03:00 19:58	02:25 20:58	03:13 20:16	04:24 18:55	05:35 18:22 (5)	06:46 17:23	08:00 15:58	08:36 14:44
29	07:57 15:47		05:17 18:12	03:48 19:26	03:00 19:58	02:25 20:58	03:15 20:14	04:26 18:52	05:37 18:16 (5)	06:48 17:20	08:02 15:56	08:36 14:45
30	07:55 15:49		05:14 18:15	03:45 19:29	03:00 19:58	02:26 20:58	03:17 20:11	04:29 18:49	05:39 17:17	06:51 15:53	08:04 14:49	08:36 14:46
31	07:53 15:52		05:11 18:17		03:00 19:58	02:37 20:37	03:19 20:09	04:31 18:46		06:53 15:50		08:36 14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case				106				108				
Sun reduction				0.30				0.24				
Oper. time red.				0.93				0.93				
Wind dir. red.				0.67				0.67				
Total reduction				0.19				0.15				
Total, real				20				16				

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)	Last time (hh:mm) with flicker (WTG causing flicker last time)
	Sun set (hh:mm)			



Project:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FX - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (384)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	03:42 19:31	02:36 20:38	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	06:56 15:48	08:06 14:48
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:33	02:34 20:40	02:28 20:56	03:24 20:04	04:35 18:40	05:44 17:11	06:58 15:45	08:08 14:47
3	08:34 14:52	07:46 15:59	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	08:10 14:46
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:29 20:00	04:40 18:34	05:48 17:06	07:03 15:40	08:12 14:45
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:40	02:30 20:45	02:32 20:54	03:31 19:57	04:42 18:31	05:51 17:03	07:06 15:38	08:14 14:44
6	08:32 14:57	07:39 16:07	06:24 17:17	04:53 18:31	03:30 19:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36	08:16 14:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:47	02:34 20:52	03:35 19:52	04:47 18:26	05:55 16:57	07:11 15:33	08:17 14:42
8	08:31 15:00	07:34 16:12	06:18 17:22	04:47 18:36	03:25 19:48	02:27 20:49	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 15:31	08:19 14:41
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	07:16 15:28	08:21 14:40
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:52	02:26 20:51	02:38 20:48	03:42 19:44	04:54 18:17	06:02 16:48	07:18 15:26	08:22 14:40
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:52	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24	08:24 14:39
12	08:26 15:08	07:24 16:23	06:07 17:32	04:36 18:46	03:15 19:57	02:24 20:53	02:42 20:46	03:47 19:39	04:58 18:11	06:07 16:42	07:23 15:22	08:25 14:39
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	03:12 19:59	02:24 20:54	02:43 20:44	03:49 19:36	05:01 18:36 (5)	06:10 18:08	07:26 16:40	08:26 15:19
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:34 (5)	06:12 18:05	07:28 16:37	08:28 15:17
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:23 20:56	02:47 20:41	03:54 19:31	05:05 18:46 (5)	06:14 18:02	07:30 16:34	08:29 15:15
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	02:22 20:57	02:49 20:39	03:56 19:28	05:07 18:31 (5)	06:17 17:59	07:33 16:31	08:30 15:13
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	03:03 20:08	02:22 20:57	02:50 20:38	03:59 19:26	05:10 18:46 (5)	06:19 17:56	07:35 16:28	08:31 15:11
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	03:01 20:10	02:22 20:58	02:52 20:36	04:01 19:23	05:12 18:46 (5)	06:22 17:53	07:38 16:25	08:32 15:09
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	02:59 20:13	02:22 20:58	02:54 20:34	04:03 19:20	05:14 18:45 (5)	06:24 17:50	07:40 16:23	08:32 15:07
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	02:57 20:15	02:22 20:59	02:56 20:32	04:05 19:17	05:16 18:29 (5)	06:26 17:47	07:42 16:20	08:33 15:05
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	02:55 20:17	02:22 20:59	02:58 20:30	04:08 19:15	05:19 18:41 (5)	06:29 17:44	07:45 16:17	08:34 15:03
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	02:53 20:19	02:22 20:59	03:00 20:29	04:10 19:12	05:21 18:38 (5)	06:31 17:41	07:47 16:14	08:34 15:02
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	02:51 20:21	02:22 20:59	03:02 20:27	04:12 19:09	05:23 18:35 (5)	06:34 17:38	07:49 16:12	08:35 15:00
24	08:07 15:35	06:52 16:53	05:31 18:01	04:01 19:14	02:49 20:23	02:23 20:59	03:04 20:25	04:15 19:06	05:26 17:35	06:36 16:09	07:52 14:58	08:35 14:41
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	02:47 20:25	02:23 20:59	03:06 20:22	04:17 19:03	05:28 17:32	06:39 16:06	07:54 14:57	08:36 14:41
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 19:19	02:45 20:27	02:23 20:59	03:09 20:20	04:19 19:00	05:30 17:29	06:41 16:04	07:56 14:55	08:36 14:42
27	08:02 15:42	06:44 17:00	05:22 18:08	03:53 19:21	02:44 20:29	02:24 20:59	03:11 20:18	04:22 18:58	05:32 17:26	06:43 16:01	07:58 14:53	08:36 14:43
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	02:25 20:58	03:13 20:16	04:24 18:55	05:35 17:23	06:46 15:58	08:00 14:52	08:36 14:44
29	07:57 15:47		05:17 18:12	03:48 19:26	02:40 20:33	02:25 20:58	03:15 20:14	04:26 18:52	05:37 17:20	06:48 15:56	08:02 14:51	08:36 14:45
30	07:55 15:49		05:14 18:15	03:45 19:29	02:39 20:35	02:26 20:58	03:17 20:11	04:29 18:49	05:39 17:17	06:51 15:53	08:04 14:49	08:36 14:46
31	07:53 15:52		05:11 18:17		02:37 20:37		03:19 20:09	04:31 18:46		06:53 15:50		08:36 14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case				136				133				
Sun reduction				0.30				0.24				
Oper. time red.				0.93				0.93				
Wind dir. red.				0.68				0.68				
Total reduction				0.19				0.15				
Total, real				26				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)

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SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FY - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (385)

Assumptions for shadow calculations

Maximum distance for influence 1 500 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182
Idle start wind speed: Cut in wind speed from power curve

Table with columns for months (January to December) and rows for days (1 to 31). Each cell contains sun rise and set times. Summary rows include Potential sun hours, Total, worst case, Sun reduction, Oper. time red., Wind dir. red., Total reduction, and Total, real.

