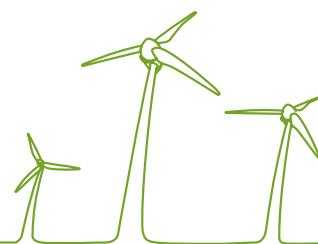


OX2

Märkenkall vindkraftpark

Buller- och skuggmodelleringar V136 x 15 x HH172



Vadbäck Hans

13.6.2016

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1 SYFTET MED BULLER- OCH SKUGGMODELLERINGARNA

Buller- och skuggkonsekvenserna för vindkraftsprojektet, som planeras på Korsholm kommuns och Vasa stads områden, har bedömts genom att modellera de ljudtrycksnivåer och skuggor som vindkraftverken ger upphov till. Syftet med modelleringarna är att illustrera på hur stort område ifrågavarande konsekvenser uppstår samt att uppskatta konsekvenserna för närliggande permanenta bostäder och fritidsbostäder.

Det buller som förorsakas av vindkraftverken har bedömts med hjälp av en kalkylmodell enligt vilken har en bullermodellering utarbetats med dataprogrammet WindPRO. Utbredningszoner av vindkraftsbuller enligt projektplanen modellerades i överensstämmelse med de nyaste anvisningarna om vindkraftsbuller (anvisning OH 2/2014 Modellering av buller från vindkraftverk, miljöministeriet 2014).

De skuggor som förorsakas av vindkraftverken har modellerats med hjälp av Shadow-modulen i dataprogrammet WindPRO i enlighet med vindkraftverkens preliminära placeringar.

Buller- och skuggmodelleringarna har gjorts av FCG Design och planering Ab Ins. Hans Vadbäck och för kvalitetsgranskningen har ansvarat distriktchef Jakob Kjellman.

2 UTGÅNGSDATA OCH METODER

2.1 Buller

2.1.1 Bullermodellering MM OH 2/2014

Ljudtrycksnivåerna från vindkraftverken har modellerats med kalkylprogrammet WindPRO enligt standarden ISO 9613-2. I modelleringen användes som vindens hastighet 8 m/s uppmätt i 10 meters höjd, som lufttemperatur 15 °C, som lufttryck 101,325 kPa och som luftens relativa fuktighet 70 %.

Som utgångsdata d.v.s. som referenskraftverk har kraftverket V136 på 3,45 MW från kraftverksleverantören Vestas använts. Som kraftverkets navhöjd användes 172 m och därmed är vindkraftverkens totala höjd 240 m.

Ljudeffektnivån har uppskattats på basen av uppgifter från kraftverkstillverkaren, med att först beräkna den i navhöjden förhärskande vindens hastighet enligt formel 5.3.1 i miljöministeriets anvisning 4/2014. Som markytans grovhet användes värdet 0,3 och som vindkraftverkens ljudeffekt (L_{WA}) värdet 108,2 dB(A). Enligt uppgifter från vindkraftstillverkaren motsvarar den ljudeffektnivån som användes högre 95% CL.

Beräkningen gjordes för höjden 4,0 meter över markytan. Som markens hårdhet användes värdet 0,4 enligt miljöförvaltningens anvisning 2/2014 "Modellering av buller från vindkraftverk".

Resultaten av ljudmodelleringen har åskådliggjorts med kartor som visar den s.k. genomsnittliga ljudnivån. I medelljudnivåkartan presenteras medelljudnivå- dvs. ekvivalentljudnivåkurvor (L_{Aeq}) med 5 dB intervall.

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Tabell 1. Modelleringsprogram, vindkraftverkens ljudeffektnivåer och bullrets särdrag.

UPPGIFTER OM MODELLERINGSPROGRAMMET							
Modelleringsprogram och version: WindPRO version 3.0.619				Modelleringsmetod: ISO 9613-2			
VINDKRAFTVERKETS (VINDKRAFTVERKENS) UPPGIFTER							
Vindkraftverkets tillverkare: Vestas				Typ: V136-3.45 MW		Serienummer:-	
Nominell effekt: 3,45 MW		Navhöjd:172		Rotordiameter: 136 m		Torntyp: hybrid	
Möjligheter at påverka vindkraftverkets bullerutsläpp under drift och åtgärdens inverkan på bullret							
Reglering av bladvinkeln		Rotationshastighet		Annat, vad: NO STE			
Ja	- dB	Ja	- dB	Noise mode justering:		-	
Nej		Nej		Noise mode, källjud:		-	
AKUSTISKA DATA/BERÄKNINGENS UTGÅNGSDATA							
Ljuddata grundar sig på tillverkarens dokument " DMS no.: DMS 0055-9919_V00, V136-mk3--3.45MW- Third octave noise emission, Date 2015-11-23).							
Per oktav [Hz], dB(A)		Per 1/3-oktav, LWA dB [Hz]					
		20	73,8	200	89,7	2000	96,4
63	86,7	25	74,4	250	91,5	2500	92,8
125	95,0	31,5	73,9	315	93,5	3150	88,3
250	96,9	40	77,3	400	95,4	4000	85,9
500	101,0	50	81,3	500	95,6	5000	75,1
1000	104,3	63	81,2	630	97,0	6300	66,2
2000	102,2	80	83,3	800	98,5	8000	56,9
4000	90,8	100	86,4	1000	99,5	10000	57,2
8000	68,6	125	91,8	1250	100,1		
108,2 dB(A)		160	91,0	1600	100,5		
Mätning och observationer av ljuddatas särdrag:							
Smalbandighet / Tonalitet		Impulsartat		Betydelsefullt pulserande (amplitudmodulation)		Annat, vad: ökning på +2 dB (markytans höjd >60m)	
ja	nej	ja	nej	ja	nej	ja	nej

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Tabell 1. Använda modelleringsparametrar i beräkningarna i enlighet med ISO 9613-2 samt objekt utsatta för buller.

AKUSTISKA DATA/BERÄKNINGENS UTGÅNGSDATA			
Beräkningshöjd		Beräkningsrutans storlek [m·m]	
ISO 9613-2: 4,0 m		25x25 m	
Relativ fuktighet		Temperatur	
70 %	Annat, vad och varför:	ISO 9613-2: 15 C°	
Terrängmodellens källa och noggrannhet			
Terrängmodellens källa: LMV terrängdatabas		Vågrät upplösning: 1,0 m	Lodrät upplösning: 0,5 m
Beaktande av absorption och reflektion vid mark- och vattenytan, använda faktorer			
ISO 9613-2	0,4		OBS
Atmosfärens stabilitet i beräkningen/meteorologisk korrigering			
Neutral, (0): Neutral		Annat, vad och varför:	
Beaktande av väderförhållandena; vindriktning och hastighet som används i beräkningen			
Vindens riktning: 0-360°		Vindens hastighet: 8 m/s (ref. 10 m)	
Kraftverksljudets riktningsverkan och dämpning			
Fri rymd: ja		Annat, vad och varför:	
De för buller utsatta invånarna och objekt > 40 dB(A), antal (utan bullerbekämpning/styrning av kraftverk)			
Invånare: 0 st	Fritidsbostäder: 0 st		Vårdinrättningar och läroanstalter: 0 st
Utbredning av buller till rekreations- och naturskyddsområden			
Rekreatiomsområden: 0 st		Naturskyddsområden: 0 st	

2.1.2 Modellering av lågfrekvent buller

Det lågfrekventa bullret beräknades enligt metoder framfört i miljöministeriets anvisning OH 2/2014. I beräkningen användes kraftverksleverantörernas uppgifter om kraftverkens bedömda ljudtrycksnivåer (tabell 1).

Social- och hälsovårdsministeriets förordning om boendehälsa 545/2015 anger åtgärdsgränser för det lågfrekventa ljudet. Förordningen trädde i kraft 15.5.2015. Åtgärdsgränserna gäller bostadsrum och är angivna som ovägda tersvisa medelljudnivåer under en timme. Riktvärdena gäller nattetid och dagtid tillåts 5 dB högre värden.

Ljudnivået inomhus bedömdes enligt ljudisoleringsvärden angett i den danska beräkningsanvisningen DSO1284 och resultaten jämfördes med åtgärdsgränserna.

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I tillägg får buller i nattetid, som eventuellt orsakar sömnstörningar och som tydligt kan urskiljas från bakgrundsbullret, inte överskrida 25 dB mätt som ekvivalentnivå $L_{Aeq,1h}$ under en timme i sådana utrymmen som är avsedda att sova i.

Följande planeringsriktvärden angivna som ovägd tersvisa medelljudnivåer under en timme $L_{eq,1h}$ används för det lågfrekventa eller smalbandiga bullers del inomhus i bostäder.

Tabell 3. Åtgärdsgränser för medelljudnivån för en timme lågfrekvensbuller inomhus i utrymmen som är avsedda att sova i.

Band / Hz	20	25	31,5	40	50	63	80	100	125	160	200
Medelljudnivå $L_{Zeq,1h}$, dB	74	64	56	49	44	42	40	38	36	34	32
Av det föregående beräknade A-betonad medelljudnivå ($L_{Aeq,1h}$, dB)	24	19	17	14	14	16	18	19	20	21	21

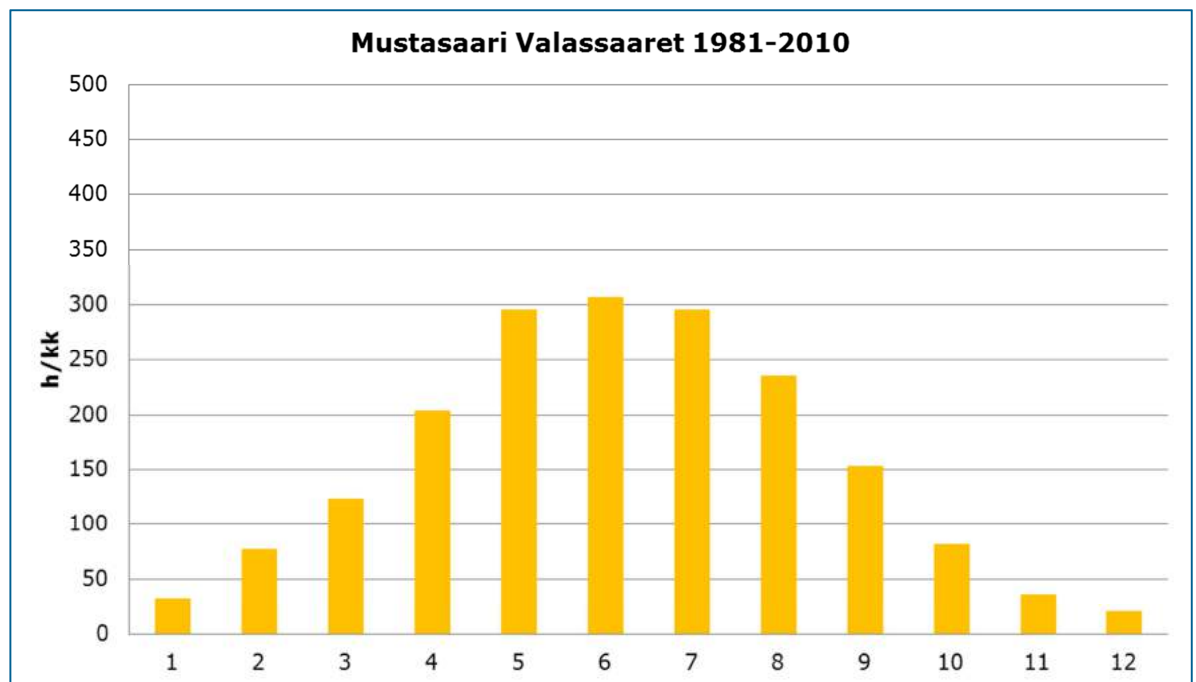
2.2 Skuggmodellering

De skuggor som förorsakas av vindkraftverken har modellerats med hjälp av Shadow-modulen i dataprogrammet WindPRO. I skuggmodelleringen användes kraftverket Vestas V136-3.45 MW med en rotordiameter på 136 m och navhöjd på 172 m. Modelleringen gjordes för den s.k. verkliga situationen ("real case"). Modelleringarna gjordes för två olika beräkningssituationer:

- 1) Den verkliga situationen, där skogens skyddande effekt inte har beaktats (real case, no forest), kraftverkens navhöjd = 172 m (HH172)
- 2) Den verkliga situationen, där skogens skyddande effekt har beaktats (real case, forest luke), kraftverkens navhöjd = 172 m (HH172). Data om skogens höjd baserar sig på Naturresursinstitutets (Luke) flerkällinventering av rikets skogar (MVMI) från år 2013. I tillägg till terrängmätningar av rikets skoginventering (VMI) används i MVMI-inventeringen satellitbilder och andra informationskällor liksom Lantmäteriverkets numeriska terrängdatabas och höjdmodell. Storleken av terrängelementet till skogresursernas karttemaer är nu 16 x 16 meter.

De genomsnittliga solskenstimmarna baserar sig på väderdata från långtidsuppföljningen vid väderstationen i Valsörarna i Korsnäs i 1981-2010 (Figur 1). Som vindens riktning och hastighet i beräkningarna användes data från projektområdet (lib 30051) i Finlands vindatlas.

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Figur 1. De genomsnittliga månatliga solskenstimmarna vid väderstationen Korsnäs Valsörarna i åren 1981-2010 (Källa: Meteorologiska institutets rapport 2012:1).

Resultaten av skuggmodelleringen har åskådliggjorts med hjälp av en karta. Kartan visar områdesvis hur länge skuggbildningen varar (1, 8, 10 och 20 timmar per år). Dessutom har konsekvenser för känsliga objekt i vindkraftsparkens omgivning beräknats skilt för sig i modelleringen.

Vid beräkningarna beaktas skuggorna om solen ligger mer än tre grader ovanför horisonten och som skugga räknas en situation då vingen täcker minst 20 procent av solen.

Vid beräkning av modellen beaktas höjdförhållandena i terrängen, kraftverkens placering enligt den preliminära planen, kraftverkens navhöjd och rotordiameter samt tidzonen på projektområdet. Vid modelleringen tar man hänsyn till solens läge över horisonten vid olika tider av dygnet och året, molnigheten per månad, det vill säga hur mycket solen skiner när den är ovanför horisonten, samt vindkraftverkens uppskattade drifttid per år.

Skuggning betraktades på en höjd av 1,0 m och på en beräkningsområdet på 5,0 x 5,0 m i gårdsområden av bostäder och fritidsbostäder, som är belägna i närområdet.

2.3 Gräns- och riktvärden

Statsrådets förordning (1107/2015) för vindkraft anger planeringsriktvärden för maximumvärden till medeljudnivåer i dag- och nattetid. Förordningen trädde i kraft 1.9.2015. Om bullret från vindkraftverken innehåller tonala, smalbandiga eller impulsartade komponenter eller om det är tydligt amplitudmodulerat, ska man enligt anvisningarna tillägga fem decibel till modelleringsresultatet innan man jämför det med planeringsriktvärdet. Eftersom riktvärdet redan innehåller buller som är karaktäristiskt för vindkraftverk, ska ovan nämnda ljudkaraktäristika vara ovanligt kraftiga från vindkraftverk för att det ska vara nödvändigt att tillägga fem decibel till modelleringsresultatets ljudstyrka.

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Tabell 4. Riktvärden för buller från vindkraftverk enligt statsrådets förordning (Statsrådets förordning 27.8.2015).

Utsatt objekt	Dagtid (7-22)	Nattetid (22-7)
Permanent bebyggelse	45 dB	40 dB
Fritidsbebyggelse	45 dB	40 dB
Vårdinrättningar	45 dB	40 dB
Läroanstalter	45 dB	—
Rekreatiomsområden	45 dB	—
Campingplatser	45 dB	40 dB
Nationalparker	40 dB	40 dB

Social- och hälsovårdsministeriets förordning (545/2015) anger åtgärdsgränser för det lågfrekventa ljudet. Förordningen trädde i kraft 15.5.2015. Åtgärdsgränserna gäller bostadsrum och är angivna som ovägda tersvisa medelljudnivåer under en timme. Riktvärdena gäller nattetid och dagtid tillåts 5 dB högre värden.

Tabell 5. Åtgärdsgränser för medelljudnivån för en timme lågfrekvensbuller inomhus i utrymmen som är avsedda att sova i.

Teressikaista Hz	20	25	31,5	40	50	63	80	100	125	160	200
Medelljudnivå (L _{Req} , 1h, dB)	74	64	56	49	44	42	40	38	36	34	32
Av det föregående beräknade A-betonad medelljudnivå (L _{Aeq,1h} , dB)	24	19	17	14	14	16	18	19	20	21	21

I tillägg får buller som eventuellt orsakar sömnstörningar och som tydligt kan urskiljas från bakgrundsbullret, inte överskrida 25 dB mätt som ekvivalentnivå L_{Aeq,1h} under en timme i sådana utrymmen som är avsedda att sova i.

I Finland har myndigheterna inte utfärdat några allmänna bestämmelser om den maximala varaktigheten av skuggbildningen som orsakas av vindkraftverk eller om grunderna för bedömningen av skuggbildningen. I miljöministeriets anvisningar för planering av vindkraftsutbyggnad föreslås att man använder sig av de rekommendationer som andra länder har gett om begränsning av blinkeffekter (Miljöministeriet 2012).

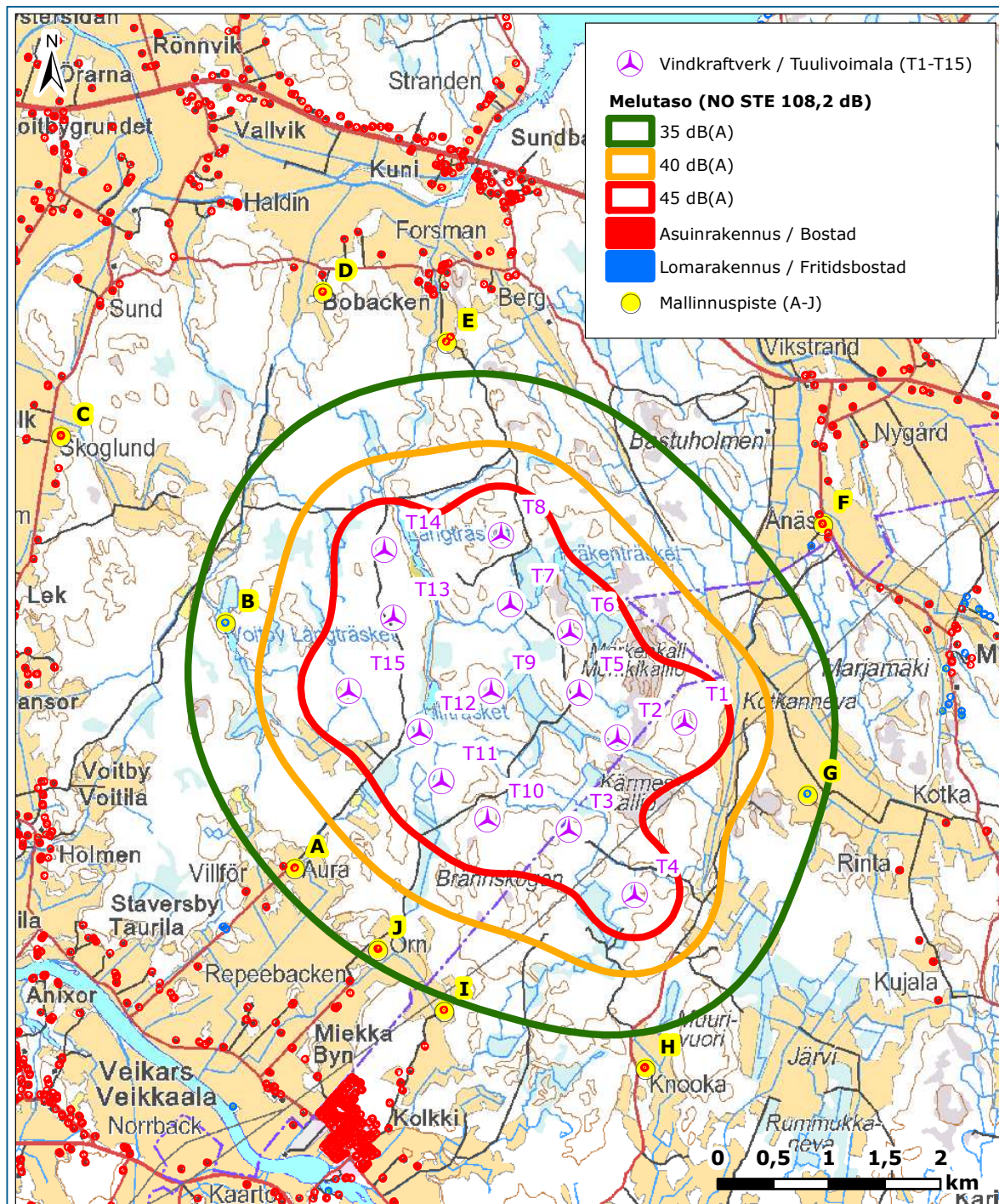
I flera länder har gränsvärden eller rekommendationer angetts om blinkeffekternas acceptabla varaktighet. Till exempel i Danmark tillämpas gränsvärdet maximum 10 timmar per år i den verkliga situationen. I Sverige är den motsvarande rekommendationen åtta timma per år och 30 minuter om dagen.

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3 RESULTATET AV BULLER- OCH SKUGGMODELLERINGARNA

3.1 Resultat av bullermodelleringen ISO 9613-2

De närmaste fritidsbostäderna och bostäderna är belägna på ca 1,3 kilometers avstånd från det närmaste kraftverket. Inom gårdsområdena av de närmaste fritidsbostäderna och bostäderna underskrider bullernivåerna enligt modelleringen 40 dB(A). Beräkningsresultaten presenteras i detalj i bilaga 1.



Figur 2. Beräknade ljudnivåer med vindkraftverk Vestas V136-3.45 MW "NO STE" enligt standarden ISO 9613-2. Navhöjd = 172 m.

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Tabell 2. Beräknade bullernivåer enligt standarden ISO 9613-2 i objekt A-J.

Beräkningspunkt	ETRS89- TM35 Öst	ETRS89- TM35 Nord	Z (m)	Beräknings höjd (m)	Ljudnivå dB(A)
A Bostadshus (Langkujavägen 200)	244 392	7 07 85	10,0	4,0	36,3
B Fritidsbostad (Voitby Långträsket)	243 772	7 009 284	12,8	4,0	37,0
C Bostadshus (Voitbyntie 480)	242 293	7 010 963	5,0	4,0	27,1
D Bostadshus (Kunintie 289)	244 642	7 012 253	5,0	4,0	29,7
E Bostadshus (Sandhedsvägen 65)	245 754	7 011 805	10,0	4,0	33,2
F Bostadshus (Mullontie 128)	249 130	7 010 173	7,5	4,0	31,9
G Fritidsbostad/Scoutstuga (Korpilahdenkuja 134)	248 995	7 007 749	10,0	4,0	36,1
HBostadshus (Kotkannevantie 269)	247 537	7 005 291	18,5	4,0	32,9
I Bostadshus (Klumpintie 171)	245 733	7 005 809	12,5	4,0	34,4
J Bostadshus (Klumpvägen 170)	245 136	7 006 355	10,0	4,0	35,8

3.2 Lågfrekventa ljudnivåer

Resultaten inomhus har jämförts med åtgärdsgränser angett i Social- och hälsovårdsministeriets förordning (545/2015). Åtgärdsgränserna representerar maximumvärden som har uppgjorts för buller i nattetid i sådana utrymmen som är avsedda att sova i. Åtgärdsgränsen har även jämförts med ljudnivån utanför de betraktade byggnaderna. I tabell 7 finns resultaten av den lågfrekventa bullermodelleringen samlade och jämförda med SHM:s åtgärdsgränser. Åtgärdsgränsen har även jämförts med ljudnivån utanför de betraktade byggnaderna. Ett negativt värde (-) i tabellen betyder att åtgärdsgränsen underskrids och ett positivt värde (+) att det överskrids.

Tabell 3. Modelleringsresultat för lågfrekvent buller (V136-3.45 x 15 x HH172 "NO STE") vid känsliga objekt jämfört med Social- och hälsovårdsministeriets åtgärdsgränser.

Byggnad	Ljudnivå utomhus		Ljudnivå inomhus	
	L eq,1h – anvisning om boendehälsa inomhus	Hz	L eq,1h – anvisning om boendehälsa inomhus	Hz
A Bostadshus (Langkujavägen 200)	6,2	125	-7,6	50
B Fritidsbostad (Voitby Långträsket)	6,5	125	-7,3	50
C Bostadshus (Voitbyntie 480)	0,0	125	-13,2	50
D Bostadshus (Kunintie 289)	1,7	125	-11,7	50
E Bostadshus (Sandhedsvägen 65)	4,0	125	-9,6	50
F Bostadshus (Mullontie 128)	3,3	125	-10,2	50
G Fritidsbostad-Scoutstuga (Korpilahdenkuja 134)	5,9	125	-7,9	50
H Bostadshus (Kotkannevantie 269)	3,6	125	-10,0	50
I Bostadshus (Klumpintie 171)	4,9	125	-8,8	50
J Bostadshus (Klumpvägen 170)	5,9	125	-7,9	50

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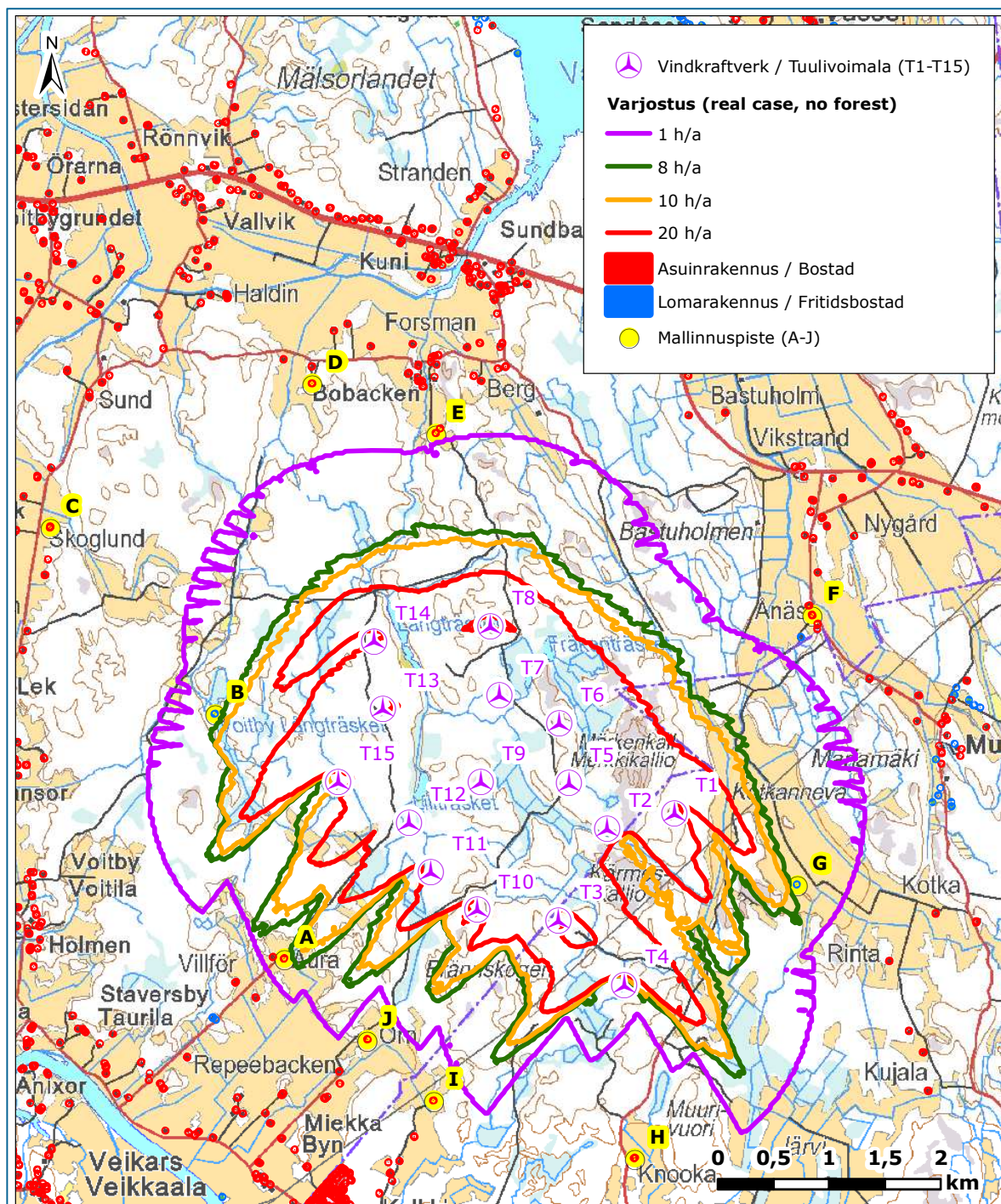
Lågfrekventa ljudnivåer underskrider åtgärdsgränsen för alla byggnader, då byggnadernas ljudisolering beaktas. De bostadsspecifika lågfrekventa ljudnivåerna för de närmaste byggnaderna finns presenterade i bilaga 2. Bostäderna har samma bokstavskännetecken som i ISO 9613-2 modelleringen (bilaga 1).

3.3 Resultat av skuggmodelleringen

Real case, no forest

Enligt resultatet av "real case, no forest"-beräkningen underskrider skuggtiden 8 timmar per år vid alla fritidsbostäder och bostäder som är belägna i närheten av vindkraftparken i alla beräkningspunkter (A-J). Resultaten av skuggmodelleringen presenteras i detalj i bilaga 3.

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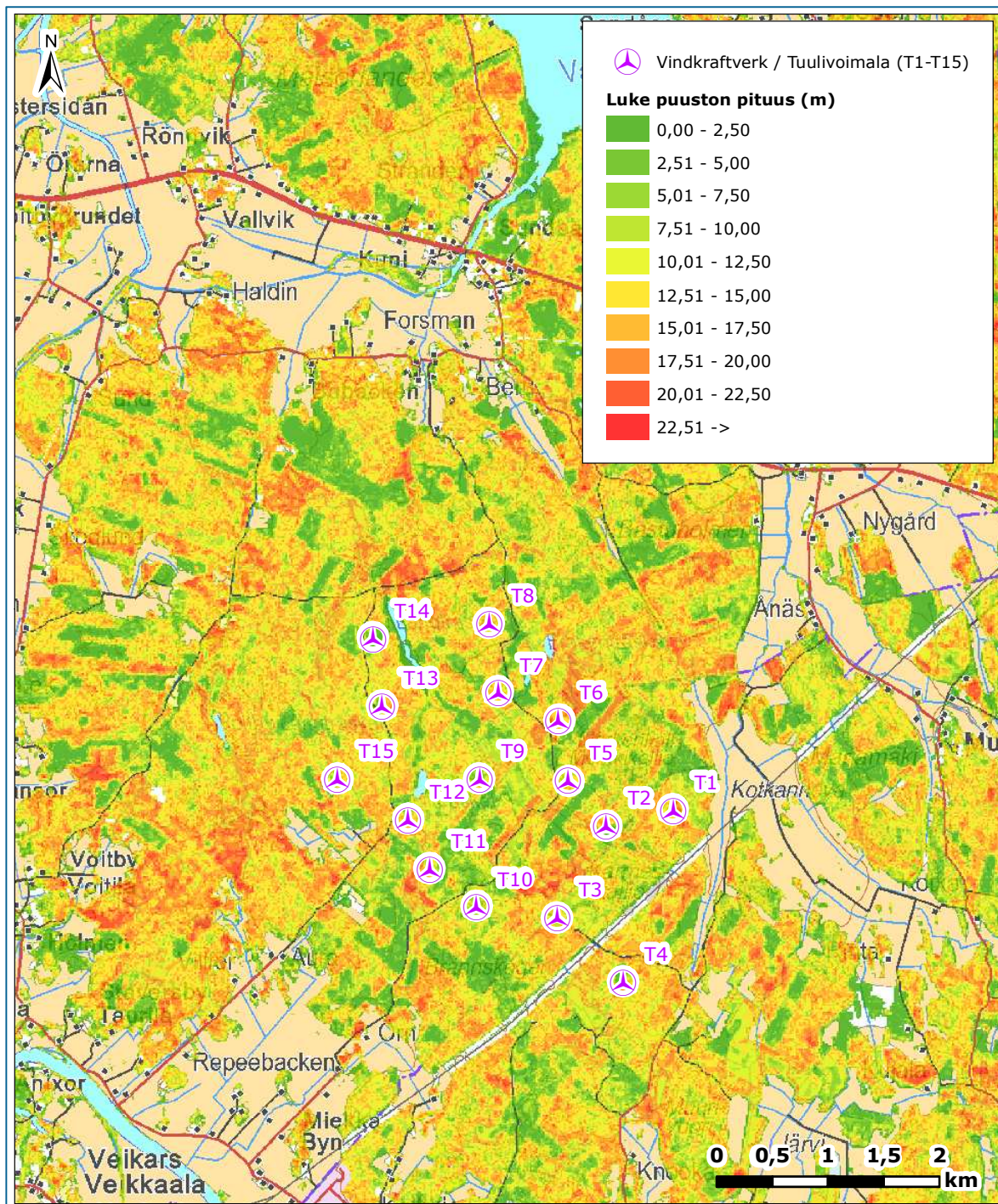


Figur 3. Skuggmodelleringen V136-3.45 MW x 15 x HH172, skogens skyddande effekt har inte beaktats.

Real case, forest luke

Data om skogens höjd i skuggmodelleringen baserar sig på Naturresursinstitutets (Luke) flerkällinventering av rikets skogar (MVMI) från år 2013, (Figur 4).

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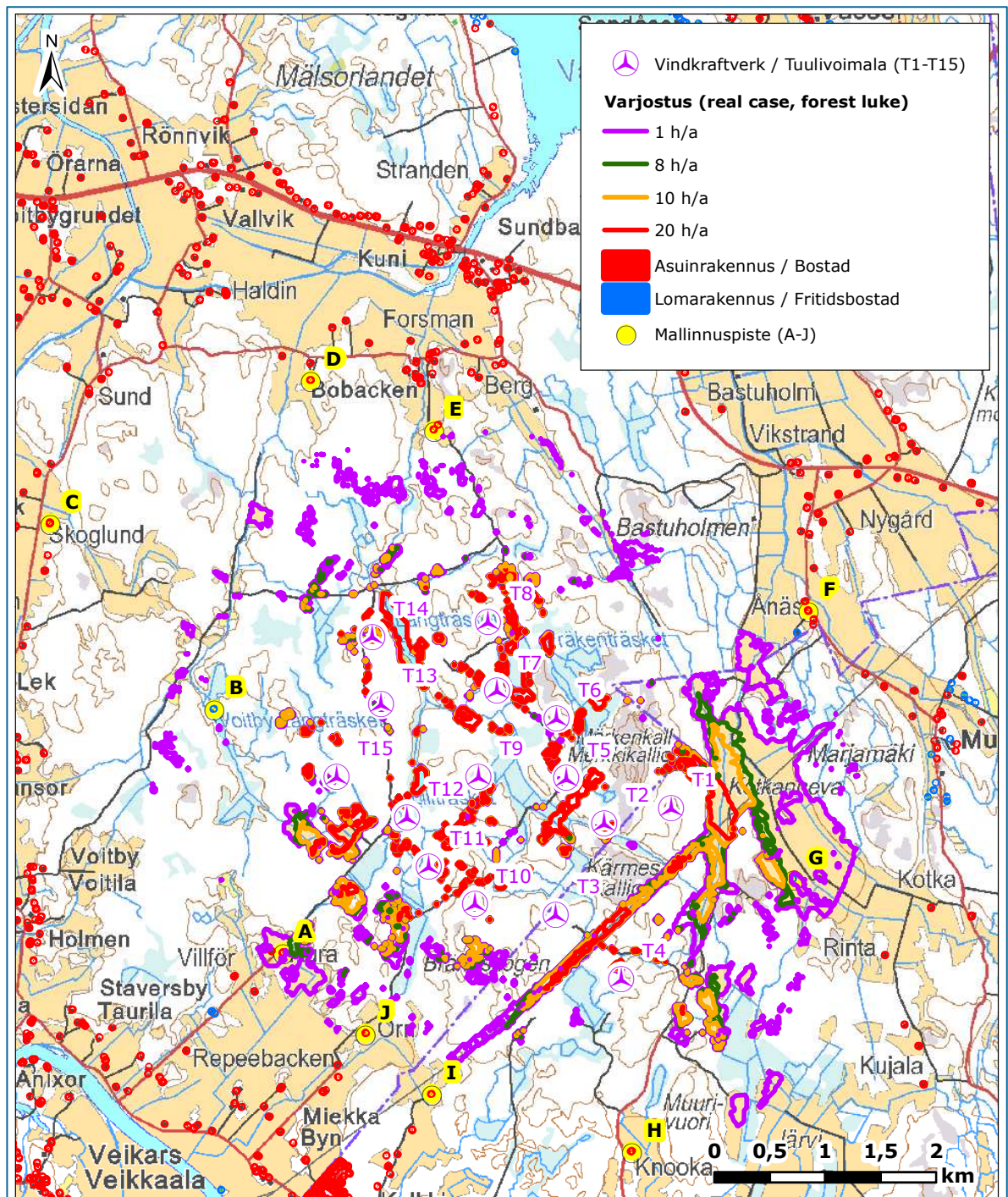


Figur 4. Data om skogens höjd i skuggmodelleringen baserar sig på Naturresursinstitutets (Luke) flerkällinventering av rikets skogar (MVMI) från år 2013.

När skogens skyddande effekt beaktas, blir skuggeffekterna enligt beräkningsresultat betydligt lindrigare, (Figur 5).

Enligt resultatet av "real case, forest luke"-beräkningen underskrider skuggtiden 8 timmar per år vid alla fritidsbostäder och bostäder som är belägna i närheten av vindkraftsverken i alla beräkningspunkter (A-J). Resultaten av skuggmodelleringen presenteras i detalj i bilaga 4.

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Figur 5. Skuggmodelleringen V136-3.45 MW x 15 x HH172, skogens skyddande effekt har beaktats.