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) Minutes with flicker Last time (hh:mm) with flicker (WTG causing flicker last time)

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SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: FZ - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (386)

Assumptions for shadow calculations

- Maximum distance for influence: 1 500 m
Minimum sun height over horizon for influence: 3 °
Day step for calculation: 1 days
Time step for calculation: 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Table with 12 columns (Jan-Dec) and values for sunshine probability: 0.27, 0.29, 0.28, 0.30, 0.35, 0.30, 0.26, 0.24, 0.26, 0.28, 0.28, 0.30

Operational time

Table showing operational time for directions N, NNE, ENE, E, ESE, SSE, S, SSW, WSW, W, WNW, NNW, Sum. Values range from 813 to 182.

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

Main shadow calculation table with columns for months (January to December) and rows for each day of the month, including sun rise/set times, shadow times, and potential sun hours.

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

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

Project:  
**Gismarvik**

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15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

Calculation: Skyggekast Gismarvik Shadow receptor: GA - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (387)

**Assumptions for shadow calculations**

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	03:42 19:31	02:36 20:38	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	06:56 15:48	08:06 14:48	
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:33	02:34 20:40	02:28 20:56	03:24 20:04	04:35 18:40	05:44 17:11	06:58 15:45	08:08 14:47	
3	08:34 14:52	07:46 15:59	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	08:10 14:46	
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:29 20:00	04:40 18:34	05:48 17:06	07:03 15:40	08:12 14:45	
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:40	02:30 20:45	02:31 20:54	03:31 19:57	04:42 18:31	05:51 17:03	07:06 15:38	08:14 14:44	
6	08:32 14:57	07:39 16:07	06:24 17:17	04:53 18:31	03:30 19:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36	08:16 14:43	
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:47	02:34 20:52	03:35 19:52	04:47 18:26	05:55 16:57	07:11 15:33	08:17 14:42	
8	08:31 15:00	07:34 16:12	06:18 17:22	04:47 18:36	03:25 19:48	02:27 20:49	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 15:31	08:19 14:41	
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	07:16 15:28	08:21 14:40	
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:52	02:26 20:51	02:38 20:48	03:42 19:44	04:54 18:17	06:02 16:48	07:18 15:26	08:22 14:40	
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:52	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24	08:24 14:39	
12	08:26 15:08	07:24 16:22	06:07 17:32	04:35 18:46	03:15 19:57	02:24 20:53	02:42 20:46	03:47 19:39	04:58 18:11	06:07 16:42	07:23 15:22	08:25 14:39	
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	03:12 19:59	02:24 20:54	02:43 20:44	03:49 19:36	05:01 18:08	06:10 16:40	07:26 15:19	08:26 14:39	
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:17	08:28 14:38	
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:23 20:56	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	07:30 15:15	08:29 14:38	
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	3 18:19 (5) 18:22 (5)	03:06 20:06	02:22 20:57	02:49 20:39	03:56 19:28	05:07 17:59	06:17 16:31	07:33 15:13	08:30 14:38
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	6 18:19 (5) 18:25 (5)	03:03 20:08	02:22 20:57	02:50 20:38	03:59 19:26	05:10 17:56	06:19 16:28	07:35 15:11	08:31 14:38
18	08:18 15:20	07:09 16:38	05:49 17:46	04:18 19:00	9 18:18 (5) 18:27 (5)	03:01 20:10	02:22 20:58	02:52 20:36	04:01 19:23	05:12 18:35 (5)	06:22 17:53	07:38 16:25	08:32 15:09
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	12 18:17 (5) 18:29 (5)	02:59 20:13	02:22 20:58	02:54 20:34	04:03 19:20	05:14 18:36 (5)	06:24 17:50	07:40 16:23	08:32 15:07
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	14 18:18 (5) 18:32 (5)	02:57 20:15	02:22 20:59	02:56 20:32	04:05 19:17	05:16 18:37 (5)	06:26 17:47	07:42 16:20	08:33 15:05
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	17 18:17 (5) 18:34 (5)	02:55 20:17	02:22 20:59	02:58 20:30	04:08 19:15	05:19 18:38 (5)	06:29 17:44	07:45 16:17	08:34 15:03
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	16 18:17 (5) 18:33 (5)	02:53 20:19	02:22 20:59	03:00 20:29	04:10 19:12	05:21 18:38 (5)	06:31 17:41	07:47 16:14	08:34 15:02
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	13 18:19 (5) 18:32 (5)	02:51 20:21	02:22 20:59	03:02 20:27	04:12 19:09	05:23 18:35 (5)	06:34 17:38	07:49 16:12	08:35 15:00
24	08:07 15:35	06:52 16:53	05:31 18:01	04:01 19:14	11 18:19 (5) 18:30 (5)	02:49 20:23	02:23 20:59	03:04 20:25	04:15 19:06	05:26 18:32 (5)	06:36 17:35	07:52 16:09	08:35 14:58
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	7 18:21 (5) 18:28 (5)	02:47 20:25	02:23 20:59	03:06 20:22	04:17 19:03	05:28 18:29 (5)	06:39 17:32	07:54 16:06	08:36 14:57
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 19:19	18 18:22 (5) 18:29 (5)	02:45 20:27	02:23 20:59	03:09 20:20	04:19 19:00	05:30 18:27 (5)	06:41 17:29	07:56 16:04	08:36 14:55
27	08:02 15:42	06:44 17:00	05:22 18:08	03:53 19:21	19 18:22 (5) 18:31 (5)	02:44 20:29	02:24 20:59	03:11 20:18	04:22 18:58	05:32 18:25 (5)	06:43 17:26	07:58 16:01	08:36 14:53
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24	20 18:23 (5) 18:31 (5)	02:42 20:31	02:25 20:58	03:13 20:16	04:24 18:55	05:35 17:23	06:46 15:58	08:00 14:52	08:36 14:44
29	07:57 15:47	06:40 17:03	05:17 18:12	03:48 19:26	21 18:24 (5) 18:32 (5)	02:40 20:33	02:25 20:58	03:15 20:14	04:26 18:52	05:37 17:20	06:48 15:56	08:02 14:51	08:36 14:45
30	07:55 15:49	06:39 17:05	05:14 18:15	03:45 19:29	22 18:25 (5) 18:33 (5)	02:39 20:35	02:26 20:58	03:17 20:11	04:29 18:49	05:39 17:17	06:51 15:53	08:04 14:49	08:36 14:46
31	07:53 15:52	06:38 17:10	05:11 18:17	03:44 19:30	23 18:26 (5) 18:34 (5)	02:37 20:37	02:27 20:59	03:19 20:09	04:31 18:46	06:53 15:50	08:06 14:47	08:36 14:47	
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194	
Total, worst case				108				106					
Sun reduction				0.30				0.24					
Oper. time red.				0.93				0.93					
Wind dir. red.				0.67				0.67					
Total reduction				0.19				0.15					
Total, real				20				16					

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:

Gismarvik

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Calculated:

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## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: GB - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (388)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December	
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	03:42 19:31	02:36 20:38	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	06:56 15:48	08:06 14:48	
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:33	02:34 20:40	02:28 20:56	03:24 20:04	04:35 18:40	05:44 17:11	06:58 15:45	08:08 14:47	
3	08:34 14:52	07:46 15:59	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	08:10 14:46	
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:29 20:00	04:40 18:34	05:48 17:06	07:03 15:40	08:12 14:45	
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:40	02:30 20:45	02:31 20:54	03:31 19:57	04:42 18:31	05:51 17:03	07:06 15:38	08:14 14:44	
6	08:32 14:57	07:39 16:07	06:24 17:17	04:53 18:31	03:30 19:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36	08:16 14:43	
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:47	02:34 20:52	03:35 19:52	04:47 18:26	05:55 16:57	07:11 15:33	08:17 14:42	
8	08:31 15:00	07:34 16:12	06:18 17:22	04:47 18:36	03:25 19:48	02:27 20:49	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 15:31	08:19 14:41	
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	07:16 15:28	08:21 14:40	
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:52	02:26 20:51	02:38 20:48	03:42 19:44	04:54 18:17	06:02 16:48	07:18 15:26	08:22 14:40	
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:52	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24	08:24 14:39	
12	08:26 15:08	07:24 16:22	06:07 17:32	04:35 18:46	03:15 19:57	02:24 20:53	02:42 20:46	03:47 19:39	04:58 18:11	06:07 16:42	07:23 15:22	08:25 14:39	
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	03:12 19:59	02:24 20:54	02:43 20:44	03:49 19:36	05:01 18:08	06:10 16:40	07:26 15:19	08:26 14:39	
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:17	08:28 14:38	
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:23 20:56	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	07:30 15:15	08:29 14:38	
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	18:21 (5) 20:06	03:06 20:57	02:22 20:39	03:56 19:28	05:07 17:59	06:17 16:31	07:33 15:13	08:30 14:38	
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	18:21 (5) 20:08	03:03 20:57	02:22 20:38	03:59 19:26	18:31 (5) 18:34 (5)	05:10 17:56	06:19 16:28	07:35 15:11	08:31 14:38
18	08:18 15:20	07:09 16:38	05:49 17:46	04:18 19:00	18:20 (5) 20:10	03:01 20:58	02:22 20:36	04:01 19:23	18:28 (5) 18:37 (5)	05:12 17:53	06:22 16:25	07:38 15:09	08:32 14:38
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	18:19 (5) 20:13	02:59 20:58	02:22 20:34	04:03 19:20	18:26 (5) 18:38 (5)	05:14 17:50	06:24 16:23	07:40 15:07	08:32 14:38
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	18:19 (5) 20:15	02:57 20:59	02:22 20:32	04:05 19:17	18:24 (5) 18:39 (5)	05:16 17:47	06:26 16:20	07:42 15:05	08:33 14:39
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	18:18 (5) 20:17	02:55 20:59	02:22 20:30	04:08 19:15	18:24 (5) 18:40 (5)	05:19 17:44	06:29 16:17	07:45 15:03	08:34 14:39
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	18:19 (5) 20:19	02:53 20:59	02:22 20:29	03:00 19:12	18:24 (5) 18:38 (5)	05:21 17:41	06:31 16:14	07:47 15:02	08:34 14:39
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	18:20 (5) 20:21	02:51 20:59	02:22 20:27	03:02 19:09	18:23 (5) 18:35 (5)	05:23 17:38	06:34 16:12	07:49 15:00	08:35 14:40
24	08:07 15:35	06:52 16:53	05:31 18:01	04:01 19:14	18:20 (5) 20:23	02:49 20:59	02:23 20:25	03:04 19:06	18:23 (5) 18:32 (5)	05:26 17:35	06:36 16:09	07:52 14:58	08:35 14:41
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	18:22 (5) 20:25	02:47 20:59	02:23 20:22	03:06 19:03	18:23 (5) 18:29 (5)	05:28 17:32	06:39 16:06	07:54 14:57	08:36 14:41
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 19:19	18:30 (5) 20:27	02:45 20:59	02:23 20:20	03:09 19:00	18:23 (5) 18:27 (5)	05:30 17:29	06:41 16:04	07:56 14:55	08:36 14:42
27	08:02 15:42	06:44 17:00	05:22 18:08	03:53 19:21	18:19 (5) 20:29	02:57 20:59	02:22 20:18	04:05 18:58	18:24 (5) 18:25 (5)	05:32 17:26	06:43 16:01	07:58 14:53	08:36 14:43
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24	18:18 (5) 20:31	02:55 20:58	02:22 20:16	04:04 18:55	18:25 (5) 17:23	05:35 15:58	06:46 14:52	08:00 14:44	08:36 14:44
29	07:57 15:47	06:40 17:03	05:17 18:12	03:48 19:26	18:17 (5) 20:33	02:54 20:58	02:22 20:14	03:15 18:52	18:26 (5) 17:20	05:37 15:56	06:48 14:51	08:02 14:45	08:36 14:45
30	07:55 15:49	06:39 17:05	05:14 18:15	03:45 19:29	18:16 (5) 20:35	02:53 20:58	02:22 20:11	03:17 18:49	18:27 (5) 17:17	05:39 15:53	06:51 14:49	08:04 14:46	08:36 14:46
31	07:53 15:52	06:37 17:08	05:11 18:17	03:43 19:31	18:15 (5) 20:37	02:52 20:59	02:22 20:09	03:19 18:46	18:28 (5) 18:46	05:40 15:50	06:53 14:49	08:06 14:47	08:36 14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194	
Total, worst case				100				102					
Sun reduction				0.30				0.24					
Oper. time red.				0.93				0.93					
Wind dir. red.				0.67				0.67					
Total reduction				0.19				0.15					
Total, real				19				15					