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Tabell 8. Beräknade skuggtimmar per år i närområdets beräkningspunkter, när skogens skyddande effekt inte har beaktats "real case, no forest"

Beräkningspunkt	ETRS89-TM35 Öst	ETRS89-TM35 Nord	Z (m)	Beräknings-fönster (m)	Skuggning (h/a)
A Bostadshus (Langkujavägen 200)	244 392	7 07 85	10,0	5 x 5	6:47
B Fritidsbostad (Voitby Långträsket)	243 772	7 009 284	12,8	5 x 5	7:32
C Bostadshus (Voitbyntie 480)	242 293	7 010 963	5,0	5 x 5	0:00
D Bostadshus (Kunintie 289)	244 642	7 012 253	5,0	5 x 5	0:00
E Bostadshus (Sandhedsvägen 65)	245 754	7 011 805	10,0	5 x 5	0:00
F Bostadshus (Mullontie 128)	249 130	7 010 173	7,5	5 x 5	0:00
G Fritidsbostad/Scoutstuga (Korpilahdenkuja 134)	248 995	7 007 749	10,0	5 x 5	5:24
H Bostadshus (Kotkannevantie 269)	247 537	7 005 291	18,5	5 x 5	0:00
I Bostadshus (Klumpintie 171)	245 733	7 005 809	12,5	5 x 5	0:00
J Bostadshus (Klumpvägen 170)	245 136	7 006 355	10,0	5 x 5	0:00

Tabell 4. Beräknade skuggtimmar per år i närområdets beräkningspunkter (HH147), när skogens skyddande effekt har beaktats "real case, forest luke"

Beräkningspunkt	ETRS89-TM35 Öst	ETRS89-TM35 Nord	Z (m)	Beräknings-fönster (m)	Skuggning (h/a)
A Bostadshus (Langkujavägen 200)	244 392	7 07 85	10,0	5 x 5	6:47
B Fritidsbostad (Voitby Långträsket)	243 772	7 009 284	12,8	5 x 5	0:00
C Bostadshus (Voitbyntie 480)	242 293	7 010 963	5,0	5 x 5	0:00
D Bostadshus (Kunintie 289)	244 642	7 012 253	5,0	5 x 5	0:00
E Bostadshus (Sandhedsvägen 65)	245 754	7 011 805	10,0	5 x 5	0:00
F Bostadshus (Mullontie 128)	249 130	7 010 173	7,5	5 x 5	0:00
G Fritidsbostad/Scoutstuga (Korpilahdenkuja 134)	248 995	7 007 749	10,0	5 x 5	0:00
H Bostadshus (Kotkannevantie 269)	247 537	7 005 291	18,5	5 x 5	0:00
I Bostadshus (Klumpintie 171)	245 733	7 005 809	12,5	5 x 5	0:00
J Bostadshus (Klumpvägen 170)	245 136	7 006 355	10,0	5 x 5	0:00

FCG Design och planering AbHans Vadbäck
Ins. UtarbetareJakob Kjellman
MMT Kvalitetsgranskning/Godkännare

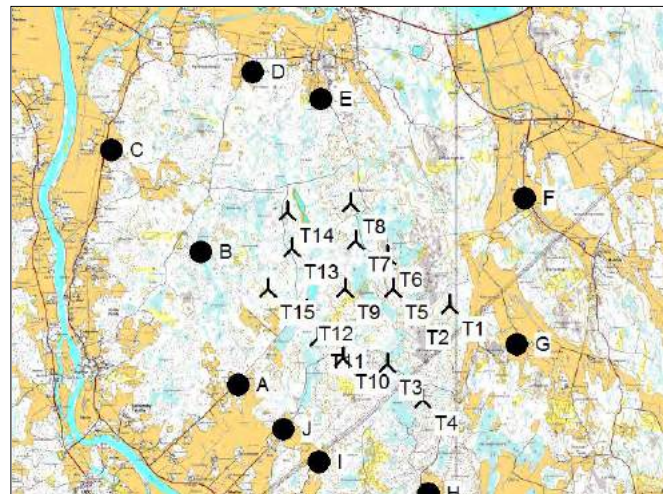
Bilaga1: Resultat av bullermodelleringen MM OH2/2014

DECIBEL - Main Result

Calculation: V136-3.45 x 15 x HH172 NO STE (108,2 dB)

Calculation is done according to Finnish guideline "Ympäristöhallinnon ohjeita 2 | 2014" from the Ministry of the Environment of Finland

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



WTGs

East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	Status	LwA,ref [dB(A)]	Pure tones
T1	247 894	7 008 402	20,0 T1	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	USER	Mode 0 - Clean blade 108,2	8,0	From other hub height	108,2	No f
T10	246 126	7 007 532	23,2 T10	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	USER	Mode 0 - Clean blade 108,2	8,0	From other hub height	108,2	No f
T11	245 712	7 007 870	15,0 T11	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	USER	Mode 0 - Clean blade 108,2	8,0	From other hub height	108,2	No f
T12	245 517	7 008 318	15,0 T12	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	USER	Mode 0 - Clean blade 108,2	8,0	From other hub height	108,2	No f
T13	245 281	7 009 344	17,5 T13	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	USER	Mode 0 - Clean blade 108,2	8,0	From other hub height	108,2	No f
T14	245 200	7 009 948	17,5 T14	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	USER	Mode 0 - Clean blade 108,2	8,0	From other hub height	108,2	No f
T15	244 881	7 008 680	15,0 T15	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	USER	Mode 0 - Clean blade 108,2	8,0	From other hub height	108,2	No f
T2	247 294	7 008 259	23,6 T2	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	USER	Mode 0 - Clean blade 108,2	8,0	From other hub height	108,2	No f
T3	246 855	7 007 441	25,0 T3	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	USER	Mode 0 - Clean blade 108,2	8,0	From other hub height	108,2	No f
T4	247 445	7 006 854	26,8 T4	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	USER	Mode 0 - Clean blade 108,2	8,0	From other hub height	108,2	No f
T5	246 950	7 008 670	25,0 T5	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	USER	Mode 0 - Clean blade 108,2	8,0	From other hub height	108,2	No f
T6	246 864	7 009 208	20,3 T6	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	USER	Mode 0 - Clean blade 108,2	8,0	From other hub height	108,2	No f
T7	246 326	7 009 461	17,7 T7	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	USER	Mode 0 - Clean blade 108,2	8,0	From other hub height	108,2	No f
T8	246 247	7 010 081	21,5 T8	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	USER	Mode 0 - Clean blade 108,2	8,0	From other hub height	108,2	No f
T9	246 160	7 008 681	29,6 T9	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	USER	Mode 0 - Clean blade 108,2	8,0	From other hub height	108,2	No f

f) From other hub height

Calculation Results

Sound Level

Noise sensitive area

No.	Name	East	North	Z	Imission height	Demands Noise	Sound Level From WTGs	Distance to noise demand	Demands fulfilled ? Noise	2 dB penalty applied for one or more WTGs
A	Asuinrakennus (Langkujavägen 200)	244 392	7 007 085	10,0	4,0	40,0	36,3	511	Yes	No
B	Lomarakenus (Voitby Långträsket)	243 772	7 009 284	12,8	4,0	40,0	37,0	372	Yes	No
C	Asuinrakennus (Voitbyntie 480)	242 293	7 010 963	5,0	4,0	40,0	27,1	2 263	Yes	No
D	Asuinrakennus (Kunintie 289)	244 642	7 012 253	5,0	4,0	40,0	29,7	1 577	Yes	No
E	Asuinrakennus (Sandhedsvägen 65)	245 754	7 011 805	10,0	4,0	40,0	33,2	946	Yes	No
F	Asuinrakennus (Mullontie 128)	249 130	7 010 173	7,5	4,0	40,0	31,9	1 304	Yes	No
G	Lomarakenus/Partiomaja (Korpilahdenkuja 134)	248 995	7 007 749	10,0	4,0	40,0	36,1	476	Yes	No
H	Asuinrakennus (Kotkannevantie 269)	247 537	7 005 291	18,5	4,0	40,0	32,9	844	Yes	No
I	Asuinrakennus (Klumpintie 171)	245 733	7 005 809	12,5	4,0	40,0	34,4	821	Yes	No
J	Asuinrakennus (Klumpvägen 170)	245 136	7 006 355	10,0	4,0	40,0	35,8	567	Yes	No

Project:

Merkkikallio

Licensed user:

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Hans Vadback / hans.vadback@fcg.fi
Calculated:
10.6.2016 9:39/3.0.619

DECIBEL - Main Result

Calculation: V136-3.45 x 15 x HH172 NO STE (108,2 dB)

Distances (m)

WTG	A	B	C	D	E	F	G	H	I	J
T1	3739	4212	6154	5037	4017	2158	1279	3129	3373	3432
T10	1790	2932	5140	4945	4286	3997	2875	2646	1766	1537
T11	1535	2399	4607	4508	3932	4118	3282	3157	2060	1620
T12	1668	1993	4167	4028	3492	4058	3521	3637	2517	1998
T13	2425	1509	3396	2976	2504	3934	4039	4635	3561	2990
T14	2972	1574	3076	2370	1936	3934	4383	5207	4170	3591
T15	1667	1262	3448	3578	3242	4500	4215	4303	2993	2337
T2	3128	3665	5681	4791	3863	2650	1774	2976	2903	2876
T3	2487	3589	5759	5293	4497	3552	2160	2254	1979	2032
T4	3060	4401	6585	6079	5228	3719	1788	1565	2004	2361
T5	3007	3234	5187	4259	3353	2646	2241	3427	3107	2939
T6	3256	3091	4892	3767	2822	2461	2581	3972	3580	3333
T7	3061	2558	4300	3258	2411	2891	3168	4339	3697	3324
T8	3521	2598	4048	2699	1792	2882	3601	4957	4300	3885
T9	2380	2461	4486	3878	3148	3321	2982	3657	2901	2540

DECIBEL - Detailed results

Calculation: V136-3.45 x 15 x HH172 NO STE (108,2 dB) Noise calculation model: ISO 9613-2 Finland 8,0 m/s

Assumptions

Calculated L(DW) = LWA,ref + K + Dc - (Adiv + Aatm + Agr + Abar + Amisc) - Cmet
 (when calculated with ground attenuation, then Dc = Domega)

LWA,ref:	Sound pressure level at WTG
K:	Pure tone
Dc:	Directivity correction
Adiv:	the attenuation due to geometrical divergence
Aatm:	the attenuation due to atmospheric absorption
Agr:	the attenuation due to ground effect
Abar:	the attenuation due to a barrier
Amisc:	the attenuation due to miscellaneous other effects
Cmet:	Meteorological correction

Calculation Results

Noise sensitive area: A Asuinrakennus (Langkujavägen 200)

WTG				Wind speed: 8,0 m/s									
No.	Distance	Sound distance	Penalty	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
T1	3 739	3 743	0	17,22	108,2	0,00	82,46	-	-	0,00	0,00	-	0,00
T10	1 790	1 799	0	27,50	108,2	0,00	76,10	-	-	0,00	0,00	-	0,00
T11	1 535	1 544	0	29,50	108,2	0,00	74,78	-	-	0,00	0,00	-	0,00
T12	1 668	1 677	0	28,43	108,2	0,00	75,49	-	-	0,00	0,00	-	0,00
T13	2 425	2 432	0	23,39	108,2	0,00	78,72	-	-	0,00	0,00	-	0,00
T14	2 972	2 977	0	20,52	108,2	0,00	80,48	-	-	0,00	0,00	-	0,00
T15	1 667	1 676	0	28,44	108,2	0,00	75,48	-	-	0,00	0,00	-	0,00
T2	3 128	3 133	0	19,79	108,2	0,00	80,92	-	-	0,00	0,00	-	0,00
T3	2 487	2 494	0	23,04	108,2	0,00	78,94	-	-	0,00	0,00	-	0,00
T4	3 060	3 065	0	20,11	108,2	0,00	80,73	-	-	0,00	0,00	-	0,00
T5	3 007	3 013	0	20,36	108,2	0,00	80,58	-	-	0,00	0,00	-	0,00
T6	3 256	3 261	0	19,22	108,2	0,00	81,27	-	-	0,00	0,00	-	0,00
T7	3 061	3 066	0	20,10	108,2	0,00	80,73	-	-	0,00	0,00	-	0,00
T8	3 521	3 525	0	18,09	108,2	0,00	81,94	-	-	0,00	0,00	-	0,00
T9	2 380	2 387	0	23,64	108,2	0,00	78,56	-	-	0,00	0,00	-	0,00

Sum 36,25

- Data undefined due to calculation with octave data

Noise sensitive area: B Lomarakennus (Voitby Långträsket)

WTG			Wind speed: 8,0 m/s										
No.	Distance	Sound distance	Penalty	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
T1	4 212	4 216	0	15,49	108,2	0,00	83,50	-	-	0,00	0,00	-	0,00
T10	2 932	2 937	0	20,72	108,2	0,00	80,36	-	-	0,00	0,00	-	0,00
T11	2 399	2 405	0	23,54	108,2	0,00	78,62	-	-	0,00	0,00	-	0,00
T12	1 993	2 000	0	26,07	108,2	0,00	77,02	-	-	0,00	0,00	-	0,00
T13	1 509	1 519	0	29,71	108,2	0,00	74,63	-	-	0,00	0,00	-	0,00
T14	1 574	1 583	0	29,18	108,2	0,00	74,99	-	-	0,00	0,00	-	0,00
T15	1 262	1 273	0	31,96	108,2	0,00	73,10	-	-	0,00	0,00	-	0,00
T2	3 665	3 670	0	17,51	108,2	0,00	82,29	-	-	0,00	0,00	-	0,00
T3	3 589	3 593	0	17,81	108,2	0,00	82,11	-	-	0,00	0,00	-	0,00
T4	4 401	4 404	0	14,85	108,2	0,00	83,88	-	-	0,00	0,00	-	0,00
T5	3 234	3 239	0	19,31	108,2	0,00	81,21	-	-	0,00	0,00	-	0,00
T6	3 091	3 096	0	19,97	108,2	0,00	80,81	-	-	0,00	0,00	-	0,00
T7	2 558	2 564	0	22,64	108,2	0,00	79,18	-	-	0,00	0,00	-	0,00
T8	2 598	2 604	0	22,43	108,2	0,00	79,31	-	-	0,00	0,00	-	0,00
T9	2 461	2 468	0	23,18	108,2	0,00	78,85	-	-	0,00	0,00	-	0,00

Sum 37,00

- Data undefined due to calculation with octave data

DECIBEL - Detailed results

Calculation: V136-3.45 x 15 x HH172 NO STE (108,2 dB) Noise calculation model: ISO 9613-2 Finland 8,0 m/s

Noise sensitive area: C Asuinrakennus (Voitbyntie 480)

WTG		Wind speed: 8,0 m/s											
No.	Distance	Sound distance	Penalty	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
T1	6 154	6 156	0	10,31	108,2	0,00	86,79	-	-	0,00	0,00	-	0,00
T10	5 140	5 143	0	12,61	108,2	0,00	85,23	-	-	0,00	0,00	-	0,00
T11	4 607	4 610	0	14,19	108,2	0,00	84,27	-	-	0,00	0,00	-	0,00
T12	4 167	4 170	0	15,65	108,2	0,00	83,40	-	-	0,00	0,00	-	0,00
T13	3 396	3 400	0	18,61	108,2	0,00	81,63	-	-	0,00	0,00	-	0,00
T14	3 076	3 082	0	20,03	108,2	0,00	80,78	-	-	0,00	0,00	-	0,00
T15	3 448	3 453	0	18,39	108,2	0,00	81,76	-	-	0,00	0,00	-	0,00
T2	5 681	5 684	0	11,31	108,2	0,00	86,09	-	-	0,00	0,00	-	0,00
T3	5 759	5 762	0	11,14	108,2	0,00	86,21	-	-	0,00	0,00	-	0,00
T4	6 585	6 587	0	9,47	108,2	0,00	87,37	-	-	0,00	0,00	-	0,00
T5	5 187	5 190	0	12,48	108,2	0,00	85,30	-	-	0,00	0,00	-	0,00
T6	4 892	4 896	0	13,32	108,2	0,00	84,80	-	-	0,00	0,00	-	0,00
T7	4 300	4 304	0	15,19	108,2	0,00	83,68	-	-	0,00	0,00	-	0,00
T8	4 048	4 052	0	16,07	108,2	0,00	83,15	-	-	0,00	0,00	-	0,00
T9	4 486	4 491	0	14,57	108,2	0,00	84,05	-	-	0,00	0,00	-	0,00

Sum 27,08

- Data undefined due to calculation with octave data

Noise sensitive area: D Asuinrakennus (Kunintie 289)

WTG		Wind speed: 8,0 m/s											
No.	Distance	Sound distance	Penalty	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
T1	5 037	5 040	0	12,90	108,2	0,00	85,05	-	-	0,00	0,00	-	0,00
T10	4 945	4 949	0	13,16	108,2	0,00	84,89	-	-	0,00	0,00	-	0,00
T11	4 508	4 512	0	14,50	108,2	0,00	84,09	-	-	0,00	0,00	-	0,00
T12	4 028	4 032	0	16,14	108,2	0,00	83,11	-	-	0,00	0,00	-	0,00
T13	2 976	2 982	0	20,50	108,2	0,00	80,49	-	-	0,00	0,00	-	0,00
T14	2 370	2 377	0	23,71	108,2	0,00	78,52	-	-	0,00	0,00	-	0,00
T15	3 578	3 583	0	17,86	108,2	0,00	82,08	-	-	0,00	0,00	-	0,00
T2	4 791	4 794	0	13,62	108,2	0,00	84,61	-	-	0,00	0,00	-	0,00
T3	5 293	5 296	0	12,19	108,2	0,00	85,48	-	-	0,00	0,00	-	0,00
T4	6 079	6 082	0	10,47	108,2	0,00	86,68	-	-	0,00	0,00	-	0,00
T5	4 259	4 263	0	15,33	108,2	0,00	83,59	-	-	0,00	0,00	-	0,00
T6	3 767	3 771	0	17,11	108,2	0,00	82,53	-	-	0,00	0,00	-	0,00
T7	3 258	3 263	0	19,21	108,2	0,00	81,27	-	-	0,00	0,00	-	0,00
T8	2 699	2 705	0	21,89	108,2	0,00	79,64	-	-	0,00	0,00	-	0,00
T9	3 878	3 883	0	16,69	108,2	0,00	82,78	-	-	0,00	0,00	-	0,00

Sum 29,72

- Data undefined due to calculation with octave data

Noise sensitive area: E Asuinrakennus (Sandhedsvägen 65)

WTG		Wind speed: 8,0 m/s											
No.	Distance	Sound distance	Penalty	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
T1	4 017	4 021	0	16,18	108,2	0,00	83,09	-	-	0,00	0,00	-	0,00
T10	4 286	4 290	0	15,24	108,2	0,00	83,65	-	-	0,00	0,00	-	0,00
T11	3 932	3 936	0	16,49	108,2	0,00	82,90	-	-	0,00	0,00	-	0,00
T12	3 492	3 497	0	18,21	108,2	0,00	81,87	-	-	0,00	0,00	-	0,00
T13	2 504	2 510	0	22,94	108,2	0,00	78,99	-	-	0,00	0,00	-	0,00
T14	1 936	1 944	0	26,46	108,2	0,00	76,78	-	-	0,00	0,00	-	0,00
T15	3 242	3 247	0	19,28	108,2	0,00	81,23	-	-	0,00	0,00	-	0,00
T2	3 863	3 867	0	16,75	108,2	0,00	82,75	-	-	0,00	0,00	-	0,00
T3	4 497	4 501	0	14,54	108,2	0,00	84,07	-	-	0,00	0,00	-	0,00
T4	5 228	5 231	0	12,36	108,2	0,00	85,37	-	-	0,00	0,00	-	0,00
T5	3 353	3 358	0	18,79	108,2	0,00	81,52	-	-	0,00	0,00	-	0,00
T6	2 822	2 828	0	21,26	108,2	0,00	80,03	-	-	0,00	0,00	-	0,00
T7	2 411	2 417	0	23,47	108,2	0,00	78,67	-	-	0,00	0,00	-	0,00
T8	1 792	1 801	0	27,48	108,2	0,00	76,11	-	-	0,00	0,00	-	0,00
T9	3 148	3 153	0	19,70	108,2	0,00	80,98	-	-	0,00	0,00	-	0,00

Sum 33,20

- Data undefined due to calculation with octave data

DECIBEL - Detailed results

Calculation: V136-3.45 x 15 x HH172 NO STE (108,2 dB) Noise calculation model: ISO 9613-2 Finland 8,0 m/s

Noise sensitive area: F Asuinrakennus (Mullontie 128)

WTG		Wind speed: 8,0 m/s											
No.	Distance	Sound distance	Penalty	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
T1	2 158	2 165	0	24,99	108,2	0,00	77,71	-	-	0,00	0,00	-	0,00
T10	3 997	4 001	0	16,25	108,2	0,00	83,04	-	-	0,00	0,00	-	0,00
T11	4 118	4 122	0	15,82	108,2	0,00	83,30	-	-	0,00	0,00	-	0,00
T12	4 058	4 062	0	16,03	108,2	0,00	83,17	-	-	0,00	0,00	-	0,00
T13	3 934	3 938	0	16,48	108,2	0,00	82,91	-	-	0,00	0,00	-	0,00
T14	3 934	3 938	0	16,48	108,2	0,00	82,90	-	-	0,00	0,00	-	0,00
T15	4 500	4 504	0	14,53	108,2	0,00	84,07	-	-	0,00	0,00	-	0,00
T2	2 650	2 656	0	22,15	108,2	0,00	79,49	-	-	0,00	0,00	-	0,00
T3	3 552	3 557	0	17,96	108,2	0,00	82,02	-	-	0,00	0,00	-	0,00
T4	3 719	3 724	0	17,29	108,2	0,00	82,42	-	-	0,00	0,00	-	0,00
T5	2 646	2 652	0	22,17	108,2	0,00	79,47	-	-	0,00	0,00	-	0,00
T6	2 461	2 468	0	23,18	108,2	0,00	78,85	-	-	0,00	0,00	-	0,00
T7	2 891	2 896	0	20,92	108,2	0,00	80,24	-	-	0,00	0,00	-	0,00
T8	2 882	2 888	0	20,96	108,2	0,00	80,21	-	-	0,00	0,00	-	0,00
T9	3 321	3 327	0	18,93	108,2	0,00	81,44	-	-	0,00	0,00	-	0,00

Sum 31,85

- Data undefined due to calculation with octave data

Noise sensitive area: G Lomarakennus/Partiomaja (Korpilahdenkuja 134)

WTG		Wind speed: 8,0 m/s											
No.	Distance	Sound distance	Penalty	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
T1	1 279	1 291	0	31,78	108,2	0,00	73,22	-	-	0,00	0,00	-	0,00
T10	2 875	2 880	0	21,00	108,2	0,00	80,19	-	-	0,00	0,00	-	0,00
T11	3 282	3 287	0	19,10	108,2	0,00	81,34	-	-	0,00	0,00	-	0,00
T12	3 521	3 525	0	18,09	108,2	0,00	81,94	-	-	0,00	0,00	-	0,00
T13	4 039	4 043	0	16,10	108,2	0,00	83,13	-	-	0,00	0,00	-	0,00
T14	4 383	4 386	0	14,91	108,2	0,00	83,84	-	-	0,00	0,00	-	0,00
T15	4 215	4 218	0	15,48	108,2	0,00	83,50	-	-	0,00	0,00	-	0,00
T2	1 774	1 783	0	27,61	108,2	0,00	76,03	-	-	0,00	0,00	-	0,00
T3	2 160	2 168	0	24,98	108,2	0,00	77,72	-	-	0,00	0,00	-	0,00
T4	1 788	1 797	0	27,51	108,2	0,00	76,09	-	-	0,00	0,00	-	0,00
T5	2 241	2 248	0	24,48	108,2	0,00	78,04	-	-	0,00	0,00	-	0,00
T6	2 581	2 587	0	22,52	108,2	0,00	79,25	-	-	0,00	0,00	-	0,00
T7	3 168	3 173	0	19,61	108,2	0,00	81,03	-	-	0,00	0,00	-	0,00
T8	3 601	3 606	0	17,76	108,2	0,00	82,14	-	-	0,00	0,00	-	0,00
T9	2 982	2 988	0	20,47	108,2	0,00	80,51	-	-	0,00	0,00	-	0,00

Sum 36,09

- Data undefined due to calculation with octave data

Noise sensitive area: H Asuinrakennus (Kotkannevantie 269)

WTG		Wind speed: 8,0 m/s											
No.	Distance	Sound distance	Penalty	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
T1	3 129	3 134	0	19,79	108,2	0,00	80,92	-	-	0,00	0,00	-	0,00
T10	2 646	2 652	0	22,17	108,2	0,00	79,47	-	-	0,00	0,00	-	0,00
T11	3 157	3 162	0	19,66	108,2	0,00	81,00	-	-	0,00	0,00	-	0,00
T12	3 637	3 640	0	17,62	108,2	0,00	82,22	-	-	0,00	0,00	-	0,00
T13	4 635	4 638	0	14,10	108,2	0,00	84,33	-	-	0,00	0,00	-	0,00
T14	5 207	5 209	0	12,42	108,2	0,00	85,34	-	-	0,00	0,00	-	0,00
T15	4 303	4 306	0	15,18	108,2	0,00	83,68	-	-	0,00	0,00	-	0,00
T2	2 976	2 981	0	20,51	108,2	0,00	80,49	-	-	0,00	0,00	-	0,00
T3	2 254	2 261	0	24,40	108,2	0,00	78,09	-	-	0,00	0,00	-	0,00
T4	1 565	1 575	0	29,25	108,2	0,00	74,94	-	-	0,00	0,00	-	0,00
T5	3 427	3 432	0	18,48	108,2	0,00	81,71	-	-	0,00	0,00	-	0,00
T6	3 972	3 975	0	16,34	108,2	0,00	82,99	-	-	0,00	0,00	-	0,00
T7	4 339	4 342	0	15,06	108,2	0,00	83,75	-	-	0,00	0,00	-	0,00
T8	4 957	4 960	0	13,13	108,2	0,00	84,91	-	-	0,00	0,00	-	0,00
T9	3 657	3 661	0	17,54	108,2	0,00	82,27	-	-	0,00	0,00	-	0,00

Sum 32,87

- Data undefined due to calculation with octave data

DECIBEL - Detailed results

Calculation: V136-3.45 x 15 x HH172 NO STE (108,2 dB) Noise calculation model: ISO 9613-2 Finland 8,0 m/s

Noise sensitive area: I Asuinrakennus (Klumpintie 171)

WTG		Wind speed: 8,0 m/s											
No.	Distance	Sound distance	Penalty	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
T1	3 373	3 377	0	18,71	108,2	0,00	81,57	-	-	0,00	0,00	-	0,00
T10	1 766	1 775	0	27,68	108,2	0,00	75,98	-	-	0,00	0,00	-	0,00
T11	2 060	2 067	0	25,63	108,2	0,00	77,31	-	-	0,00	0,00	-	0,00
T12	2 517	2 522	0	22,88	108,2	0,00	79,04	-	-	0,00	0,00	-	0,00
T13	3 561	3 565	0	17,93	108,2	0,00	82,04	-	-	0,00	0,00	-	0,00
T14	4 170	4 174	0	15,64	108,2	0,00	83,41	-	-	0,00	0,00	-	0,00
T15	2 993	2 998	0	20,43	108,2	0,00	80,54	-	-	0,00	0,00	-	0,00
T2	2 903	2 908	0	20,86	108,2	0,00	80,27	-	-	0,00	0,00	-	0,00
T3	1 979	1 987	0	26,16	108,2	0,00	76,96	-	-	0,00	0,00	-	0,00
T4	2 004	2 012	0	25,99	108,2	0,00	77,07	-	-	0,00	0,00	-	0,00
T5	3 107	3 112	0	19,89	108,2	0,00	80,86	-	-	0,00	0,00	-	0,00
T6	3 580	3 584	0	17,85	108,2	0,00	82,09	-	-	0,00	0,00	-	0,00
T7	3 697	3 701	0	17,38	108,2	0,00	82,37	-	-	0,00	0,00	-	0,00
T8	4 300	4 303	0	15,19	108,2	0,00	83,68	-	-	0,00	0,00	-	0,00
T9	2 901	2 907	0	20,86	108,2	0,00	80,27	-	-	0,00	0,00	-	0,00

Sum 34,36

- Data undefined due to calculation with octave data

Noise sensitive area: J Asuinrakennus (Klumpvägen 170)

WTG		Wind speed: 8,0 m/s											
No.	Distance	Sound distance	Penalty	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
T1	3 432	3 437	0	18,46	108,2	0,00	81,72	-	-	0,00	0,00	-	0,00
T10	1 537	1 548	0	29,47	108,2	0,00	74,79	-	-	0,00	0,00	-	0,00
T11	1 620	1 629	0	28,81	108,2	0,00	75,24	-	-	0,00	0,00	-	0,00
T12	1 998	2 006	0	26,04	108,2	0,00	77,05	-	-	0,00	0,00	-	0,00
T13	2 990	2 995	0	20,44	108,2	0,00	80,53	-	-	0,00	0,00	-	0,00
T14	3 591	3 595	0	17,81	108,2	0,00	82,11	-	-	0,00	0,00	-	0,00
T15	2 337	2 343	0	23,90	108,2	0,00	78,40	-	-	0,00	0,00	-	0,00
T2	2 876	2 882	0	20,99	108,2	0,00	80,19	-	-	0,00	0,00	-	0,00
T3	2 032	2 040	0	25,80	108,2	0,00	77,19	-	-	0,00	0,00	-	0,00
T4	2 361	2 368	0	23,76	108,2	0,00	78,49	-	-	0,00	0,00	-	0,00
T5	2 939	2 945	0	20,68	108,2	0,00	80,38	-	-	0,00	0,00	-	0,00
T6	3 333	3 338	0	18,88	108,2	0,00	81,47	-	-	0,00	0,00	-	0,00
T7	3 324	3 328	0	18,92	108,2	0,00	81,44	-	-	0,00	0,00	-	0,00
T8	3 885	3 889	0	16,66	108,2	0,00	82,80	-	-	0,00	0,00	-	0,00
T9	2 540	2 547	0	22,74	108,2	0,00	79,12	-	-	0,00	0,00	-	0,00

Sum 35,78

- Data undefined due to calculation with octave data

DECIBEL - Assumptions for noise calculation

Calculation: V136-3.45 x 15 x HH172 NO STE (108,2 dB) Noise calculation model: ISO 9613-2 Finland 8,0 m/s

Noise calculation model:

ISO 9613-2 Finland

Wind speed:

8,0 m/s

Ground attenuation:

General, fixed, Ground factor: 0,4

Meteorological coefficient, C0:

0,0 dB

Type of demand in calculation:

1: WTG noise is compared to demand (DK, DE, SE, NL etc.)

Noise values in calculation:

All noise values are mean values (Lwa) (Normal)

Pure tones:

Pure and Impulse tone penalty are added to WTG source noise

Height above ground level, when no value in NSA object:

4,0 m Don't allow override of model height with height from NSA object

Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:

0,0 dB(A)

Octave data required

Air absorption

63	125	250	500	1 000	2 000	4 000	8 000
[db/km]	[db/km]	[db/km]	[db/km]	[db/km]	[db/km]	[db/km]	[db/km]
0,1	0,4	1,1	2,4	4,1	8,8	26,6	95,0

WTG: VESTAS V136-3.45 3450 136.0 !O!

Noise: Mode 0 - Clean blade 108,2

Source

Source/Date Creator Edited

Manufacturer 23.11.2015 USER 27.5.2016 13:02

Based on Document no.: DMS 0055-9919_V00

Status	Hub height [m]	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones	Octave data							
					63	125	250	500	1000	2000	4000	8000
From other hub height	172,0	8,0	108,2	No	86,7	95,0	96,9	101,0	104,3	102,2	90,8	68,6

NSA: Asuinrakennus (Langkujavägen 200)-A

Predefined calculation standard:

Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

NSA: Lomarakennus (Voitby Långträsket)-B

Predefined calculation standard:

Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

NSA: Asuinrakennus (Voitbyntie 480)-C

Predefined calculation standard:

Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

NSA: Asuinrakennus (Kunintie 289)-D

Predefined calculation standard:

Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

DECIBEL - Assumptions for noise calculation

Calculation: V136-3.45 x 15 x HH172 NO STE (108,2 dB) Noise calculation model: ISO 9613-2 Finland 8,0 m/s

NSA: Asuinrakennus (Sandhedsvägen 65)-E

Predefined calculation standard:

Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

NSA: Asuinrakennus (Mullontie 128)-F

Predefined calculation standard:

Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

NSA: Lomarakennus/Partiomaja (Korpilahdenkuja 134)-G

Predefined calculation standard:

Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

NSA: Asuinrakennus (Kotkannevantie 269)-H

Predefined calculation standard:

Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

NSA: Asuinrakennus (Klumpintie 171)-I

Predefined calculation standard:

Imission height(a.g.l.): Use standard value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

NSA: Asuinrakennus (Klumpvägen 170)-J

Predefined calculation standard:

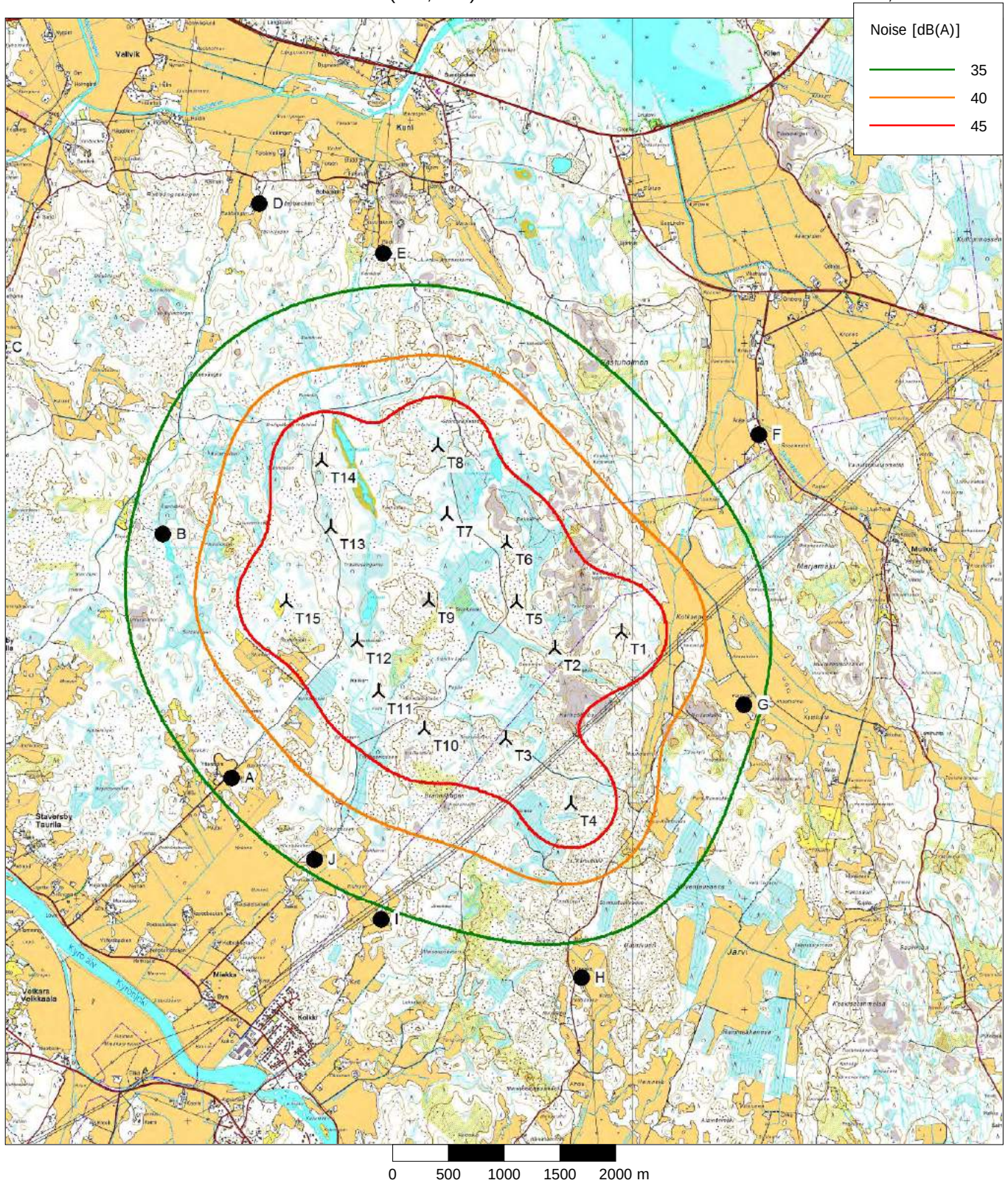
Imission height(a.g.l.): Use standard value from calculation model

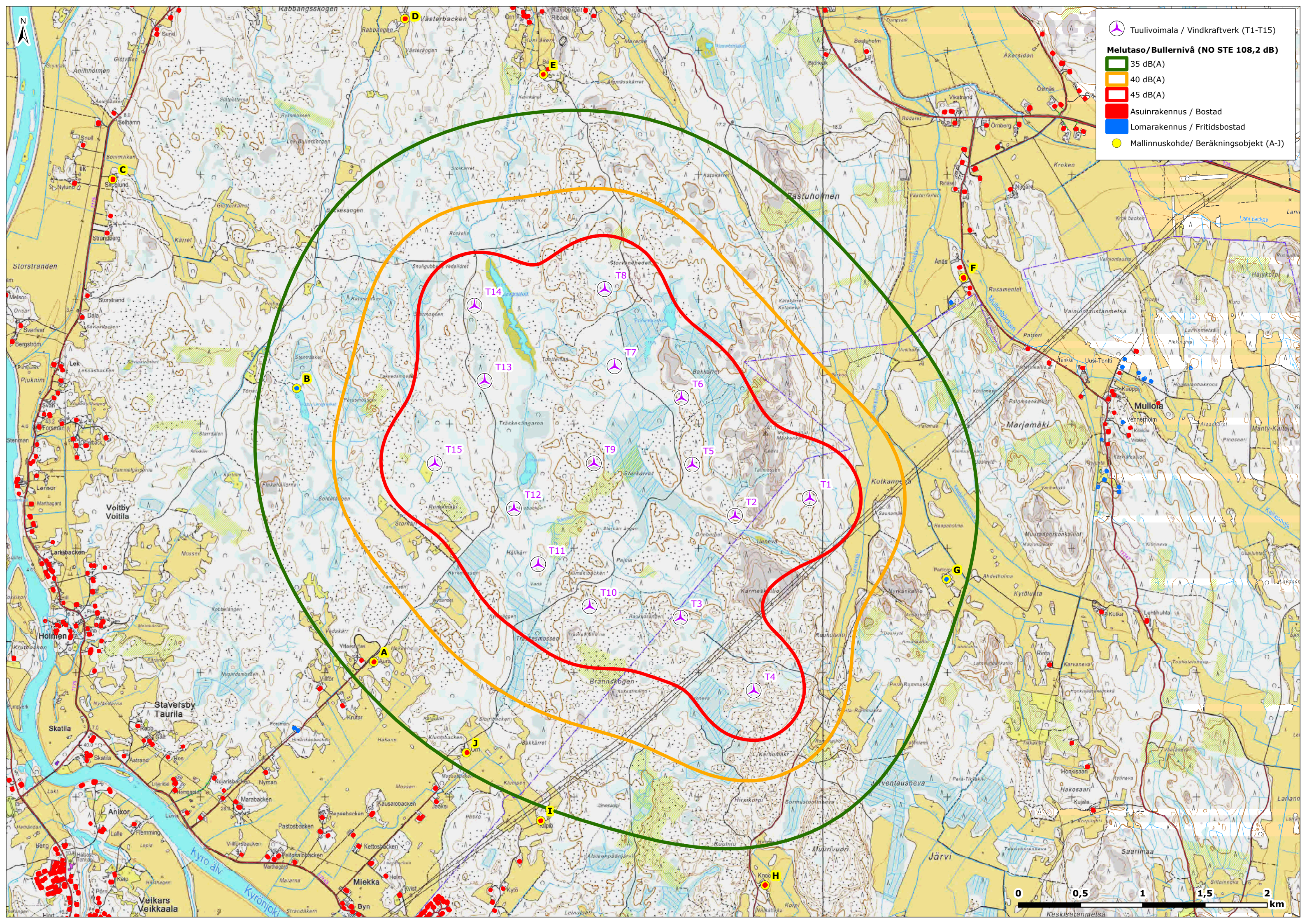
Noise demand: 40,0 dB(A)

No distance demand

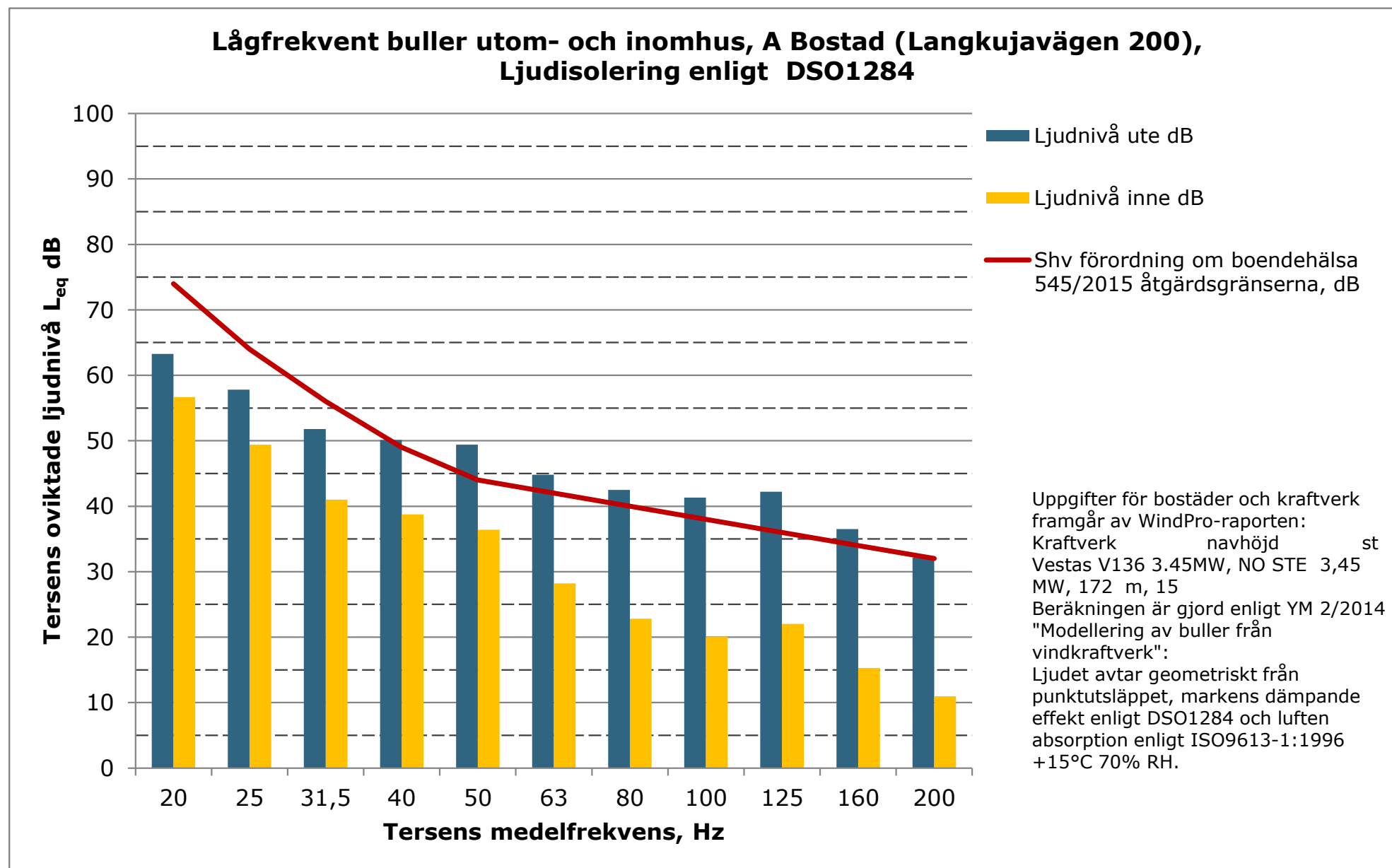
DECIBEL - Map 8,0 m/s

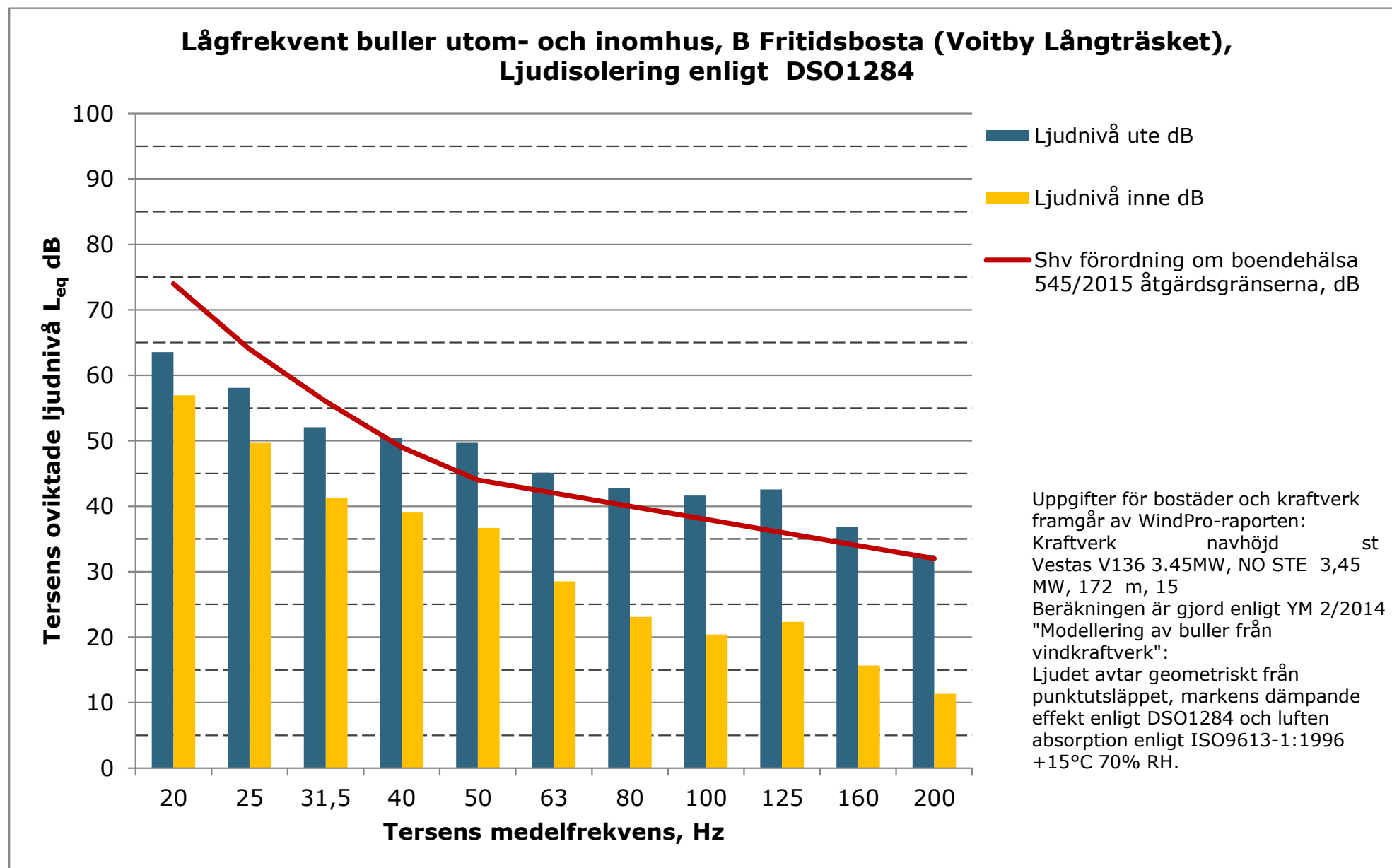
Calculation: V136-3.45 x 15 x HH172 NO STE (108,2 dB) Noise calculation model: ISO 9613-2 Finland 8,0 m/s