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:  
**Gismarvik**

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Calculated:  
15.08.2011 09:56/2.7.486



**SHADOW - Calendar**

Calculation: Skyggekast Gismarvik Shadow receptor: GC - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (389)

**Assumptions for shadow calculations**

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	03:42 19:31	02:36 20:38	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	06:56 15:48	08:06 14:48
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:33	02:34 20:40	02:28 20:56	03:24 20:04	04:35 18:40	05:44 17:11	06:58 15:45	08:08 14:47
3	08:34 14:52	07:46 15:59	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	08:10 14:46
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:29 20:00	04:40 18:34	05:48 17:06	07:03 15:40	08:12 14:45
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:40	02:30 20:45	02:32 20:54	03:31 19:57	04:42 18:31	05:51 17:03	07:06 15:38	08:14 14:44
6	08:32 14:57	07:39 16:07	06:24 17:17	04:53 18:31	03:30 19:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36	08:16 14:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:47	02:34 20:52	03:35 19:52	04:47 18:26	05:55 16:57	07:11 15:33	08:17 14:42
8	08:31 15:00	07:34 16:12	06:18 17:22	04:47 18:36	03:25 19:48	02:27 20:49	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 15:31	08:19 14:41
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	07:16 15:28	08:21 14:40
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:52	02:26 20:51	02:38 20:48	03:42 19:44	04:54 18:17	06:02 16:48	07:18 15:26	08:22 14:40
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:52	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24	08:24 14:39
12	08:26 15:08	07:24 16:22	06:07 17:32	04:35 18:46	03:15 19:57	02:24 20:53	02:42 20:46	03:47 19:39	04:58 18:11	06:07 16:42	07:23 15:22	08:25 14:39
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	03:12 19:59	02:24 20:54	02:43 20:44	03:49 19:36	05:01 18:08	06:10 16:40	07:26 15:19	08:26 14:39
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:36 (5)	06:12 18:05	07:28 16:37	08:28 15:17
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:23 20:56	02:47 20:41	03:54 19:31	05:05 18:46 (5)	06:14 18:02	07:30 16:34	08:29 15:15
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	03:06 20:06	02:22 20:57	02:49 20:39	03:56 19:28	05:07 18:46 (5)	06:17 17:59	07:33 16:31	08:30 15:13
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	03:03 20:08	02:22 20:57	02:50 20:38	03:59 19:26	05:10 18:47 (5)	06:19 17:56	07:35 16:28	08:31 15:11
18	08:18 15:21	07:09 16:38	05:49 17:46	04:18 19:00	03:01 20:10	02:22 20:58	02:52 20:36	04:01 19:23	05:12 18:31 (5)	06:22 17:53	07:38 16:25	08:32 15:09
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	02:59 20:13	02:22 20:58	02:54 20:34	04:03 19:20	05:14 18:45 (5)	06:24 17:50	07:40 16:23	08:32 15:07
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	02:57 20:15	02:22 20:59	02:56 20:32	04:05 19:17	05:16 18:43 (5)	06:26 17:47	07:42 16:20	08:33 15:05
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	02:55 20:17	02:22 20:59	02:58 20:30	04:08 19:15	05:19 18:41 (5)	06:29 17:44	07:45 16:17	08:34 15:03
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	8 18:34 (5) 02:53 20:19	02:22 20:59	03:00 20:29	04:10 19:12	10 18:41 (5) 05:21 17:41	06:31 16:14	07:47 15:02	08:34 14:39
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	11 18:36 (5) 02:51 20:19	02:22 20:59	03:02 20:27	04:12 19:09	7 18:38 (5) 05:23 17:38	06:34 16:12	07:49 15:00	08:35 14:40
24	08:07 15:35	06:52 16:53	05:31 18:01	04:01 19:14	13 18:38 (5) 02:49 20:23	02:23 20:59	03:04 20:24	04:15 19:06	4 18:35 (5) 05:26 17:35	06:36 16:09	07:52 14:58	08:35 14:41
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	15 18:40 (5) 02:47 20:25	02:23 20:59	03:06 20:22	04:17 19:03	05:28 17:32	06:39 16:06	07:54 14:57	08:36 14:41
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 19:19	16 18:40 (5) 02:45 20:27	02:23 20:59	03:09 20:20	04:19 19:00	05:30 17:29	06:41 16:04	07:56 14:55	08:36 14:42
27	08:02 15:42	06:44 17:00	05:22 18:08	03:53 19:21	18 18:25 (5) 02:44 20:29	02:24 20:59	03:11 20:18	04:22 18:58	05:32 17:26	06:43 16:01	07:58 14:53	08:36 14:43
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24	11 18:27 (5) 02:42 20:31	02:25 20:58	03:13 20:16	04:24 18:55	05:35 17:23	06:46 15:58	08:00 14:52	08:36 14:44
29	07:57 15:47	06:40 17:03	05:17 18:12	03:48 19:26	14 18:39 (5) 02:40 20:33	02:25 20:58	03:15 20:14	04:26 18:52	05:37 17:20	06:48 15:56	08:02 14:51	08:36 14:45
30	07:55 15:49	06:38 17:05	05:14 18:15	03:45 19:29	7 18:35 (5) 02:39 20:35	02:26 20:58	03:17 20:11	04:29 18:49	05:39 17:17	06:51 15:53	08:04 14:49	08:36 14:46
31	07:53 15:52	06:35 17:08	05:11 18:17	03:43 19:30	02:37 20:37	02:30 20:09	03:19 18:46	04:31 18:46	05:40 15:50	06:53 14:50	08:04 14:49	08:36 14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case				117				115				
Sun reduction				0.30				0.24				
Oper. time red.				0.93				0.93				
Wind dir. red.				0.68				0.68				
Total reduction				0.19				0.15				
Total, real				22				17				

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:

Gismarvik

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Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: GD - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (390)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	03:42 19:31	02:36 20:38	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	06:56 15:48	08:06 14:48
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:33	02:34 20:40	02:28 20:56	03:24 20:04	04:35 18:40	05:44 17:11	06:58 15:45	08:08 14:47
3	08:34 14:52	07:46 15:59	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	08:10 14:46
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:28 20:00	04:40 18:34	05:48 17:06	07:03 15:40	08:12 14:45
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:40	02:30 20:45	02:31 20:54	03:31 19:57	04:42 18:31	05:51 17:03	07:06 15:38	08:14 14:44
6	08:32 14:56	07:39 16:07	06:24 17:17	04:53 18:31	03:30 19:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36	08:16 14:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:47	02:34 20:52	03:35 19:52	04:47 18:26	05:55 16:57	07:11 15:33	08:17 14:42
8	08:31 15:00	07:34 16:12	06:18 17:22	04:47 18:36	03:25 19:48	02:27 20:49	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 15:31	08:19 14:41
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	07:16 15:28	08:21 14:40
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:52	02:26 20:51	02:38 20:48	03:42 19:44	04:54 18:17	06:02 16:48	07:18 15:26	08:22 14:40
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:52	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24	08:24 14:39
12	08:26 15:08	07:24 16:22	06:07 17:32	04:35 18:46	03:15 19:57	02:24 20:53	02:42 20:46	03:47 19:39	04:58 18:11	06:07 16:42	07:23 15:22	08:25 14:39
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	03:12 19:59	02:24 20:54	02:43 20:44	03:49 19:36	05:01 18:08	06:10 16:40	07:26 15:19	08:26 14:39
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	03:10 19:52	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:17	08:28 14:38
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	03:08 19:54	02:23 20:56	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	07:30 15:15	08:29 14:38
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	03:06 19:57	02:22 20:57	02:49 20:39	03:56 19:28	05:07 17:59	06:17 16:31	07:33 15:13	08:30 14:38
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	03:03 19:59	02:22 20:58	02:50 20:38	03:59 19:26	05:10 17:56	06:19 16:28	07:35 15:11	08:31 14:38
18	08:18 15:20	07:09 16:38	05:49 17:46	04:18 19:00	03:01 19:52	02:22 20:58	02:52 20:36	04:01 19:23	05:12 17:53	06:22 16:25	07:38 15:09	08:32 14:38
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	02:59 19:54	02:22 20:58	02:54 20:34	04:03 19:20	05:14 17:50	06:24 16:23	07:40 15:07	08:32 14:38
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	02:57 19:56	02:22 20:59	02:56 20:32	04:05 19:17	05:16 18:26 (5)	06:26 17:47	07:42 15:05	08:33 14:39
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	02:55 19:57	02:22 20:59	02:58 20:30	04:08 19:15	05:19 18:23 (5)	06:29 17:44	07:45 15:03	08:34 14:39
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	02:53 19:59	02:22 20:59	03:00 20:29	04:10 19:12	05:21 18:33 (5)	06:31 17:41	07:47 15:02	08:34 14:39
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	02:51 20:21	02:22 20:59	03:02 20:27	04:12 19:09	05:23 18:34 (5)	06:34 17:38	07:49 15:00	08:35 14:40
24	08:07 15:35	06:52 16:53	05:31 18:01	04:01 19:14	02:49 20:23	02:22 20:59	03:04 20:25	04:15 19:06	05:25 18:32 (5)	06:36 17:35	07:52 15:09	08:35 14:41
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	02:47 20:25	02:23 20:59	03:06 20:22	04:17 19:03	05:28 18:18 (5)	06:39 17:32	07:54 15:06	08:36 14:41
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 19:19	02:45 20:27	02:23 20:59	03:09 20:20	04:19 19:00	05:30 18:17 (5)	06:41 17:29	07:56 15:04	08:36 14:42
27	08:02 15:42	06:44 17:00	05:22 18:08	03:53 19:21	02:44 20:29	02:24 20:59	03:11 20:18	04:22 18:58	05:32 18:18 (5)	06:43 17:26	07:58 16:01	08:36 14:43
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24	02:42 20:31	02:25 20:58	03:13 20:16	04:24 18:55	05:35 18:22 (5)	06:46 17:23	08:00 15:58	08:36 14:44
29	07:57 15:47		05:17 18:12	03:48 19:26	02:40 20:33	02:25 20:58	03:15 20:14	04:26 18:52	05:37 18:19 (5)	06:48 17:20	08:02 15:56	08:36 14:45
30	07:55 15:49		05:14 18:15	03:45 19:29	02:39 20:35	02:26 20:58	03:17 20:11	04:29 18:49	05:39 17:17	06:51 15:53	08:04 14:49	08:36 14:46
31	07:53 15:52		05:11 18:17		02:37 20:37		03:19 20:09	04:31 18:46		06:53 15:50		08:36 14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case				83				86				
Sun reduction				0.30				0.24				
Oper. time red.				0.93				0.93				
Wind dir. red.				0.67				0.67				
Total reduction				0.19				0.15				
Total, real				15				13				