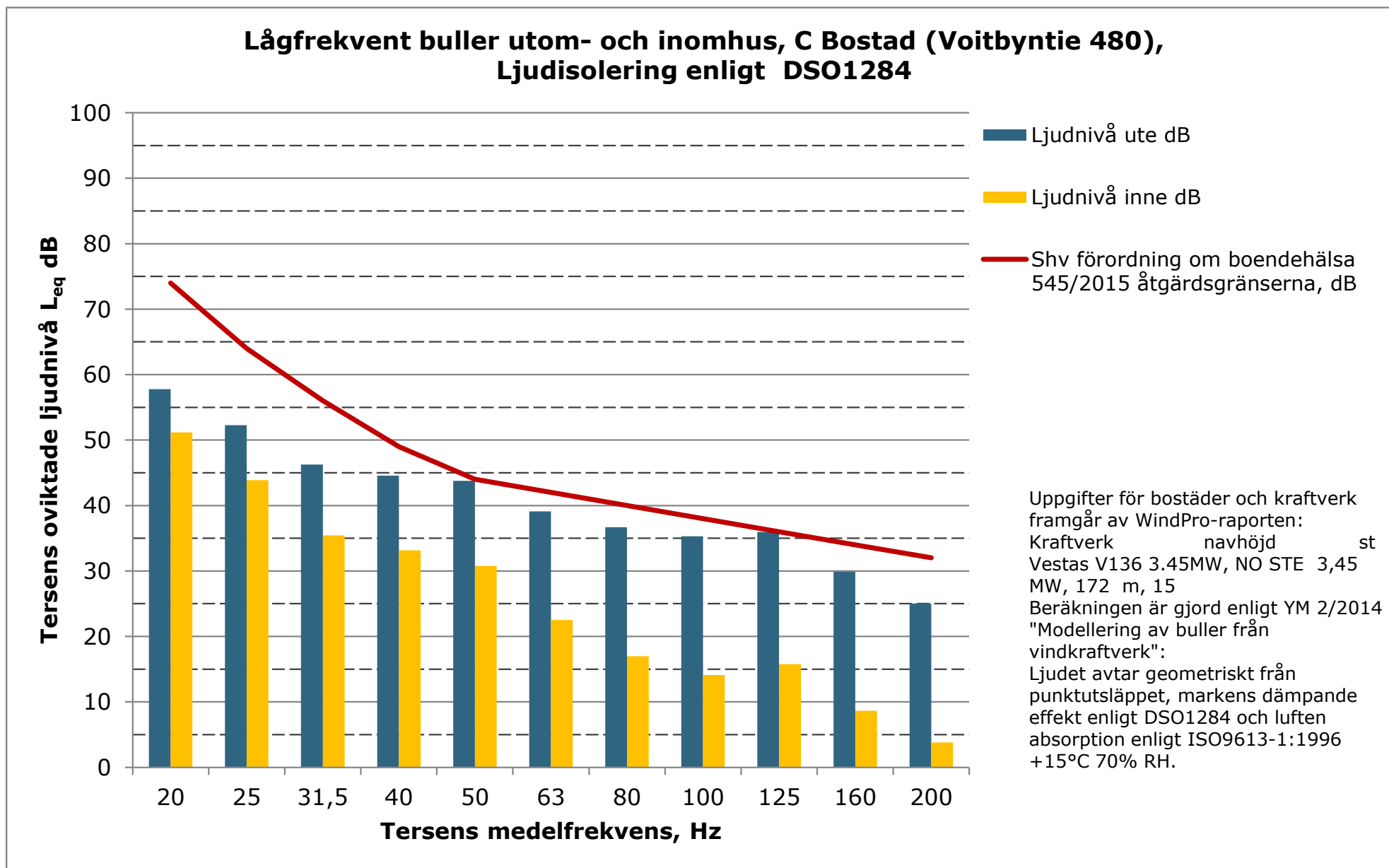


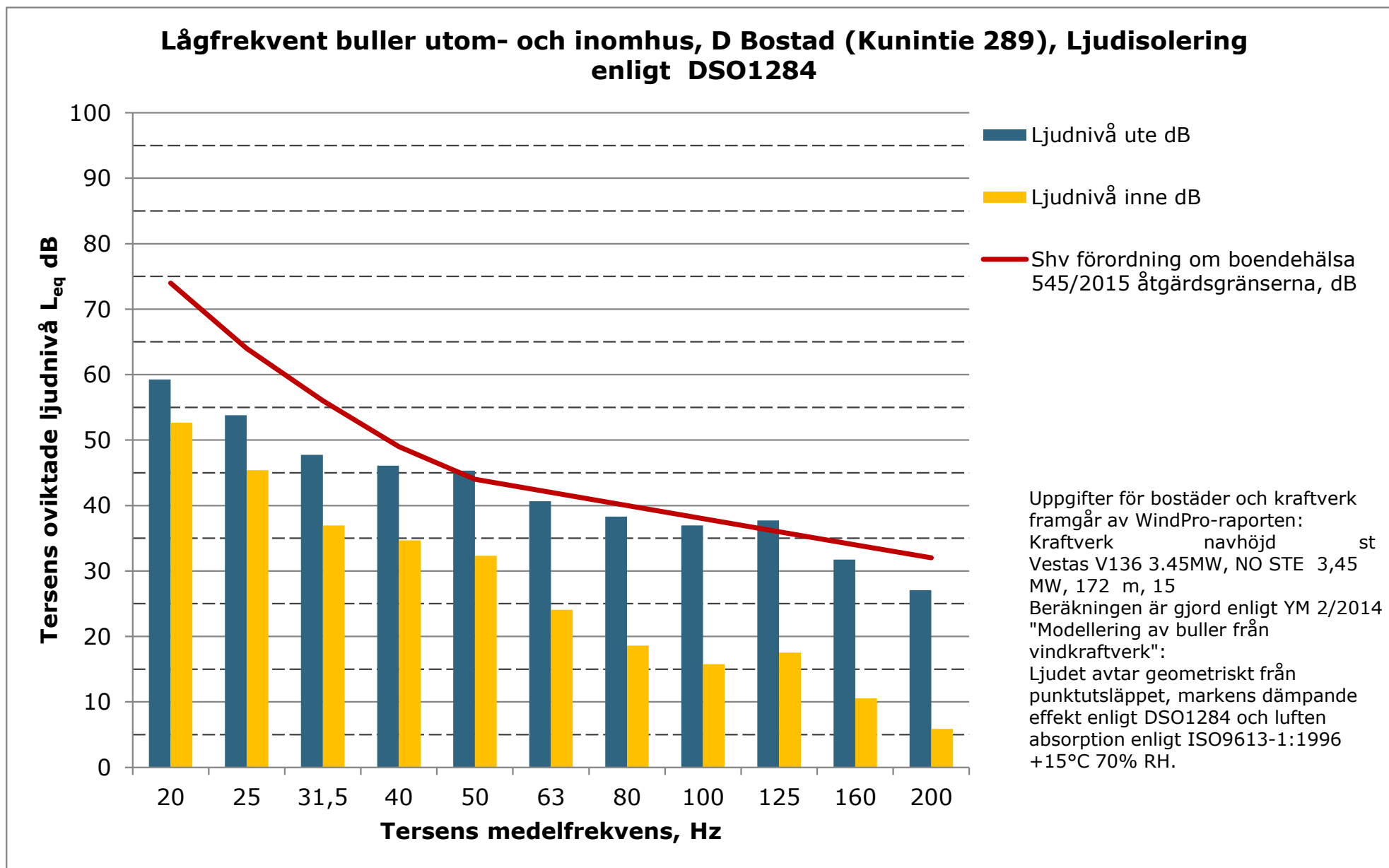


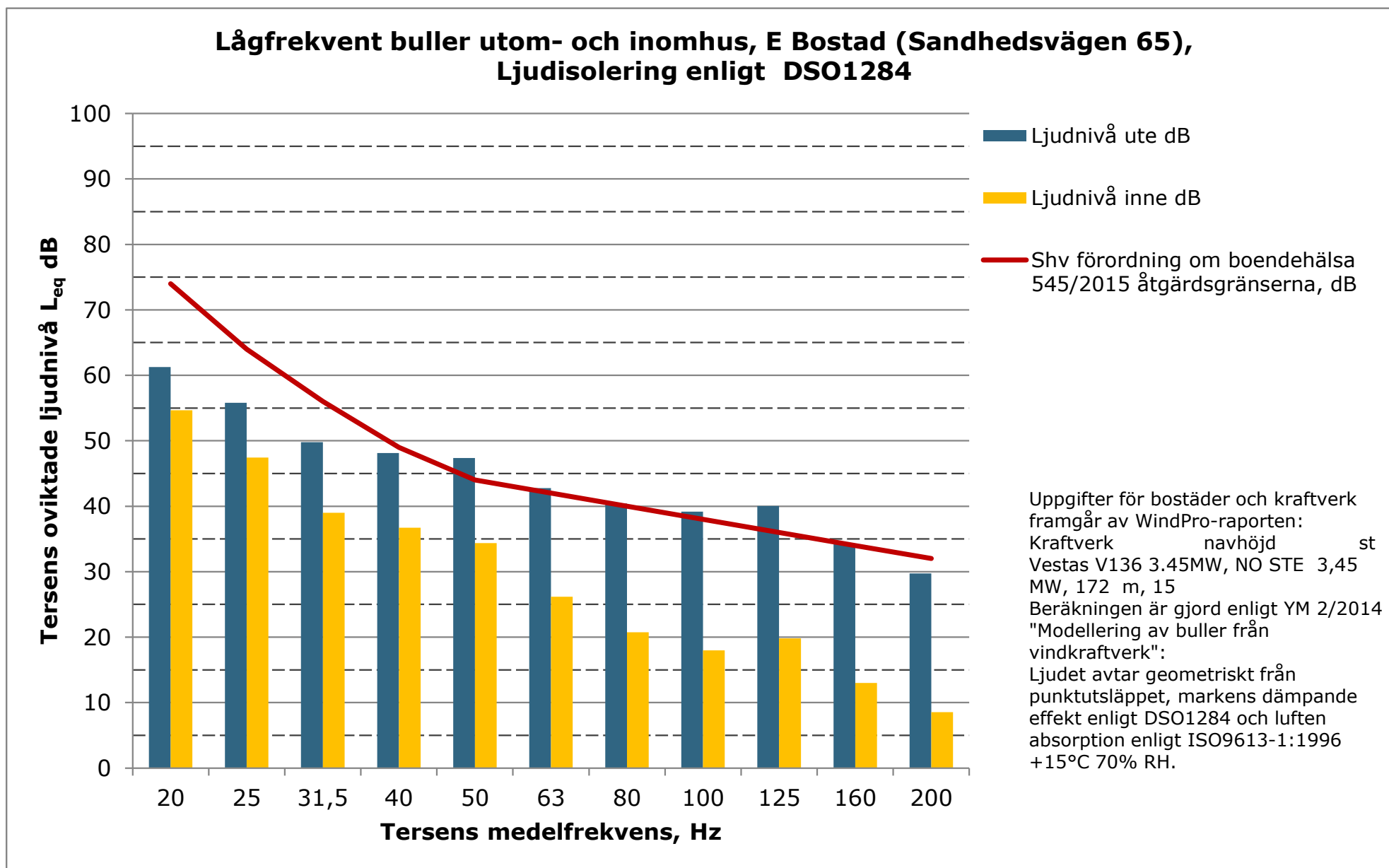
Bilaga 2: Bostadsspecifika resultat för lågfrekvent buller (A-J)

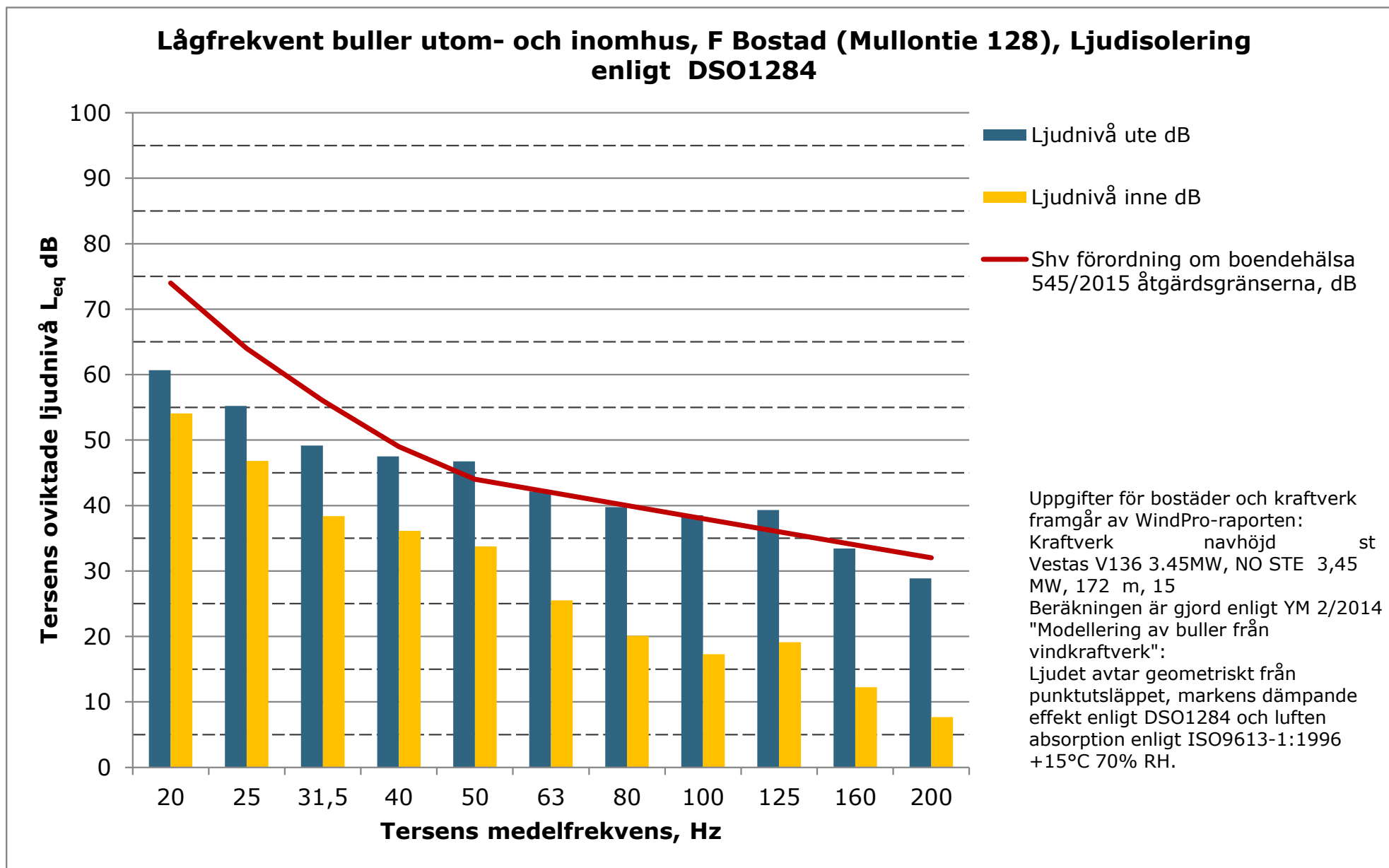


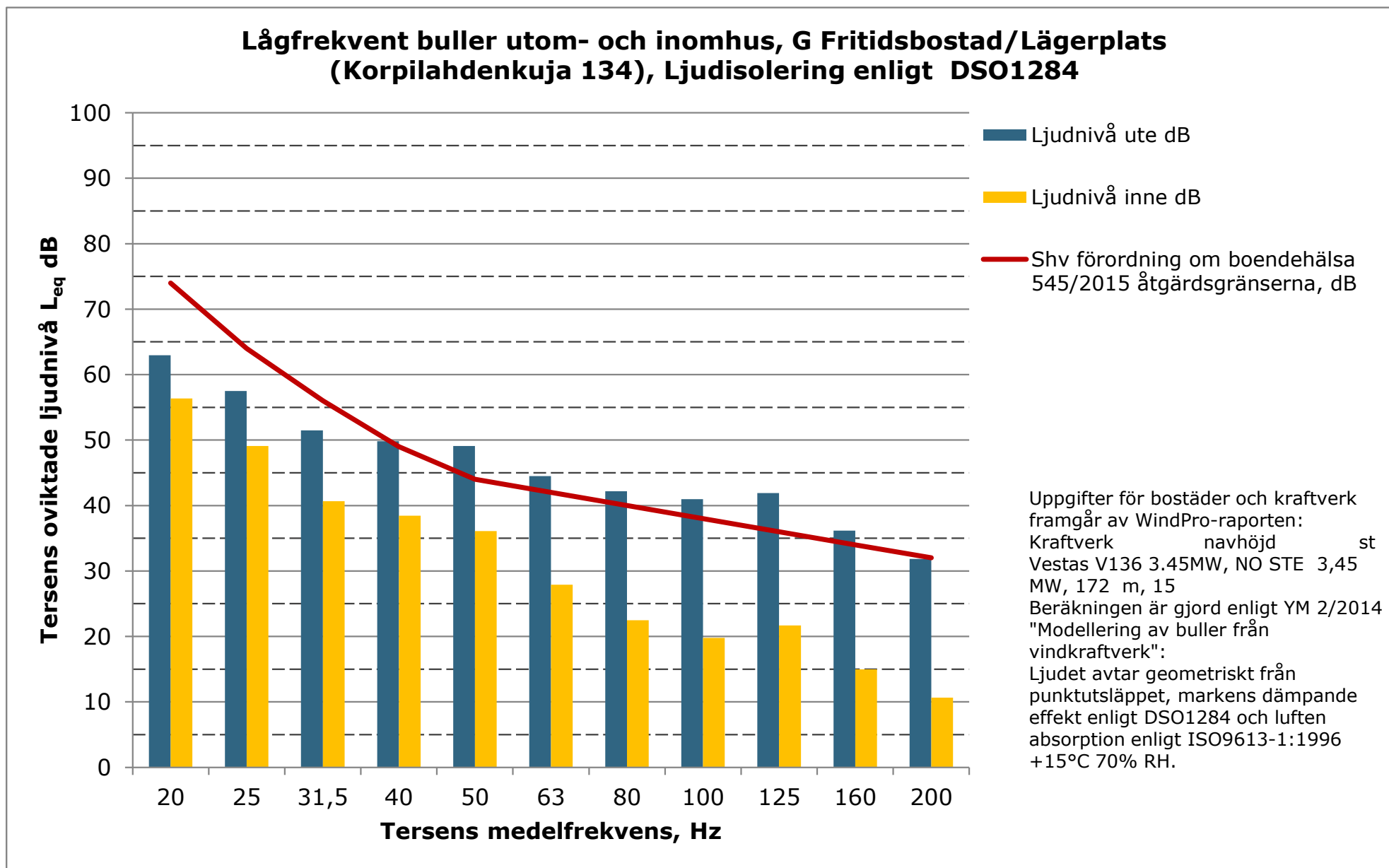


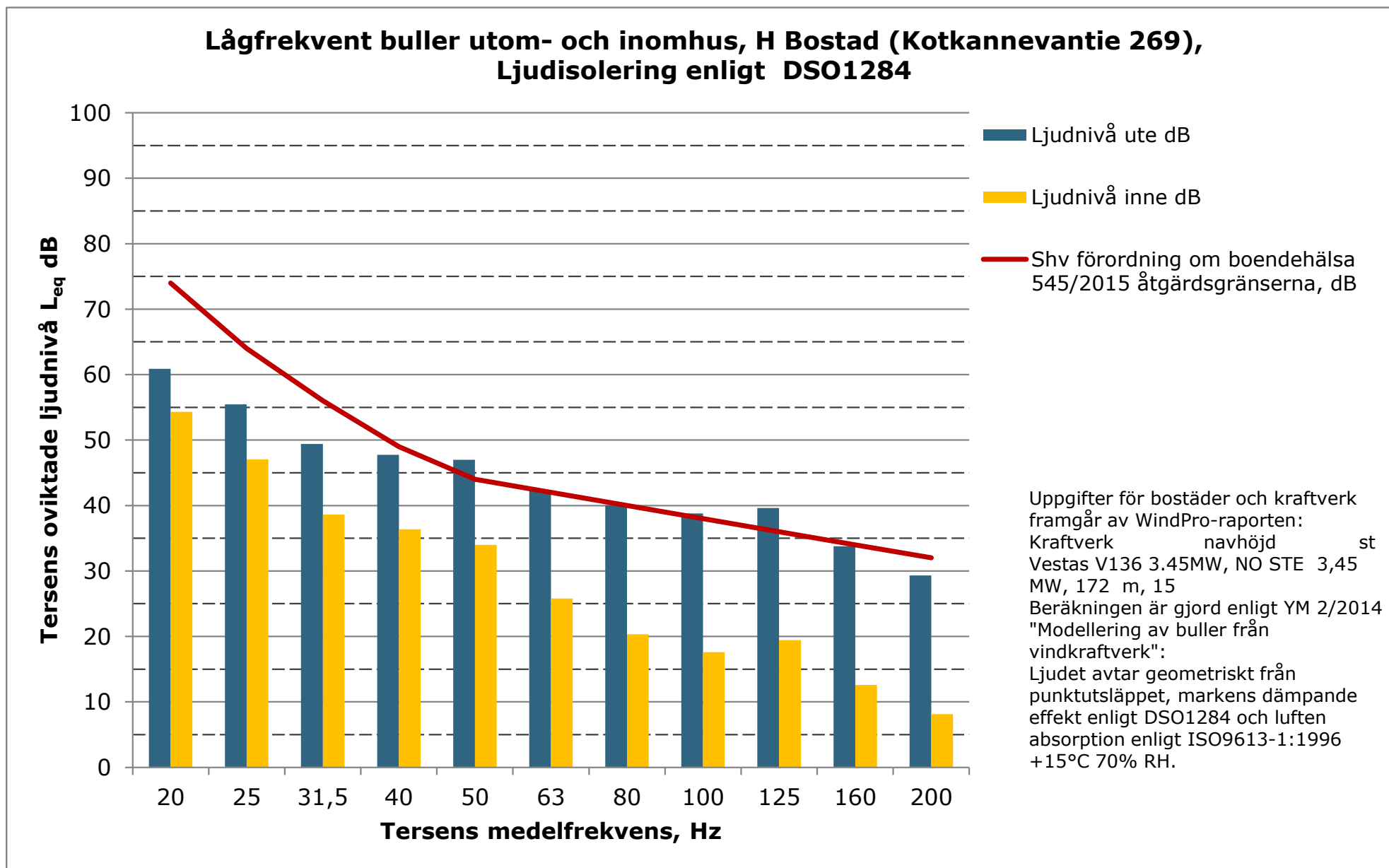


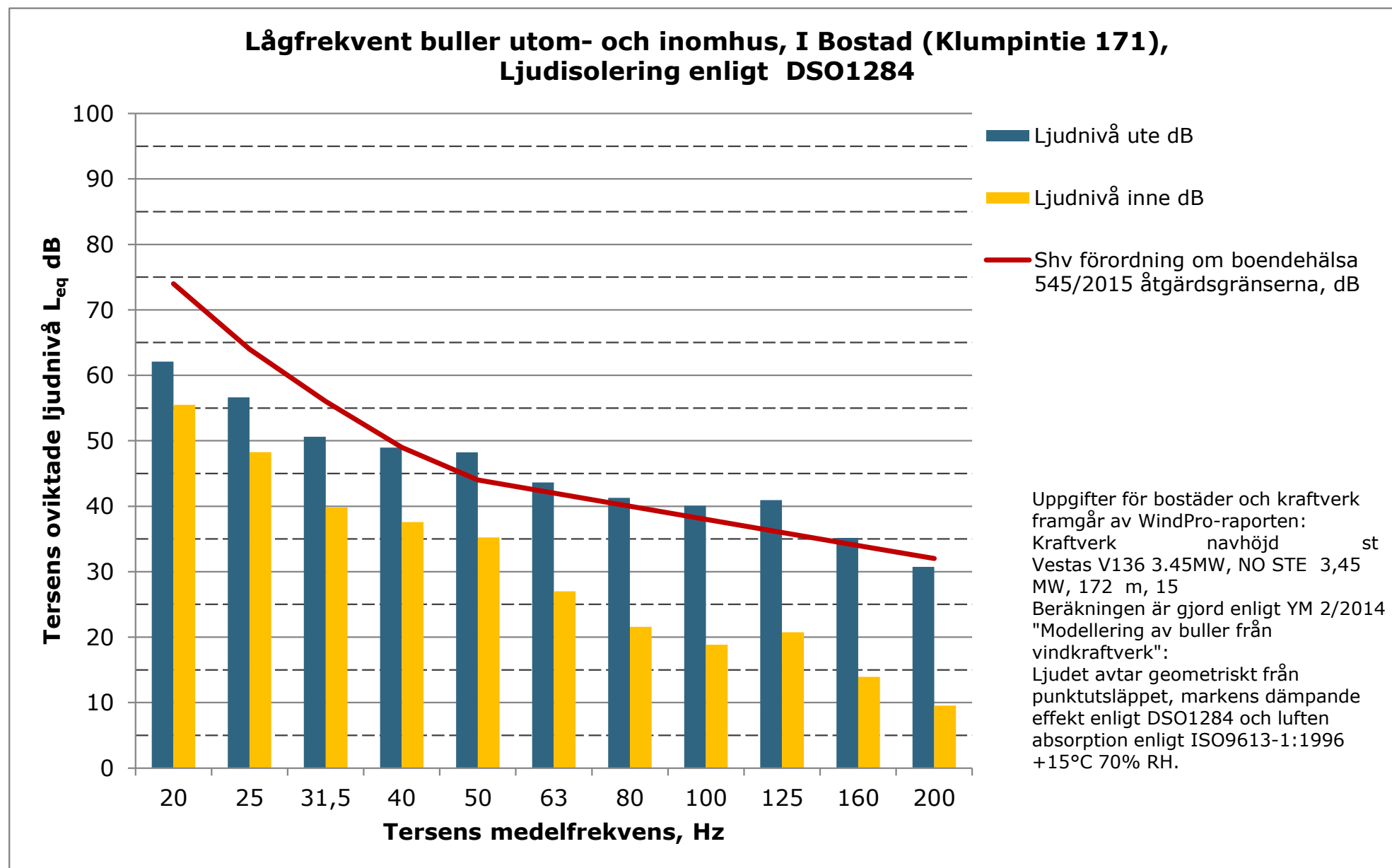




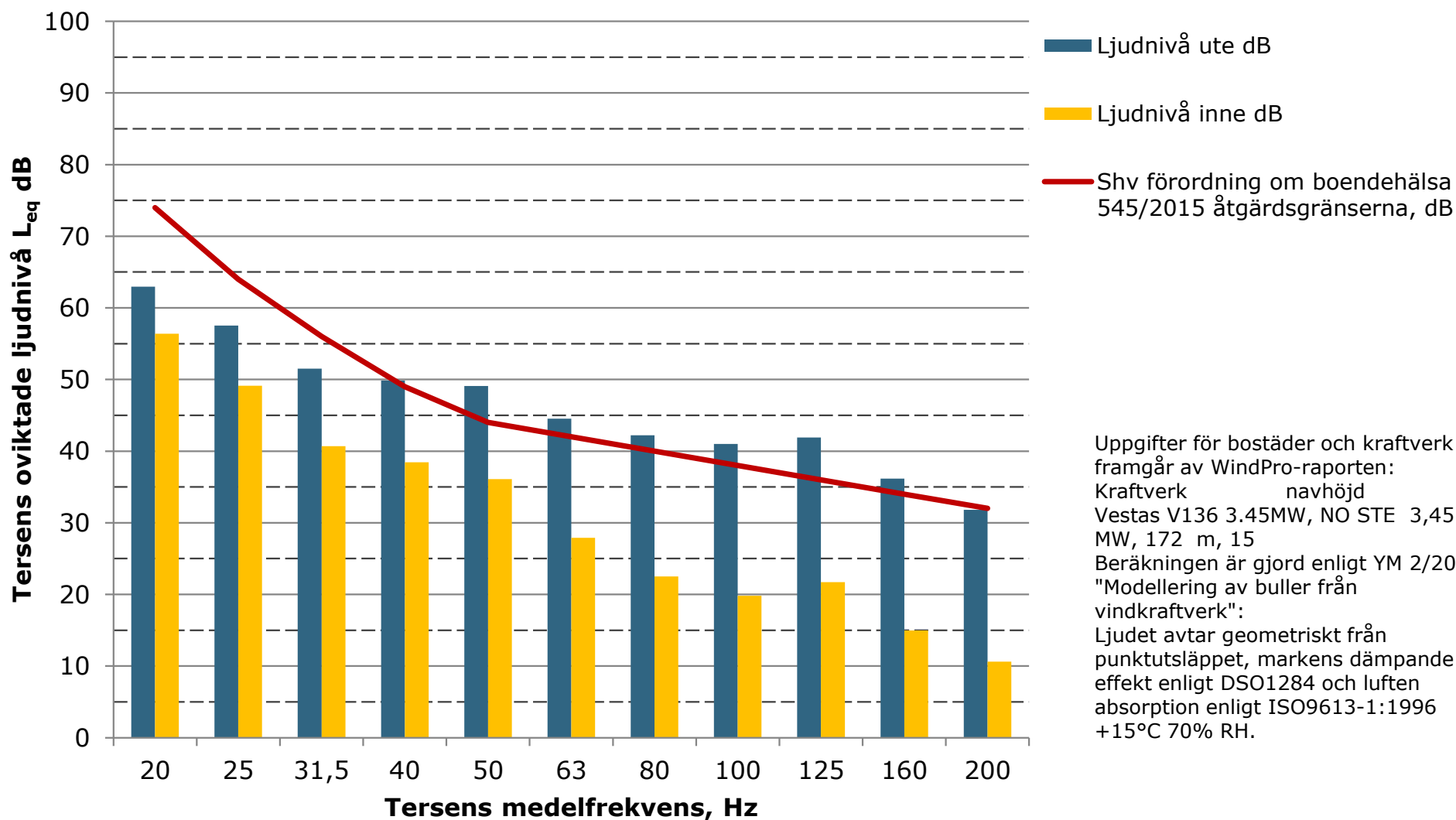








Lågfrekvent buller utom- och inomhus, J Bostad (Klumpvägen 170), Ljudisolering enligt DSO1284



Bilaga 3: Resultat av skuggmodellering "real case, no forest"

SHADOW - Main Result

Calculation: V136 x 15 x HH172 real case_no forest

Assumptions for shadow calculations

Maximum distance for influence

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

Please look in WTG table

Minimum sun height over horizon for influence

3 °

Day step for calculation

1 days

Time step for calculation

1 minutes

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

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

Tuuliatlas lib 30051

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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: Merkkikallio_height contour lines.wpo

Obstacles used in calculation

Eye height: 1,5 m

Grid resolution: 10,0 m

All coordinates are in

Finish TM ETRS-TM35FIN-ETRS89

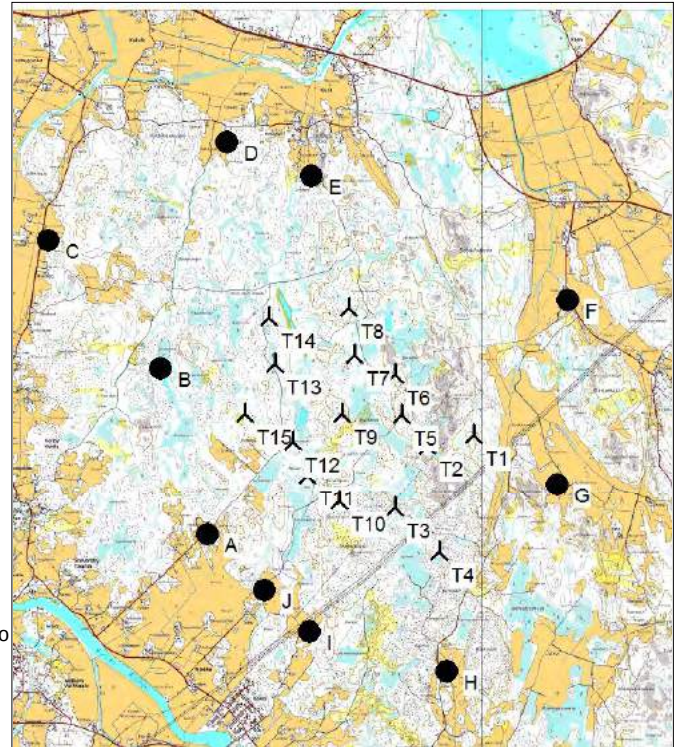
WTGs

	East	North	Z	Row data/Description	WTG type		Power, rated	Rotor diameter	Hub height	Shadow data	
					Valid	Manufact.				Calculation distance	RPM
			[m]				[kW]	[m]	[m]	[m]	[RPM]
T1	247 894	7 008 402	20,0	T1	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T10	246 126	7 007 532	23,2	T10	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T11	245 712	7 007 870	15,0	T11	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T12	245 517	7 008 318	15,0	T12	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T13	245 281	7 009 344	17,5	T13	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T14	245 200	7 009 948	17,5	T14	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T15	244 881	7 008 680	15,0	T15	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T2	247 294	7 008 259	23,6	T2	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T3	246 855	7 007 441	25,0	T3	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T4	247 445	7 006 854	26,8	T4	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T5	246 950	7 008 670	25,0	T5	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T6	246 864	7 009 208	20,3	T6	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T7	246 326	7 009 461	17,7	T7	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T8	246 247	7 010 081	21,5	T8	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T9	246 160	7 008 681	29,6	T9	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0

Shadow receptor-Input

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	°	°	
A	Asuinrakennus (Langkujavägen 200)	244 392	7 007 085	10,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
B	Lomarakenus (Voitby Långträsket)	243 772	7 009 284	12,8	5,0	5,0	1,0	0,0	0,0	"Green house mode"
C	Asuinrakennus (Voitbyntie 480)	242 293	7 010 963	5,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
D	Asuinrakennus (Kunintie 289)	244 642	7 012 253	5,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
E	Asuinrakennus (Sandhedsvägen 65)	245 754	7 011 805	10,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
F	Asuinrakennus (Mullontie 128)	249 130	7 010 173	7,5	5,0	5,0	1,0	0,0	0,0	"Green house mode"
G	Lomarakenus/Partiomaja (Korpilahdenkuja 134)	248 995	7 007 749	10,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
H	Asuinrakennus (Kotkannevantie 269)	247 537	7 005 291	18,5	5,0	5,0	1,0	0,0	0,0	"Green house mode"

To be continued on next page...



New WTG

Scale 1:100 000
Shadow receptor

Project:

Merkkikallio

Licensed user:

FCG Suunnittelu ja tekniikka Oy
 Osmontie 34, PO Box 950
 FI-00601 Helsinki
 +358104095666
 Hans Vadback / hans.vadback@fcg.fi
 Calculated:
 10.6.2016 11:06/3.0.619

SHADOW - Main Result

Calculation: V136 x 15 x HH172 real case_no forest

...continued from previous page

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
I	Asuinrakennus (Klumpintie 171)	245 733	7 005 809	12,5	5,0	5,0	1,0	0,0	0,0	"Green house mode"
J	Asuinrakennus (Klumpvägen 170)	245 136	7 006 355	10,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values Shadow hours per year [h/year]
A	Asuinrakennus (Langkujavägen 200)	6:47
B	Lomarakennus (Voitby Långträsket)	7:32
C	Asuinrakennus (Voitbyntie 480)	0:00
D	Asuinrakennus (Kunintie 289)	0:00
E	Asuinrakennus (Sandhedsvägen 65)	0:00
F	Asuinrakennus (Mullontie 128)	0:00
G	Lomarakennus/Partiomaja (Korpilahdenkuja 134)	5:24
H	Asuinrakennus (Kotkannevantie 269)	0:00
I	Asuinrakennus (Klumpintie 171)	0:00
J	Asuinrakennus (Klumpvägen 170)	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
T1	T1	18:44	5:24
T10	T10	0:00	0:00
T11	T11	21:36	6:47
T12	T12	0:00	0:00
T13	T13	8:10	1:59
T14	T14	12:00	3:41
T15	T15	10:31	1:54
T2	T2	0:00	0:00
T3	T3	0:00	0:00
T4	T4	0:00	0:00
T5	T5	0:00	0:00
T6	T6	0:00	0:00
T7	T7	0:00	0:00
T8	T8	0:00	0:00
T9	T9	0:00	0:00

Project:

Merkkikallio

Licensed user:

FCG Suunnittelu ja tekniikka Oy
Osmontie 34, PO Box 950
FI-00601 Helsinki
+358104095666
Hans Vadback / hans.vadback@fcg.fi
Calculated:
10.6.2016 11:06/3.0.619

SHADOW - Calendar

Calculation: V136 x 15 x HH172 real case_no forestShadow receptor: A - Asuinrakennus (Langkujavägen 200)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December		
1	10:10 15:02	09:08 16:25	07:41 17:51	06:56 20:19	05:16 21:47	03:47 23:16	05:21 (T11) 05:42 (T11)	03:30 23:42	05:29 (T11) 05:44 (T11)	04:46 22:30	06:16 20:48	07:38 19:06	08:07 16:25	09:36 15:07
2	10:09 15:04	09:05 16:28	07:38 17:54	06:53 20:22	05:12 21:50	03:45 23:18	05:20 (T11) 05:41 (T11)	03:32 23:40	05:30 (T11) 05:45 (T11)	04:49 22:27	06:19 20:45	07:41 19:03	08:10 16:22	09:38 15:05
3	10:08 15:06	09:03 16:32	07:34 17:57	06:49 20:25	05:09 21:53	03:43 23:21	05:21 (T11) 05:41 (T11)	03:33 23:39	05:30 (T11) 05:45 (T11)	04:52 22:24	06:21 20:42	07:44 18:59	08:13 16:18	09:41 15:03
4	10:07 15:08	09:00 16:35	07:31 18:00	06:46 20:28	05:06 21:56	03:41 23:23	05:22 (T11) 05:42 (T11)	03:35 23:38	05:29 (T11) 05:46 (T11)	04:55 22:20	06:24 20:38	07:46 18:56	08:16 16:15	09:43 15:02
5	10:06 15:10	08:57 16:38	07:28 18:03	06:43 20:31	05:03 21:59	03:39 23:25	05:22 (T11) 05:41 (T11)	03:37 23:36	05:29 (T11) 05:46 (T11)	04:58 22:17	06:27 20:35	07:49 18:52	08:19 16:12	09:45 15:00
6	10:05 15:12	08:54 16:41	07:24 18:06	06:39 20:34	05:00 22:02	03:37 23:27	05:22 (T11) 05:41 (T11)	03:39 23:35	05:29 (T11) 05:47 (T11)	05:01 22:14	06:30 20:31	07:52 18:49	08:22 16:09	09:48 14:59
7	10:04 15:14	08:51 16:44	07:21 18:08	06:36 20:36	04:56 22:05	03:35 23:29	05:23 (T11) 05:41 (T11)	03:41 23:33	05:28 (T11) 05:47 (T11)	05:04 22:11	06:32 20:28	07:55 18:46	08:25 16:07	09:50 14:58
8	10:02 15:16	08:48 16:47	07:18 18:11	06:32 20:39	04:53 22:08	03:34 23:31	05:23 (T11) 05:40 (T11)	03:43 23:31	05:29 (T11) 05:48 (T11)	05:07 22:08	06:35 20:25	07:57 18:42	08:29 16:04	09:52 14:56
9	10:01 15:19	08:45 16:50	07:14 18:14	06:29 20:42	04:50 22:11	03:32 23:33	05:24 (T11) 05:40 (T11)	03:45 23:29	05:28 (T11) 05:48 (T11)	05:10 22:05	06:38 20:21	08:00 18:39	08:32 16:01	09:54 14:55
10	09:59 15:21	08:42 16:53	07:11 18:17	06:26 20:45	04:47 22:14	03:31 23:35	05:24 (T11) 05:40 (T11)	03:47 23:27	05:28 (T11) 05:49 (T11)	05:13 22:01	06:41 20:18	08:03 18:36	08:35 15:58	09:56 14:54
11	09:58 15:24	08:39 16:57	07:08 18:20	06:22 20:48	04:44 22:17	03:29 23:36	05:26 (T11) 05:40 (T11)	03:49 23:25	05:29 (T11) 05:49 (T11)	05:16 21:58	06:43 20:14	08:06 18:32	08:38 15:55	09:58 14:53
12	09:56 15:26	08:36 17:00	07:04 18:23	06:19 20:51	04:41 22:20	03:28 23:38	05:26 (T11) 05:40 (T11)	03:52 23:23	05:29 (T11) 05:50 (T11)	05:19 21:55	06:46 20:11	08:09 18:29	08:41 15:52	10:00 14:52
13	09:54 15:29	08:33 17:03	07:01 18:26	06:15 20:54	04:38 22:23	03:27 23:39	05:26 (T11) 05:39 (T11)	03:54 23:21	05:28 (T11) 05:49 (T11)	05:22 21:52	06:49 20:07	08:12 18:26	08:44 15:49	10:01 14:52
14	09:52 15:32	08:29 17:06	06:58 18:29	06:12 20:57	04:35 22:26	03:26 23:41	05:27 (T11) 05:25 (T11)	03:56 23:19	05:28 (T11) 05:50 (T11)	05:25 21:49	06:52 20:04	08:14 18:22	08:47 15:47	10:03 14:51
15	09:50 15:34	08:26 17:09	06:54 18:31	06:09 20:59	04:32 22:29	03:25 23:42	05:27 (T11) 05:35 (T11)	03:59 23:16	05:28 (T11) 05:50 (T11)	05:27 21:45	06:54 20:01	08:17 18:19	08:50 15:44	10:04 14:51
16	09:48 15:37	08:23 17:12	06:51 18:34	06:05 21:02	04:29 22:32	03:24 23:43	05:24 (T11) 05:37 (T11)	04:02 23:43	05:28 (T11) 05:50 (T11)	05:30 21:42	06:57 20:07	08:20 18:16	08:53 15:41	10:06 14:50
17	09:46 15:40	08:20 17:15	06:47 18:37	06:02 21:05	04:26 22:35	03:24 23:44	05:22 (T11) 05:37 (T11)	04:04 23:12	05:28 (T11) 05:50 (T11)	05:33 21:39	07:00 20:04	08:23 18:12	08:56 15:39	10:07 14:50
18	09:44 15:43	08:17 17:18	06:44 18:40	05:59 21:08	04:23 22:38	03:23 23:44	05:21 (T11) 05:39 (T11)	04:07 23:09	05:28 (T11) 05:50 (T11)	05:36 21:35	07:02 20:05	08:26 18:09	08:59 15:36	10:08 14:50
19	09:42 15:46	08:14 17:21	06:41 18:43	05:55 21:11	04:20 22:40	03:23 23:45	05:21 (T11) 05:40 (T11)	04:09 23:07	05:29 (T11) 05:51 (T11)	05:39 21:32	07:05 20:07	08:29 18:06	09:02 15:33	10:09 14:50
20	09:39 15:49	08:10 17:24	06:37 18:46	05:52 21:14	04:17 22:43	03:23 23:45	05:20 (T11) 05:39 (T11)	04:12 23:04	05:29 (T11) 05:51 (T11)	05:42 21:29	07:08 20:07	08:32 18:03	09:05 15:31	10:10 14:50
21	09:37 15:52	08:07 17:27	06:34 18:48	05:48 21:17	04:15 22:46	03:23 23:46	05:19 (T11) 05:40 (T11)	04:15 23:01	05:29 (T11) 05:51 (T11)	05:45 21:25	07:11 20:07	08:35 18:07	09:08 15:28	10:11 14:50
22	09:35 15:55	08:04 17:30	06:30 18:51	05:45 21:20	04:12 22:49	03:23 23:46	05:19 (T11) 05:41 (T11)	04:18 22:59	05:29 (T11) 05:50 (T11)	05:48 21:22	07:13 20:07	08:37 18:07	09:11 15:26	10:11 14:51
23	09:32 15:58	08:01 17:33	06:27 18:54	05:42 21:23	04:09 22:52	03:23 23:46	05:19 (T11) 05:41 (T11)	04:20 22:56	05:30 (T11) 05:50 (T11)	05:50 21:19	07:16 20:07	08:40 18:07	09:14 15:24	10:12 14:51
24	09:30 16:01	07:58 17:36	06:24 18:57	05:38 21:26	04:06 22:55	03:24 23:46	05:19 (T11) 05:41 (T11)	04:23 22:53	05:31 (T11) 05:50 (T11)	05:53 21:15	07:19 20:07	08:43 18:07	09:17 15:21	10:12 14:52
25	09:27 16:04	07:54 17:39	06:20 19:00	05:35 21:29	04:04 22:58	03:24 23:46	05:19 (T11) 05:41 (T11)	04:26 22:50	05:31 (T11) 05:49 (T11)	05:56 21:12	07:22 20:07	08:46 18:07	09:19 15:19	10:12 14:53
26	09:25 16:07	07:51 17:42	06:17 19:02	05:32 21:32	04:01 23:00	03:25 23:46	05:19 (T11) 05:41 (T11)	04:29 22:47	05:32 (T11) 05:48 (T11)	05:59 21:09	07:24 20:07	08:49 18:07	09:22 15:17	10:12 14:54
27	09:22 16:10	07:48 17:45	06:13 19:05	05:29 21:35	03:59 23:03	03:26 23:45	05:19 (T11) 05:41 (T11)	04:32 22:44	05:33 (T11) 05:48 (T11)	06:02 21:05	07:27 20:07	08:52 18:07	09:25 15:15	10:12 14:55
28	09:19 16:13	07:44 17:48	06:10 19:08	05:25 21:38	03:56 23:06	03:27 23:44	05:19 (T11) 05:41 (T11)	04:35 22:42	05:34 (T11) 05:46 (T11)	06:05 21:02	07:30 20:07	08:55 18:07	09:28 15:13	10:12 14:56
29	09:17 16:16		07:06 20:11	05:22 21:41	03:54 23:08	03:28 23:43	05:20 (T11) 05:42 (T11)	04:38 22:39	05:37 (T11) 05:45 (T11)	06:07 20:59	07:32 20:07	08:58 18:07	09:30 16:34	10:12 14:57
30	09:14 16:19		07:03 20:14	05:19 21:44	03:51 23:11	03:29 23:43	05:20 (T11) 05:42 (T11)	04:41 22:36	06:10 20:55	07:35 20:07	08:01 18:07	09:33 16:31	10:11 15:09	10:11 14:59
31	09:11 16:22		07:00 20:17		03:49 23:13	03:21 23:43	05:20 (T11) 05:41 (T11)	04:44 22:33	06:13 20:52		08:04 16:28		10:11 15:00	
Potential sun hours	183	243	363	447	559	604	593	502	392	308	207	152		
Total, worst case					337	416	543							
Sun reduction					0,53	0,51	0,50							
Oper. time red.					0,97	0,97	0,97							
Wind dir. red.					0,64	0,64	0,64							
Total reduction					0,33	0,31	0,31							
Total, real					111	129	168							