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:  
Gismarvik

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Calculated:  
15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: GE - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (391)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []  
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time  
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35	07:51	06:38	05:08	03:42	02:36	02:27	03:22	04:33	05:42	06:56	08:06
	14:49	15:54	17:05	18:19	19:31	20:38	20:57	20:07	18:43	17:14	15:48	14:48
2	08:35	07:49	06:36	05:05	03:40	02:34	02:28	03:24	04:35	05:44	06:58	08:08
	14:50	15:57	17:08	18:22	19:33	20:40	20:56	20:04	18:40	17:11	15:45	14:47
3	08:34	07:46	06:33	05:02	03:37	02:33	02:29	03:26	04:38	05:46	07:01	08:10
	14:52	15:59	17:10	18:24	19:36	20:42	20:56	20:02	18:37	17:09	15:43	14:46
4	08:34	07:44	06:30	04:59	03:35	02:32	02:30	03:28	04:40	05:48	07:03	08:12
	14:53	16:02	17:13	18:27	19:38	20:43	20:55	20:00	18:34	17:06	15:40	14:45
5	08:33	07:42	06:27	04:56	03:32	02:30	02:31	03:31	04:42	05:51	07:06	08:14
	14:55	16:05	17:15	18:29	19:40	20:45	20:54	19:57	18:31	17:03	15:38	14:44
6	08:32	07:39	06:24	04:53	03:30	02:29	02:33	03:33	04:45	05:53	07:08	08:16
	14:57	16:07	17:17	18:31	19:43	20:46	20:53	19:55	18:29	17:00	15:36	14:43
7	08:32	07:37	06:21	04:50	03:27	02:28	02:34	03:35	04:47	05:55	07:11	08:17
	14:58	16:10	17:20	18:34	19:45	20:47	20:52	19:52	18:26	16:57	15:33	14:42
8	08:31	07:34	06:18	04:47	03:25	02:27	02:35	03:38	04:49	05:58	07:13	08:19
	15:00	16:12	17:22	18:36	19:48	20:49	20:51	19:50	18:23	16:54	15:31	14:41
9	08:30	07:32	06:15	04:44	03:22	02:26	02:37	03:40	04:51	06:00	07:16	08:21
	15:02	16:15	17:25	18:38	19:50	20:50	20:50	19:47	18:20	16:51	15:28	14:40
10	08:29	07:30	06:13	04:41	03:20	02:26	02:38	03:42	04:54	06:02	07:18	08:22
	15:04	16:17	17:27	18:41	19:52	20:51	20:48	19:44	18:17	16:48	15:26	14:40
11	08:28	07:27	06:10	04:38	03:17	02:25	02:40	03:45	04:56	06:05	07:21	08:24
	15:06	16:20	17:30	18:43	19:55	20:52	20:47	19:42	18:14	16:45	15:24	14:39
12	08:26	07:24	06:07	04:35	03:15	02:24	02:42	03:47	04:58	06:07	07:23	08:25
	15:08	16:22	17:32	18:46	19:57	20:53	20:46	19:39	18:11	16:42	15:22	14:39
13	08:25	07:22	06:04	04:33	03:12	02:24	02:43	03:49	05:01	06:10	07:26	08:26
	15:10	16:25	17:34	18:48	19:59	20:54	20:44	19:36	18:08	16:40	15:19	14:39
14	08:24	07:19	06:01	04:30	03:10	02:23	02:45	03:52	05:03	06:12	07:28	08:28
	15:12	16:28	17:37	18:50	20:02	20:55	20:43	19:34	18:05	16:37	15:17	14:38
15	08:23	07:17	05:58	04:27	03:08	02:23	02:47	03:54	05:05	06:14	07:30	08:29
	15:14	16:30	17:39	18:53	20:04	20:56	20:41	19:31	18:02	16:34	15:15	14:38
16	08:21	07:14	05:55	04:24	03:06	02:22	02:49	03:56	5 18:34 (5)	05:07	06:17	07:33
	15:16	16:33	17:42	18:55	20:06	20:57	20:39	19:28	4 18:38 (5)	17:59	16:31	15:13
17	08:20	07:11	05:52	04:21	03:03	02:22	02:50	03:59	6 18:31 (5)	05:10	06:19	07:35
	15:18	16:35	17:44	18:57	20:08	20:57	20:38	19:26	9 18:40 (5)	17:56	16:28	15:11
18	08:18	07:09	05:49	04:18	3 18:24 (5)	03:01	02:22	02:52	04:01	18:29 (5)	05:12	06:22
	15:20	16:38	17:46	19:00	3 18:27 (5)	20:10	20:58	20:36	12 18:41 (5)	17:53	16:25	15:09
19	08:16	07:06	05:46	04:15	6 18:23 (5)	02:59	02:22	02:54	04:03	18:28 (5)	05:14	06:24
	15:23	16:40	17:49	19:02	6 18:29 (5)	20:13	20:58	20:34	14 18:42 (5)	17:50	16:23	15:07
20	08:15	07:03	05:43	04:13	9 18:23 (5)	02:57	02:22	02:56	04:05	18:27 (5)	05:16	06:26
	15:25	16:43	17:51	19:05	9 18:32 (5)	20:15	20:59	20:32	15 18:42 (5)	17:47	16:20	15:05
21	08:13	07:01	05:40	04:10	12 18:22 (5)	02:55	02:22	02:58	04:08	18:27 (5)	05:19	06:29
	15:27	16:45	17:53	19:07	12 18:34 (5)	20:17	20:59	20:30	14 18:41 (5)	17:44	16:17	15:03
22	08:11	06:58	05:37	04:07	14 18:22 (5)	02:53	02:22	03:00	04:10	18:27 (5)	05:21	06:31
	15:30	16:48	17:56	19:09	14 18:36 (5)	20:19	20:59	20:29	11 18:38 (5)	17:41	16:14	15:02
23	08:09	06:55	05:34	04:04	16 18:22 (5)	02:51	02:22	03:02	04:12	18:26 (5)	05:23	06:34
	15:32	16:50	17:58	19:12	16 18:38 (5)	20:21	20:59	20:27	9 18:35 (5)	17:38	16:12	15:00
24	08:07	06:52	05:31	04:01	18 18:22 (5)	02:49	02:23	03:04	04:15	18:26 (5)	05:25	06:36
	15:35	16:53	18:01	19:14	14 18:36 (5)	20:23	20:59	20:24	6 18:32 (5)	17:35	16:09	14:58
25	08:06	06:50	05:28	03:59	18 18:23 (5)	02:47	02:23	03:06	04:17	18:27 (5)	05:28	06:39
	15:37	16:55	18:03	19:17	12 18:35 (5)	20:25	20:59	20:22	2 18:29 (5)	17:32	16:06	14:57
26	08:04	06:47	05:25	03:56	18 18:25 (5)	02:45	02:23	03:09	04:19	05:30	06:41	07:56
	15:39	16:58	18:05	19:19	9 18:34 (5)	20:27	20:59	20:20	19:00	17:29	16:04	14:55
27	08:02	06:44	05:22	03:53	12 18:24 (5)	02:44	02:24	03:11	04:22	05:32	06:43	07:58
	15:42	17:00	18:08	19:21	20:29	20:59	20:18	18:58	17:26	16:01	14:53	14:43
28	08:00	06:41	05:20	03:51	14 18:24 (5)	02:42	02:25	03:13	04:24	05:35	06:46	08:00
	15:44	17:03	18:10	19:24	20:31	20:58	20:16	18:55	17:23	15:58	14:52	14:44
29	07:57		05:17	03:48	16 18:25 (5)	02:40	02:25	03:15	04:26	05:37	06:48	08:02
	15:47		18:12	19:26	20:33	20:58	20:14	18:52	17:20	15:56	14:51	14:45
30	07:55		05:14	03:45	18 18:25 (5)	02:39	02:26	03:17	04:29	05:39	06:51	08:04
	15:49		18:15	19:29	20:35	20:58	20:11	18:49	17:17	15:53	14:49	14:46
31	07:53		05:11		20:37	02:37	03:19	04:31		06:53		08:36
	15:52		18:17		20:37		20:09	18:46		15:50		14:47
Potential sun hours	216	257	365	434	526	554	551	481		387	318	232
Total, worst case				95								194
Sun reduction				0.30								0.24
Oper. time red.				0.93								0.93
Wind dir. red.				0.67								0.67
Total reduction				0.19								0.15
Total, real				18								14

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:

Gismarvik

Printed/Page

15.08.2011 12:14 / 250

Licensed user:

Kjeller Vindteknikk AS  
Gunnar Randres vei 12  
NO-2007 Kjeller  
(+47) 480 50 480

Tove Risberg / tove.risberg@vindteknikk.no

Calculated:

15.08.2011 09:56/2.7.486



## SHADOW - Calendar

Calculation: Skyggekast Gismarvik Shadow receptor: GF - Shadow Receptor: 2.0 x 2.0 Azimuth: -180.0° Slope: 0.0° (392)

### Assumptions for shadow calculations

Maximum distance for influence 1 500 m  
Minimum sun height over horizon for influence 3 °  
Day step for calculation 1 days  
Time step for calculation 1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0.27 0.29 0.28 0.30 0.35 0.30 0.26 0.24 0.26 0.28 0.28 0.30

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
813 231 221 428 610 1 281 1 143 697 478 515 675 1 091 8 182  
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:35 14:49	07:51 15:54	06:38 17:05	05:08 18:19	03:42 19:31	02:36 20:38	02:27 20:57	03:22 20:07	04:33 18:43	05:42 17:14	06:56 15:48	08:06 14:48
2	08:35 14:50	07:49 15:57	06:36 17:08	05:05 18:22	03:40 19:33	02:34 20:40	02:28 20:56	03:24 20:04	04:35 18:40	05:44 17:11	06:58 15:45	08:08 14:47
3	08:34 14:52	07:46 15:59	06:33 17:10	05:02 18:24	03:37 19:36	02:33 20:42	02:29 20:56	03:26 20:02	04:38 18:37	05:46 17:09	07:01 15:43	08:10 14:46
4	08:34 14:53	07:44 16:02	06:30 17:13	04:59 18:27	03:35 19:38	02:32 20:43	02:30 20:55	03:28 20:00	04:40 18:34	05:48 17:06	07:03 15:40	08:12 14:45
5	08:33 14:55	07:42 16:05	06:27 17:15	04:56 18:29	03:32 19:40	02:30 20:45	02:31 20:54	03:31 19:57	04:42 18:31	05:51 17:03	07:06 15:38	08:14 14:44
6	08:32 14:57	07:39 16:07	06:24 17:17	04:53 18:31	03:30 19:43	02:29 20:46	02:33 20:53	03:33 19:55	04:45 18:29	05:53 17:00	07:08 15:36	08:16 14:43
7	08:32 14:58	07:37 16:10	06:21 17:20	04:50 18:34	03:27 19:45	02:28 20:47	02:34 20:52	03:35 19:52	04:47 18:26	05:55 16:57	07:11 15:33	08:17 14:42
8	08:31 15:00	07:34 16:12	06:18 17:22	04:47 18:36	03:25 19:48	02:27 20:49	02:35 20:51	03:38 19:50	04:49 18:23	05:58 16:54	07:13 15:31	08:19 14:41
9	08:30 15:02	07:32 16:15	06:15 17:25	04:44 18:38	03:22 19:50	02:26 20:50	02:37 20:50	03:40 19:47	04:51 18:20	06:00 16:51	07:16 15:28	08:21 14:40
10	08:29 15:04	07:30 16:17	06:13 17:27	04:41 18:41	03:20 19:52	02:26 20:51	02:38 20:48	03:42 19:44	04:54 18:17	06:02 16:48	07:18 15:26	08:22 14:40
11	08:28 15:06	07:27 16:20	06:10 17:30	04:38 18:43	03:17 19:55	02:25 20:52	02:40 20:47	03:45 19:42	04:56 18:14	06:05 16:45	07:21 15:24	08:24 14:39
12	08:26 15:08	07:24 16:22	06:07 17:32	04:35 18:46	03:15 19:57	02:24 20:53	02:42 20:46	03:47 19:39	04:58 18:11	06:07 16:42	07:23 15:22	08:25 14:39
13	08:25 15:10	07:22 16:25	06:04 17:34	04:33 18:48	03:12 19:59	02:24 20:54	02:43 20:44	03:49 19:36	05:01 18:08	06:10 16:40	07:26 15:19	08:26 14:39
14	08:24 15:12	07:19 16:28	06:01 17:37	04:30 18:50	03:10 20:02	02:23 20:55	02:45 20:43	03:52 19:34	05:03 18:05	06:12 16:37	07:28 15:17	08:28 14:38