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)

SHADOW - Calendar

Calculation: V136 x 15 x HH172 real case_no forestShadow receptor: B - Lomarakennus (Voitby Långträsket)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June
1	10:10	09:08	07:41	06:56	05:15	03:47
	15:02	16:25	17:51	20:20	21:47	23:16
2	10:10	09:06	07:38	06:53	05:12	03:45
	15:04	16:28	17:54	20:22	21:50	23:19
3	10:09	09:03	07:35	06:49	05:09	03:42
	15:06	16:32	17:57	20:25	21:53	23:21
4	10:08	09:00	07:31	08:21 (T15)	06:46	05:06
	15:08	16:35	18:00	8 08:29 (T15)	20:28	21:56
5	10:07	08:57	07:28	08:17 (T15)	06:43	05:03
	15:10	16:38	18:03	14 08:31 (T15)	20:31	21:59
6	10:05	08:54	07:25	08:15 (T15)	06:39	07:21 (T13)
	15:12	16:41	18:06	18 08:33 (T15)	20:34	3 07:24 (T13)
7	10:04	08:51	07:21	08:13 (T15)	06:36	07:17 (T13)
	15:14	16:44	18:08	21 08:34 (T15)	20:37	11 07:28 (T13)
8	10:03	08:48	07:18	08:12 (T15)	06:32	07:15 (T13)
	15:16	16:47	18:11	23 08:35 (T15)	20:39	15 07:30 (T13)
9	10:01	08:45	07:14	08:11 (T15)	06:29	07:12 (T13)
	15:19	16:50	18:14	24 08:35 (T15)	20:42	18 07:30 (T13)
10	10:00	08:42	07:11	08:11 (T15)	06:26	07:11 (T13)
	15:21	16:53	18:17	25 08:36 (T15)	20:45	20 07:31 (T13)
11	09:58	08:39	07:08	08:10 (T15)	06:22	07:11 (T13)
	15:24	16:56	18:20	25 08:35 (T15)	20:48	20 07:31 (T13)
12	09:56	08:36	07:04	08:10 (T15)	06:19	07:10 (T13)
	15:26	17:00	18:23	25 08:35 (T15)	20:51	22 07:32 (T13)
13	09:54	08:33	07:01	08:09 (T15)	06:15	07:09 (T13)
	15:29	17:03	18:26	25 08:34 (T15)	20:54	22 07:31 (T13)
14	09:52	08:30	06:58	08:10 (T15)	06:12	07:09 (T13)
	15:32	17:06	18:29	24 08:34 (T15)	20:57	22 07:31 (T13)
15	09:51	08:26	06:54	08:10 (T15)	06:09	07:10 (T13)
	15:34	17:09	18:31	22 08:32 (T15)	21:00	20 07:30 (T13)
16	09:48	08:23	06:51	08:11 (T15)	06:05	07:10 (T13)
	15:37	17:12	18:34	20 08:31 (T15)	21:02	19 07:29 (T13)
17	09:46	08:20	06:47	08:11 (T15)	06:02	07:10 (T13)
	15:40	17:15	18:37	18 08:29 (T15)	21:05	18 07:28 (T13)
18	09:44	08:17	06:44	08:13 (T15)	05:59	07:11 (T13)
	15:43	17:18	18:40	14 08:27 (T15)	21:08	15 07:26 (T13)
19	09:42	08:14	06:41	08:15 (T15)	05:55	07:12 (T13)
	15:46	17:21	18:43	8 08:23 (T15)	21:11	12 07:24 (T13)
20	09:40	08:11	06:37		05:52	07:15 (T13)
	15:49	17:24	18:46		21:14	6 07:21 (T13)
21	09:37	08:07	06:34		05:48	
	15:51	17:27	18:48		21:17	
22	09:35	08:04	06:30		05:45	
	15:54	17:30	18:51		21:20	
23	09:32	08:01	06:27		05:42	
	15:57	17:33	18:54		21:23	
24	09:30	07:58	06:24		05:38	
	16:01	17:36	18:57		21:26	
25	09:27	07:54	06:20		05:35	
	16:04	17:39	19:00		21:29	
26	09:25	07:51	06:17		05:32	
	16:07	17:42	19:03		21:32	
27	09:22	07:48	06:13		05:29	
	16:10	17:45	19:05		21:35	
28	09:20	07:45	06:10		05:25	
	16:13	17:48	19:08		21:38	
29	09:17		07:06		05:22	
	16:16		20:11		21:41	
30	09:14		07:03		05:19	
	16:19		20:14		21:44	
31	09:11		07:00			
	16:22		20:17			
Potential sun hours	182	242	363	447	559	604
Total, worst case			314	243	363	
Sun reduction			0,34	0,45	0,53	
Oper. time red.			0,97	0,97	0,97	
Wind dir. red.			0,58	0,56	0,62	
Total reduction			0,19	0,25	0,32	
Total, real			59	60	116	

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: V136 x 15 x HH172 real case_no forestShadow receptor: B - Lomarakennus (Voitby Långträsket)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

July			August			September			October			November			December		
1	03:30		04:46		05:52 (T14)	06:16		07:10 (T13)	07:38		08:48 (T15)	08:07		09:36			
	23:42		22:30	21	06:13 (T14)	20:49	20	07:30 (T13)	19:06	25	09:13 (T15)	16:25		15:07			
2	03:32		04:49		05:52 (T14)	06:19		07:10 (T13)	07:41		08:48 (T15)	08:10		09:39			
	23:41		22:27	20	06:12 (T14)	20:45	20	07:30 (T13)	19:03	25	09:13 (T15)	16:21		15:05			
3	03:33		04:52		05:53 (T14)	06:21		07:10 (T13)	07:44		08:48 (T15)	08:13		09:41			
	23:39		22:24	19	06:12 (T14)	20:42	18	07:28 (T13)	18:59	25	09:13 (T15)	16:18		15:03			
4	03:35		04:55		05:53 (T14)	06:24		07:12 (T13)	07:46		08:48 (T15)	08:17		09:43			
	23:38		22:21	17	06:10 (T14)	20:38	15	07:27 (T13)	18:56	25	09:13 (T15)	16:15		15:02			
5	03:37		04:58		05:54 (T14)	06:27		07:13 (T13)	07:49		08:48 (T15)	08:20		09:46			
	23:37		22:18	16	06:10 (T14)	20:35	11	07:24 (T13)	18:53	24	09:12 (T15)	16:12		15:00			
6	03:38		05:01		05:55 (T14)	06:30		07:16 (T13)	07:52		08:49 (T15)	08:23		09:48			
	23:35		22:14	13	06:08 (T14)	20:31	5	07:21 (T13)	18:49	22	09:11 (T15)	16:09		14:59			
7	03:40		05:04		05:57 (T14)	06:32			07:55		08:50 (T15)	08:26		09:50			
	23:33		22:11	10	06:07 (T14)	20:28			18:46	20	09:10 (T15)	16:06		14:57			
8	03:42		05:07			06:35			07:58		08:51 (T15)	08:29		09:52			
	23:32		22:08			20:25			18:42	17	09:08 (T15)	16:04		14:56			
9	03:45		05:10			06:38			08:00		08:54 (T15)	08:32		09:54			
	23:30		22:05			20:21			18:39	11	09:05 (T15)	16:01		14:55			
10	03:47		05:13			06:41			08:03			08:35		09:56			
	23:28		22:02			20:18			18:36			15:58		14:54			
11	03:49		05:16			06:43			08:06			08:38		09:58			
	23:26		21:58			20:14			18:32			15:55		14:53			
12	03:51		05:19			06:46			08:09			08:41		10:00			
	23:24		21:55			20:11			18:29			15:52		14:52			
13	03:54		05:22			06:49			08:12			08:44		10:02			
	23:21		21:52			20:08			18:26			15:49		14:51			
14	03:56		05:25			06:52			08:14			08:47		10:03			
	23:19		21:49			20:04			18:22			15:47		14:51			
15	03:59		05:27			06:54			08:17			08:50		10:05			
	23:17		21:45			20:01			18:19			15:44		14:50			
16	04:01		05:30			06:57			08:20			08:53		10:06			
	23:14		21:42			19:57			18:16			15:41		14:50			
17	04:04		05:33			07:00			08:23			08:56		10:07			
	23:12		21:39			19:54			18:12			15:38		14:50			
18	04:07	05:58 (T14)	05:36			07:03			08:26			08:59		10:08			
	23:09	6	06:04 (T14)	21:36		19:50			18:09			15:36		14:50			
19	04:09		05:56 (T14)	05:39		07:05			08:29			09:02		10:09			
	23:07	10	06:06 (T14)	21:32		19:47			18:06			15:33		14:50			
20	04:12		05:56 (T14)	05:42		07:08			08:32			09:05		10:10			
	23:04	12	06:08 (T14)	21:29		19:44			18:03			15:31		14:50			
21	04:15		05:54 (T14)	05:45		07:11			08:35			09:08		10:11			
	23:02	15	06:09 (T14)	21:26		19:40			17:59			15:28		14:50			
22	04:18		05:54 (T14)	05:48		07:13			08:38			09:11		10:11			
	22:59	16	06:10 (T14)	21:22		19:37			17:56			15:26		14:51			
23	04:20		05:53 (T14)	05:50	07:18 (T13)	07:16			08:41			09:14		10:12			
	22:56	17	06:10 (T14)	21:19	7	07:25 (T13)	19:33		17:53			15:24		14:51			
24	04:23		05:53 (T14)	05:53	07:16 (T13)	07:19		09:01 (T15)	08:43			09:17		10:12			
	22:53	19	06:12 (T14)	21:16	12	07:28 (T13)	19:30	4	09:05 (T15)	17:50		15:21		14:52			
25	04:26		05:52 (T14)	05:56	07:14 (T13)	07:22		08:57 (T15)	07:46			09:20		10:13			
	22:50	20	06:12 (T14)	21:12	16	07:30 (T13)	19:26	12	09:09 (T15)	16:47		15:19		14:53			
26	04:29		05:52 (T14)	05:59	07:12 (T13)	07:24		08:55 (T15)	07:49			09:22		10:13			
	22:48	20	06:12 (T14)	21:09	18	07:30 (T13)	19:23	17	09:12 (T15)	16:43		15:17		14:54			
27	04:32		05:52 (T14)	06:02	07:12 (T13)	07:27		08:52 (T15)	07:52			09:25		10:13			
	22:45	21	06:13 (T14)	21:05	19	07:31 (T13)	19:20	20	09:12 (T15)	16:40		15:15		14:55			
28	04:35		05:51 (T14)	06:05	07:11 (T13)	07:30		08:51 (T15)	07:55			09:28		10:12			
	22:42	22	06:13 (T14)	21:02	21	07:32 (T13)	19:16	22	09:13 (T15)	16:37		15:13		14:56			
29	04:38		05:52 (T14)	06:07	07:10 (T13)	07:33		08:50 (T15)	07:58			09:31		10:12			
	22:39	21	06:13 (T14)	20:59	21	07:31 (T13)	19:13	24	09:14 (T15)	16:34		15:11		14:57			
30	04:40		05:52 (T14)	06:10	07:10 (T13)	07:35		08:50 (T15)	08:01			09:33		10:12			
	22:36	21	06:13 (T14)	20:55	22	07:32 (T13)	19:09	24	09:14 (T15)	16:31		15:09		14:58			
31	04:43		05:51 (T14)	06:13	07:09 (T13)				08:04					10:11			
	22:33	21	06:12 (T14)	20:52	22	07:31 (T13)			16:28					15:00			
Potential sun hours	594		502			392			308			206		152			
Total, worst case	241		274			212			194								
Sun reduction	0,50		0,47			0,39			0,27								
Oper. time red.	0,97		0,97			0,97			0,97								
Wind dir. red.	0,62		0,59			0,57			0,58								
Total reduction	0,30		0,26			0,21			0,15								
Total, real	72		73			45			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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SHADOW - Calendar

Calculation: V136 x 15 x HH172 real case_no forestShadow receptor: C - Asuinrakennus (Voitbyntie 480)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 1,03 2,53 3,97 6,77 9,62 10,20 9,62 7,58 5,07 2,64 1,20 0,65

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
 950 485 257 338 655 682 961 1 447 1 196 618 441 434 8 465
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:11	09:09	07:41	06:56	05:16	03:47	03:30	04:46	06:16	07:38	08:08	09:36
	15:02	16:25	17:51	20:20	21:47	23:17	23:42	22:30	20:49	19:06	16:25	15:07
2	10:10	09:06	07:38	06:53	05:12	03:44	03:31	04:49	06:19	07:41	08:11	09:39
	15:04	16:28	17:54	20:23	21:50	23:19	23:41	22:27	20:45	19:03	16:22	15:05
3	10:09	09:03	07:35	06:50	05:09	03:42	03:33	04:52	06:21	07:44	08:14	09:41
	15:06	16:32	17:57	20:25	21:53	23:21	23:40	22:24	20:42	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:06	03:40	03:35	04:55	06:24	07:47	08:17	09:44
	15:08	16:35	18:00	20:28	21:56	23:24	23:38	22:21	20:38	18:56	16:15	15:02
5	10:07	08:57	07:28	06:43	05:03	03:38	03:36	04:58	06:27	07:49	08:20	09:46
	15:10	16:38	18:03	20:31	21:59	23:26	23:37	22:18	20:35	18:53	16:12	15:00
6	10:06	08:54	07:25	06:39	04:59	03:37	03:38	05:01	06:30	07:52	08:23	09:48
	15:12	16:41	18:06	20:34	22:02	23:28	23:35	22:15	20:32	18:49	16:09	14:59
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:33	07:55	08:26	09:51
	15:14	16:44	18:09	20:37	22:05	23:30	23:34	22:11	20:28	18:46	16:06	14:57
8	10:03	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:58	08:29	09:53
	15:16	16:47	18:11	20:40	22:08	23:32	23:32	22:08	20:25	18:43	16:04	14:56
9	10:02	08:45	07:15	06:29	04:50	03:32	03:44	05:10	06:38	08:00	08:32	09:55
	15:19	16:50	18:14	20:42	22:11	23:34	23:30	22:05	20:21	18:39	16:01	14:55
10	10:00	08:42	07:11	06:26	04:47	03:30	03:47	05:13	06:41	08:03	08:35	09:57
	15:21	16:53	18:17	20:45	22:14	23:36	23:28	22:02	20:18	18:36	15:58	14:54
11	09:58	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:44	08:06	08:38	09:59
	15:24	16:57	18:20	20:48	22:17	23:37	23:26	21:59	20:15	18:32	15:55	14:53
12	09:57	08:36	07:05	06:19	04:41	03:28	03:51	05:19	06:46	08:09	08:41	10:00
	15:26	17:00	18:23	20:51	22:20	23:39	23:24	21:55	20:11	18:29	15:52	14:52
13	09:55	08:33	07:01	06:15	04:38	03:27	03:54	05:22	06:49	08:12	08:44	10:02
	15:29	17:03	18:26	20:54	22:23	23:40	23:22	21:52	20:08	18:26	15:49	14:51
14	09:53	08:30	06:58	06:12	04:35	03:26	03:56	05:25	06:52	08:15	08:47	10:04
	15:31	17:06	18:29	20:57	22:26	23:41	23:19	21:49	20:04	18:22	15:47	14:51
15	09:51	08:27	06:54	06:09	04:32	03:25	03:59	05:27	06:54	08:17	08:50	10:05
	15:34	17:09	18:32	21:00	22:29	23:43	23:17	21:46	20:01	18:19	15:44	14:50
16	09:49	08:24	06:51	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:03	22:32	23:44	23:15	21:42	19:57	18:16	15:41	14:50
17	09:47	08:20	06:48	06:02	04:26	03:23	04:04	05:33	07:00	08:23	08:56	10:08
	15:40	17:15	18:37	21:06	22:35	23:44	23:12	21:39	19:54	18:13	15:38	14:50
18	09:44	08:17	06:44	05:59	04:23	03:23	04:07	05:36	07:03	08:26	08:59	10:09
	15:43	17:18	18:40	21:09	22:38	23:45	23:10	21:36	19:51	18:09	15:36	14:50
19	09:42	08:14	06:41	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:10
	15:46	17:21	18:43	21:11	22:41	23:46	23:07	21:32	19:47	18:06	15:33	14:50
20	09:40	08:11	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:32	09:05	10:10
	15:49	17:24	18:46	21:14	22:44	23:46	23:04	21:29	19:44	18:03	15:31	14:50
21	09:38	08:08	06:34	05:49	04:14	03:23	04:15	05:45	07:11	08:35	09:08	10:11
	15:51	17:27	18:49	21:17	22:47	23:47	23:02	21:26	19:40	17:59	15:28	14:50
22	09:35	08:04	06:31	05:45	04:12	03:23	04:17	05:48	07:14	08:38	09:11	10:12
	15:54	17:30	18:51	21:20	22:50	23:47	22:59	21:22	19:37	17:56	15:26	14:51
23	09:33	08:01	06:27	05:42	04:09	03:23	04:20	05:51	07:16	08:41	09:14	10:12
	15:57	17:33	18:54	21:23	22:53	23:47	22:56	21:19	19:33	17:53	15:24	14:51
24	09:30	07:58	06:24	05:39	04:06	03:23	04:23	05:53	07:19	08:44	09:17	10:13
	16:01	17:36	18:57	21:26	22:55	23:47	22:54	21:16	19:30	17:50	15:21	14:52
25	09:28	07:55	06:20	05:35	04:04	03:24	04:26	05:56	07:22	07:47	09:20	10:13
	16:04	17:39	19:00	21:29	22:58	23:47	22:51	21:12	19:27	17:47	15:19	14:53
26	09:25	07:51	06:17	05:32	04:01	03:25	04:29	05:59	07:24	07:50	09:23	10:13
	16:07	17:42	19:03	21:32	23:01	23:46	22:48	21:09	19:23	16:43	15:17	14:53
27	09:22	07:48	06:13	05:29	03:58	03:25	04:32	06:02	07:27	07:53	09:26	10:13
	16:10	17:45	19:06	21:35	23:04	23:46	22:45	21:06	19:20	16:40	15:15	14:55
28	09:20	07:45	06:10	05:25	03:56	03:26	04:35	06:05	07:30	07:56	09:28	10:13
	16:13	17:48	19:08	21:38	23:06	23:45	22:42	21:02	19:16	16:37	15:13	14:56
29	09:17		07:07	05:22	03:54	03:27	04:38	06:08	07:33	07:59	09:31	10:13
	16:16		20:11	21:41	23:09	23:44	22:39	20:59	19:13	16:34	15:11	14:57
30	09:14		07:03	05:19	03:51	03:29	04:40	06:10	07:35	08:02	09:34	10:12
	16:19		20:14	21:44	23:12	23:43	22:36	20:55	19:10	16:31	15:09	14:58
31	09:12		07:00		03:49		04:43	06:13		08:05		10:12
	16:22		20:17		23:14		22:33	20:52		16:28		15:00
Potential sun hours	182	242	363	447	559	605	594	502	392	308	206	151
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)	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		

SHADOW - Calendar

Calculation: V136 x 15 x HH172 real case_no forestShadow receptor: D - Asuinrakennus (Kunintie 289)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:11	09:09	07:41	06:56	05:15	03:46	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:20	21:47	23:17	23:42	22:30	20:49	19:06	16:24	15:06
2	10:10	09:06	07:38	06:53	05:12	03:44	03:31	04:49	06:18	07:41	08:11	09:39
	15:03	16:28	17:54	20:22	21:50	23:19	23:41	22:27	20:45	19:03	16:21	15:05
3	10:09	09:03	07:35	06:49	05:09	03:42	03:33	04:52	06:21	07:44	08:14	09:41
	15:05	16:31	17:57	20:25	21:53	23:21	23:40	22:24	20:42	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:06	03:40	03:34	04:55	06:24	07:46	08:17	09:44
	15:07	16:34	18:00	20:28	21:56	23:24	23:39	22:21	20:38	18:56	16:15	15:01
5	10:07	08:57	07:28	06:42	05:02	03:38	03:36	04:58	06:27	07:49	08:20	09:46
	15:09	16:38	18:03	20:31	21:59	23:26	23:37	22:18	20:35	18:52	16:12	15:00
6	10:06	08:54	07:25	06:39	04:59	03:36	03:38	05:01	06:30	07:52	08:23	09:48
	15:11	16:41	18:05	20:34	22:02	23:28	23:35	22:15	20:32	18:49	16:09	14:58
7	10:04	08:51	07:21	06:36	04:56	03:34	03:40	05:04	06:32	07:55	08:26	09:51
	15:14	16:44	18:08	20:37	22:05	23:30	23:34	22:11	20:28	18:46	16:06	14:57
8	10:03	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:58	08:29	09:53
	15:16	16:47	18:11	20:39	22:08	23:32	23:32	22:08	20:25	18:42	16:03	14:56
9	10:02	08:45	07:14	06:29	04:50	03:31	03:44	05:10	06:38	08:00	08:32	09:55
	15:18	16:50	18:14	20:42	22:11	23:34	23:30	22:05	20:21	18:39	16:00	14:55
10	10:00	08:42	07:11	06:25	04:47	03:30	03:46	05:13	06:41	08:03	08:35	09:57
	15:21	16:53	18:17	20:45	22:14	23:36	23:28	22:02	20:18	18:36	15:57	14:54
11	09:58	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:59
	15:23	16:56	18:20	20:48	22:17	23:37	23:26	21:59	20:14	18:32	15:55	14:53
12	09:57	08:36	07:04	06:19	04:40	03:27	03:51	05:18	06:46	08:09	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:39	23:24	21:55	20:11	18:29	15:52	14:52
13	09:55	08:33	07:01	06:15	04:37	03:26	03:53	05:21	06:49	08:12	08:44	10:02
	15:28	17:03	18:26	20:54	22:23	23:40	23:22	21:52	20:08	18:26	15:49	14:51
14	09:53	08:30	06:58	06:12	04:34	03:25	03:56	05:24	06:52	08:14	08:47	10:04
	15:31	17:06	18:29	20:57	22:26	23:41	23:19	21:49	20:04	18:22	15:46	14:50
15	09:51	08:27	06:54	06:08	04:31	03:24	03:58	05:27	06:54	08:17	08:50	10:05
	15:34	17:09	18:31	21:00	22:29	23:43	23:17	21:46	20:01	18:19	15:44	14:50
16	09:49	08:23	06:51	06:05	04:28	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:03	22:32	23:44	23:15	21:42	19:57	18:16	15:41	14:50
17	09:47	08:20	06:47	06:02	04:25	03:23	04:03	05:33	07:00	08:23	08:56	10:08
	15:40	17:15	18:37	21:05	22:35	23:45	23:12	21:39	19:54	18:12	15:38	14:49
18	09:44	08:17	06:44	05:58	04:23	03:23	04:06	05:36	07:02	08:26	08:59	10:09
	15:42	17:18	18:40	21:08	22:38	23:45	23:10	21:36	19:50	18:09	15:36	14:49
19	09:42	08:14	06:41	05:55	04:20	03:22	04:09	05:39	07:05	08:29	09:02	10:10
	15:45	17:21	18:43	21:11	22:41	23:46	23:07	21:32	19:47	18:06	15:33	14:49
20	09:40	08:11	06:37	05:52	04:17	03:22	04:12	05:42	07:08	08:32	09:05	10:10
	15:48	17:24	18:46	21:14	22:44	23:46	23:04	21:29	19:44	18:03	15:30	14:49
21	09:37	08:07	06:34	05:48	04:14	03:22	04:14	05:45	07:11	08:35	09:08	10:11
	15:51	17:27	18:48	21:17	22:47	23:47	23:02	21:26	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:11	03:22	04:17	05:47	07:13	08:38	09:11	10:12
	15:54	17:30	18:51	21:20	22:50	23:47	22:59	21:22	19:37	17:56	15:26	14:50
23	09:33	08:01	06:27	05:42	04:09	03:22	04:20	05:50	07:16	08:41	09:14	10:12
	15:57	17:33	18:54	21:23	22:53	23:47	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:58	06:24	05:38	04:06	03:23	04:23	05:53	07:19	08:44	09:17	10:13
	16:00	17:36	18:57	21:26	22:55	23:47	22:54	21:16	19:30	17:50	15:21	14:51
25	09:28	07:54	06:20	05:35	04:03	03:23	04:26	05:56	07:22	07:46	09:20	10:13
	16:03	17:39	19:00	21:29	22:58	23:47	22:51	21:12	19:26	17:46	15:19	14:52
26	09:25	07:51	06:17	05:32	04:01	03:24	04:29	05:59	07:24	07:49	09:23	10:13
	16:06	17:42	19:03	21:32	23:01	23:46	22:48	21:09	19:23	16:43	15:16	14:53
27	09:22	07:48	06:13	05:28	03:58	03:25	04:31	06:02	07:27	07:52	09:25	10:13
	16:09	17:45	19:05	21:35	23:04	23:46	22:45	21:06	19:20	16:40	15:14	14:54
28	09:20	07:45	06:10	05:25	03:56	03:26	04:34	06:04	07:30	07:55	09:28	10:13
	16:13	17:48	19:08	21:38	23:06	23:45	22:42	21:02	19:16	16:37	15:12	14:55
29	09:17		07:06	05:22	03:53	03:27	04:37	06:07	07:33	07:58	09:31	10:13
	16:16		20:11	21:41	23:09	23:44	22:39	20:59	19:13	16:34	15:10	14:57
30	09:14		07:03	05:19	03:51	03:28	04:40	06:10	07:35	08:01	09:34	10:12
	16:19		20:14	21:44	23:12	23:43	22:36	20:55	19:09	16:31	15:08	14:58
31	09:11		07:00		03:49		04:43	06:13		08:04		10:12
	16:22		20:17		23:14		22:33	20:52		16:27		15:00
Potential sun hours	182	242	363	447	559	605	594	502	392	308	206	151
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)	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: V136 x 15 x HH172 real case_no forestShadow receptor: E - Asuinrakennus (Sandhedsvägen 65)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:11	09:09	07:41	06:56	05:15	03:46	03:29	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16	23:42	22:30	20:48	19:06	16:24	15:06
2	10:10	09:06	07:38	06:53	05:12	03:44	03:31	04:49	06:18	07:41	08:10	09:39
	15:03	16:28	17:54	20:22	21:50	23:19	23:41	22:27	20:45	19:03	16:21	15:05
3	10:09	09:03	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:41
	15:05	16:31	17:57	20:25	21:53	23:21	23:40	22:24	20:42	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:05	03:40	03:34	04:55	06:24	07:46	08:16	09:44
	15:07	16:34	18:00	20:28	21:56	23:24	23:38	22:21	20:38	18:56	16:15	15:01
5	10:07	08:57	07:28	06:42	05:02	03:38	03:36	04:58	06:27	07:49	08:20	09:46
	15:09	16:37	18:02	20:31	21:59	23:26	23:37	22:18	20:35	18:52	16:12	15:00
6	10:06	08:54	07:24	06:39	04:59	03:36	03:38	05:01	06:29	07:52	08:23	09:48
	15:11	16:41	18:05	20:34	22:02	23:28	23:35	22:14	20:31	18:49	16:09	14:58
7	10:04	08:51	07:21	06:36	04:56	03:34	03:40	05:04	06:32	07:55	08:26	09:50
	15:14	16:44	18:08	20:37	22:05	23:30	23:34	22:11	20:28	18:46	16:06	14:57
8	10:03	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:29	09:53
	15:16	16:47	18:11	20:39	22:08	23:32	23:32	22:08	20:25	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:31	03:44	05:10	06:38	08:00	08:32	09:55
	15:18	16:50	18:14	20:42	22:11	23:34	23:30	22:05	20:21	18:39	16:00	14:55
10	10:00	08:42	07:11	06:25	04:47	03:30	03:46	05:13	06:41	08:03	08:35	09:57
	15:21	16:53	18:17	20:45	22:14	23:35	23:28	22:02	20:18	18:36	15:57	14:53
11	09:58	08:39	07:08	06:22	04:43	03:28	03:49	05:15	06:43	08:06	08:38	09:58
	15:23	16:56	18:20	20:48	22:17	23:37	23:26	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:40	03:27	03:51	05:18	06:46	08:09	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:39	23:24	21:55	20:11	18:29	15:52	14:52
13	09:55	08:33	07:01	06:15	04:37	03:26	03:53	05:21	06:49	08:12	08:44	10:02
	15:28	17:02	18:26	20:54	22:23	23:40	23:22	21:52	20:07	18:26	15:49	14:51
14	09:53	08:30	06:57	06:12	04:34	03:25	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:06	18:28	20:57	22:26	23:41	23:19	21:49	20:04	18:22	15:46	14:50
15	09:51	08:26	06:54	06:08	04:31	03:24	03:58	05:27	06:54	08:17	08:50	10:05
	15:34	17:09	18:31	21:00	22:29	23:42	23:17	21:45	20:01	18:19	15:43	14:50
16	09:49	08:23	06:51	06:05	04:28	03:24	04:01	05:30	06:57	08:20	08:53	10:06
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17	09:46	08:20	06:47	06:02	04:25	03:23	04:03	05:33	07:00	08:23	08:56	10:07
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18	09:44	08:17	06:44	05:58	04:23	03:23	04:06	05:36	07:02	08:26	08:59	10:09
	15:42	17:18	18:40	21:08	22:38	23:45	23:10	21:36	19:50	18:09	15:36	14:49
19	09:42	08:14	06:40	05:55	04:20	03:22	04:09	05:39	07:05	08:29	09:02	10:09
	15:45	17:21	18:43	21:11	22:41	23:46	23:07	21:32	19:47	18:06	15:33	14:49
20	09:40	08:11	06:37	05:52	04:17	03:22	04:12	05:42	07:08	08:32	09:05	10:10
	15:48	17:24	18:46	21:14	22:44	23:46	23:04	21:29	19:43	18:02	15:30	14:49
21	09:37	08:07	06:34	05:48	04:14	03:22	04:14	05:44	07:11	08:35	09:08	10:11
	15:51	17:27	18:48	21:17	22:47	23:47	23:02	21:26	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:11	03:22	04:17	05:47	07:13	08:38	09:11	10:12
	15:54	17:30	18:51	21:20	22:50	23:47	22:59	21:22	19:37	17:56	15:26	14:50
23	09:33	08:01	06:27	05:42	04:09	03:22	04:20	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:47	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:58	06:23	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:17	10:13
	16:00	17:36	18:57	21:26	22:55	23:47	22:53	21:16	19:30	17:49	15:21	14:51
25	09:27	07:54	06:20	05:35	04:03	03:23	04:26	05:56	07:21	07:46	09:20	10:13
	16:03	17:39	19:00	21:29	22:58	23:46	22:51	21:12	19:26	17:46	15:19	14:52
26	09:25	07:51	06:17	05:32	04:01	03:24	04:28	05:59	07:24	07:49	09:23	10:13
	16:06	17:42	19:02	21:32	23:01	23:46	22:48	21:09	19:23	16:43	15:16	14:53
27	09:22	07:48	06:13	05:28	03:58	03:25	04:31	06:02	07:27	07:52	09:25	10:13
	16:09	17:45	19:05	21:35	23:04	23:46	22:45	21:05	19:20	16:40	15:14	14:54
28	09:20	07:44	06:10	05:25	03:56	03:26	04:34	06:04	07:30	07:55	09:28	10:13
	16:12	17:48	19:08	21:38	23:06	23:45	22:42	21:02	19:16	16:37	15:12	14:55
29	09:17		07:06	05:22	03:53	03:27	04:37	06:07	07:32	07:58	09:31	10:12
	16:16		20:11	21:41	23:09	23:44	22:39	20:59	19:13	16:34	15:10	14:57
30	09:14		07:03	05:18	03:51	03:28	04:40	06:10	07:35	08:01	09:33	10:12
	16:19		20:14	21:44	23:11	23:43	22:36	20:55	19:09	16:30	15:08	14:58
31	09:11		06:59		03:48		04:43	06:13		08:04		10:11
	16:22		20:17		23:14		22:33	20:52		16:27		14:59
Potential sun hours	182	242	363	447	559	605	594	502	392	308	206	151
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)	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: V136 x 15 x HH172 real case_no forestShadow receptor: F - Asuinrakennus (Mullontie 128)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:46	03:29	04:46	06:15	07:38	08:07	09:36
	15:01	16:25	17:51	20:19	21:46	23:16	23:42	22:30	20:48	19:06	16:24	15:06
2	10:09	09:05	07:37	06:52	05:12	03:44	03:31	04:49	06:18	07:40	08:10	09:38
	15:03	16:28	17:53	20:22	21:49	23:18	23:41	22:27	20:45	19:02	16:21	15:04
3	10:09	09:02	07:34	06:49	05:09	03:42	03:32	04:52	06:21	07:43	08:13	09:41
	15:05	16:31	17:56	20:25	21:52	23:21	23:39	22:23	20:41	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:05	03:40	03:34	04:55	06:24	07:46	08:16	09:43
	15:07	16:34	17:59	20:28	21:55	23:23	23:38	22:20	20:38	18:55	16:15	15:01
5	10:06	08:57	07:28	06:42	05:02	03:38	03:36	04:58	06:26	07:49	08:19	09:45
	15:09	16:37	18:02	20:31	21:59	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:36	03:38	05:01	06:29	07:52	08:22	09:48
	15:11	16:40	18:05	20:33	22:02	23:27	23:35	22:14	20:31	18:49	16:09	14:58
7	10:04	08:51	07:21	06:35	04:56	03:34	03:40	05:03	06:32	07:54	08:25	09:50
	15:13	16:44	18:08	20:36	22:05	23:29	23:33	22:11	20:28	18:45	16:06	14:57
8	10:02	08:48	07:17	06:32	04:53	03:33	03:42	05:06	06:35	07:57	08:28	09:52
	15:16	16:47	18:11	20:39	22:08	23:31	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:49	03:31	03:44	05:09	06:38	08:00	08:31	09:54
	15:18	16:50	18:14	20:42	22:11	23:33	23:29	22:05	20:21	18:39	16:00	14:54
10	09:59	08:42	07:11	06:25	04:46	03:30	03:46	05:12	06:40	08:03	08:34	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:27	22:01	20:17	18:35	15:57	14:53
11	09:58	08:39	07:07	06:22	04:43	03:28	03:48	05:15	06:43	08:06	08:38	09:58
	15:23	16:56	18:20	20:48	22:17	23:37	23:25	21:58	20:14	18:32	15:54	14:52
12	09:56	08:35	07:04	06:18	04:40	03:27	03:51	05:18	06:46	08:08	08:41	10:00
	15:26	16:59	18:22	20:51	22:20	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:32	07:01	06:15	04:37	03:26	03:53	05:21	06:48	08:11	08:44	10:01
	15:28	17:02	18:25	20:53	22:23	23:40	23:21	21:52	20:07	18:25	15:49	14:51
14	09:52	08:29	06:57	06:12	04:34	03:25	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:05	18:28	20:56	22:26	23:41	23:19	21:48	20:04	18:22	15:46	14:50
15	09:50	08:26	06:54	06:08	04:31	03:24	03:58	05:27	06:54	08:17	08:50	10:04
	15:34	17:08	18:31	20:59	22:29	23:42	23:16	21:45	20:00	18:19	15:43	14:50
16	09:48	08:23	06:50	06:05	04:28	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:36	17:11	18:34	21:02	22:32	23:43	23:14	21:42	19:57	18:15	15:41	14:49
17	09:46	08:20	06:47	06:01	04:25	03:23	04:03	05:33	06:59	08:23	08:56	10:07
	15:39	17:15	18:37	21:05	22:35	23:44	23:12	21:39	19:53	18:12	15:38	14:49
18	09:44	08:17	06:44	05:58	04:22	03:23	04:06	05:36	07:02	08:26	08:59	10:08
	15:42	17:18	18:40	21:08	22:37	23:45	23:09	21:35	19:50	18:09	15:35	14:49
19	09:42	08:13	06:40	05:55	04:20	03:22	04:09	05:39	07:05	08:28	09:02	10:09
	15:45	17:21	18:42	21:11	22:40	23:45	23:07	21:32	19:47	18:05	15:33	14:49
20	09:39	08:10	06:37	05:51	04:17	03:22	04:11	05:41	07:08	08:31	09:05	10:10
	15:48	17:24	18:45	21:14	22:43	23:46	23:04	21:29	19:43	18:02	15:30	14:49
21	09:37	08:07	06:33	05:48	04:14	03:22	04:14	05:44	07:10	08:34	09:08	10:11
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
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	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:52	15:23	14:51
24	09:30	07:57	06:23	05:38	04:06	03:23	04:23	05:53	07:18	08:43	09:16	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:29	17:49	15:21	14:51
25	09:27	07:54	06:20	05:35	04:03	03:23	04:25	05:56	07:21	07:46	09:19	10:12
	16:03	17:39	18:59	21:29	22:58	23:46	22:50	21:12	19:26	17:46	15:18	14:52
26	09:24	07:51	06:16	05:31	04:00	03:24	04:28	05:59	07:24	07:49	09:22	10:12
	16:06	17:42	19:02	21:32	23:00	23:46	22:47	21:08	19:23	16:43	15:16	14:53
27	09:22	07:47	06:13	05:28	03:58	03:25	04:31	06:01	07:27	07:52	09:25	10:12
	16:09	17:45	19:05	21:34	23:03	23:45	22:44	21:05	19:19	16:40	15:14	14:54
28	09:19	07:44	06:09	05:25	03:55	03:26	04:34	06:04	07:29	07:55	09:28	10:12
	16:12	17:48	19:08	21:37	23:06	23:44	22:42	21:02	19:16	16:37	15:12	14:55
29	09:16		07:06	05:22	03:53	03:27	04:37	06:07	07:32	07:58	09:30	10:12
	16:15		20:11	21:40	23:08	23:44	22:39	20:58	19:12	16:33	15:10	14:56
30	09:14		07:03	05:18	03:51	03:28	04:40	06:10	07:35	08:01	09:33	10:12
	16:18		20:13	21:43	23:11	23:43	22:36	20:55	19:09	16:30	15:08	14:58
31	09:11		06:59		03:48		04:43	06:13		08:04		10:11
	16:22		20:16		23:14		22:33	20:52		16:27		14:59
Potential sun hours	182	242	363	447	559	605	594	502	392	308	206	151
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)	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:

Merkkikallio

Licensed user:

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Hans Vadback / hans.vadback@fcg.fi
Calculated:
10.6.2016 11:06/3.0.619

SHADOW - Calendar

Calculation: V136 x 15 x HH172 real case_no forestShadow receptor: G - Lomarakenus/Partiomaja (Korpilahdenkuja 134)
Assumptions for shadow calculations

Shine probability S (Average daily sunshine hours) []
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1,03 2,53 3,97 6,77 9,62 10,20 9,62 7,58 5,07 2,64 1,20 0,65

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
950 485 257 338 655 682 961 1 447 1 196 618 441 434 8 465
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December		
1	10:10	09:08	07:41	06:56	05:15	03:46	03:30	04:46	20:47 (T1)	06:15	07:38	08:07	09:35	
2	15:02	16:25	17:51	20:19	21:46	23:16	23:41	22:29	25	21:12 (T1)	20:48	19:06	16:24	15:06
	10:09	09:05	07:37	06:52	05:12	03:44	03:31	04:49	20:46 (T1)	06:18	07:40	08:10	09:38	
3	15:04	16:28	17:54	20:22	21:49	23:18	23:40	22:26	25	21:11 (T1)	20:45	19:02	16:21	15:05
	10:08	09:02	07:34	06:49	05:09	03:42	03:33	04:52	20:47 (T1)	06:21	07:43	08:13	09:40	
4	15:05	16:31	17:56	20:25	21:52	23:20	23:39	22:23	24	21:11 (T1)	20:41	18:59	16:18	15:03
	10:07	08:59	07:31	06:46	05:05	20:45 (T1)	03:40	04:55	20:47 (T1)	06:24	07:46	08:16	09:43	
5	15:07	16:34	17:59	20:28	21:55	23:23	23:38	22:20	23	21:10 (T1)	20:38	18:55	16:15	15:01
	10:06	08:56	07:27	06:42	05:02	20:42 (T1)	03:38	04:58	20:48 (T1)	06:27	07:49	08:19	09:45	
6	15:09	16:37	18:02	20:30	21:58	23:25	23:36	22:17	21	21:09 (T1)	20:34	18:52	16:12	15:00
	10:05	08:54	07:24	06:39	04:59	20:40 (T1)	03:36	05:01	20:49 (T1)	06:29	07:51	08:22	09:48	
7	15:12	16:41	18:05	20:33	22:01	23:27	23:34	22:14	19	21:08 (T1)	20:31	18:49	16:09	14:58
	10:04	08:51	07:21	06:35	04:56	20:38 (T1)	03:35	05:04	20:50 (T1)	06:32	07:54	08:25	09:50	
8	15:14	16:44	18:08	20:36	22:04	23:29	23:33	22:11	16	21:06 (T1)	20:28	18:45	16:06	14:57
	10:02	08:48	07:17	06:32	04:53	20:38 (T1)	03:33	05:07	20:52 (T1)	06:35	07:57	08:28	09:52	
9	15:16	16:47	18:11	20:39	22:07	23:31	23:31	22:08	12	21:04 (T1)	20:24	18:42	16:03	14:56
	10:01	08:45	07:14	06:29	04:50	20:37 (T1)	03:32	05:10	20:55 (T1)	06:38	08:00	08:31	09:54	
10	15:18	16:50	18:14	20:42	22:10	23:33	23:29	22:04	6	21:01 (T1)	20:21	18:39	16:00	14:55
	09:59	08:42	07:11	06:25	04:47	20:36 (T1)	03:30	05:12		06:40	08:03	08:34	09:56	
11	15:21	16:53	18:17	20:45	22:13	23:35	23:27	22:01		20:17	18:35	15:57	14:54	
	09:57	08:38	07:07	06:22	04:43	20:36 (T1)	03:29	05:15		06:43	08:06	08:37	09:58	
12	15:23	16:56	18:20	20:48	22:16	23:36	23:25	21:58		20:14	18:32	15:55	14:53	
	09:56	08:35	07:04	06:18	04:40	20:35 (T1)	03:28	05:18		06:46	08:08	08:40	09:59	
13	15:26	16:59	18:22	20:50	22:19	23:38	23:23	21:55		20:11	18:29	15:52	14:52	
	09:54	08:32	07:01	06:15	04:37	20:36 (T1)	03:26	05:21	20:56 (T1)	05:21	06:48	08:11	08:43	10:01
14	15:29	17:02	18:25	20:53	22:22	23:39	23:21	21:51	5	21:01 (T1)	21:51	18:25	15:49	14:51
	09:52	08:29	06:57	06:12	04:34	20:35 (T1)	03:26	05:56	20:54 (T1)	05:24	06:51	08:14	08:47	10:03
15	15:31	17:05	18:28	20:56	22:25	23:40	23:18	21:53	9	21:03 (T1)	21:48	18:22	15:46	14:51
	09:50	08:26	06:54	06:08	04:31	20:36 (T1)	03:25	05:58	20:53 (T1)	05:27	06:54	08:17	08:50	10:04
16	15:34	17:08	18:31	20:59	22:28	23:42	23:16	21:45	12	21:05 (T1)	21:45	18:19	15:43	14:50
	09:48	08:23	06:50	06:05	04:28	20:35 (T1)	03:24	05:30	20:51 (T1)	05:30	06:57	08:20	08:53	10:05
17	15:37	17:12	18:34	21:02	22:31	23:43	23:14	21:42	15	21:06 (T1)	21:42	18:15	15:41	14:50
	09:46	08:20	06:47	06:01	04:25	20:36 (T1)	03:23	05:33	20:50 (T1)	05:33	06:59	08:23	08:56	10:07
18	15:40	17:15	18:37	21:05	22:34	23:43	23:11	21:38	17	21:07 (T1)	21:38	18:12	15:38	14:50
	09:44	08:17	06:44	05:58	04:23	20:35 (T1)	03:23	05:36	20:50 (T1)	05:36	07:02	08:25	08:59	10:08
19	15:42	17:18	18:40	21:08	22:37	23:44	23:09	21:35	18	21:08 (T1)	21:35	18:09	15:36	14:49
	09:41	08:13	06:40	05:55	04:20	20:36 (T1)	03:23	05:39	20:49 (T1)	05:39	07:05	08:28	09:02	10:09
20	15:45	17:21	18:42	21:11	22:40	23:45	23:06	21:32	20	21:09 (T1)	21:32	18:06	15:33	14:49
	09:39	08:10	06:37	05:51	04:17	20:36 (T1)	03:22	05:42	20:48 (T1)	05:42	07:08	08:31	09:05	10:10
21	15:48	17:24	18:45	21:14	22:43	23:45	23:04	21:28	21	21:09 (T1)	21:28	18:02	15:30	14:50
	09:37	08:07	06:33	05:48	04:14	20:37 (T1)	03:22	05:44	20:48 (T1)	05:44	07:10	08:34	09:08	10:10
22	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	23	21:11 (T1)	21:25	18:00	15:28	14:50
	09:34	08:04	06:30	05:45	04:11	20:38 (T1)	03:23	05:47	20:47 (T1)	05:47	07:13	08:37	09:10	10:11
23	15:54	17:30	18:51	21:20	22:49	23:46	22:58	21:22	24	21:11 (T1)	21:22	18:06	15:26	14:50
	09:32	08:00	06:27	05:41	04:09	20:38 (T1)	03:23	05:50	20:47 (T1)	05:50	07:16	08:40	09:13	10:11
24	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:18	24	21:11 (T1)	21:18	18:33	15:23	14:51
	09:29	07:57	06:23	05:38	04:06	20:38 (T1)	03:23	05:53	20:46 (T1)	05:53	07:18	08:43	09:16	10:12
25	16:00	17:36	18:57	21:25	22:55	23:46	22:53	21:15	25	21:11 (T1)	21:15	18:29	15:21	14:52
	09:27	07:54	06:20	05:35	04:03	20:40 (T1)	03:24	05:56	20:47 (T1)	05:56	07:21	07:46	09:19	10:12
26	16:03	17:39	18:59	21:28	22:57	23:46	22:50	21:12	25	21:12 (T1)	21:12	18:26	15:19	14:52
	09:24	07:51	06:16	05:31	04:01	20:41 (T1)	03:24	05:59	20:46 (T1)	05:59	07:24	07:49	09:22	10:12
27	16:06	17:42	19:02	21:31	23:00	23:45	22:47	21:08	26	21:12 (T1)	21:08	18:23	15:16	14:53
	09:22	07:47	06:13	05:28	03:58	20:42 (T1)	03:25	06:01	20:45 (T1)	06:01	07:27	07:52	09:25	10:12
28	16:09	17:45	19:05	21:34	23:03	23:45	22:44	21:05	27	21:12 (T1)	21:05	18:19	15:14	14:54
	09:19	07:44	06:10	05:25	03:56	20:43 (T1)	03:26	06:04	20:46 (T1)	06:04	07:29	07:55	09:27	10:12
29	16:12	17:48	19:08	21:37	23:05	23:44	22:41	21:02	26	21:12 (T1)	21:02	18:16	15:12	14:55
	09:16		07:06	05:22	03:53	20:44 (T1)	03:27	06:07	20:46 (T1)	06:07	07:32	07:58	09:30	10:12
30	16:16		20:11	21:40	23:08	23:44	22:38	21:08	26	21:12 (T1)	21:08	18:12	15:10	14:57
	09:14		07:03	05:18	03:51	20:46 (T1)	03:29	06:10		07:35	08:01	09:33	10:11	
31	16:19		20:13	21:43	23:11	23:42	22:35	21:05	26	21:12 (T1)	21:05	18:10	15:08	14:58
	09:11		06:59		03:49	20:53 (T1)	23:42	04:43		07:35	08:01	09:33	10:11	
	16:22		20:16		23:13		22:32	21:05	26	21:12 (T1)	21:05	16:27	15:00	
Potential sun hours	182	243	363	447	559	604	593	502		392	308	206	152	
Total, worst case					558		395	171						
Sun reduction					0,53		0,50	0,47						
Oper. time red.					0,97		0,97	0,97						
Wind dir. red.					0,58		0,58	0,58						
Total reduction					0,30		0,28	0,26						
Total, real					168		112	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:

Merkkikallio

Licensed user:

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Hans Vadback / hans.vadback@fcg.fi
Calculated:
10.6.2016 11:06/3.0.619

SHADOW - Calendar

Calculation: V136 x 15 x HH172 real case_no forestShadow receptor: H - Asuinrakennus (Kotkannevantie 269)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:35
	15:02	16:25	17:51	20:19	21:46	23:15	23:41	22:29	20:48	19:06	16:24	15:07
2	10:09	09:05	07:37	06:53	05:12	03:45	03:32	04:49	06:18	07:40	08:10	09:38
	15:04	16:28	17:54	20:22	21:49	23:18	23:40	22:26	20:45	19:02	16:21	15:05
3	10:08	09:02	07:34	06:49	05:09	03:43	03:33	04:52	06:21	07:43	08:13	09:40
	15:06	16:31	17:57	20:25	21:52	23:20	23:39	22:23	20:41	18:59	16:18	15:03
4	10:07	08:59	07:31	06:46	05:06	03:41	03:35	04:55	06:24	07:46	08:16	09:43
	15:08	16:35	18:00	20:28	21:55	23:22	23:37	22:20	20:38	18:56	16:15	15:02
5	10:06	08:56	07:28	06:42	05:03	03:39	03:37	04:58	06:27	07:49	08:19	09:45
	15:10	16:38	18:02	20:30	21:58	23:25	23:36	22:17	20:34	18:52	16:12	15:00
6	10:05	08:53	07:24	06:39	04:59	03:37	03:39	05:01	06:29	07:52	08:22	09:47
	15:12	16:41	18:05	20:33	22:01	23:27	23:34	22:14	20:31	18:49	16:09	14:59
7	10:03	08:51	07:21	06:36	04:56	03:35	03:41	05:04	06:32	07:54	08:25	09:50
	15:14	16:44	18:08	20:36	22:04	23:29	23:32	22:11	20:28	18:46	16:06	14:57
8	10:02	08:48	07:17	06:32	04:53	03:34	03:43	05:07	06:35	07:57	08:28	09:52
	15:16	16:47	18:11	20:39	22:07	23:31	23:31	22:07	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:45	05:10	06:38	08:00	08:31	09:54
	15:19	16:50	18:14	20:42	22:10	23:33	23:29	22:04	20:21	18:39	16:01	14:55
10	09:59	08:41	07:11	06:25	04:47	03:31	03:47	05:13	06:40	08:03	08:34	09:56
	15:21	16:53	18:17	20:45	22:13	23:34	23:27	22:01	20:17	18:35	15:58	14:54
11	09:57	08:38	07:07	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:37	09:57
	15:24	16:56	18:20	20:48	22:16	23:36	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:35	07:04	06:19	04:41	03:28	03:52	05:19	06:46	08:08	08:40	09:59
	15:26	16:59	18:23	20:50	22:19	23:37	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:32	07:01	06:15	04:38	03:27	03:54	05:22	06:49	08:11	08:43	10:01
	15:29	17:03	18:25	20:53	22:22	23:39	23:21	21:51	20:07	18:25	15:49	14:52
14	09:52	08:29	06:57	06:12	04:35	03:26	03:56	05:24	06:51	08:14	08:46	10:02
	15:32	17:06	18:28	20:56	22:25	23:40	23:18	21:48	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:08	04:32	03:25	03:59	05:27	06:54	08:17	08:49	10:04
	15:34	17:09	18:31	20:59	22:28	23:41	23:16	21:45	20:00	18:19	15:44	14:51
16	09:48	08:23	06:50	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:52	10:05
	15:37	17:12	18:34	21:02	22:31	23:42	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:24	04:04	05:33	07:00	08:23	08:56	10:06
	15:40	17:15	18:37	21:05	22:34	23:43	23:11	21:38	19:53	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	03:23	04:07	05:36	07:02	08:26	08:59	10:08
	15:43	17:18	18:40	21:08	22:37	23:44	23:09	21:35	19:50	18:09	15:36	14:50
19	09:41	08:13	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:28	09:01	10:09
	15:46	17:21	18:42	21:11	22:40	23:44	23:06	21:32	19:47	18:06	15:33	14:50
20	09:39	08:10	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:31	09:04	10:09
	15:49	17:24	18:45	21:14	22:43	23:45	23:03	21:28	19:43	18:02	15:31	14:50
21	09:37	08:07	06:33	05:48	04:14	03:23	04:15	05:45	07:10	08:34	09:07	10:10
	15:51	17:27	18:48	21:17	22:46	23:45	23:01	21:25	19:40	17:59	15:28	14:50
22	09:34	08:04	06:30	05:45	04:12	03:23	04:18	05:47	07:13	08:37	09:10	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:58	21:22	19:36	17:56	15:26	14:51
23	09:32	08:00	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:13	10:11
	15:57	17:33	18:54	21:22	22:52	23:46	22:55	21:18	19:33	17:53	15:24	14:51
24	09:29	07:57	06:23	05:38	04:06	03:24	04:23	05:53	07:19	08:43	09:16	10:12
	16:00	17:36	18:57	21:25	22:54	23:45	22:53	21:15	19:30	17:50	15:21	14:52
25	09:27	07:54	06:20	05:35	04:04	03:24	04:26	05:56	07:21	07:46	09:19	10:12
	16:04	17:39	18:59	21:28	22:57	23:45	22:50	21:12	19:26	17:46	15:19	14:53
26	09:24	07:51	06:16	05:32	04:01	03:25	04:29	05:59	07:24	07:49	09:22	10:12
	16:07	17:42	19:02	21:31	23:00	23:45	22:47	21:08	19:23	16:43	15:17	14:54
27	09:22	07:47	06:13	05:28	03:59	03:26	04:32	06:02	07:27	07:52	09:25	10:12
	16:10	17:45	19:05	21:34	23:03	23:44	22:44	21:05	19:19	16:40	15:15	14:55
28	09:19	07:44	06:10	05:25	03:56	03:27	04:35	06:04	07:29	07:55	09:27	10:12
	16:13	17:48	19:08	21:37	23:05	23:44	22:41	21:02	19:16	16:37	15:13	14:56
29	09:16		07:06	05:22	03:54	03:28	04:38	06:07	07:32	07:58	09:30	10:11
	16:16		20:11	21:40	23:08	23:43	22:38	20:58	19:13	16:34	15:11	14:57
30	09:13		07:03	05:19	03:51	03:29	04:40	06:10	07:35	08:01	09:33	10:11
	16:19		20:14	21:43	23:10	23:42	22:35	20:55	19:09	16:31	15:09	14:59
31	09:11		06:59		03:49		04:43	06:13		08:04		10:10
	16:22		20:16		23:13		22:32	20:51		16:27		15:00
Potential sun hours	183	243	363	447	558	604	593	502	392	308	207	152
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)	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:

Merkkikallio

Licensed user:

FCG Suunnittelu ja tekniikka Oy
Osmontie 34, PO Box 950
FI-00601 Helsinki
+358104095666
Hans Vadback / hans.vadback@fcg.fi
Calculated:
10.6.2016 11:06/3.0.619

SHADOW - Calendar

Calculation: V136 x 15 x HH172 real case_no forestShadow receptor: I - Asuinrakennus (Klumpintie 171)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:35
	15:02	16:25	17:51	20:19	21:46	23:16	23:41	22:29	20:48	19:06	16:25	15:07
2	10:09	09:05	07:38	06:53	05:12	03:45	03:32	04:49	06:19	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:49	23:18	23:40	22:26	20:45	19:03	16:21	15:05
3	10:08	09:02	07:34	06:49	05:09	03:43	03:33	04:52	06:21	07:43	08:13	09:40
	15:06	16:32	17:57	20:25	21:52	23:20	23:39	22:23	20:41	18:59	16:18	15:03
4	10:07	09:00	07:31	06:46	05:06	03:41	03:35	04:55	06:24	07:46	08:16	09:43
	15:08	16:35	18:00	20:28	21:55	23:23	23:37	22:20	20:38	18:56	16:15	15:02
5	10:06	08:57	07:28	06:42	05:03	03:39	03:37	04:58	06:27	07:49	08:19	09:45
	15:10	16:38	18:03	20:31	21:58	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:37	03:39	05:01	06:30	07:52	08:22	09:48
	15:12	16:41	18:05	20:33	22:01	23:27	23:34	22:14	20:31	18:49	16:09	14:59
7	10:04	08:51	07:21	06:36	04:56	03:35	03:41	05:04	06:32	07:54	08:25	09:50
	15:14	16:44	18:08	20:36	22:04	23:29	23:33	22:11	20:28	18:46	16:06	14:58
8	10:02	08:48	07:18	06:32	04:53	03:34	03:43	05:07	06:35	07:57	08:28	09:52
	15:17	16:47	18:11	20:39	22:07	23:31	23:31	22:08	20:24	18:42	16:04	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:45	05:10	06:38	08:00	08:31	09:54
	15:19	16:50	18:14	20:42	22:10	23:33	23:29	22:04	20:21	18:39	16:01	14:55
10	09:59	08:42	07:11	06:25	04:47	03:31	03:47	05:13	06:41	08:03	08:34	09:56
	15:21	16:53	18:17	20:45	22:13	23:34	23:27	22:01	20:18	18:36	15:58	14:54
11	09:57	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:37	09:58
	15:24	16:56	18:20	20:48	22:16	23:36	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:41	03:28	03:52	05:19	06:46	08:09	08:41	09:59
	15:26	17:00	18:23	20:51	22:19	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:32	07:01	06:15	04:38	03:27	03:54	05:22	06:49	08:11	08:44	10:01
	15:29	17:03	18:26	20:54	22:22	23:39	23:21	21:52	20:07	18:26	15:49	14:52
14	09:52	08:29	06:57	06:12	04:35	03:26	03:56	05:25	06:51	08:14	08:47	10:03
	15:32	17:06	18:28	20:56	22:25	23:40	23:18	21:48	20:04	18:22	15:47	14:51
15	09:50	08:26	06:54	06:09	04:32	03:25	03:59	05:27	06:54	08:17	08:50	10:04
	15:34	17:09	18:31	20:59	22:28	23:41	23:16	21:45	20:00	18:19	15:44	14:51
16	09:48	08:23	06:51	06:05	04:29	03:25	04:02	05:30	06:57	08:20	08:53	10:05
	15:37	17:12	18:34	21:02	22:31	23:42	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:24	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:34	23:43	23:11	21:39	19:54	18:12	15:39	14:50
18	09:44	08:17	06:44	05:58	04:23	03:24	04:07	05:36	07:02	08:26	08:59	10:08
	15:43	17:18	18:40	21:08	22:37	23:44	23:09	21:35	19:50	18:09	15:36	14:50
19	09:41	08:14	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:46	17:21	18:43	21:11	22:40	23:45	23:06	21:32	19:47	18:06	15:33	14:50
20	09:39	08:10	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:31	09:05	10:10
	15:49	17:24	18:45	21:14	22:43	23:45	23:04	21:29	19:43	18:03	15:31	14:50
21	09:37	08:07	06:34	05:48	04:15	03:23	04:15	05:45	07:11	08:34	09:08	10:10
	15:52	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:34	08:04	06:30	05:45	04:12	03:23	04:18	05:48	07:13	08:37	09:11	10:11
	15:55	17:30	18:51	21:20	22:49	23:46	22:58	21:22	19:37	17:56	15:26	14:51
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:13	10:11
	15:58	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:24	14:51
24	09:30	07:57	06:23	05:38	04:06	03:24	04:23	05:53	07:19	08:43	09:16	10:12
	16:01	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:50	15:21	14:52
25	09:27	07:54	06:20	05:35	04:04	03:24	04:26	05:56	07:21	07:46	09:19	10:12
	16:04	17:39	19:00	21:29	22:57	23:45	22:50	21:12	19:26	17:46	15:19	14:53
26	09:24	07:51	06:17	05:32	04:01	03:25	04:29	05:59	07:24	07:49	09:22	10:12
	16:07	17:42	19:02	21:32	23:00	23:45	22:47	21:09	19:23	16:43	15:17	14:54
27	09:22	07:48	06:13	05:29	03:59	03:26	04:32	06:02	07:27	07:52	09:25	10:12
	16:10	17:45	19:05	21:34	23:03	23:45	22:44	21:05	19:19	16:40	15:15	14:55
28	09:19	07:44	06:10	05:25	03:56	03:27	04:35	06:05	07:30	07:55	09:27	10:12
	16:13	17:48	19:08	21:37	23:05	23:44	22:41	21:02	19:16	16:37	15:13	14:56
29	09:16		07:06	05:22	03:54	03:28	04:38	06:07	07:32	07:58	09:30	10:12
	16:16		20:11	21:40	23:08	23:43	22:38	20:58	19:13	16:34	15:11	14:57
30	09:14		07:03	05:19	03:51	03:29	04:41	06:10	07:35	08:01	09:33	10:11
	16:19		20:14	21:43	23:11	23:42	22:35	20:55	19:09	16:31	15:09	14:59
31	09:11		07:00		03:49		04:44	06:13		08:04		10:11
	16:22		20:16		23:13		22:32	20:52		16:28		15:00
Potential sun hours	183	243	363	447	558	604	593	502	392	308	207	152
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)	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: V136 x 15 x HH172 real case_no forestShadow receptor: J - Asuinrakennus (Klumpvågen 170)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

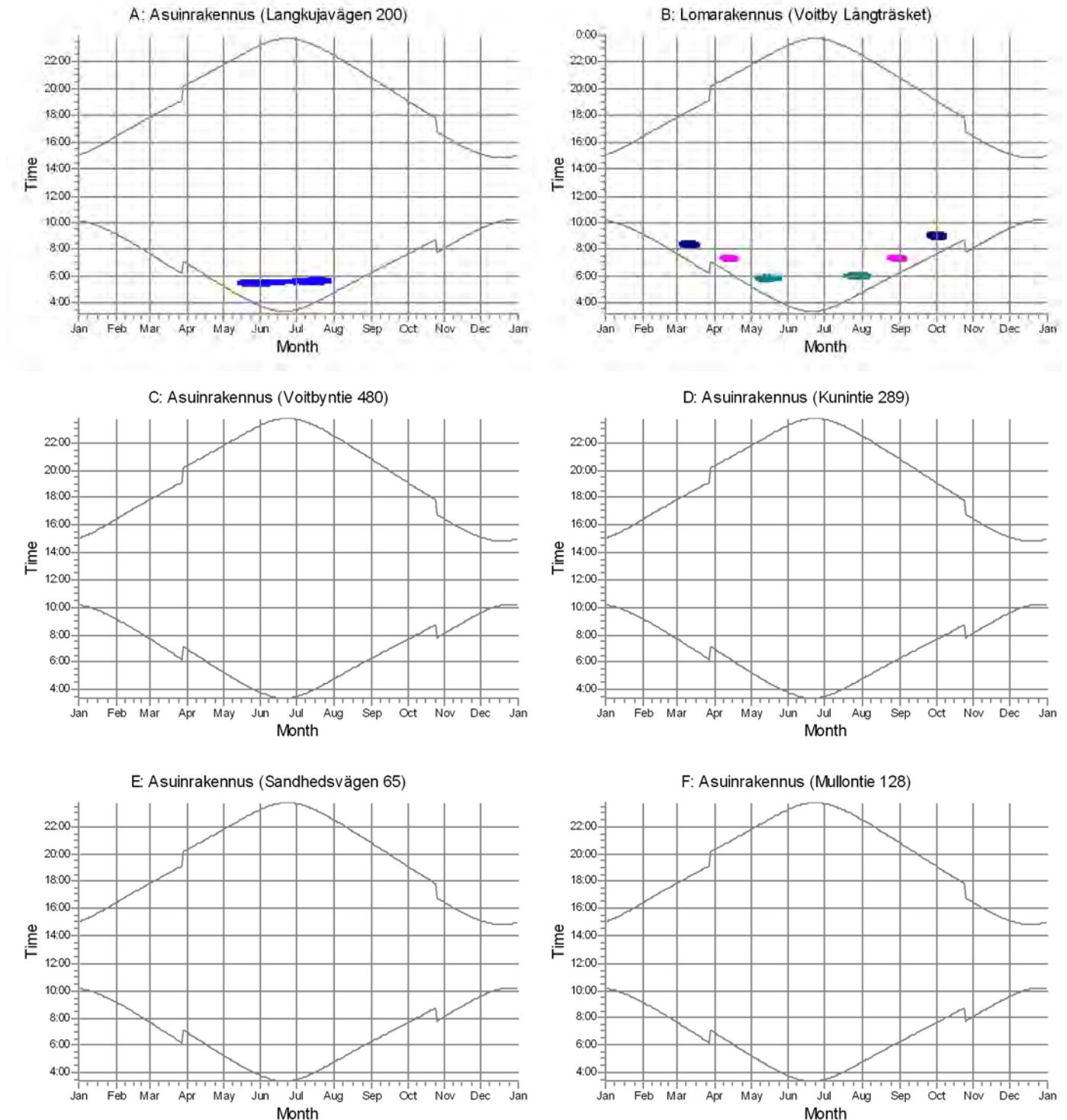
	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:16	03:47	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16	23:41	22:30	20:48	19:06	16:25	15:07
2	10:09	09:05	07:38	06:53	05:12	03:45	03:32	04:49	06:19	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:50	23:18	23:40	22:26	20:45	19:03	16:21	15:05
3	10:08	09:02	07:34	06:49	05:09	03:43	03:33	04:52	06:21	07:43	08:13	09:41
	15:06	16:32	17:57	20:25	21:53	23:20	23:39	22:23	20:42	18:59	16:18	15:03
4	10:07	09:00	07:31	06:46	05:06	03:41	03:35	04:55	06:24	07:46	08:16	09:43
	15:08	16:35	18:00	20:28	21:56	23:23	23:38	22:20	20:38	18:56	16:15	15:02
5	10:06	08:57	07:28	06:43	05:03	03:39	03:37	04:58	06:27	07:49	08:19	09:45
	15:10	16:38	18:03	20:31	21:59	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	05:00	03:37	03:39	05:01	06:30	07:52	08:22	09:48
	15:12	16:41	18:06	20:34	22:02	23:27	23:34	22:14	20:31	18:49	16:09	14:59
7	10:04	08:51	07:21	06:36	04:56	03:35	03:41	05:04	06:32	07:55	08:25	09:50
	15:14	16:44	18:08	20:36	22:05	23:29	23:33	22:11	20:28	18:46	16:06	14:58
8	10:02	08:48	07:18	06:32	04:53	03:34	03:43	05:07	06:35	07:57	08:28	09:52
	15:16	16:47	18:11	20:39	22:08	23:31	23:31	22:08	20:24	18:42	16:04	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:45	05:10	06:38	08:00	08:31	09:54
	15:19	16:50	18:14	20:42	22:11	23:33	23:29	22:05	20:21	18:39	16:01	14:55
10	09:59	08:42	07:11	06:26	04:47	03:31	03:47	05:13	06:41	08:03	08:35	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:27	22:01	20:18	18:36	15:58	14:54
11	09:58	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:24	16:57	18:20	20:48	22:17	23:36	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:41	03:28	03:52	05:19	06:46	08:09	08:41	10:00
	15:26	17:00	18:23	20:51	22:20	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:32	07:01	06:15	04:38	03:27	03:54	05:22	06:49	08:11	08:44	10:01
	15:29	17:03	18:26	20:54	22:23	23:39	23:21	21:52	20:07	18:26	15:49	14:52
14	09:52	08:29	06:57	06:12	04:35	03:26	03:56	05:25	06:52	08:14	08:47	10:03
	15:32	17:06	18:28	20:56	22:26	23:40	23:19	21:48	20:04	18:22	15:47	14:51
15	09:50	08:26	06:54	06:09	04:32	03:25	03:59	05:27	06:54	08:17	08:50	10:04
	15:34	17:09	18:31	20:59	22:29	23:42	23:16	21:45	20:01	18:19	15:44	14:51
16	09:48	08:23	06:51	06:05	04:29	03:25	04:02	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:32	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:24	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:34	23:43	23:11	21:39	19:54	18:12	15:39	14:50
18	09:44	08:17	06:44	05:58	04:23	03:24	04:07	05:36	07:02	08:26	08:59	10:08
	15:43	17:18	18:40	21:08	22:37	23:44	23:09	21:35	19:50	18:09	15:36	14:50
19	09:42	08:14	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:46	17:21	18:43	21:11	22:40	23:45	23:06	21:32	19:47	18:06	15:33	14:50
20	09:39	08:10	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:32	09:05	10:10
	15:49	17:24	18:46	21:14	22:43	23:45	23:04	21:29	19:43	18:03	15:31	14:50
21	09:37	08:07	06:34	05:48	04:15	03:23	04:15	05:45	07:11	08:34	09:08	10:10
	15:52	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:12	03:23	04:18	05:48	07:13	08:37	09:11	10:11
	15:55	17:30	18:51	21:20	22:49	23:46	22:58	21:22	19:37	17:56	15:26	14:51
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:14	10:11
	15:58	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:24	14:51
24	09:30	07:57	06:23	05:38	04:06	03:24	04:23	05:53	07:19	08:43	09:16	10:12
	16:01	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:50	15:21	14:52
25	09:27	07:54	06:20	05:35	04:04	03:24	04:26	05:56	07:21	07:46	09:19	10:12
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26	09:24	07:51	06:17	05:32	04:01	03:25	04:29	05:59	07:24	07:49	09:22	10:12
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28	09:19	07:44	06:10	05:25	03:56	03:27	04:35	06:05	07:30	07:55	09:28	10:12
	16:13	17:48	19:08	21:38	23:06	23:44	22:41	21:02	19:16	16:37	15:13	14:56
29	09:16		07:06	05:22	03:54	03:28	04:38	06:07	07:32	07:58	09:30	10:12
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30	09:14		07:03	05:19	03:51	03:29	04:41	06:10	07:35	08:01	09:33	10:11
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31	09:11		07:00		03:49		04:44	06:13		08:04		10:11
	16:22		20:17		23:13		22:33	20:52		16:28		15:00
Potential sun hours	183	243	363	447	558	604	593	502	392	308	207	152
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)	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)

SHADOW - Calendar, graphical

Calculation: V136 x 15 x HH172 real case_no forest

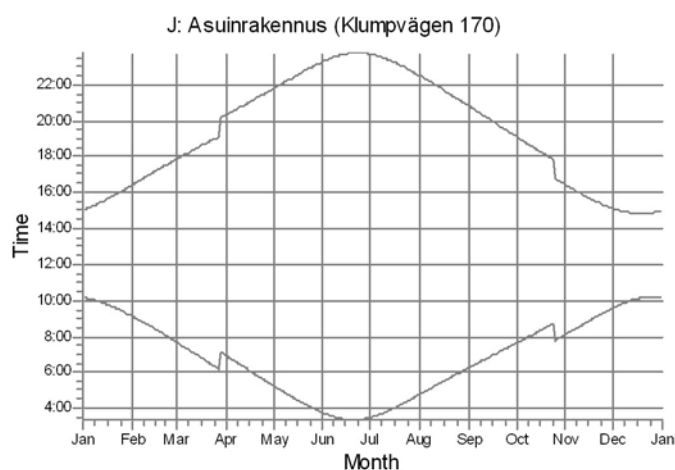
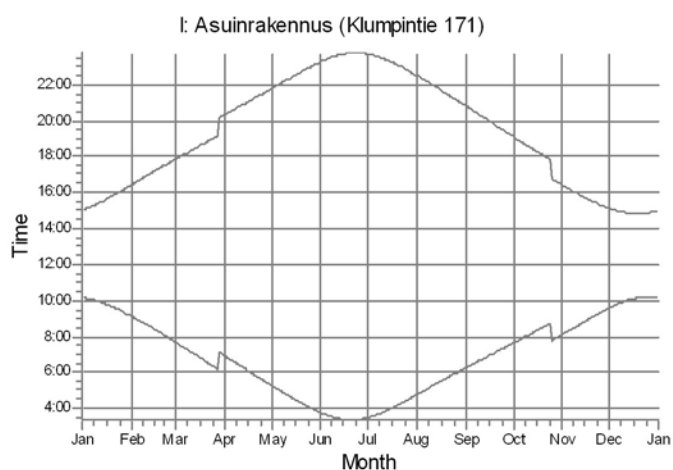
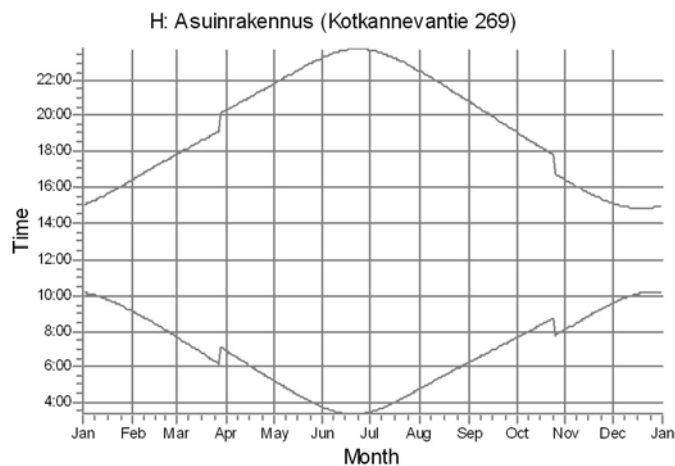
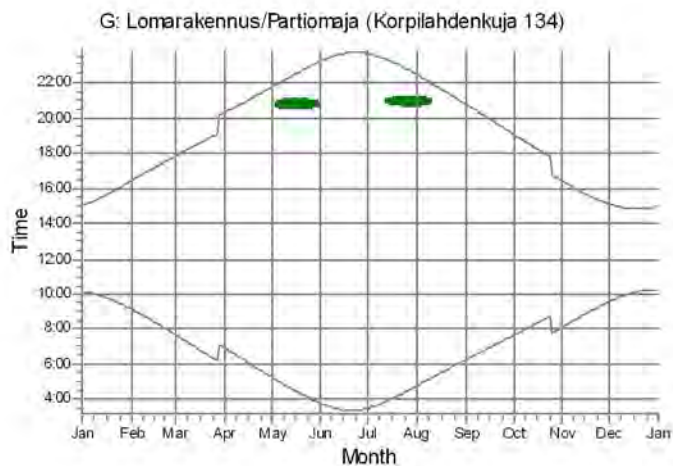


WTGs



SHADOW - Calendar, graphical

Calculation: V136 x 15 x HH172 real case_no forest



WTGs

T1: T1

Project:

Merkkikallio

Licensed user:

FCG Suunnittelu ja tekniikka Oy
Osmontie 34, PO Box 950
FI-00601 Helsinki
+358104095666
Hans Vadback / hans.vadback@fcg.fi
Calculated:
10.6.2016 11:06/3.0.619

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_no forestWTG: T1 - T1

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10 15:02	09:08 16:25	07:41 17:51	06:56 20:19	05:15 21:46	03:46 23:16	03:30 23:42	04:46 22:29	20:47-21:12/25	06:16 20:48	07:38 19:06	08:07 16:24
2	10:09 15:04	09:05 16:28	07:38 17:54	06:53 20:22	05:12 21:49	03:44 23:18	03:31 23:40	04:49 22:26	20:46-21:11/25	06:18 20:45	07:40 19:02	08:10 16:21
3	10:08 15:05	09:02 16:31	07:34 17:57	06:49 20:25	05:09 21:52	03:42 23:21	03:33 23:39	04:52 22:23	20:47-21:11/24	06:21 20:41	07:43 18:59	08:13 16:18
4	10:07 15:07	09:00 16:34	07:31 17:59	06:46 20:28	05:06 21:55	20:45-20:53/8	03:40 23:38	04:55 22:20	20:47-21:10/23	06:24 20:38	07:46 18:56	08:16 16:15
5	10:06 15:09	08:57 16:37	07:28 18:02	06:42 20:31	05:02 21:58	20:42-20:55/13	03:38 23:36	04:58 22:17	20:48-21:09/21	06:27 20:35	07:49 18:52	08:19 16:12
6	10:05 15:12	08:54 16:41	07:24 18:05	06:39 20:33	04:59 22:01	20:40-20:57/17	03:36 23:35	05:01 22:14	20:49-21:08/19	06:29 20:31	07:52 18:49	08:22 16:09
7	10:04 15:14	08:51 16:44	07:21 18:08	06:35 20:36	04:56 22:04	20:38-20:58/20	03:35 23:33	05:04 22:11	20:50-21:06/16	06:32 20:28	07:54 18:45	08:25 16:06
8	10:02 15:16	08:48 16:47	07:18 18:11	06:32 20:39	04:53 22:08	20:38-20:59/21	03:33 23:31	05:07 22:08	20:52-21:04/12	06:35 20:24	07:57 18:42	08:28 16:03
9	10:01 15:18	08:45 16:50	07:14 18:14	06:29 20:42	04:50 22:11	20:37-21:00/23	03:32 23:29	05:10 22:05	20:55-21:01/6	06:38 20:21	08:00 18:39	08:31 16:00
10	09:59 15:21	08:42 16:53	07:11 18:17	06:25 20:45	04:47 22:14	20:36-21:00/24	03:30 23:27	05:13 22:01		06:40 20:17	08:03 18:35	08:34 15:57
11	09:58 15:23	08:39 16:56	07:07 18:20	06:22 20:48	04:44 22:17	20:36-21:01/25	03:29 23:25	05:15 21:58		06:43 20:14	08:06 18:32	08:38 15:55
12	09:56 15:26	08:35 16:59	07:04 18:23	06:18 20:51	04:40 22:20	20:35-21:01/26	03:28 23:23	05:18 21:55		06:46 20:11	08:08 18:29	08:41 15:52
13	09:54 15:29	08:32 17:02	07:01 18:25	06:15 20:53	04:37 22:23	20:36-21:02/26	03:26 23:21	05:21 21:52		06:49 20:07	08:11 18:25	08:44 15:49
14	09:52 15:31	08:29 17:05	06:57 18:28	06:12 20:56	04:34 22:26	20:35-21:01/26	03:26 23:19	05:24 21:48		06:51 20:04	08:14 18:22	08:47 15:46
15	09:50 15:34	08:26 17:09	06:54 18:31	06:08 20:59	04:31 22:29	20:36-21:02/26	03:25 23:16	05:27 21:45		06:54 20:00	08:17 18:19	08:50 15:44
16	09:48 15:37	08:23 17:12	06:50 18:34	06:05 21:02	04:28 22:32	20:35-21:01/26	03:24 23:14	05:30 21:42		06:57 19:57	08:20 18:15	08:53 15:41
17	09:46 15:40	08:20 17:15	06:47 18:37	06:02 21:05	04:26 22:34	20:36-21:02/26	03:23 23:11	05:33 21:38		06:59 19:54	08:23 18:12	08:56 15:38
18	09:44 15:42	08:17 17:18	06:44 18:40	05:58 21:08	04:23 22:37	20:35-21:01/26	03:23 23:09	05:36 21:35		07:02 19:50	08:26 18:09	08:59 15:36
19	09:42 15:45	08:13 17:21	06:40 18:42	05:55 21:11	04:20 22:40	20:36-21:01/25	03:23 23:06	05:39 21:32		07:05 19:47	08:28 18:06	09:02 15:33
20	09:39 15:48	08:10 17:24	06:37 18:45	05:51 21:14	04:17 22:43	20:36-21:01/25	03:22 23:04	05:42 21:29		07:08 19:43	08:31 18:02	09:05 15:31
21	09:37 15:51	08:07 17:27	06:33 18:48	05:48 21:17	04:14 22:46	20:37-21:01/24	03:22 23:01	05:44 21:25		07:10 19:40	08:34 17:59	09:08 15:28
22	09:35 15:54	08:04 17:30	06:30 18:51	05:45 21:20	04:11 22:49	20:38-21:01/23	03:23 23:46	05:47 21:22		07:13 19:36	08:37 17:56	09:11 15:26
23	09:32 15:57	08:01 17:33	06:27 18:54	05:41 21:23	04:09 22:52	20:38-21:00/22	03:23 23:46	05:50 21:19		07:16 19:33	08:40 17:53	09:14 15:23
24	09:30 16:00	07:57 17:36	06:23 18:57	05:38 21:26	04:06 22:55	20:38-20:59/21	03:23 23:46	05:53 21:15		07:19 19:30	08:43 17:49	09:16 15:21
25	09:27 16:03	07:54 17:39	06:20 18:59	05:35 21:29	04:03 22:57	20:40-20:59/19	03:24 23:46	05:56 21:12		07:21 19:26	07:46 16:46	09:19 15:19
26	09:24 16:06	07:51 17:42	06:16 19:02	05:32 21:32	04:01 23:00	20:41-20:59/18	03:24 23:45	05:59 21:08		07:24 19:23	07:49 16:43	09:22 15:16
27	09:22 16:09	07:47 17:45	06:13 19:05	05:28 21:34	03:58 23:03	20:42-20:58/16	03:25 23:45	06:01 21:05		07:27 19:19	07:52 16:40	09:25 15:14
28	09:19 16:12	07:44 17:48	06:10 19:08	05:25 21:37	03:56 23:06	20:43-20:57/14	03:26 23:44	06:04 21:02		07:29 19:16	07:55 16:37	09:28 15:12
29	09:16 16:16		07:06 20:11	05:22 21:40	03:53 23:08	20:44-20:55/11	03:27 23:43	06:07 20:58		07:32 19:13	07:58 16:34	09:30 15:10
30	09:14 16:19		07:03 20:14	05:18 21:43	03:51 23:11	20:46-20:53/7	03:28 23:43	06:10 20:55		07:35 19:09	08:01 16:30	09:33 15:08
31	09:11 16:22		06:59 20:16		03:49 23:13			06:13 20:52		08:04 16:27		10:11 15:00
Potential sun hours	182	242	363	447	559	604	593	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	558	0	395	171	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_no forestWTG: T10 - T10

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16	23:41	22:30	20:48	19:06	16:24	15:07
2	10:09	09:05	07:38	06:53	05:12	03:45	03:32	04:49	06:18	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:50	23:18	23:40	22:26	20:45	19:02	16:21	15:05
3	10:08	09:02	07:34	06:49	05:09	03:43	03:33	04:52	06:21	07:43	08:13	09:41
	15:06	16:31	17:57	20:25	21:53	23:21	23:39	22:23	20:41	18:59	16:18	15:03
4	10:07	09:00	07:31	06:46	05:06	03:41	03:35	04:55	06:24	07:46	08:16	09:43
	15:08	16:35	18:00	20:28	21:56	23:23	23:38	22:20	20:38	18:56	16:15	15:02
5	10:06	08:57	07:28	06:42	05:03	03:39	03:37	04:58	06:27	07:49	08:19	09:45
	15:10	16:38	18:03	20:31	21:59	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:37	03:38	05:01	06:30	07:52	08:22	09:48
	15:12	16:41	18:05	20:34	22:02	23:27	23:35	22:14	20:31	18:49	16:09	14:59
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:55	08:25	09:50
	15:14	16:44	18:08	20:36	22:05	23:29	23:33	22:11	20:28	18:46	16:06	14:57
8	10:02	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:28	09:52
	15:16	16:47	18:11	20:39	22:08	23:31	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:45	05:10	06:38	08:00	08:31	09:54
	15:19	16:50	18:14	20:42	22:11	23:33	23:29	22:05	20:21	18:39	16:01	14:55
10	09:59	08:42	07:11	06:25	04:47	03:30	03:47	05:13	06:41	08:03	08:35	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:27	22:01	20:18	18:36	15:58	14:54
11	09:58	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:24	16:56	18:20	20:48	22:17	23:36	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:41	03:28	03:51	05:19	06:46	08:09	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:32	07:01	06:15	04:38	03:27	03:54	05:22	06:49	08:11	08:44	10:01
	15:29	17:03	18:26	20:54	22:23	23:39	23:21	21:52	20:07	18:26	15:49	14:51
14	09:52	08:29	06:57	06:12	04:35	03:26	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:06	18:28	20:56	22:26	23:41	23:19	21:48	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:08	04:32	03:25	03:59	05:27	06:54	08:17	08:50	10:04
	15:34	17:09	18:31	20:59	22:29	23:42	23:16	21:45	20:00	18:19	15:44	14:50
16	09:48	08:23	06:51	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:32	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:24	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:35	23:44	23:11	21:39	19:54	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	03:23	04:07	05:36	07:02	08:26	08:59	10:08
	15:43	17:18	18:40	21:08	22:37	23:44	23:09	21:35	19:50	18:09	15:36	14:50
19	09:42	08:14	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:46	17:21	18:43	21:11	22:40	23:45	23:06	21:32	19:47	18:06	15:33	14:50
20	09:39	08:10	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:31	09:05	10:10
	15:48	17:24	18:45	21:14	22:43	23:45	23:04	21:29	19:43	18:03	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:23	04:15	05:45	07:10	08:34	09:08	10:10
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:12	03:23	04:17	05:47	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:58	21:22	19:37	17:56	15:26	14:51
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:57	06:23	05:38	04:06	03:24	04:23	05:53	07:19	08:43	09:16	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:50	15:21	14:52
25	09:27	07:54	06:20	05:35	04:04	03:24	04:26	05:56	07:21	07:46	09:19	10:12
	16:03	17:39	19:00	21:29	22:57	23:46	22:50	21:12	19:26	16:46	15:19	14:53
26	09:24	07:51	06:17	05:32	04:01	03:25	04:29	05:59	07:24	07:49	09:22	10:12
	16:07	17:42	19:02	21:32	23:00	23:45	22:47	21:09	19:23	16:43	15:17	14:54
27	09:22	07:48	06:13	05:28	03:58	03:26	04:32	06:02	07:27	07:52	09:25	10:12
	16:10	17:45	19:05	21:35	23:03	23:45	22:44	21:05	19:19	16:40	15:15	14:55
28	09:19	07:44	06:10	05:25	03:56	03:27	04:35	06:04	07:30	07:55	09:28	10:12
	16:13	17:48	19:08	21:38	23:06	23:44	22:41	21:02	19:16	16:37	15:13	14:56
29	09:16		07:06	05:22	03:54	03:28	04:38	06:07	07:32	07:58	09:30	10:12
	16:16		20:11	21:41	23:08	23:43	22:39	20:58	19:13	16:34	15:11	14:57
30	09:14		07:03	05:19	03:51	03:29	04:40	06:10	07:35	08:01	09:33	10:11
	16:19		20:14	21:44	23:11	23:43	22:36	20:55	19:09	16:31	15:09	14:58
31	09:11		06:59		03:49		04:43	06:13		08:04		10:11
	16:22		20:16		23:13		22:33	20:52		16:28		15:00
Potential sun hours	183	243	363	447	559	604	593	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