15	08:23 15:14	07:17 16:30	05:58 17:39	04:27 18:53	03:08 20:04	02:23 20:56	02:47 20:41	03:54 19:31	05:05 18:02	06:14 16:34	07:30 15:15	08:29 14:38
16	08:21 15:16	07:14 16:33	05:55 17:42	04:24 18:55	18:20 (5) 20:06	03:06 20:06	02:22 20:39	03:56 19:28	05:07 17:59	06:17 16:31	07:33 15:13	08:30 14:38
17	08:20 15:18	07:11 16:35	05:52 17:44	04:21 18:57	18:19 (5) 20:08	03:03 20:07	02:22 20:57	03:59 19:26	05:10 17:56	06:19 16:28	07:35 15:11	08:31 14:38
18	08:18 15:20	07:09 16:38	05:49 17:46	04:18 19:00	18:19 (5) 20:10	03:01 20:08	02:22 20:58	04:01 19:23	05:12 17:53	06:22 16:25	07:38 15:09	08:32 14:38
19	08:16 15:23	07:06 16:40	05:46 17:49	04:15 19:02	18:18 (5) 20:13	02:59 20:13	02:22 20:58	04:03 19:20	18:28 (5) 17:50	05:14 16:23	06:24 15:07	08:32 14:38
20	08:15 15:25	07:03 16:43	05:43 17:51	04:13 19:05	18:19 (5) 20:15	02:57 20:15	02:22 20:59	04:05 19:17	18:25 (5) 17:47	05:16 16:20	06:26 15:05	08:33 14:39
21	08:13 15:27	07:01 16:45	05:40 17:53	04:10 19:07	18:19 (5) 20:17	02:55 20:17	02:22 20:59	04:08 19:15	18:24 (5) 17:44	05:19 16:17	06:29 15:03	08:34 14:39
22	08:11 15:30	06:58 16:48	05:37 17:56	04:07 19:09	18:19 (5) 20:19	02:53 20:19	02:22 20:59	04:10 19:12	18:38 (5) 17:41	05:21 16:14	06:31 15:02	08:34 14:39
23	08:09 15:32	06:55 16:50	05:34 17:58	04:04 19:12	18:21 (5) 20:21	02:51 20:19	02:22 20:59	04:12 19:09	18:22 (5) 17:38	05:23 16:12	06:34 15:00	08:35 14:40
24	08:07 15:35	06:52 16:53	05:31 18:01	04:01 19:14	18:23 (5) 20:23	02:49 20:19	02:23 20:59	04:15 19:06	18:22 (5) 17:35	05:25 16:09	06:36 14:58	08:35 14:41
25	08:06 15:37	06:50 16:55	05:28 18:03	03:59 19:17	18:28 (5) 20:27	02:47 20:19	02:23 20:59	04:17 19:03	18:21 (5) 17:32	05:28 16:06	06:39 14:57	08:36 14:41
26	08:04 15:39	06:47 16:58	05:25 18:05	03:56 19:19	18:29 (5) 20:27	02:45 20:19	02:23 20:59	04:19 19:20	18:21 (5) 17:29	05:30 16:04	06:41 14:55	08:36 14:42
27	08:02 15:42	06:44 17:00	05:22 18:08	03:53 19:21	18:32 (5) 20:29	02:57 20:18	02:22 20:59	04:05 18:58	18:25 (5) 17:26	05:32 16:01	06:43 14:53	08:36 14:43
28	08:00 15:44	06:41 17:03	05:20 18:10	03:51 19:24	18:33 (5) 20:31	02:55 20:16	02:22 20:58	04:04 18:55	18:22 (5) 17:23	05:35 15:58	06:46 14:52	08:36 14:44
29	07:57 15:47	06:40 17:03	05:17 18:12	03:48 19:26	18:34 (5) 20:33	02:54 20:14	02:25 20:58	04:26 18:52	18:23 (5) 17:20	05:37 15:56	06:48 14:51	08:36 14:45
30	07:55 15:49	06:39 17:05	05:14 18:15	03:45 19:29	18:35 (5) 20:37	02:56 20:11	02:26 20:58	04:29 18:49	18:24 (5) 17:17	05:39 15:53	06:51 14:49	08:36 14:46
31	07:53 15:52	06:37 17:08	05:11 18:17	03:43 19:31	18:36 (5) 20:39	02:57 20:09	02:27 20:59	04:31 18:46	18:25 (5) 17:15	05:40 15:50	06:53 14:47	08:36 14:47
Potential sun hours	216	257	365	434	526	554	551	481	387	318	232	194
Total, worst case				82				86				
Sun reduction				0.30				0.24				
Oper. time red.				0.93				0.93				
Wind dir. red.				0.67				0.67				
Total reduction				0.19				0.15				
Total, real				15				13				

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)