Project:

Merkkikallio

Licensed user:

FCG Suunnittelu ja tekniikka Oy

Osmontie 34, PO Box 950

FI-00601 Helsinki

+358104095666

Hans Vadback / hans.vadback@fcg.fi

Calculated:

10.6.2016 11:06/3.0.619

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_no forestWTG: T11 - T11

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December		
1	10:10	09:08	07:41	06:56	05:15	03:47	05:21-05:42/21	03:30	05:29-05:44/15	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16		23:42	22:30	20:48	19:06	16:24	15:07	
2	10:09	09:05	07:38	06:53	05:12	03:45	05:20-05:41/21	03:32	05:30-05:45/15	04:49	06:18	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:50	23:18		23:40	22:27	20:45	19:03	16:21	15:05	
3	10:08	09:03	07:34	06:49	05:09	03:42	05:21-05:41/20	03:33	05:30-05:45/15	04:52	06:21	07:43	08:13	09:41
	15:06	16:31	17:57	20:25	21:53	23:21		23:39	22:23	20:42	18:59	16:18	15:03	
4	10:07	09:00	07:31	06:46	05:06	03:40	05:22-05:42/20	03:35	05:29-05:46/17	04:55	06:24	07:46	08:16	09:43
	15:08	16:35	18:00	20:28	21:56	23:23		23:38	22:20	20:38	18:56	16:15	15:02	
5	10:06	08:57	07:28	06:42	05:03	03:39	05:22-05:41/19	03:37	05:29-05:46/17	04:58	06:27	07:49	08:19	09:45
	15:10	16:38	18:03	20:31	21:59	23:25		23:36	22:17	20:35	18:52	16:12	15:00	
6	10:05	08:54	07:24	06:39	04:59	03:37	05:22-05:41/19	03:38	05:29-05:47/18	05:01	06:30	07:52	08:22	09:48
	15:12	16:41	18:05	20:34	22:02	23:27		23:35	22:14	20:31	18:49	16:09	14:59	
7	10:04	08:51	07:21	06:36	04:56	03:35	05:23-05:41/18	03:40	05:28-05:47/19	05:04	06:32	07:55	08:25	09:50
	15:14	16:44	18:08	20:36	22:05	23:29		23:33	22:11	20:28	18:46	16:06	14:57	
8	10:02	08:48	07:18	06:32	04:53	03:33	05:23-05:40/17	03:42	05:29-05:48/19	05:07	06:35	07:57	08:28	09:52
	15:16	16:47	18:11	20:39	22:08	23:31		23:31	22:08	20:24	18:42	16:03	14:56	
9	10:01	08:45	07:14	06:29	04:50	03:32	05:24-05:40/16	03:45	05:28-05:48/20	05:10	06:38	08:00	08:32	09:54
	15:19	16:50	18:14	20:42	22:11	23:33		23:29	22:05	20:21	18:39	16:01	14:55	
10	09:59	08:42	07:11	06:25	04:47	03:30	05:24-05:40/16	03:47	05:28-05:49/21	05:13	06:41	08:03	08:35	09:56
	15:21	16:53	18:17	20:45	22:14	23:35		23:27	22:01	20:18	18:36	15:58	14:54	
11	09:58	08:39	07:08	06:22	04:44	03:29	05:26-05:40/14	03:49	05:29-05:49/20	05:16	06:43	08:06	08:38	09:58
	15:24	16:56	18:20	20:48	22:17	23:36		23:25	21:58	20:14	18:32	15:55	14:53	
12	09:56	08:36	07:04	06:19	04:41	03:28	05:26-05:40/14	03:51	05:29-05:50/21	05:19	06:46	08:09	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:38		23:23	21:55	20:11	18:29	15:52	14:52	
13	09:54	08:33	07:01	06:15	04:38	03:27	05:26-05:39/13	03:54	05:28-05:49/21	05:22	06:49	08:11	08:44	10:01
	15:29	17:03	18:26	20:54	22:23	23:39		23:21	21:52	20:07	18:26	15:49	14:51	
14	09:52	08:29	06:57	06:12	04:35	05:25	05:27-05:40/13	03:56	05:28-05:50/22	05:24	06:51	08:14	08:47	10:03
	15:31	17:06	18:28	20:56	22:26	23:41		23:19	21:48	20:04	18:22	15:46	14:51	
15	09:50	08:26	06:54	06:09	04:32	05:25	05:25-05:35/10	03:25	05:27-05:39/12	03:59	05:28-05:50/22	05:27	06:54	08:17
	15:34	17:09	18:31	20:59	22:29	23:42		23:16	21:45	20:01	18:19	15:44	14:50	10:04
16	09:48	08:23	06:51	06:05	04:29	05:24	05:24-05:37/13	03:24	05:28-05:39/11	04:01	05:28-05:50/22	05:30	06:57	08:20
	15:37	17:12	18:34	21:02	22:32	23:43		23:14	21:42	19:57	18:16	15:41	14:50	08:53
17	09:46	08:20	06:47	06:02	04:26	05:22	05:22-05:37/15	03:24	05:28-05:39/11	04:04	05:28-05:50/22	05:33	07:00	08:23
	15:40	17:15	18:37	21:05	22:35	23:44		23:12	21:39	19:54	18:12	15:38	14:50	08:56
18	09:44	08:17	06:44	05:58	04:23	05:21	05:21-05:39/18	03:23	05:29-05:39/10	04:07	05:28-05:50/22	05:36	07:02	08:26
	15:43	17:18	18:40	21:08	22:38	23:44		23:09	21:35	19:50	18:09	15:36	14:50	08:59
19	09:42	08:14	06:40	05:55	04:20	05:21	05:21-05:40/19	03:23	05:29-05:39/10	04:09	05:29-05:51/22	05:39	07:05	08:29
	15:46	17:21	18:43	21:11	22:40	23:45		23:07	21:32	19:47	18:06	15:33	14:50	09:02
20	09:39	08:10	06:37	05:52	04:17	05:20	05:20-05:39/19	03:23	05:29-05:39/10	04:12	05:29-05:51/22	05:42	07:08	08:32
	15:48	17:24	18:45	21:14	22:43	23:46		23:04	21:29	19:43	18:03	15:31	14:50	09:05
21	09:37	08:07	06:34	05:48	04:14	05:19	05:19-05:40/21	03:23	05:30-05:39/9	04:15	05:29-05:51/22	05:45	07:11	08:34
	15:51	17:27	18:48	21:17	22:46	23:46		23:01	21:25	19:40	17:59	15:28	14:50	09:08
22	09:35	08:04	06:30	05:45	04:12	05:19	05:19-05:41/22	03:23	05:30-05:39/9	04:17	05:29-05:50/21	05:48	07:13	08:37
	15:54	17:30	18:51	21:20	22:49	23:46		22:59	21:22	19:37	17:56	15:26	14:51	09:11
23	09:32	08:01	06:27	05:42	04:09	05:19	05:19-05:41/22	03:23	05:30-05:40/10	04:20	05:30-05:50/20	05:50	07:16	08:40
	15:57	17:33	18:54	21:23	22:52	23:46		22:56	21:19	19:33	17:53	15:23	14:51	09:14
24	09:30	07:57	06:23	05:38	04:06	05:19	05:19-05:41/22	03:24	05:30-05:40/10	04:23	05:31-05:50/19	05:53	07:19	08:43
	16:00	17:36	18:57	21:26	22:55	23:46		22:53	21:15	19:30	17:50	15:21	14:52	09:17
25	09:27	07:54	06:20	05:35	04:04	05:19	05:19-05:41/22	03:24	05:31-05:41/10	04:26	05:31-05:49/18	05:56	07:21	07:46
	16:03	17:39	19:00	21:29	22:58	23:46		22:50	21:12	19:26	16:46	15:19	14:53	09:19
26	09:25	07:51	06:17	05:32	04:01	05:19	05:19-05:41/22	03:25	05:30-05:41/11	04:29	05:32-05:48/16	05:59	07:24	07:49
	16:07	17:42	19:02	21:32	23:00	23:45		22:47	21:09	19:23	16:43	15:17	14:54	09:22
27	09:22	07:48	06:13	05:28	03:58	05:19	05:19-05:41/22	03:26	05:30-05:42/12	04:32	05:33-05:48/15	06:02	07:27	07:52
	16:10	17:45	19:05	21:35	23:03	23:45		22:44	21:05	19:20	16:40	15:15	14:55	09:25
28	09:19	07:44	06:10	05:25	03:56	05:19	05:19-05:41/22	03:26	05:30-05:43/13	04:35	05:34-05:46/12	06:05	07:30	07:55
	16:13	17:48	19:08	21:38	23:06	23:44		22:42	21:02	19:16	16:37	15:13	14:56	09:28
29	09:17		07:06	05:22	03:54	05:20	05:20-05:42/22	03:28	05:29-05:42/13	04:38	05:37-05:45/8	06:07	07:32	07:58
	16:16		20:11	21:41	23:08	23:43		22:39	20:58	19:13	16:34	15:11	14:57	09:30
30	09:14		07:03	05:19	03:51	05:20	05:20-05:42/22	03:29	05:29-05:43/14	04:40		06:10	07:35	08:01
	16:19		20:14	21:44	23:11	23:43		22:36	20:55	19:09	16:31	15:09	14:58	09:33
31	09:11		07:00		03:49	05:20	05:20-05:41/21			04:43		08:04		10:11
	16:22		20:17		23:13			22:33	20:52		16:28		15:00	10:11
Potential sun hours	183	243	363	447	559	604	416	593	502	392	308	206	152	0
Sum of minutes with flicker	0	0	0	0	337	604	416	543	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_no forestWTG: T12 - T12

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16	23:42	22:30	20:48	19:06	16:24	15:07
2	10:09	09:05	07:38	06:53	05:12	03:45	03:32	04:49	06:19	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:50	23:18	23:40	22:27	20:45	19:03	16:21	15:05
3	10:09	09:03	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:41
	15:06	16:31	17:57	20:25	21:53	23:21	23:39	22:24	20:42	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:06	03:40	03:35	04:55	06:24	07:46	08:16	09:43
	15:08	16:35	18:00	20:28	21:56	23:23	23:38	22:20	20:38	18:56	16:15	15:02
5	10:06	08:57	07:28	06:42	05:03	03:39	03:37	04:58	06:27	07:49	08:19	09:46
	15:10	16:38	18:03	20:31	21:59	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:37	03:38	05:01	06:30	07:52	08:22	09:48
	15:12	16:41	18:05	20:34	22:02	23:27	23:35	22:14	20:31	18:49	16:09	14:59
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:55	08:25	09:50
	15:14	16:44	18:08	20:36	22:05	23:29	23:33	22:11	20:28	18:46	16:06	14:57
8	10:03	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:29	09:52
	15:16	16:47	18:11	20:39	22:08	23:31	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:45	05:10	06:38	08:00	08:32	09:54
	15:19	16:50	18:14	20:42	22:11	23:33	23:29	22:05	20:21	18:39	16:01	14:55
10	09:59	08:42	07:11	06:25	04:47	03:30	03:47	05:13	06:41	08:03	08:35	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:27	22:01	20:18	18:36	15:58	14:54
11	09:58	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:24	16:56	18:20	20:48	22:17	23:37	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:41	03:28	03:51	05:19	06:46	08:09	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:33	07:01	06:15	04:38	03:27	03:54	05:22	06:49	08:11	08:44	10:01
	15:29	17:03	18:26	20:54	22:23	23:39	23:21	21:52	20:07	18:26	15:49	14:51
14	09:52	08:29	06:57	06:12	04:35	03:26	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:06	18:28	20:57	22:26	23:41	23:19	21:49	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:09	04:32	03:25	03:59	05:27	06:54	08:17	08:50	10:04
	15:34	17:09	18:31	20:59	22:29	23:42	23:16	21:45	20:01	18:19	15:44	14:50
16	09:48	08:23	06:51	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:32	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:24	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:35	23:44	23:12	21:39	19:54	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	03:23	04:07	05:36	07:02	08:26	08:59	10:08
	15:43	17:18	18:40	21:08	22:38	23:45	23:09	21:35	19:50	18:09	15:36	14:50
19	09:42	08:14	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:46	17:21	18:43	21:11	22:40	23:45	23:07	21:32	19:47	18:06	15:33	14:50
20	09:39	08:10	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:32	09:05	10:10
	15:48	17:24	18:45	21:14	22:43	23:46	23:04	21:29	19:43	18:03	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:23	04:15	05:45	07:11	08:34	09:08	10:11
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:12	03:23	04:17	05:47	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:59	21:22	19:37	17:56	15:26	14:51
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:57	06:23	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:17	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:50	15:21	14:52
25	09:27	07:54	06:20	05:35	04:04	03:24	04:26	05:56	07:21	07:46	09:19	10:12
	16:03	17:39	19:00	21:29	22:58	23:46	22:50	21:12	19:26	16:46	15:19	14:53
26	09:25	07:51	06:17	05:32	04:01	03:25	04:29	05:59	07:24	07:49	09:22	10:12
	16:07	17:42	19:02	21:32	23:00	23:46	22:47	21:09	19:23	16:43	15:17	14:53
27	09:22	07:48	06:13	05:28	03:58	03:25	04:32	06:02	07:27	07:52	09:25	10:12
	16:10	17:45	19:05	21:35	23:03	23:45	22:45	21:05	19:20	16:40	15:15	14:55
28	09:19	07:44	06:10	05:25	03:56	03:26	04:35	06:05	07:30	07:55	09:28	10:12
	16:13	17:48	19:08	21:38	23:06	23:44	22:42	21:02	19:16	16:37	15:12	14:56
29	09:17		07:06	05:22	03:54	03:28	04:37	06:07	07:32	07:58	09:30	10:12
	16:16		20:11	21:41	23:08	23:44	22:39	20:59	19:13	16:34	15:10	14:57
30	09:14		07:03	05:19	03:51	03:29	04:40	06:10	07:35	08:01	09:33	10:12
	16:19		20:14	21:44	23:11	23:43	22:36	20:55	19:09	16:31	15:09	14:58
31	09:11		07:00		03:49		04:43	06:13		08:04		10:11
	16:22		20:17		23:13		22:33	20:52		16:28		15:00
Potential sun hours	182	242	363	447	559	604	593	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

Project:

Merkkikallio

Licensed user:

FCG Suunnittelu ja tekniikka Oy
Osmontie 34, PO Box 950
FI-00601 Helsinki
+358104095666
Hans Vadback / hans.vadback@fcg.fi
Calculated:
10.6.2016 11:06/3.0.619

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_no forestWTG: T13 - T13

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December	
1	10:10 15:02	09:08 16:25	07:41 17:51	06:56 20:19	05:15 21:47	03:47 23:16	03:30 23:42	04:46 22:30	06:16 20:48	07:10-07:30/20	07:38 19:06	08:07 16:24	09:36 15:07
2	10:10 15:04	09:06 16:28	07:38 17:54	06:53 20:22	05:12 21:50	03:44 23:19	03:31 23:41	04:49 22:27	06:18 20:45	07:10-07:30/20	07:41 19:03	08:10 16:21	09:38 15:05
3	10:09 15:06	09:03 16:31	07:34 17:57	06:49 20:25	05:09 21:53	03:42 23:21	03:33 23:39	04:52 22:24	06:21 20:42	07:10-07:28/18	07:43 18:59	08:13 16:18	09:41 15:03
4	10:08 15:07	09:00 16:35	07:31 18:00	06:46 20:28	05:06 21:56	03:40 23:23	03:35 23:38	04:55 22:21	06:24 20:38	07:12-07:27/15	07:46 18:56	08:16 16:15	09:43 15:02
5	10:07 15:10	08:57 16:38	07:28 18:03	06:42 20:31	05:02 21:59	03:38 23:25	03:36 23:37	04:58 22:17	06:27 20:35	07:13-07:24/11	07:49 18:52	08:19 16:12	09:46 15:00
6	10:05 15:12	08:54 16:41	07:24 18:05	06:39 20:34	04:59 22:02	03:37 23:27	03:38 23:35	05:01 22:14	06:30 20:31	07:16-07:21/5	07:52 18:49	08:22 16:09	09:48 14:59
7	10:04 15:14	08:51 16:44	07:21 18:08	06:36 20:36	04:56 22:05	03:35 23:30	03:40 23:33	05:04 22:11	06:32 20:28		07:55 18:46	08:26 16:06	09:50 14:57
8	10:03 15:16	08:48 16:47	07:18 18:11	06:32 20:39	04:53 22:08	03:33 23:31	03:42 23:31	05:07 22:08	06:35 20:25		07:57 18:42	08:29 16:03	09:52 14:56
9	10:01 15:19	08:45 16:50	07:14 18:14	06:29 20:42	04:50 22:11	03:32 23:33	03:44 23:30	05:10 22:05	06:38 20:21		08:00 18:39	08:32 16:00	09:54 14:55
10	10:00 15:21	08:42 16:53	07:11 18:17	06:25 20:45	04:47 22:14	03:30 23:35	03:47 23:28	05:13 22:02	06:41 20:18		08:03 18:36	08:35 15:58	09:56 14:54
11	09:58 15:24	08:39 16:56	07:08 18:20	06:22 20:48	04:44 22:17	03:29 23:37	03:49 23:26	05:16 21:58	06:43 20:14		08:06 18:32	08:38 15:55	09:58 14:53
12	09:56 15:26	08:36 16:59	07:04 18:23	06:19 20:51	04:41 22:20	03:28 23:38	03:51 23:23	05:19 21:55	06:46 20:11		08:09 18:29	08:41 15:52	10:00 14:52
13	09:54 15:29	08:33 17:03	07:01 18:26	06:15 20:54	04:38 22:23	03:27 23:40	03:54 23:21	05:21 21:52	06:49 20:07		08:12 18:26	08:44 15:49	10:02 14:51
14	09:52 15:31	08:30 17:06	06:57 18:28	06:12 20:57	04:35 22:26	03:26 23:41	03:56 23:19	05:24 21:49	06:52 20:04		08:14 18:22	08:47 15:46	10:03 14:51
15	09:50 15:34	08:26 17:09	06:54 18:31	06:08 20:59	04:32 22:29	03:25 23:42	03:59 23:17	05:27 21:45	06:54 20:01		08:17 18:19	08:50 15:44	10:05 14:50
16	09:48 15:37	08:23 17:12	06:51 18:34	06:05 21:02	04:29 22:32	03:24 23:43	04:01 23:14	05:30 21:42	06:57 19:57		08:20 18:16	08:53 15:41	10:06 14:50
17	09:46 15:40	08:20 17:15	06:47 18:37	06:02 21:05	04:26 22:35	03:23 23:44	04:04 23:12	05:33 21:39	07:00 19:54		08:23 18:12	08:56 15:38	10:07 14:50
18	09:44 15:43	08:17 17:18	06:44 18:40	05:58 21:08	04:23 22:38	03:23 23:45	04:06 23:09	05:36 21:35	07:02 19:50		08:26 18:09	08:59 15:36	10:08 14:50
19	09:42 15:45	08:14 17:21	06:41 18:43	05:55 21:11	04:20 22:41	03:23 23:45	04:09 23:07	05:39 21:32	07:05 19:47		08:29 18:06	09:02 15:33	10:09 14:50
20	09:40 15:48	08:10 17:24	06:37 18:46	05:52 21:14	04:17 22:44	03:23 23:46	04:12 23:04	05:42 21:29	07:08 19:43		08:32 18:03	09:05 15:31	10:10 14:50
21	09:37 15:51	08:07 17:27	06:34 18:48	05:48 21:17	04:14 22:46	03:23 23:46	04:15 23:01	05:45 21:25	07:11 19:40		08:35 17:59	09:08 15:28	10:11 14:50
22	09:35 15:54	08:04 17:30	06:30 18:51	05:45 21:20	04:12 22:49	03:23 23:46	04:17 22:59	05:47 21:22	07:13 19:37		08:37 17:56	09:11 15:26	10:11 14:50
23	09:32 15:57	08:01 17:33	06:27 18:54	05:42 21:23	04:09 22:52	03:23 23:46	04:20 22:56	05:50 21:19	07:16 19:33	07:18-07:25/7	08:40 17:53	09:14 15:23	10:12 14:51
24	09:30 16:00	07:58 17:36	06:23 18:57	05:38 21:26	04:06 22:55	03:23 23:46	04:23 22:53	05:53 21:15	07:16-07:28/12		08:43 17:50	09:17 15:21	10:12 14:52
25	09:27 16:03	07:54 17:39	06:20 19:00	05:35 21:29	04:03 22:58	03:24 23:46	04:26 22:50	05:56 21:12	07:14-07:30/16		07:21 19:26	09:20 15:19	10:12 14:52
26	09:25 16:06	07:51 17:42	06:17 19:02	05:32 21:32	04:01 23:01	03:25 23:46	04:29 22:48	05:59 21:09	07:12-07:30/18		07:24 19:23	09:22 15:17	10:13 14:53
27	09:22 16:10	07:48 17:45	06:13 19:05	05:28 21:35	03:58 23:03	03:25 23:45	04:32 22:45	06:02 21:05	07:12-07:31/19		07:27 19:20	09:25 15:14	10:13 14:54
28	09:19 16:13	07:44 17:48	06:10 19:08	05:25 21:38	03:56 23:06	03:26 23:45	04:35 22:42	06:05 21:02	07:11-07:32/21		07:30 19:16	09:28 15:12	10:12 14:56
29	09:17 16:16		07:06 20:11	05:22 21:41	03:53 23:09	03:27 23:44	04:37 22:39	06:07 20:59	07:10-07:31/21		07:32 19:13	09:31 15:10	10:12 14:57
30	09:14 16:19		07:03 20:14	05:19 21:44	03:51 23:11	03:29 23:43	04:40 22:36	06:10 20:55	07:10-07:32/22		07:35 19:09	09:33 15:08	10:12 14:58
31	09:11 16:22		07:00 20:17		03:49 23:14		04:43 22:33	06:13 20:52	07:09-07:31/22		08:04 19:09		10:11 15:00
Potential sun hours	182	242	363	447	559	604	594	502	392	308	206	152	
Sum of minutes with flicker	0	0	0	243	0	0	0	158	89	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

Project:

Merkkikallio

Licensed user:

FCG Suunnittelu ja tekniikka Oy
Osmontie 34, PO Box 950
FI-00601 Helsinki
+358104095666
Hans Vadback / hans.vadback@fcg.fi
Calculated:
10.6.2016 11:06/3.0.619

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_no forestWTG: T14 - T14

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

		January	February	March	April	May	June	July	August	September	October	November	December	
1	10:10	09:08	07:41	06:56	05:15		03:47	03:30	04:46	05:52-06:13/21	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47		23:16	23:42	22:30		20:48	19:06	16:24	15:07
2	10:10	09:06	07:38	06:53	05:12		03:44	03:31	04:49	05:52-06:12/20	06:18	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:50		23:19	23:41	22:27		20:45	19:03	16:21	15:05
3	10:09	09:03	07:34	06:49	05:09		03:42	03:33	04:52	05:53-06:12/19	06:21	07:43	08:13	09:41
	15:05	16:31	17:57	20:25	21:53		23:21	23:40	22:24		20:42	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:06		03:40	03:35	04:55	05:53-06:10/17	06:24	07:46	08:16	09:43
	15:07	16:34	18:00	20:28	21:56		23:23	23:38	22:21		20:38	18:56	16:15	15:01
5	10:07	08:57	07:28	06:42	05:02	05:50-05:55/5	03:38	03:36	04:58	05:54-06:10/16	06:27	07:49	08:19	09:46
	15:09	16:38	18:03	20:31	21:59		23:25	23:37	22:17		20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	05:47-05:58/11	03:37	03:38	05:01	05:55-06:08/13	06:30	07:52	08:23	09:48
	15:12	16:41	18:05	20:34	22:02		23:28	23:35	22:14		20:31	18:49	16:09	14:58
7	10:04	08:51	07:21	06:36	04:56	05:45-05:59/14	03:35	03:40	05:04	05:57-06:07/10	06:32	07:55	08:26	09:50
	15:14	16:44	18:08	20:37	22:05		23:30	23:33	22:11		20:28	18:46	16:06	14:57
8	10:03	08:48	07:18	06:32	04:53	05:44-06:00/16	03:33	03:42	05:07		06:35	07:57	08:29	09:52
	15:16	16:47	18:11	20:39	22:08		23:32	23:32	22:08		20:25	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	05:42-06:01/19	03:32	03:44	05:10		06:38	08:00	08:32	09:54
	15:18	16:50	18:14	20:42	22:11		23:33	23:30	22:05		20:21	18:39	16:00	14:55
10	10:00	08:42	07:11	06:25	04:47	05:42-06:02/20	03:30	03:47	05:13		06:41	08:03	08:35	09:56
	15:21	16:53	18:17	20:45	22:14		23:35	23:28	22:02		20:18	18:36	15:58	14:54
11	09:58	08:39	07:08	06:22	04:44	05:42-06:02/20	03:29	03:49	05:16		06:43	08:06	08:38	09:58
	15:23	16:56	18:20	20:48	22:17		23:37	23:26	21:58		20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:41	05:42-06:03/21	03:28	03:51	05:19		06:46	08:09	08:41	10:00
	15:26	16:59	18:23	20:51	22:20		23:38	23:24	21:55		20:11	18:29	15:52	14:52
13	09:54	08:33	07:01	06:15	04:38	05:41-06:02/21	03:26	03:54	05:21		06:49	08:12	08:44	10:02
	15:29	17:03	18:26	20:54	22:23		23:40	23:21	21:52		20:07	18:26	15:49	14:51
14	09:52	08:30	06:58	06:12	04:35	05:40-06:02/22	03:26	03:56	05:24		06:52	08:14	08:47	10:03
	15:31	17:06	18:28	20:57	22:26		23:41	23:19	21:49		20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:08	04:32	05:41-06:02/21	03:25	03:59	05:27		06:54	08:17	08:50	10:05
	15:34	17:09	18:31	21:00	22:29		23:42	23:17	21:45		20:01	18:19	15:44	14:50
16	09:48	08:23	06:51	06:05	04:29	05:41-06:03/22	03:24	04:01	05:30		06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:32		23:43	23:14	21:42		19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	05:41-06:02/21	03:23	04:04	05:33		07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:35		23:44	23:12	21:39		19:54	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	05:42-06:02/20	03:23	04:06	05:58-06:04/6	05:36	07:02	08:26	08:59	10:08
	15:43	17:18	18:40	21:08	22:38		23:45	23:09	21:35		19:50	18:09	15:36	14:50
19	09:42	08:14	06:41	05:55	04:20	05:42-06:02/20	03:23	04:09	05:56-06:06/10	05:39	07:05	08:29	09:02	10:09
	15:45	17:21	18:43	21:11	22:41		23:45	23:07	21:32		19:47	18:06	15:33	14:50
20	09:40	08:11	06:37	05:52	04:17	05:42-06:01/19	03:22	04:12	05:56-06:08/12	05:42	07:08	08:32	09:05	10:10
	15:48	17:24	18:46	21:14	22:44		23:46	23:04	21:29		19:43	18:03	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	05:43-06:00/17	03:22	04:15	05:54-06:09/15	05:45	07:11	08:35	09:08	10:11
	15:51	17:27	18:48	21:17	22:47		23:46	23:02	21:26		19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:11	05:44-06:00/16	03:23	04:17	05:54-06:10/16	05:47	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49		23:46	22:59	21:22		19:37	17:56	15:26	14:50
23	09:32	08:01	06:27	05:42	04:09	05:45-05:59/14	03:23	04:20	05:53-06:10/17	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52		23:47	22:56	21:19		19:33	17:53	15:23	14:51
24	09:30	07:58	06:23	05:38	04:06	05:46-05:58/12	03:23	04:23	05:53-06:12/19	05:53	07:19	08:43	09:17	10:12
	16:00	17:36	18:57	21:26	22:55		23:46	22:53	21:15		19:30	17:50	15:21	14:52
25	09:27	07:54	06:20	05:35	04:03	05:48-05:56/8	03:24	04:26	05:52-06:12/20	05:56	07:21	07:46	09:20	10:13
	16:03	17:39	19:00	21:29	22:58		23:46	22:50	21:12		19:26	16:46	15:19	14:52
26	09:25	07:51	06:17	05:32	04:01	05:50-05:54/4	03:24	04:29	05:52-06:12/20	05:59	07:24	07:49	09:22	10:13
	16:06	17:42	19:02	21:32	23:01		23:46	22:48	21:09		19:23	16:43	15:17	14:53
27	09:22	07:48	06:13	05:28	03:58		03:25	04:32	05:52-06:13/21	06:02	07:27	07:52	09:25	10:13
	16:10	17:45	19:05	21:35	23:03		23:45	22:45	21:05		19:20	16:40	15:14	14:54
28	09:19	07:44	06:10	05:25	03:56		03:26	04:34	05:51-06:13/22	06:04	07:30	07:55	09:28	10:12
	16:13	17:48	19:08	21:38	23:06		23:45	22:42	21:02		19:16	16:37	15:12	14:56
29	09:17		07:06	05:22	03:53		03:27	04:37	05:52-06:13/21	06:07	07:32	07:58	09:31	10:12
	16:16		20:11	21:41	23:09		23:44	22:39	20:59		19:13	16:34	15:10	14:57
30	09:14		07:03	05:19	03:51		03:29	04:40	05:52-06:13/21	06:10	07:35	08:01	09:33	10:12
	16:19		20:14	21:44	23:11		23:43	22:36	20:55		19:09	16:31	15:08	14:58
31	09:11		07:00		03:49			04:43	05:51-06:12/21	06:13		08:04		10:11
	16:22		20:17		23:14			22:33	20:52			16:27		15:00
Potential sun hours	182	242	363	447	559		604	594	502	392	308	206	151	
Sum of minutes with flicker	0	0	0	0	363		0	241	116	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

Project:

Merkkikallio

Licensed user:

FCG Suunnittelu ja tekniikka Oy
Osmontie 34, PO Box 950
FI-00601 Helsinki
+358104095666
Hans Vadback / hans.vadback@fcg.fi
Calculated:
10.6.2016 11:06/3.0.619

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_no forestWTG: T15 - T15

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10 15:02	09:08 16:25	07:41 17:51	06:56 20:19	05:15 21:47	03:47 23:16	03:30 23:42	04:46 22:30	06:16 20:48	07:38 19:06	08:48-09:13/25 16:24	08:07 15:07
2	10:10 15:04	09:06 16:28	07:38 17:54	06:53 20:22	05:12 21:50	03:45 23:18	03:32 23:41	04:49 22:27	06:19 20:45	07:41 19:03	08:48-09:13/25 16:21	08:10 15:05
3	10:09 15:06	09:03 16:31	07:34 17:57	06:49 20:25	05:09 21:53	03:42 23:21	03:33 23:39	04:52 22:24	06:21 20:42	07:44 18:59	08:48-09:13/25 16:18	08:13 15:03
4	10:08 15:08	09:00 16:35	07:31 18:00	06:46 20:28	05:06 21:56	03:40 23:23	03:35 23:38	04:55 22:21	06:24 20:38	07:46 18:56	08:48-09:13/25 16:15	08:16 15:02
5	10:07 15:10	08:57 16:38	07:28 18:03	06:43 20:31	05:03 21:59	03:39 23:25	03:37 23:36	04:58 22:17	06:27 20:35	07:49 18:52	08:48-09:12/24 16:12	08:19 15:00
6	10:05 15:12	08:54 16:41	07:24 18:06	06:39 20:34	04:59 22:02	03:37 23:27	03:38 23:35	05:01 22:14	06:30 20:31	07:52 18:49	08:49-09:11/22 16:09	08:22 14:59
7	10:04 15:14	08:51 16:44	07:21 18:08	06:36 20:36	04:56 22:05	03:35 23:29	03:40 23:33	05:04 22:11	06:32 20:28	07:55 18:46	08:50-09:10/20 16:06	08:26 14:57
8	10:03 15:16	08:48 16:47	07:18 18:11	06:32 20:39	04:53 22:08	03:33 23:31	03:42 23:31	05:07 22:08	06:35 20:25	07:57 18:42	08:51-09:08/17 16:03	08:29 14:56
9	10:01 15:19	08:45 16:50	07:14 18:14	06:29 20:42	04:50 22:11	03:32 23:33	03:45 23:29	05:10 22:05	06:38 20:21	08:00 18:39	08:54-09:05/11 16:01	08:32 14:55
10	10:00 15:21	08:42 16:53	07:11 18:17	06:25 20:45	04:47 22:14	03:30 23:35	03:47 23:28	05:13 22:02	06:41 20:18	08:03 18:36	08:35 15:58	08:36 14:54
11	09:58 15:24	08:39 16:56	07:08 18:20	06:22 20:48	04:44 22:17	03:29 23:37	03:49 23:25	05:16 21:58	06:43 20:14	08:06 18:32	08:38 15:55	08:58 14:53
12	09:56 15:26	08:36 17:00	07:04 18:23	06:19 20:51	04:41 22:20	03:28 23:38	03:51 23:23	05:19 21:55	06:46 20:11	08:09 18:29	08:41 15:52	10:00 14:52
13	09:54 15:29	08:33 17:03	07:01 18:26	06:15 20:54	04:38 22:23	03:27 23:40	03:54 23:21	05:22 21:52	06:49 20:07	08:12 18:26	08:44 15:49	10:02 14:51
14	09:52 15:31	08:30 17:06	06:58 18:29	06:12 20:57	04:35 22:26	03:26 23:41	03:56 23:19	05:24 21:49	06:52 20:04	08:14 18:22	08:47 15:46	10:03 14:51
15	09:50 15:34	08:26 17:09	06:54 18:31	06:09 20:59	04:32 22:29	03:25 23:42	03:59 23:17	05:27 21:45	06:54 20:01	08:17 18:19	08:50 15:44	10:05 14:50
16	09:48 15:37	08:23 17:12	06:51 18:34	06:05 21:02	04:29 22:32	03:24 23:43	04:01 23:14	05:30 21:42	06:57 19:57	08:20 18:16	08:53 15:41	10:06 14:50
17	09:46 15:40	08:20 17:15	06:47 18:37	06:02 21:05	04:26 22:35	03:24 23:44	04:04 23:12	05:33 21:39	07:00 19:54	08:23 18:12	08:56 15:38	10:07 14:50
18	09:44 15:43	08:17 17:18	06:44 18:40	05:58 21:08	04:23 22:38	03:23 23:45	04:07 23:09	05:36 21:35	07:02 19:50	08:26 18:09	08:59 15:36	10:08 14:50
19	09:42 15:46	08:14 17:21	06:41 18:43	05:55 21:11	04:20 22:41	03:23 23:45	04:09 23:07	05:39 21:32	07:05 19:47	08:29 18:06	09:02 15:33	10:09 14:50
20	09:40 15:48	08:10 17:24	06:37 18:46	05:52 21:14	04:17 22:43	03:23 23:46	04:12 23:04	05:42 21:29	07:08 19:43	08:32 18:03	09:05 15:31	10:10 14:50
21	09:37 15:51	08:07 17:27	06:34 18:48	05:48 21:17	04:14 22:46	03:23 23:46	04:15 23:01	05:45 21:25	07:11 19:40	08:35 17:59	09:08 15:28	10:11 14:50
22	09:35 15:54	08:04 17:30	06:30 18:51	05:45 21:20	04:12 22:49	03:23 23:46	04:17 22:59	05:48 21:22	07:13 19:37	08:37 17:56	09:11 15:26	10:11 14:51
23	09:32 15:57	08:01 17:33	06:27 18:54	05:42 21:23	04:09 22:52	03:23 23:46	04:20 22:56	05:50 21:19	07:16 19:33	08:40 17:53	09:14 15:23	10:12 14:51
24	09:30 16:00	07:58 17:36	06:23 18:57	05:38 21:26	04:06 22:55	03:23 23:46	04:23 22:53	05:53 21:15	07:19 19:30	09:01-09:05/4 17:50	08:43 15:21	10:12 14:52
25	09:27 16:03	07:54 17:39	06:20 19:00	05:35 21:29	04:04 22:58	03:24 23:46	04:26 22:50	05:56 21:12	07:22 19:26	08:57-09:09/12 16:46	07:46 15:19	10:12 14:53
26	09:25 16:07	07:51 17:42	06:17 19:02	05:32 21:32	04:01 23:00	03:25 23:46	04:29 22:47	05:59 21:09	07:24 19:23	08:55-09:12/17 16:43	07:49 15:17	10:12 14:54
27	09:22 16:10	07:48 17:45	06:13 19:05	05:28 21:35	03:58 23:03	03:25 23:45	04:32 22:45	06:02 21:05	07:27 19:20	08:52-09:12/20 16:40	07:52 15:15	10:12 14:55
28	09:19 16:13	07:44 17:48	06:10 19:08	05:25 21:38	03:56 23:06	03:26 23:44	04:35 22:42	06:05 21:02	07:30 19:16	08:51-09:13/22 16:37	07:55 15:13	10:12 14:56
29	09:17 16:16		07:06 20:11	05:22 21:41	03:54 23:08	03:28 23:44	04:38 22:39	06:07 20:59	07:32 19:13	08:50-09:14/24 16:34	07:58 15:11	10:12 14:57
30	09:14 16:19		07:03 20:14	05:19 21:44	03:51 23:11	03:29 23:43	04:40 22:36	06:10 20:55	07:35 19:09	08:50-09:14/24 16:31	08:01 15:09	10:12 14:58
31	09:11 16:22		07:00 20:17		03:49 23:14		04:43 22:33	06:13 20:52		08:04 16:28		10:11 15:00
Potential sun hours	182	242	363	447	559	604	593	502	392	308	206	152
Sum of minutes with flicker	0	0	314	0	0	0	0	0	123	194	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_no forestWTG: T2 - T2

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:46	23:16	23:42	22:30	20:48	19:06	16:24	15:07
2	10:09	09:05	07:38	06:53	05:12	03:44	03:31	04:49	06:18	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:49	23:18	23:40	22:26	20:45	19:02	16:21	15:05
3	10:08	09:02	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:41
	15:05	16:31	17:57	20:25	21:52	23:21	23:39	22:23	20:41	18:59	16:18	15:03
4	10:07	09:00	07:31	06:46	05:06	03:40	03:35	04:55	06:24	07:46	08:16	09:43
	15:07	16:34	17:59	20:28	21:55	23:23	23:38	22:20	20:38	18:56	16:15	15:01
5	10:06	08:57	07:28	06:42	05:02	03:38	03:36	04:58	06:27	07:49	08:19	09:45
	15:09	16:38	18:02	20:31	21:58	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:37	03:38	05:01	06:29	07:52	08:22	09:48
	15:12	16:41	18:05	20:33	22:02	23:27	23:35	22:14	20:31	18:49	16:09	14:58
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:54	08:25	09:50
	15:14	16:44	18:08	20:36	22:05	23:29	23:33	22:11	20:28	18:46	16:06	14:57
8	10:02	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:28	09:52
	15:16	16:47	18:11	20:39	22:08	23:31	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:44	05:10	06:38	08:00	08:31	09:54
	15:18	16:50	18:14	20:42	22:11	23:33	23:29	22:05	20:21	18:39	16:00	14:55
10	09:59	08:42	07:11	06:25	04:47	03:30	03:47	05:13	06:40	08:03	08:34	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:27	22:01	20:18	18:35	15:57	14:54
11	09:58	08:39	07:07	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:23	16:56	18:20	20:48	22:17	23:36	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:41	03:28	03:51	05:18	06:46	08:08	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:32	07:01	06:15	04:37	03:27	03:54	05:21	06:49	08:11	08:44	10:01
	15:29	17:02	18:25	20:54	22:23	23:39	23:21	21:52	20:07	18:25	15:49	14:51
14	09:52	08:29	06:57	06:12	04:34	03:26	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:06	18:28	20:56	22:26	23:41	23:19	21:48	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:08	04:31	03:25	03:59	05:27	06:54	08:17	08:50	10:04
	15:34	17:09	18:31	20:59	22:29	23:42	23:16	21:45	20:00	18:19	15:44	14:50
16	09:48	08:23	06:51	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:32	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:23	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:34	23:44	23:12	21:39	19:54	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	03:23	04:06	05:36	07:02	08:26	08:59	10:08
	15:42	17:18	18:40	21:08	22:37	23:44	23:09	21:35	19:50	18:09	15:36	14:50
19	09:42	08:13	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:45	17:21	18:43	21:11	22:40	23:45	23:06	21:32	19:47	18:06	15:33	14:50
20	09:39	08:10	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:31	09:05	10:10
	15:48	17:24	18:45	21:14	22:43	23:46	23:04	21:29	19:43	18:02	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:23	04:15	05:44	07:10	08:34	09:08	10:11
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:11	03:23	04:17	05:47	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:58	21:22	19:36	17:56	15:26	14:50
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:57	06:23	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:16	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:49	15:21	14:52
25	09:27	07:54	06:20	05:35	04:03	03:24	04:26	05:56	07:21	07:46	09:19	10:12
	16:03	17:39	18:59	21:29	22:57	23:46	22:50	21:12	19:26	16:46	15:19	14:52
26	09:24	07:51	06:16	05:32	04:01	03:25	04:29	05:59	07:24	07:49	09:22	10:12
	16:06	17:42	19:02	21:32	23:00	23:45	22:47	21:09	19:23	16:43	15:17	14:53
27	09:22	07:47	06:13	05:28	03:58	03:25	04:32	06:02	07:27	07:52	09:25	10:12
	16:09	17:45	19:05	21:35	23:03	23:45	22:44	21:05	19:19	16:40	15:14	14:54
28	09:19	07:44	06:10	05:25	03:56	03:26	04:34	06:04	07:30	07:55	09:28	10:12
	16:13	17:48	19:08	21:37	23:06	23:44	22:41	21:02	19:16	16:37	15:12	14:56
29	09:16		07:06	05:22	03:53	03:27	04:37	06:07	07:32	07:58	09:30	10:12
	16:16		20:11	21:40	23:08	23:43	22:39	20:58	19:13	16:34	15:10	14:57
30	09:14		07:03	05:18	03:51	03:29	04:40	06:10	07:35	08:01	09:33	10:11
	16:19		20:14	21:43	23:11	23:43	22:36	20:55	19:09	16:30	15:08	14:58
31	09:11		06:59		03:49		04:43	06:13		08:04		10:11
	16:22		20:16		23:13		22:33	20:52		16:27		15:00
Potential sun hours	182	242	363	447	559	604	593	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_no forestWTG: T3 - T3

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:46	23:16	23:41	22:29	20:48	19:06	16:24	15:07
2	10:09	09:05	07:38	06:53	05:12	03:45	03:32	04:49	06:18	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:49	23:18	23:40	22:26	20:45	19:02	16:21	15:05
3	10:08	09:02	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:41
	15:06	16:31	17:57	20:25	21:52	23:21	23:39	22:23	20:41	18:59	16:18	15:03
4	10:07	09:00	07:31	06:46	05:06	03:40	03:35	04:55	06:24	07:46	08:16	09:43
	15:08	16:34	18:00	20:28	21:55	23:23	23:38	22:20	20:38	18:56	16:15	15:02
5	10:06	08:57	07:28	06:42	05:02	03:39	03:37	04:58	06:27	07:49	08:19	09:45
	15:10	16:38	18:02	20:31	21:58	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:37	03:38	05:01	06:29	07:52	08:22	09:48
	15:12	16:41	18:05	20:33	22:01	23:27	23:35	22:14	20:31	18:49	16:09	14:59
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:54	08:25	09:50
	15:14	16:44	18:08	20:36	22:04	23:29	23:33	22:11	20:28	18:46	16:06	14:57
8	10:02	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:28	09:52
	15:16	16:47	18:11	20:39	22:08	23:31	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:45	05:10	06:38	08:00	08:31	09:54
	15:19	16:50	18:14	20:42	22:11	23:33	23:29	22:05	20:21	18:39	16:00	14:55
10	09:59	08:42	07:11	06:25	04:47	03:30	03:47	05:13	06:40	08:03	08:34	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:27	22:01	20:18	18:35	15:58	14:54
11	09:58	08:39	07:07	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:24	16:56	18:20	20:48	22:17	23:36	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:41	03:28	03:51	05:19	06:46	08:08	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:32	07:01	06:15	04:38	03:27	03:54	05:21	06:49	08:11	08:44	10:01
	15:29	17:03	18:26	20:54	22:23	23:39	23:21	21:52	20:07	18:25	15:49	14:51
14	09:52	08:29	06:57	06:12	04:35	03:26	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:06	18:28	20:56	22:26	23:40	23:19	21:48	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:08	04:32	03:25	03:59	05:27	06:54	08:17	08:50	10:04
	15:34	17:09	18:31	20:59	22:29	23:42	23:16	21:45	20:00	18:19	15:44	14:50
16	09:48	08:23	06:51	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:31	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:24	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:34	23:44	23:11	21:39	19:54	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	03:23	04:06	05:36	07:02	08:26	08:59	10:08
	15:43	17:18	18:40	21:08	22:37	23:44	23:09	21:35	19:50	18:09	15:36	14:50
19	09:42	08:13	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:45	17:21	18:43	21:11	22:40	23:45	23:06	21:32	19:47	18:06	15:33	14:50
20	09:39	08:10	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:31	09:05	10:10
	15:48	17:24	18:45	21:14	22:43	23:45	23:04	21:29	19:43	18:02	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:23	04:15	05:45	07:10	08:34	09:08	10:10
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:12	03:23	04:17	05:47	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:58	21:22	19:36	17:56	15:26	14:51
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:13	10:12
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:57	06:23	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:16	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:50	15:21	14:52
25	09:27	07:54	06:20	05:35	04:04	03:24	04:26	05:56	07:21	07:46	09:19	10:12
	16:03	17:39	18:59	21:29	22:57	23:46	22:50	21:12	19:26	16:46	15:19	14:53
26	09:24	07:51	06:17	05:32	04:01	03:25	04:29	05:59	07:24	07:49	09:22	10:12
	16:06	17:42	19:02	21:32	23:00	23:45	22:47	21:09	19:23	16:43	15:17	14:53
27	09:22	07:48	06:13	05:28	03:58	03:26	04:32	06:02	07:27	07:52	09:25	10:12
	16:10	17:45	19:05	21:34	23:03	23:45	22:44	21:05	19:19	16:40	15:15	14:55
28	09:19	07:44	06:10	05:25	03:56	03:26	04:35	06:04	07:30	07:55	09:28	10:12
	16:13	17:48	19:08	21:37	23:06	23:44	22:41	21:02	19:16	16:37	15:12	14:56
29	09:16		07:06	05:22	03:54	03:28	04:37	06:07	07:32	07:58	09:30	10:12
	16:16		20:11	21:40	23:08	23:43	22:38	20:58	19:13	16:34	15:10	14:57
30	09:14		07:03	05:19	03:51	03:29	04:40	06:10	07:35	08:01	09:33	10:11
	16:19		20:14	21:43	23:11	23:42	22:36	20:55	19:09	16:31	15:09	14:58
31	09:11		06:59		03:49		04:43	06:13		08:04		10:11
	16:22		20:16		23:13		22:33	20:52		16:27		15:00
Potential sun hours	183	243	363	447	559	604	593	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_no forestWTG: T4 - T4

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:35
	15:02	16:25	17:51	20:19	21:46	23:16	23:41	22:29	20:48	19:06	16:24	15:07
2	10:09	09:05	07:38	06:53	05:12	03:45	03:32	04:49	06:18	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:49	23:18	23:40	22:26	20:45	19:02	16:21	15:05
3	10:08	09:02	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:40
	15:06	16:31	17:57	20:25	21:52	23:20	23:39	22:23	20:41	18:59	16:18	15:03
4	10:07	08:59	07:31	06:46	05:06	03:40	03:35	04:55	06:24	07:46	08:16	09:43
	15:08	16:34	17:59	20:28	21:55	23:23	23:37	22:20	20:38	18:56	16:15	15:02
5	10:06	08:57	07:28	06:42	05:02	03:39	03:37	04:58	06:27	07:49	08:19	09:45
	15:10	16:38	18:02	20:31	21:58	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:37	03:38	05:01	06:29	07:52	08:22	09:48
	15:12	16:41	18:05	20:33	22:01	23:27	23:34	22:14	20:31	18:49	16:09	14:59
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:54	08:25	09:50
	15:14	16:44	18:08	20:36	22:04	23:29	23:33	22:11	20:28	18:46	16:06	14:57
8	10:02	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:28	09:52
	15:16	16:47	18:11	20:39	22:07	23:31	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:45	05:10	06:38	08:00	08:31	09:54
	15:19	16:50	18:14	20:42	22:10	23:33	23:29	22:04	20:21	18:39	16:00	14:55
10	09:59	08:42	07:11	06:25	04:47	03:30	03:47	05:13	06:40	08:03	08:34	09:56
	15:21	16:53	18:17	20:45	22:13	23:35	23:27	22:01	20:17	18:35	15:58	14:54
11	09:57	08:39	07:07	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:37	09:58
	15:24	16:56	18:20	20:48	22:16	23:36	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:35	07:04	06:19	04:41	03:28	03:51	05:19	06:46	08:08	08:40	09:59
	15:26	16:59	18:23	20:51	22:19	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:32	07:01	06:15	04:38	03:27	03:54	05:21	06:49	08:11	08:44	10:01
	15:29	17:02	18:25	20:53	22:22	23:39	23:21	21:52	20:07	18:25	15:49	14:51
14	09:52	08:29	06:57	06:12	04:35	03:26	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:06	18:28	20:56	22:25	23:40	23:18	21:48	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:08	04:32	03:25	03:59	05:27	06:54	08:17	08:50	10:04
	15:34	17:09	18:31	20:59	22:28	23:41	23:16	21:45	20:00	18:19	15:44	14:50
16	09:48	08:23	06:51	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:53	10:05
	15:37	17:12	18:34	21:02	22:31	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:24	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:34	23:43	23:11	21:38	19:54	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	03:23	04:07	05:36	07:02	08:26	08:59	10:08
	15:43	17:18	18:40	21:08	22:37	23:44	23:09	21:35	19:50	18:09	15:36	14:50
19	09:41	08:13	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:28	09:02	10:09
	15:45	17:21	18:43	21:11	22:40	23:45	23:06	21:32	19:47	18:06	15:33	14:50
20	09:39	08:10	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:31	09:05	10:10
	15:48	17:24	18:45	21:14	22:43	23:45	23:04	21:29	19:43	18:02	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:23	04:15	05:45	07:10	08:34	09:08	10:10
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:34	08:04	06:30	05:45	04:12	03:23	04:17	05:47	07:13	08:37	09:10	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:58	21:22	19:36	17:56	15:26	14:51
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:13	10:11
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:23	14:51
24	09:29	07:57	06:23	05:38	04:06	03:24	04:23	05:53	07:19	08:43	09:16	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:50	15:21	14:52
25	09:27	07:54	06:20	05:35	04:04	03:24	04:26	05:56	07:21	07:46	09:19	10:12
	16:03	17:39	18:59	21:28	22:57	23:46	22:50	21:12	19:26	16:46	15:19	14:53
26	09:24	07:51	06:16	05:32	04:01	03:25	04:29	05:59	07:24	07:49	09:22	10:12
	16:06	17:42	19:02	21:31	23:00	23:45	22:47	21:08	19:23	16:43	15:17	14:53
27	09:22	07:47	06:13	05:28	03:58	03:26	04:32	06:02	07:27	07:52	09:25	10:12
	16:10	17:45	19:05	21:34	23:03	23:45	22:44	21:05	19:19	16:40	15:15	14:55
28	09:19	07:44	06:10	05:25	03:56	03:26	04:35	06:04	07:30	07:55	09:27	10:12
	16:13	17:48	19:08	21:37	23:05	23:44	22:41	21:02	19:16	16:37	15:12	14:56
29	09:16		07:06	05:22	03:54	03:28	04:37	06:07	07:32	07:58	09:30	10:12
	16:16		20:11	21:40	23:08	23:43	22:38	20:58	19:13	16:34	15:10	14:57
30	09:14		07:03	05:19	03:51	03:29	04:40	06:10	07:35	08:01	09:33	10:11
	16:19		20:14	21:43	23:11	23:42	22:35	20:55	19:09	16:31	15:09	14:58
31	09:11		06:59		03:49		04:43	06:13		08:04		10:11
	16:22		20:16		23:13		22:32	20:52		16:27		15:00
Potential sun hours	183	243	363	447	559	604	593	502	392	308	207	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_no forestWTG: T5 - T5

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16	23:42	22:30	20:48	19:06	16:24	15:07
2	10:09	09:05	07:38	06:53	05:12	03:44	03:31	04:49	06:18	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:50	23:18	23:40	22:27	20:45	19:02	16:21	15:05
3	10:09	09:02	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:41
	15:05	16:31	17:57	20:25	21:53	23:21	23:39	22:23	20:41	18:59	16:18	15:03
4	10:07	09:00	07:31	06:46	05:06	03:40	03:35	04:55	06:24	07:46	08:16	09:43
	15:07	16:34	18:00	20:28	21:56	23:23	23:38	22:20	20:38	18:56	16:15	15:01
5	10:06	08:57	07:28	06:42	05:02	03:38	03:36	04:58	06:27	07:49	08:19	09:45
	15:09	16:38	18:02	20:31	21:59	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:37	03:38	05:01	06:29	07:52	08:22	09:48
	15:12	16:41	18:05	20:33	22:02	23:27	23:35	22:14	20:31	18:49	16:09	14:58
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:54	08:25	09:50
	15:14	16:44	18:08	20:36	22:05	23:29	23:33	22:11	20:28	18:46	16:06	14:57
8	10:02	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:28	09:52
	15:16	16:47	18:11	20:39	22:08	23:31	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:44	05:10	06:38	08:00	08:31	09:54
	15:18	16:50	18:14	20:42	22:11	23:33	23:29	22:05	20:21	18:39	16:00	14:55
10	09:59	08:42	07:11	06:25	04:47	03:30	03:47	05:13	06:40	08:03	08:35	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:27	22:01	20:18	18:35	15:57	14:54
11	09:58	08:39	07:07	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:23	16:56	18:20	20:48	22:17	23:36	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:41	03:28	03:51	05:18	06:46	08:09	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:32	07:01	06:15	04:37	03:27	03:54	05:21	06:49	08:11	08:44	10:01
	15:29	17:02	18:26	20:54	22:23	23:39	23:21	21:52	20:07	18:25	15:49	14:51
14	09:52	08:29	06:57	06:12	04:34	03:26	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:06	18:28	20:56	22:26	23:41	23:19	21:48	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:08	04:31	03:25	03:59	05:27	06:54	08:17	08:50	10:04
	15:34	17:09	18:31	20:59	22:29	23:42	23:16	21:45	20:00	18:19	15:44	14:50
16	09:48	08:23	06:51	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:32	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:23	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:35	23:44	23:12	21:39	19:54	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	03:23	04:06	05:36	07:02	08:26	08:59	10:08
	15:42	17:18	18:40	21:08	22:38	23:45	23:09	21:35	19:50	18:09	15:36	14:50
19	09:42	08:14	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:45	17:21	18:43	21:11	22:40	23:45	23:07	21:32	19:47	18:06	15:33	14:50
20	09:39	08:10	06:37	05:52	04:17	03:22	04:12	05:42	07:08	08:31	09:05	10:10
	15:48	17:24	18:45	21:14	22:43	23:46	23:04	21:29	19:43	18:02	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:22	04:15	05:45	07:10	08:34	09:08	10:11
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:11	03:23	04:17	05:47	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:59	21:22	19:36	17:56	15:26	14:50
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:57	06:23	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:16	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:49	15:21	14:52
25	09:27	07:54	06:20	05:35	04:03	03:24	04:26	05:56	07:21	07:46	09:19	10:12
	16:03	17:39	18:59	21:29	22:58	23:46	22:50	21:12	19:26	16:46	15:19	14:52
26	09:25	07:51	06:16	05:32	04:01	03:24	04:29	05:59	07:24	07:49	09:22	10:12
	16:06	17:42	19:02	21:32	23:00	23:45	22:47	21:09	19:23	16:43	15:17	14:53
27	09:22	07:48	06:13	05:28	03:58	03:25	04:32	06:02	07:27	07:52	09:25	10:12
	16:09	17:45	19:05	21:35	23:03	23:45	22:44	21:05	19:19	16:40	15:14	14:54
28	09:19	07:44	06:10	05:25	03:56	03:26	04:34	06:04	07:30	07:55	09:28	10:12
	16:13	17:48	19:08	21:38	23:06	23:44	22:42	21:02	19:16	16:37	15:12	14:56
29	09:17		07:06	05:22	03:53	03:27	04:37	06:07	07:32	07:58	09:30	10:12
	16:16		20:11	21:41	23:08	23:44	22:39	20:58	19:13	16:34	15:10	14:57
30	09:14		07:03	05:18	03:51	03:29	04:40	06:10	07:35	08:01	09:33	10:11
	16:19		20:14	21:44	23:11	23:43	22:36	20:55	19:09	16:31	15:08	14:58
31	09:11		06:59		03:49		04:43	06:13		08:04		10:11
	16:22		20:16		23:13		22:33	20:52		16:27		15:00
Potential sun hours	182	242	363	447	559	604	593	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_no forestWTG: T6 - T6

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:46	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16	23:42	22:30	20:48	19:06	16:24	15:07
2	10:09	09:05	07:38	06:53	05:12	03:44	03:31	04:49	06:18	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:50	23:18	23:41	22:27	20:45	19:02	16:21	15:05
3	10:09	09:03	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:41
	15:05	16:31	17:57	20:25	21:53	23:21	23:39	22:24	20:41	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:06	03:40	03:34	04:55	06:24	07:46	08:16	09:43
	15:07	16:34	18:00	20:28	21:56	23:23	23:38	22:20	20:38	18:56	16:15	15:01
5	10:06	08:57	07:28	06:42	05:02	03:38	03:36	04:58	06:27	07:49	08:19	09:46
	15:09	16:38	18:02	20:31	21:59	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:36	03:38	05:01	06:29	07:52	08:22	09:48
	15:12	16:41	18:05	20:34	22:02	23:27	23:35	22:14	20:31	18:49	16:09	14:58
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:54	08:25	09:50
	15:14	16:44	18:08	20:36	22:05	23:29	23:33	22:11	20:28	18:46	16:06	14:57
8	10:03	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:28	09:52
	15:16	16:47	18:11	20:39	22:08	23:31	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:44	05:10	06:38	08:00	08:32	09:54
	15:18	16:50	18:14	20:42	22:11	23:33	23:29	22:05	20:21	18:39	16:00	14:55
10	09:59	08:42	07:11	06:25	04:47	03:30	03:46	05:13	06:40	08:03	08:35	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:27	22:01	20:18	18:35	15:57	14:54
11	09:58	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:23	16:56	18:20	20:48	22:17	23:37	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:40	03:28	03:51	05:18	06:46	08:09	08:41	10:00
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	15:29	17:02	18:26	20:54	22:23	23:39	23:21	21:52	20:07	18:25	15:49	14:51
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19	09:42	08:14	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
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20	09:39	08:10	06:37	05:52	04:17	03:22	04:12	05:42	07:08	08:31	09:05	10:10
	15:48	17:24	18:45	21:14	22:43	23:46	23:04	21:29	19:43	18:02	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:22	04:14	05:44	07:10	08:34	09:08	10:11
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22	09:35	08:04	06:30	05:45	04:11	03:23	04:17	05:47	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:59	21:22	19:36	17:56	15:26	14:50
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:57	06:23	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:17	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:49	15:21	14:52
25	09:27	07:54	06:20	05:35	04:03	03:24	04:26	05:56	07:21	07:46	09:19	10:12
	16:03	17:39	19:00	21:29	22:58	23:46	22:50	21:12	19:26	16:46	15:19	14:52
26	09:25	07:51	06:16	05:32	04:01	03:24	04:29	05:59	07:24	07:49	09:22	10:12
	16:06	17:42	19:02	21:32	23:00	23:46	22:47	21:09	19:23	16:43	15:17	14:53
27	09:22	07:48	06:13	05:28	03:58	03:25	04:31	06:02	07:27	07:52	09:25	10:12
	16:09	17:45	19:05	21:35	23:03	23:45	22:45	21:05	19:19	16:40	15:14	14:54
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29	09:17		07:06	05:22	03:53	03:27	04:37	06:07	07:32	07:58	09:30	10:12
	16:16		20:11	21:41	23:08	23:44	22:39	20:58	19:13	16:34	15:10	14:57
30	09:14		07:03	05:18	03:51	03:28	04:40	06:10	07:35	08:01	09:33	10:12
	16:19		20:14	21:44	23:11	23:43	22:36	20:55	19:09	16:30	15:08	14:58
31	09:11		06:59		03:49		04:43	06:13		08:04		10:11
	16:22		20:16		23:14		22:33	20:52		16:27		15:00
Potential sun hours	182	242	363	447	559	604	594	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_no forestWTG: T7 - T7

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:46	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16	23:42	22:30	20:48	19:06	16:24	15:07
2	10:10	09:05	07:38	06:53	05:12	03:44	03:31	04:49	06:18	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:50	23:18	23:41	22:27	20:45	19:02	16:21	15:05
3	10:09	09:03	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:41
	15:05	16:31	17:57	20:25	21:53	23:21	23:39	22:24	20:42	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:06	03:40	03:34	04:55	06:24	07:46	08:16	09:43
	15:07	16:34	18:00	20:28	21:56	23:23	23:38	22:20	20:38	18:56	16:15	15:01
5	10:07	08:57	07:28	06:42	05:02	03:38	03:36	04:58	06:27	07:49	08:19	09:46
	15:09	16:38	18:02	20:31	21:59	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:36	03:38	05:01	06:29	07:52	08:22	09:48
	15:12	16:41	18:05	20:34	22:02	23:27	23:35	22:14	20:31	18:49	16:09	14:58
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:55	08:25	09:50
	15:14	16:44	18:08	20:36	22:05	23:29	23:33	22:11	20:28	18:46	16:06	14:57
8	10:03	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:29	09:52
	15:16	16:47	18:11	20:39	22:08	23:31	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:44	05:10	06:38	08:00	08:32	09:54
	15:18	16:50	18:14	20:42	22:11	23:33	23:30	22:05	20:21	18:39	16:00	14:55
10	10:00	08:42	07:11	06:25	04:47	03:30	03:46	05:13	06:40	08:03	08:35	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:28	22:01	20:18	18:36	15:58	14:54
11	09:58	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:23	16:56	18:20	20:48	22:17	23:37	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:41	03:28	03:51	05:18	06:46	08:09	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:33	07:01	06:15	04:37	03:26	03:54	05:21	06:49	08:11	08:44	10:02
	15:29	17:02	18:26	20:54	22:23	23:40	23:21	21:52	20:07	18:25	15:49	14:51
14	09:52	08:29	06:57	06:12	04:34	03:25	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:06	18:28	20:57	22:26	23:41	23:19	21:49	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:08	04:31	03:25	03:58	05:27	06:54	08:17	08:50	10:05
	15:34	17:09	18:31	20:59	22:29	23:42	23:17	21:45	20:00	18:19	15:44	14:50
16	09:48	08:23	06:51	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:32	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:23	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:35	23:44	23:12	21:39	19:54	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	03:23	04:06	05:36	07:02	08:26	08:59	10:08
	15:42	17:18	18:40	21:08	22:38	23:45	23:09	21:35	19:50	18:09	15:36	14:49
19	09:42	08:14	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:45	17:21	18:43	21:11	22:41	23:45	23:07	21:32	19:47	18:06	15:33	14:49
20	09:39	08:10	06:37	05:52	04:17	03:22	04:12	05:42	07:08	08:32	09:05	10:10
	15:48	17:24	18:45	21:14	22:43	23:46	23:04	21:29	19:43	18:02	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:22	04:14	05:45	07:10	08:34	09:08	10:11
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:11	03:23	04:17	05:47	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:59	21:22	19:37	17:56	15:26	14:50
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:57	06:23	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:17	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:50	15:21	14:52
25	09:27	07:54	06:20	05:35	04:03	03:24	04:26	05:56	07:21	07:46	09:19	10:12
	16:03	17:39	19:00	21:29	22:58	23:46	22:50	21:12	19:26	16:46	15:19	14:52
26	09:25	07:51	06:17	05:32	04:01	03:24	04:29	05:59	07:24	07:49	09:22	10:12
	16:06	17:42	19:02	21:32	23:00	23:46	22:47	21:09	19:23	16:43	15:17	14:53
27	09:22	07:48	06:13	05:28	03:58	03:25	04:32	06:02	07:27	07:52	09:25	10:12
	16:09	17:45	19:05	21:35	23:03	23:45	22:45	21:05	19:19	16:40	15:14	14:54
28	09:19	07:44	06:10	05:25	03:56	03:26	04:34	06:04	07:30	07:55	09:28	10:12
	16:13	17:48	19:08	21:38	23:06	23:45	22:42	21:02	19:16	16:37	15:12	14:55
29	09:17		07:06	05:22	03:53	03:27	04:37	06:07	07:32	07:58	09:31	10:12
	16:16		20:11	21:41	23:08	23:44	22:39	20:59	19:13	16:34	15:10	14:57
30	09:14		07:03	05:19	03:51	03:28	04:40	06:10	07:35	08:01	09:33	10:12
	16:19		20:14	21:44	23:11	23:43	22:36	20:55	19:09	16:31	15:08	14:58
31	09:11		06:59		03:49		04:43	06:13		08:04		10:11
	16:22		20:17		23:14		22:33	20:52		16:27		15:00
Potential sun hours	182	242	363	447	559	604	594	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_no forestWTG: T8 - T8

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:46	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16	23:42	22:30	20:48	19:06	16:24	15:06
2	10:10	09:06	07:38	06:53	05:12	03:44	03:31	04:49	06:18	07:41	08:10	09:38
	15:03	16:28	17:54	20:22	21:50	23:19	23:41	22:27	20:45	19:02	16:21	15:05
3	10:09	09:03	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:41
	15:05	16:31	17:57	20:25	21:53	23:21	23:39	22:24	20:42	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:06	03:40	03:34	04:55	06:24	07:46	08:16	09:43
	15:07	16:34	18:00	20:28	21:56	23:23	23:38	22:21	20:38	18:56	16:15	15:01
5	10:07	08:57	07:28	06:42	05:02	03:38	03:36	04:58	06:27	07:49	08:19	09:46
	15:09	16:38	18:02	20:31	21:59	23:25	23:37	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:36	03:38	05:01	06:29	07:52	08:22	09:48
	15:11	16:41	18:05	20:34	22:02	23:28	23:35	22:14	20:31	18:49	16:09	14:58
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:55	08:26	09:50
	15:14	16:44	18:08	20:36	22:05	23:30	23:33	22:11	20:28	18:46	16:06	14:57
8	10:03	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:29	09:52
	15:16	16:47	18:11	20:39	22:08	23:32	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:31	03:44	05:10	06:38	08:00	08:32	09:54
	15:18	16:50	18:14	20:42	22:11	23:33	23:30	22:05	20:21	18:39	16:00	14:55
10	10:00	08:42	07:11	06:25	04:47	03:30	03:46	05:13	06:40	08:03	08:35	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:28	22:02	20:18	18:36	15:57	14:54
11	09:58	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:23	16:56	18:20	20:48	22:17	23:37	23:26	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:40	03:27	03:51	05:18	06:46	08:09	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:33	07:01	06:15	04:37	03:26	03:53	05:21	06:49	08:11	08:44	10:02
	15:29	17:02	18:26	20:54	22:23	23:40	23:21	21:52	20:07	18:25	15:49	14:51
14	09:52	08:29	06:57	06:12	04:34	03:25	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:06	18:28	20:57	22:26	23:41	23:19	21:49	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:08	04:31	03:25	03:58	05:27	06:54	08:17	08:50	10:05
	15:34	17:09	18:31	20:59	22:29	23:42	23:17	21:45	20:01	18:19	15:44	14:50
16	09:48	08:23	06:51	06:05	04:28	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:32	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:23	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:35	23:44	23:12	21:39	19:54	18:12	15:38	14:49
18	09:44	08:17	06:44	05:58	04:23	03:23	04:06	05:36	07:02	08:26	08:59	10:08
	15:42	17:18	18:40	21:08	22:38	23:45	23:09	21:35	19:50	18:09	15:36	14:49
19	09:42	08:14	06:40	05:55	04:20	03:22	04:09	05:39	07:05	08:29	09:02	10:09
	15:45	17:21	18:43	21:11	22:41	23:45	23:07	21:32	19:47	18:06	15:33	14:49
20	09:40	08:10	06:37	05:52	04:17	03:22	04:12	05:42	07:08	08:32	09:05	10:10
	15:48	17:24	18:45	21:14	22:44	23:46	23:04	21:29	19:43	18:02	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:22	04:14	05:45	07:10	08:34	09:08	10:11
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:11	03:22	04:17	05:47	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:59	21:22	19:37	17:56	15:26	14:50
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:57	06:23	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:17	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:50	15:21	14:51
25	09:27	07:54	06:20	05:35	04:03	03:24	04:26	05:56	07:21	07:46	09:20	10:12
	16:03	17:39	19:00	21:29	22:58	23:46	22:50	21:12	19:26	16:46	15:19	14:52
26	09:25	07:51	06:17	05:32	04:01	03:24	04:29	05:59	07:24	07:49	09:22	10:13
	16:06	17:42	19:02	21:32	23:01	23:46	22:48	21:09	19:23	16:43	15:16	14:53
27	09:22	07:48	06:13	05:28	03:58	03:25	04:31	06:02	07:27	07:52	09:25	10:13
	16:09	17:45	19:05	21:35	23:03	23:45	22:45	21:05	19:19	16:40	15:14	14:54
28	09:19	07:44	06:10	05:25	03:56	03:26	04:34	06:04	07:30	07:55	09:28	10:12
	16:13	17:48	19:08	21:38	23:06	23:45	22:42	21:02	19:16	16:37	15:12	14:55
29	09:17		07:06	05:22	03:53	03:27	04:37	06:07	07:32	07:58	09:31	10:12
	16:16		20:11	21:41	23:09	23:44	22:39	20:59	19:13	16:34	15:10	14:57
30	09:14		07:03	05:18	03:51	03:28	04:40	06:10	07:35	08:01	09:33	10:12
	16:19		20:14	21:44	23:11	23:43	22:36	20:55	19:09	16:31	15:08	14:58
31	09:11		06:59		03:49		04:43	06:13		08:04		10:11
	16:22		20:17		23:14		22:33	20:52		16:27		15:00
Potential sun hours	182	242	363	447	559	604	594	502	392	308	206	151
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_no forestWTG: T9 - T9

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

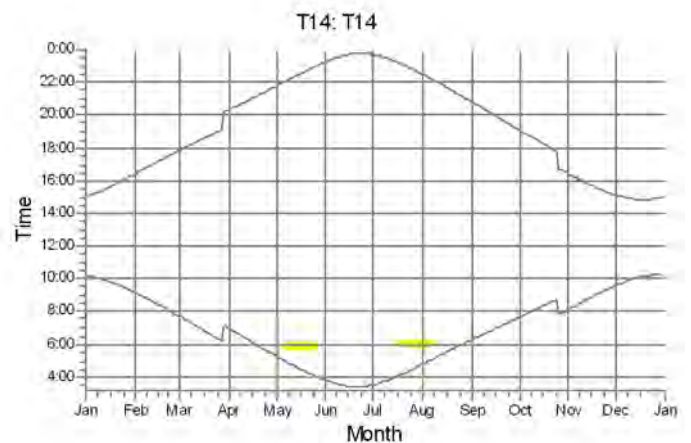
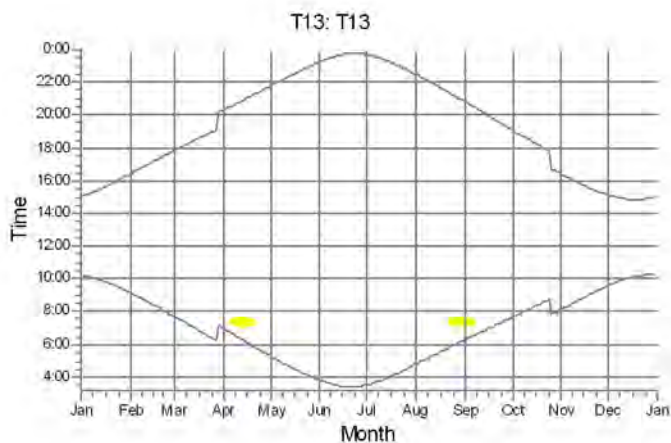
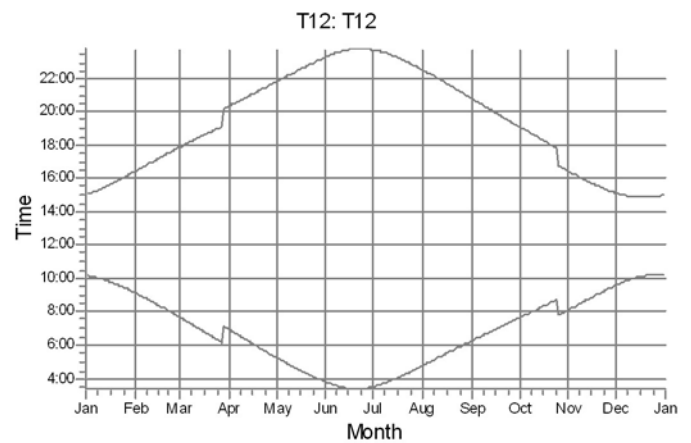
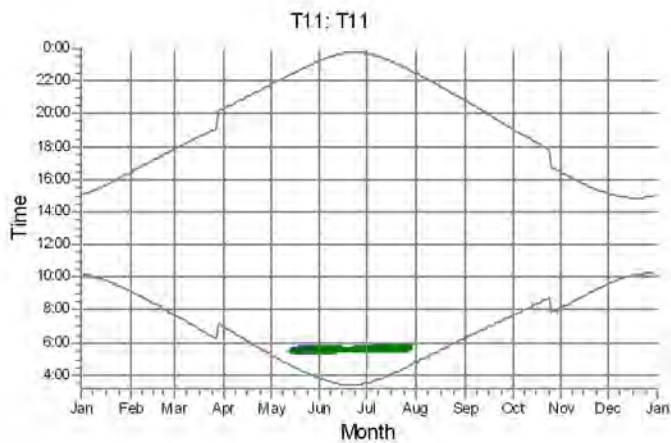
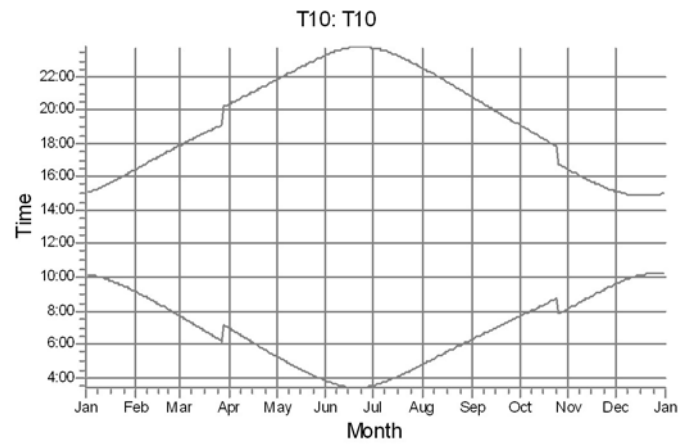
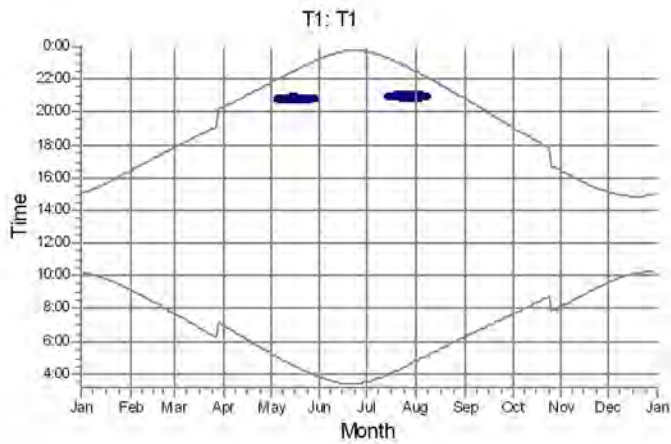
	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16	23:42	22:30	20:48	19:06	16:24	15:07
2	10:09	09:05	07:38	06:53	05:12	03:44	03:31	04:49	06:18	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:50	23:18	23:41	22:27	20:45	19:02	16:21	15:05
3	10:09	09:03	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:41
	15:06	16:31	17:57	20:25	21:53	23:21	23:39	22:24	20:42	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:06	03:40	03:35	04:55	06:24	07:46	08:16	09:43
	15:07	16:34	18:00	20:28	21:56	23:23	23:38	22:20	20:38	18:56	16:15	15:02
5	10:06	08:57	07:28	06:42	05:02	03:38	03:36	04:58	06:27	07:49	08:19	09:46
	15:10	16:38	18:02	20:31	21:59	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:37	03:38	05:01	06:30	07:52	08:22	09:48
	15:12	16:41	18:05	20:34	22:02	23:27	23:35	22:14	20:31	18:49	16:09	14:59
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:55	08:25	09:50
	15:14	16:44	18:08	20:36	22:05	23:29	23:33	22:11	20:28	18:46	16:06	14:57
8	10:03	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:28	09:52
	15:16	16:47	18:11	20:39	22:08	23:31	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:44	05:10	06:38	08:00	08:32	09:54
	15:19	16:50	18:14	20:42	22:11	23:33	23:29	22:05	20:21	18:39	16:00	14:55
10	09:59	08:42	07:11	06:25	04:47	03:30	03:47	05:13	06:41	08:03	08:35	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:27	22:01	20:18	18:36	15:58	14:54
11	09:58	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:23	16:56	18:20	20:48	22:17	23:37	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:41	03:28	03:51	05:19	06:46	08:09	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:33	07:01	06:15	04:38	03:27	03:54	05:21	06:49	08:11	08:44	10:01
	15:29	17:03	18:26	20:54	22:23	23:39	23:21	21:52	20:07	18:26	15:49	14:51
14	09:52	08:29	06:57	06:12	04:35	03:26	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:06	18:28	20:56	22:26	23:41	23:19	21:48	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:08	04:32	03:25	03:59	05:27	06:54	08:17	08:50	10:04
	15:34	17:09	18:31	20:59	22:29	23:42	23:16	21:45	20:00	18:19	15:44	14:50
16	09:48	08:23	06:51	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:32	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:23	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:35	23:44	23:12	21:39	19:54	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	03:23	04:06	05:36	07:02	08:26	08:59	10:08
	15:43	17:18	18:40	21:08	22:38	23:45	23:09	21:35	19:50	18:09	15:36	14:50
19	09:42	08:14	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:45	17:21	18:43	21:11	22:40	23:45	23:07	21:32	19:47	18:06	15:33	14:50
20	09:39	08:10	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:32	09:05	10:10
	15:48	17:24	18:45	21:14	22:43	23:46	23:04	21:29	19:43	18:02	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:23	04:15	05:45	07:10	08:34	09:08	10:11
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:12	03:23	04:17	05:47	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:59	21:22	19:37	17:56	15:26	14:50
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:57	06:23	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:17	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:50	15:21	14:52
25	09:27	07:54	06:20	05:35	04:03	03:24	04:26	05:56	07:21	07:46	09:19	10:12
	16:03	17:39	19:00	21:29	22:58	23:46	22:50	21:12	19:26	16:46	15:19	14:52
26	09:25	07:51	06:17	05:32	04:01	03:25	04:29	05:59	07:24	07:49	09:22	10:12
	16:06	17:42	19:02	21:32	23:00	23:46	22:47	21:09	19:23	16:43	15:17	14:53
27	09:22	07:48	06:13	05:28	03:58	03:25	04:32	06:02	07:27	07:52	09:25	10:12
	16:10	17:45	19:05	21:35	23:03	23:45	22:45	21:05	19:19	16:40	15:14	14:54
28	09:19	07:44	06:10	05:25	03:56	03:26	04:34	06:04	07:30	07:55	09:28	10:12
	16:13	17:48	19:08	21:38	23:06	23:44	22:42	21:02	19:16	16:37	15:12	14:56
29	09:17		07:06	05:22	03:53	03:27	04:37	06:07	07:32	07:58	09:30	10:12
	16:16		20:11	21:41	23:08	23:44	22:39	20:58	19:13	16:34	15:10	14:57
30	09:14		07:03	05:19	03:51	03:29	04:40	06:10	07:35	08:01	09:33	10:12
	16:19		20:14	21:44	23:11	23:43	22:36	20:55	19:09	16:31	15:08	14:58
31	09:11		06:59		03:49		04:43	06:13		08:04		10:11
	16:22		20:17		23:14		22:33	20:52		16:27		15:00
Potential sun hours	182	242	363	447	559	604	593	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG, graphical

Calculation: V136 x 15 x HH172 real case_no forest



Shadow receptors



A: Asuinrakennus (Langkujavägen 200)

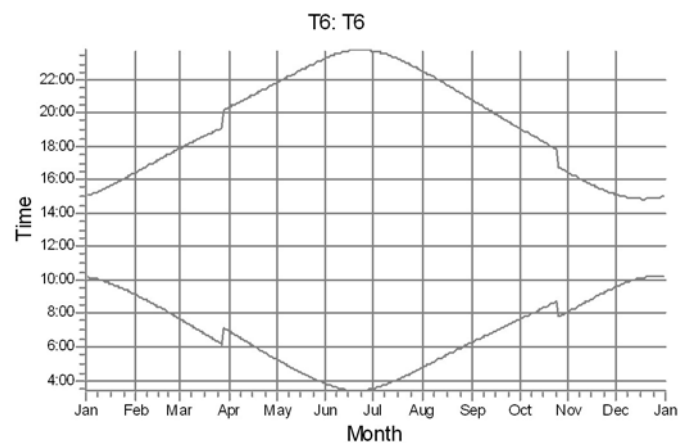
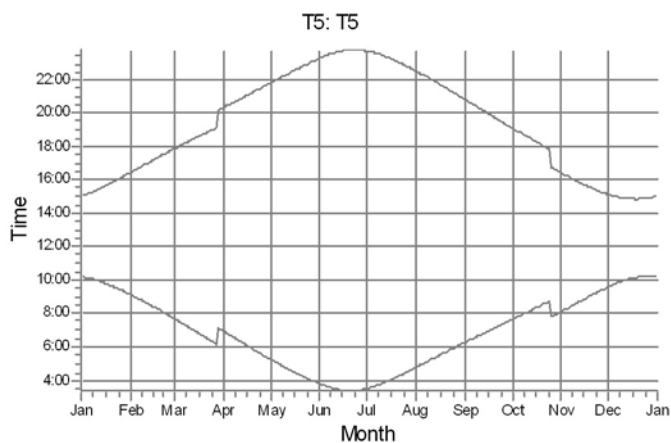
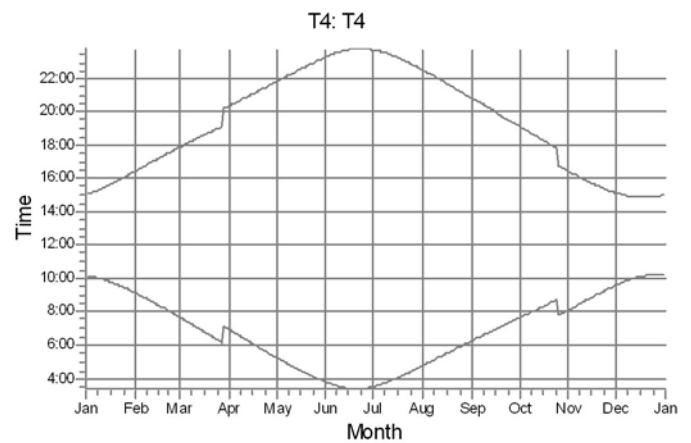
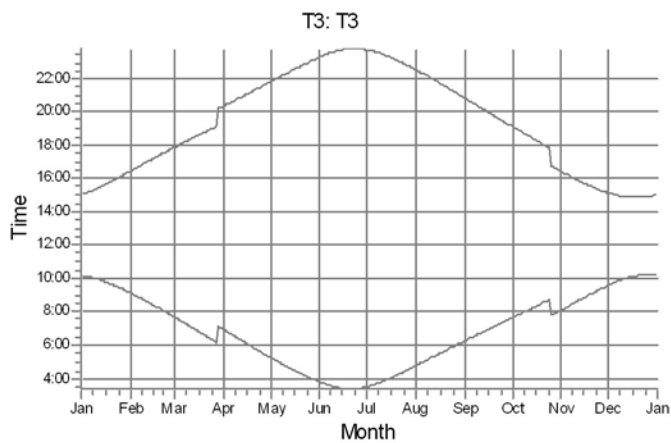
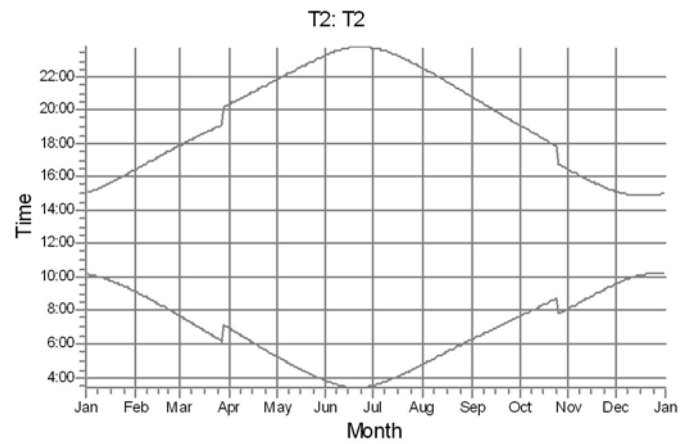
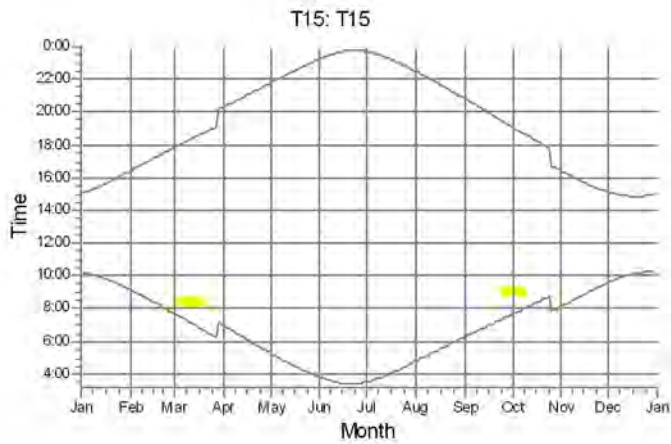
B: Lomarakennus (Voitby Långträsket)



G: Lomarakennus/Partiomaja (Korpilahdenkuja 134)

SHADOW - Calendar per WTG, graphical

Calculation: V136 x 15 x HH172 real case_no forest



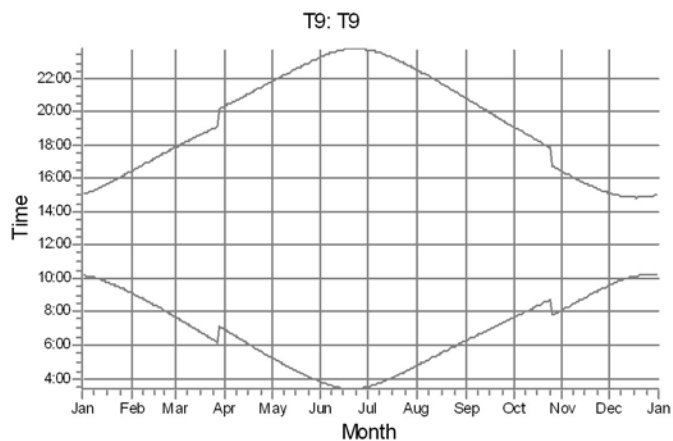
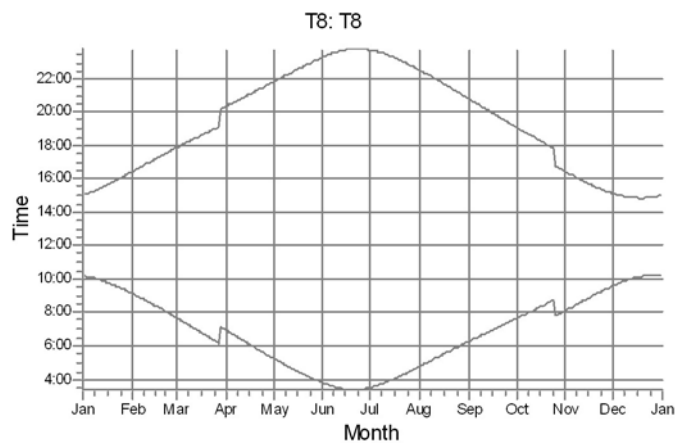
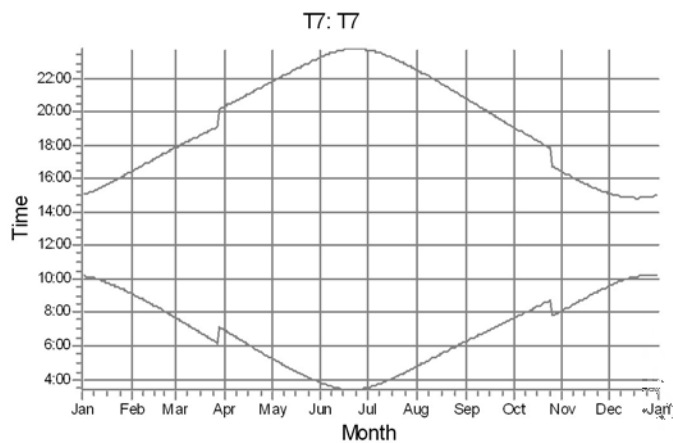
Shadow receptors



B: Lomarakenus (Voitby Långträsket)

SHADOW - Calendar per WTG, graphical

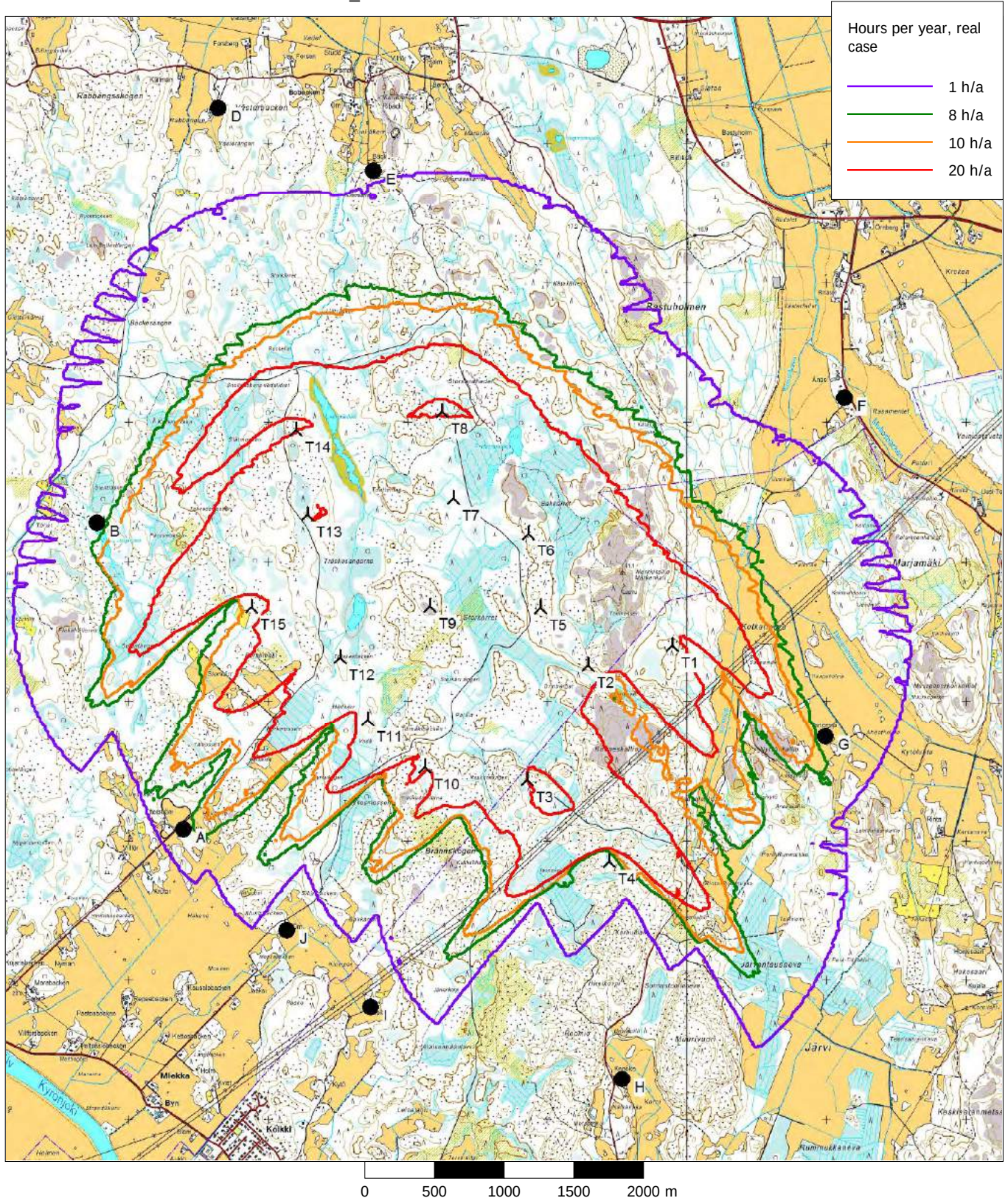
Calculation: V136 x 15 x HH172 real case_no forest



Shadow receptors

SHADOW - Map

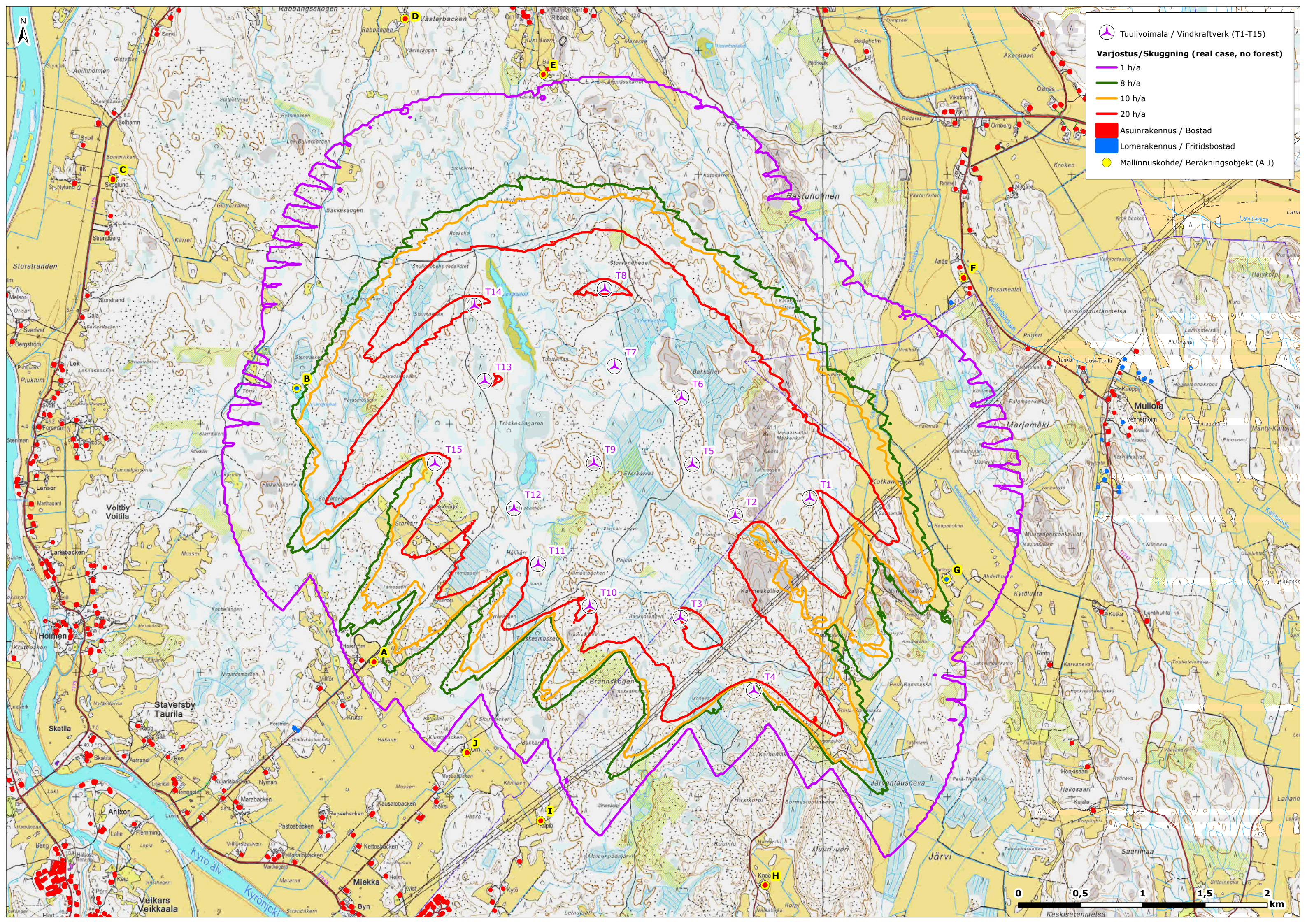
Calculation: V136 x 15 x HH172 real case_no forest



人 New WTG

Shadow receptor

Flicker map level: Height Contours: Merkkikallio_height contour lines.wpo (1)



Bilaga 4: Resultat av skuggmodellering "real case, forest luke"

SHADOW - Main Result

Calculation: V136 x 15 x HH172 real case_forest luke

Assumptions for shadow calculations

Maximum distance for influence

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

Please look in WTG table

Minimum sun height over horizon for influence

3 °

Day step for calculation

1 days

Time step for calculation

1 minutes

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

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

Tuuliatlas lib 30051

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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: Merkkikallio_height contour lines.wpo

Area object(s) used in calculation:

Puuston korkeus 8 km

Obstacles used in calculation

Eye height: 1,5 m

Grid resolution: 10,0 m

All coordinates are in

Finish TM ETRS-TM35FIN-ETRS89

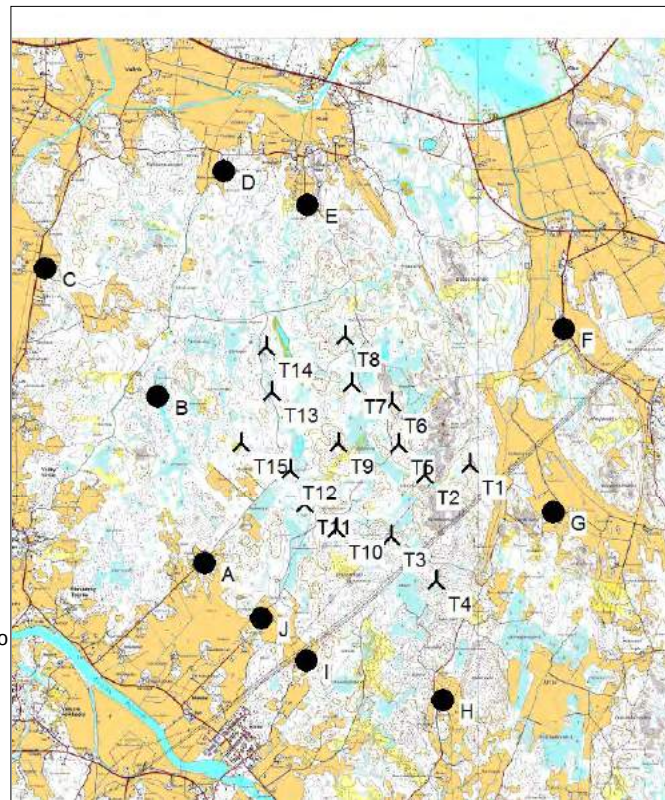
WTGs

	East	North	Z	Row data/Description	WTG type		Power, rated	Rotor diameter	Hub height	Shadow data	
					Valid	Manufact.				Calculation distance	RPM
			[m]				[kW]	[m]	[m]	[m]	[RPM]
T1	247 894	7 008 402	20,0	T1	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T10	246 126	7 007 532	23,2	T10	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T11	245 712	7 007 870	15,0	T11	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T12	245 517	7 008 318	15,0	T12	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T13	245 281	7 009 344	17,5	T13	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T14	245 200	7 009 948	17,5	T14	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T15	244 881	7 008 680	15,0	T15	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T2	247 294	7 008 259	23,6	T2	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T3	246 855	7 007 441	25,0	T3	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T4	247 445	7 006 854	26,8	T4	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T5	246 950	7 008 670	25,0	T5	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T6	246 864	7 009 208	20,3	T6	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T7	246 326	7 009 461	17,7	T7	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T8	246 247	7 010 081	21,5	T8	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0
T9	246 160	7 008 681	29,6	T9	Yes	VESTAS	V136-3.45-3 450	3 450	136,0	172,0	1 712 0,0

Shadow receptor-Input

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	°	°	
A	Asuinrakennus (Langkujavägen 200)	244 392	7 007 085	10,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
B	Lomarakennus (Voitby Långträsket)	243 772	7 009 284	12,8	5,0	5,0	1,0	0,0	0,0	"Green house mode"
C	Asuinrakennus (Voitbyntie 480)	242 293	7 010 963	5,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
D	Asuinrakennus (Kunintie 289)	244 642	7 012 253	5,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
E	Asuinrakennus (Sandhedsvägen 65)	245 754	7 011 805	10,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
F	Asuinrakennus (Mullontie 128)	249 130	7 010 173	7,5	5,0	5,0	1,0	0,0	0,0	"Green house mode"

To be continued on next page...



▲ New WTG

● Shadow receptor

SHADOW - Main Result

Calculation: V136 x 15 x HH172 real case_forest luke

...continued from previous page

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw [°]	Slope of window [°]	Direction mode
				[m]	[m]	[m]	[m]			
G	Lomarakennus/Partiomaja (Korpilahdenkuja 134)	248 995	7 007 749	10,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"
H	Asuinrakennus (Kotkannevantie 269)	247 537	7 005 291	18,5	5,0	5,0	1,0	0,0	0,0	"Green house mode"
I	Asuinrakennus (Klumpintie 171)	245 733	7 005 809	12,5	5,0	5,0	1,0	0,0	0,0	"Green house mode"
J	Asuinrakennus (Klumpvägen 170)	245 136	7 006 355	10,0	5,0	5,0	1,0	0,0	0,0	"Green house mode"

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values Shadow hours per year [h/year]
A	Asuinrakennus (Langkujavägen 200)	6:47
B	Lomarakennus (Voitby Långträsket)	0:00
C	Asuinrakennus (Voitbyntie 480)	0:00
D	Asuinrakennus (Kunintie 289)	0:00
E	Asuinrakennus (Sandhedsvägen 65)	0:00
F	Asuinrakennus (Mullontie 128)	0:00
G	Lomarakennus/Partiomaja (Korpilahdenkuja 134)	0:00
H	Asuinrakennus (Kotkannevantie 269)	0:00
I	Asuinrakennus (Klumpintie 171)	0:00
J	Asuinrakennus (Klumpvägen 170)	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
T1	T1	0:00	0:00
T10	T10	0:00	0:00
T11	T11	21:36	6:47
T12	T12	0:00	0:00
T13	T13	0:00	0:00
T14	T14	0:00	0:00
T15	T15	0:00	0:00
T2	T2	0:00	0:00
T3	T3	0:00	0:00
T4	T4	0:00	0:00
T5	T5	0:00	0:00
T6	T6	0:00	0:00
T7	T7	0:00	0:00
T8	T8	0:00	0:00
T9	T9	0:00	0:00

Project:

Merkkikallio

Licensed user:

FCG Suunnittelu ja tekniikka Oy
Osmontie 34, PO Box 950
FI-00601 Helsinki
+358104095666
Hans Vadback / hans.vadback@fcg.fi
Calculated:
10.6.2016 9:21/3.0.619

SHADOW - Calendar

Calculation: V136 x 15 x HH172 real case_forest lukeShadow receptor: A - Asuinrakennus (Langkujavägen 200)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December		
1	10:10 15:02	09:08 16:25	07:41 17:51	06:56 20:19	05:16 21:47	03:47 23:16	05:21 (T11) 05:42 (T11)	03:30 23:42	05:29 (T11) 05:44 (T11)	04:46 22:30	06:16 20:48	07:38 19:06	08:07 16:25	09:36 15:07
2	10:09 15:04	09:05 16:28	07:38 17:54	06:53 20:22	05:12 21:50	03:45 23:18	05:20 (T11) 05:41 (T11)	03:32 23:40	05:30 (T11) 05:45 (T11)	04:49 22:27	06:19 20:45	07:41 19:03	08:10 16:22	09:38 15:05
3	10:08 15:06	09:03 16:32	07:34 17:57	06:49 20:25	05:09 21:53	03:43 23:21	05:21 (T11) 05:41 (T11)	03:33 23:39	05:30 (T11) 05:45 (T11)	04:52 22:24	06:21 20:42	07:44 18:59	08:13 16:18	09:41 15:03
4	10:07 15:08	09:00 16:35	07:31 18:00	06:46 20:28	05:06 21:56	03:41 23:23	05:22 (T11) 05:42 (T11)	03:35 23:38	05:29 (T11) 05:46 (T11)	04:55 22:20	06:24 20:38	07:46 18:56	08:16 16:15	09:43 15:02
5	10:06 15:10	08:57 16:38	07:28 18:03	06:43 20:31	05:03 21:59	03:39 23:25	05:22 (T11) 05:41 (T11)	03:37 23:36	05:29 (T11) 05:46 (T11)	04:58 22:17	06:27 20:35	07:49 18:52	08:19 16:12	09:45 15:00
6	10:05 15:12	08:54 16:41	07:24 18:06	06:39 20:34	05:00 22:02	03:37 23:27	05:22 (T11) 05:41 (T11)	03:39 23:35	05:29 (T11) 05:47 (T11)	05:01 22:14	06:30 20:31	07:52 18:49	08:22 16:09	09:48 14:59
7	10:04 15:14	08:51 16:44	07:21 18:08	06:36 20:36	04:56 22:05	03:35 23:29	05:23 (T11) 05:41 (T11)	03:41 23:33	05:28 (T11) 05:47 (T11)	05:04 22:11	06:32 20:28	07:55 18:46	08:25 16:07	09:50 14:58
8	10:02 15:16	08:48 16:47	07:18 18:11	06:32 20:39	04:53 22:08	03:34 23:31	05:23 (T11) 05:40 (T11)	03:43 23:31	05:29 (T11) 05:48 (T11)	05:07 22:08	06:35 20:25	07:57 18:42	08:29 16:04	09:52 14:56
9	10:01 15:19	08:45 16:50	07:14 18:14	06:29 20:42	04:50 22:11	03:32 23:33	05:24 (T11) 05:40 (T11)	03:45 23:29	05:28 (T11) 05:48 (T11)	05:10 22:05	06:38 20:21	08:00 18:39	08:32 16:01	09:54 14:55
10	09:59 15:21	08:42 16:53	07:11 18:17	06:26 20:45	04:47 22:14	03:31 23:35	05:24 (T11) 05:40 (T11)	03:47 23:27	05:28 (T11) 05:49 (T11)	05:13 22:01	06:41 20:18	08:03 18:36	08:35 15:58	09:56 14:54
11	09:58 15:24	08:39 16:57	07:08 18:20	06:22 20:48	04:44 22:17	03:29 23:36	05:26 (T11) 05:40 (T11)	03:49 23:25	05:29 (T11) 05:49 (T11)	05:16 21:58	06:43 20:14	08:06 18:32	08:38 15:55	09:58 14:53
12	09:56 15:26	08:36 17:00	07:04 18:23	06:19 20:51	04:41 22:20	03:28 23:38	05:26 (T11) 05:40 (T11)	03:52 23:23	05:29 (T11) 05:50 (T11)	05:19 21:55	06:46 20:11	08:09 18:29	08:41 15:52	10:00 14:52
13	09:54 15:29	08:33 17:03	07:01 18:26	06:15 20:54	04:38 22:23	03:27 23:39	05:26 (T11) 05:39 (T11)	03:54 23:21	05:28 (T11) 05:49 (T11)	05:22 21:52	06:49 20:07	08:12 18:26	08:44 15:49	10:01 14:52
14	09:52 15:32	08:29 17:06	06:58 18:29	06:12 20:57	04:35 22:26	03:26 23:41	05:27 (T11) 05:25 (T11)	03:56 23:19	05:28 (T11) 05:50 (T11)	05:25 21:49	06:52 20:04	08:14 18:22	08:47 15:47	10:03 14:51
15	09:50 15:34	08:26 17:09	06:54 18:31	06:09 20:59	04:32 22:29	03:25 23:42	05:25 (T11) 05:35 (T11)	03:25 23:16	05:28 (T11) 05:50 (T11)	05:27 21:45	06:54 20:01	08:17 18:19	08:50 15:44	10:04 14:51
16	09:48 15:37	08:23 17:12	06:51 18:34	06:05 21:02	04:29 22:32	03:24 23:43	05:24 (T11) 05:37 (T11)	04:02 23:43	05:28 (T11) 05:50 (T11)	05:30 21:42	06:57 19:57	08:20 18:16	08:53 15:41	10:06 14:50
17	09:46 15:40	08:20 17:15	06:47 18:37	06:02 21:05	04:26 22:35	03:24 23:44	05:22 (T11) 05:37 (T11)	04:04 23:12	05:28 (T11) 05:50 (T11)	05:33 21:39	07:00 19:54	08:23 18:12	08:56 15:39	10:07 14:50
18	09:44 15:43	08:17 17:18	06:44 18:40	05:59 21:08	04:23 22:38	03:23 23:44	05:21 (T11) 05:39 (T11)	04:07 23:09	05:28 (T11) 05:50 (T11)	05:36 21:35	07:02 19:50	08:26 18:09	08:59 15:36	10:08 14:50
19	09:42 15:46	08:14 17:21	06:41 18:43	05:55 21:11	04:20 22:40	03:23 23:45	05:21 (T11) 05:40 (T11)	04:09 23:07	05:29 (T11) 05:51 (T11)	05:39 21:32	07:05 19:47	08:29 18:06	09:02 15:33	10:09 14:50
20	09:39 15:49	08:10 17:24	06:37 18:46	05:52 21:14	04:17 22:43	03:23 23:45	05:20 (T11) 05:39 (T11)	04:12 23:04	05:29 (T11) 05:51 (T11)	05:42 21:29	07:08 19:43	08:32 18:03	09:05 15:31	10:10 14:50
21	09:37 15:52	08:07 17:27	06:34 18:48	05:48 21:17	04:15 22:46	03:23 23:46	05:19 (T11) 05:40 (T11)	04:15 23:01	05:29 (T11) 05:51 (T11)	05:45 21:25	07:11 19:40	08:35 17:59	09:08 15:28	10:11 14:50
22	09:35 15:55	08:04 17:30	06:30 18:51	05:45 21:20	04:12 22:49	03:23 23:46	05:19 (T11) 05:41 (T11)	04:18 22:59	05:29 (T11) 05:50 (T11)	05:48 21:22	07:13 19:37	08:37 17:56	09:11 15:26	10:11 14:51
23	09:32 15:58	08:01 17:33	06:27 18:54	05:42 21:23	04:09 22:52	03:23 23:46	05:19 (T11) 05:41 (T11)	04:20 22:56	05:30 (T11) 05:50 (T11)	05:50 21:19	07:16 19:33	08:40 17:53	09:14 15:24	10:12 14:51
24	09:30 16:01	07:58 17:36	06:24 18:57	05:38 21:26	04:06 22:55	03:24 23:46	05:19 (T11) 05:41 (T11)	04:23 22:53	05:31 (T11) 05:50 (T11)	05:53 21:15	07:19 19:30	08:43 17:50	09:17 15:21	10:12 14:52
25	09:27 16:04	07:54 17:39	06:20 19:00	05:35 21:29	04:04 22:58	03:24 23:46	05:19 (T11) 05:41 (T11)	04:26 22:50	05:31 (T11) 05:49 (T11)	05:56 21:12	07:22 19:26	07:46 16:47	09:19 15:19	10:12 14:53
26	09:25 16:07	07:51 17:42	06:17 19:02	05:32 21:32	04:01 23:00	03:25 23:45	05:19 (T11) 05:41 (T11)	04:29 22:47	05:32 (T11) 05:48 (T11)	05:59 21:09	07:24 19:23	07:49 16:43	09:22 15:17	10:12 14:54
27	09:22 16:10	07:48 17:45	06:13 19:05	05:29 21:35	03:59 23:03	03:26 23:45	05:19 (T11) 05:41 (T11)	04:32 22:44	05:33 (T11) 05:48 (T11)	06:02 21:05	07:27 19:20	07:52 16:40	09:25 15:15	10:12 14:55
28	09:19 16:13	07:44 17:48	06:10 19:08	05:25 21:38	03:56 23:06	03:27 23:44	05:19 (T11) 05:41 (T11)	04:35 22:42	05:34 (T11) 05:46 (T11)	06:05 21:02	07:30 19:16	07:55 16:37	09:28 15:13	10:12 14:56
29	09:17 16:16		07:06 20:11	05:22 21:41	03:54 23:08	03:28 23:43	05:20 (T11) 05:42 (T11)	04:38 22:39	05:37 (T11) 05:45 (T11)	06:07 20:59	07:32 19:13	07:58 16:34	09:30 15:11	10:12 14:57
30	09:14 16:19		07:03 20:14	05:19 21:44	03:51 23:11	03:29 23:43	05:20 (T11) 05:42 (T11)	04:41 22:36	06:10 20:55	07:35 19:09	07:36 16:31	08:01 15:09	09:33 14:59	10:11 14:59
31	09:11 16:22		07:00 20:17		03:49 23:13	03:21 23:43	05:20 (T11) 05:41 (T11)	04:44 22:33	06:13 20:52		08:04 16:28		09:30 15:00	
Potential sun hours	183	243	363	447	559	604	593	502	392	308	207	152		
Total, worst case					337	416	543							
Sun reduction					0,53	0,51	0,50							
Oper. time red.					0,97	0,97	0,97							
Wind dir. red.					0,64	0,64	0,64							
Total reduction					0,33	0,31	0,31							
Total, real					111	129	168							

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: V136 x 15 x HH172 real case_forest lukeShadow receptor: B - Lomarakenus (Voitby Långträsket)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:20	21:47	23:16	23:42	22:30	20:49	19:06	16:25	15:07
2	10:10	09:06	07:38	06:53	05:12	03:45	03:32	04:49	06:19	07:41	08:10	09:39
	15:04	16:28	17:54	20:22	21:50	23:19	23:41	22:27	20:45	19:03	16:21	15:05
3	10:09	09:03	07:35	06:49	05:09	03:42	03:33	04:52	06:21	07:44	08:13	09:41
	15:06	16:32	17:57	20:25	21:53	23:21	23:39	22:24	20:42	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:06	03:40	03:35	04:55	06:24	07:46	08:17	09:43
	15:08	16:35	18:00	20:28	21:56	23:23	23:38	22:21	20:38	18:56	16:15	15:02
5	10:07	08:57	07:28	06:43	05:03	03:39	03:37	04:58	06:27	07:49	08:20	09:46
	15:10	16:38	18:03	20:31	21:59	23:25	23:37	22:18	20:35	18:53	16:12	15:00
6	10:05	08:54	07:25	06:39	04:59	03:37	03:38	05:01	06:30	07:52	08:23	09:48
	15:12	16:41	18:06	20:34	22:02	23:28	23:35	22:14	20:31	18:49	16:09	14:59
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:55	08:26	09:50
	15:14	16:44	18:08	20:37	22:05	23:30	23:33	22:11	20:28	18:46	16:06	14:57
8	10:03	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:58	08:29	09:52
	15:16	16:47	18:11	20:39	22:08	23:32	23:32	22:08	20:25	18:42	16:04	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:45	05:10	06:38	08:00	08:32	09:54
	15:19	16:50	18:14	20:42	22:11	23:33	23:30	22:05	20:21	18:39	16:01	14:55
10	10:00	08:42	07:11	06:26	04:47	03:30	03:47	05:13	06:41	08:03	08:35	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:28	22:02	20:18	18:36	15:58	14:54
11	09:58	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:24	16:56	18:20	20:48	22:17	23:37	23:26	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:41	03:28	03:51	05:19	06:46	08:09	08:41	10:00
	15:26	17:00	18:23	20:51	22:20	23:38	23:24	21:55	20:11	18:29	15:52	14:52
13	09:54	08:33	07:01	06:15	04:38	03:27	03:54	05:22	06:49	08:12	08:44	10:02
	15:29	17:03	18:26	20:54	22:23	23:40	23:21	21:52	20:08	18:26	15:49	14:51
14	09:52	08:30	06:58	06:12	04:35	03:26	03:56	05:25	06:52	08:14	08:47	10:03
	15:32	17:06	18:29	20:57	22:26	23:41	23:19	21:49	20:04	18:22	15:47	14:51
15	09:51	08:26	06:54	06:09	04:32	03:25	03:59	05:27	06:54	08:17	08:50	10:05
	15:34	17:09	18:31	21:00	22:29	23:42	23:17	21:45	20:01	18:19	15:44	14:50
16	09:48	08:23	06:51	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:32	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:24	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:35	23:44	23:12	21:39	19:54	18:12	15:38	14:50
18	09:44	08:17	06:44	05:59	04:23	03:23	04:07	05:36	07:03	08:26	08:59	10:08
	15:43	17:18	18:40	21:08	22:38	23:45	23:09	21:36	19:50	18:09	15:36	14:50
19	09:42	08:14	06:41	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:46	17:21	18:43	21:11	22:41	23:45	23:07	21:32	19:47	18:06	15:33	14:50
20	09:40	08:11	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:32	09:05	10:10
	15:49	17:24	18:46	21:14	22:44	23:46	23:04	21:29	19:44	18:03	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:23	04:15	05:45	07:11	08:35	09:08	10:11
	15:51	17:27	18:48	21:17	22:47	23:46	23:02	21:26	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:12	03:23	04:18	05:48	07:13	08:38	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:59	21:22	19:37	17:56	15:26	14:51
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:41	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:47	22:56	21:19	19:33	17:53	15:24	14:51
24	09:30	07:58	06:24	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:17	10:12
	16:01	17:36	18:57	21:26	22:55	23:46	22:53	21:16	19:30	17:50	15:21	14:52
25	09:27	07:54	06:20	05:35	04:04	03:24	04:26	05:56	07:22	07:46	09:20	10:13
	16:04	17:39	19:00	21:29	22:58	23:46	22:50	21:12	19:26	17:47	15:19	14:53
26	09:25	07:51	06:17	05:32	04:01	03:25	04:29	05:59	07:24	07:49	09:22	10:13
	16:07	17:42	19:03	21:32	23:01	23:46	22:48	21:09	19:23	16:43	15:17	14:54
27	09:22	07:48	06:13	05:29	03:59	03:25	04:32	06:02	07:27	07:52	09:25	10:13
	16:10	17:45	19:05	21:35	23:03	23:45	22:45	21:05	19:20	16:40	15:15	14:55
28	09:20	07:45	06:10	05:25	03:56	03:26	04:35	06:05	07:30	07:55	09:28	10:12
	16:13	17:48	19:08	21:38	23:06	23:45	22:42	21:02	19:16	16:37	15:13	14:56
29	09:17		07:06	05:22	03:54	03:28	04:38	06:07	07:33	07:58	09:31	10:12
	16:16		20:11	21:41	23:09	23:44	22:39	20:59	19:13	16:34	15:11	14:57
30	09:14		07:03	05:19	03:51	03:29	04:40	06:10	07:35	08:01	09:33	10:12
	16:19		20:14	21:44	23:11	23:43	22:36	20:55	19:09	16:31	15:09	14:58
31	09:11		07:00		03:49		04:43	06:13		08:04		10:11
	16:22		20:17		23:14		22:33	20:52		16:28		15:00
Potential sun hours	182	242	363	447	559	604	594	502	392	308	206	152
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)	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)

SHADOW - Calendar

Calculation: V136 x 15 x HH172 real case_forest lukeShadow receptor: C - Asuinrakennus (Voitbyntie 480)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:11	09:09	07:41	06:56	05:16	03:47	03:30	04:46	06:16	07:38	08:08	09:36
	15:02	16:25	17:51	20:20	21:47	23:17	23:42	22:30	20:49	19:06	16:25	15:07
2	10:10	09:06	07:38	06:53	05:12	03:44	03:31	04:49	06:19	07:41	08:11	09:39
	15:04	16:28	17:54	20:23	21:50	23:19	23:41	22:27	20:45	19:03	16:22	15:05
3	10:09	09:03	07:35	06:50	05:09	03:42	03:33	04:52	06:21	07:44	08:14	09:41
	15:06	16:32	17:57	20:25	21:53	23:21	23:40	22:24	20:42	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:06	03:40	03:35	04:55	06:24	07:47	08:17	09:44
	15:08	16:35	18:00	20:28	21:56	23:24	23:38	22:21	20:38	18:56	16:15	15:02
5	10:07	08:57	07:28	06:43	05:03	03:38	03:36	04:58	06:27	07:49	08:20	09:46
	15:10	16:38	18:03	20:31	21:59	23:26	23:37	22:18	20:35	18:53	16:12	15:00
6	10:06	08:54	07:25	06:39	04:59	03:37	03:38	05:01	06:30	07:52	08:23	09:48
	15:12	16:41	18:06	20:34	22:02	23:28	23:35	22:15	20:32	18:49	16:09	14:59
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:33	07:55	08:26	09:51
	15:14	16:44	18:09	20:37	22:05	23:30	23:34	22:11	20:28	18:46	16:06	14:57
8	10:03	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:58	08:29	09:53
	15:16	16:47	18:11	20:40	22:08	23:32	23:32	22:08	20:25	18:43	16:04	14:56
9	10:02	08:45	07:15	06:29	04:50	03:32	03:44	05:10	06:38	08:00	08:32	09:55
	15:19	16:50	18:14	20:42	22:11	23:34	23:30	22:05	20:21	18:39	16:01	14:55
10	10:00	08:42	07:11	06:26	04:47	03:30	03:47	05:13	06:41	08:03	08:35	09:57
	15:21	16:53	18:17	20:45	22:14	23:36	23:28	22:02	20:18	18:36	15:58	14:54
11	09:58	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:44	08:06	08:38	09:59
	15:24	16:57	18:20	20:48	22:17	23:37	23:26	21:59	20:15	18:32	15:55	14:53
12	09:57	08:36	07:05	06:19	04:41	03:28	03:51	05:19	06:46	08:09	08:41	10:00
	15:26	17:00	18:23	20:51	22:20	23:39	23:24	21:55	20:11	18:29	15:52	14:52
13	09:55	08:33	07:01	06:15	04:38	03:27	03:54	05:22	06:49	08:12	08:44	10:02
	15:29	17:03	18:26	20:54	22:23	23:40	23:22	21:52	20:08	18:26	15:49	14:51
14	09:53	08:30	06:58	06:12	04:35	03:26	03:56	05:25	06:52	08:15	08:47	10:04
	15:31	17:06	18:29	20:57	22:26	23:41	23:19	21:49	20:04	18:22	15:47	14:51
15	09:51	08:27	06:54	06:09	04:32	03:25	03:59	05:27	06:54	08:17	08:50	10:05
	15:34	17:09	18:32	21:00	22:29	23:43	23:17	21:46	20:01	18:19	15:44	14:50
16	09:49	08:24	06:51	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:03	22:32	23:44	23:15	21:42	19:57	18:16	15:41	14:50
17	09:47	08:20	06:48	06:02	04:26	03:23	04:04	05:33	07:00	08:23	08:56	10:08
	15:40	17:15	18:37	21:06	22:35	23:44	23:12	21:39	19:54	18:13	15:38	14:50
18	09:44	08:17	06:44	05:59	04:23	03:23	04:07	05:36	07:03	08:26	08:59	10:09
	15:43	17:18	18:40	21:09	22:38	23:45	23:10	21:36	19:51	18:09	15:36	14:50
19	09:42	08:14	06:41	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:10
	15:46	17:21	18:43	21:11	22:41	23:46	23:07	21:32	19:47	18:06	15:33	14:50
20	09:40	08:11	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:32	09:05	10:10
	15:49	17:24	18:46	21:14	22:44	23:46	23:04	21:29	19:44	18:03	15:31	14:50
21	09:38	08:08	06:34	05:49	04:14	03:23	04:15	05:45	07:11	08:35	09:08	10:11
	15:51	17:27	18:49	21:17	22:47	23:47	23:02	21:26	19:40	17:59	15:28	14:50
22	09:35	08:04	06:31	05:45	04:12	03:23	04:17	05:48	07:14	08:38	09:11	10:12
	15:54	17:30	18:51	21:20	22:50	23:47	22:59	21:22	19:37	17:56	15:26	14:51
23	09:33	08:01	06:27	05:42	04:09	03:23	04:20	05:51	07:16	08:41	09:14	10:12
	15:57	17:33	18:54	21:23	22:53	23:47	22:56	21:19	19:33	17:53	15:24	14:51
24	09:30	07:58	06:24	05:39	04:06	03:23	04:23	05:53	07:19	08:44	09:17	10:13
	16:01	17:36	18:57	21:26	22:55	23:47	22:54	21:16	19:30	17:50	15:21	14:52
25	09:28	07:55	06:20	05:35	04:04	03:24	04:26	05:56	07:22	07:47	09:20	10:13
	16:04	17:39	19:00	21:29	22:58	23:47	22:51	21:12	19:27	17:47	15:19	14:53
26	09:25	07:51	06:17	05:32	04:01	03:25	04:29	05:59	07:24	07:50	09:23	10:13
	16:07	17:42	19:03	21:32	23:01	23:46	22:48	21:09	19:23	16:43	15:17	14:53
27	09:22	07:48	06:13	05:29	03:58	03:25	04:32	06:02	07:27	07:53	09:26	10:13
	16:10	17:45	19:06	21:35	23:04	23:46	22:45	21:06	19:20	16:40	15:15	14:55
28	09:20	07:45	06:10	05:25	03:56	03:26	04:35	06:05	07:30	07:56	09:28	10:13
	16:13	17:48	19:08	21:38	23:06	23:45	22:42	21:02	19:16	16:37	15:13	14:56
29	09:17		07:07	05:22	03:54	03:27	04:38	06:08	07:33	07:59	09:31	10:13
	16:16		20:11	21:41	23:09	23:44	22:39	20:59	19:13	16:34	15:11	14:57
30	09:14		07:03	05:19	03:51	03:29	04:40	06:10	07:35	08:02	09:34	10:12
	16:19		20:14	21:44	23:12	23:43	22:36	20:55	19:10	16:31	15:09	14:58
31	09:12		07:00		03:49		04:43	06:13		08:05		10:12
	16:22		20:17		23:14		22:33	20:52		16:28		15:00
Potential sun hours	182	242	363	447	559	605	594	502	392	308	206	151
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)	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)

SHADOW - Calendar

Calculation: V136 x 15 x HH172 real case_forest lukeShadow receptor: D - Asuinrakennus (Kunintie 289)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 1,03 2,53 3,97 6,77 9,62 10,20 9,62 7,58 5,07 2,64 1,20 0,65

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
 950 485 257 338 655 682 961 1 447 1 196 618 441 434 8 465
 Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:11	09:09	07:41	06:56	05:15	03:46	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:20	21:47	23:17	23:42	22:30	20:49	19:06	16:24	15:06
2	10:10	09:06	07:38	06:53	05:12	03:44	03:31	04:49	06:18	07:41	08:11	09:39
	15:03	16:28	17:54	20:22	21:50	23:19	23:41	22:27	20:45	19:03	16:21	15:05
3	10:09	09:03	07:35	06:49	05:09	03:42	03:33	04:52	06:21	07:44	08:14	09:41
	15:05	16:31	17:57	20:25	21:53	23:21	23:40	22:24	20:42	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:06	03:40	03:34	04:55	06:24	07:46	08:17	09:44
	15:07	16:34	18:00	20:28	21:56	23:24	23:39	22:21	20:38	18:56	16:15	15:01
5	10:07	08:57	07:28	06:42	05:02	03:38	03:36	04:58	06:27	07:49	08:20	09:46
	15:09	16:38	18:03	20:31	21:59	23:26	23:37	22:18	20:35	18:52	16:12	15:00
6	10:06	08:54	07:25	06:39	04:59	03:36	03:38	05:01	06:30	07:52	08:23	09:48
	15:11	16:41	18:05	20:34	22:02	23:28	23:35	22:15	20:32	18:49	16:09	14:58
7	10:04	08:51	07:21	06:36	04:56	03:34	03:40	05:04	06:32	07:55	08:26	09:51
	15:14	16:44	18:08	20:37	22:05	23:30	23:34	22:11	20:28	18:46	16:06	14:57
8	10:03	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:58	08:29	09:53
	15:16	16:47	18:11	20:39	22:08	23:32	23:32	22:08	20:25	18:42	16:03	14:56
9	10:02	08:45	07:14	06:29	04:50	03:31	03:44	05:10	06:38	08:00	08:32	09:55
	15:18	16:50	18:14	20:42	22:11	23:34	23:30	22:05	20:21	18:39	16:00	14:55
10	10:00	08:42	07:11	06:25	04:47	03:30	03:46	05:13	06:41	08:03	08:35	09:57
	15:21	16:53	18:17	20:45	22:14	23:36	23:28	22:02	20:18	18:36	15:57	14:54
11	09:58	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:59
	15:23	16:56	18:20	20:48	22:17	23:37	23:26	21:59	20:14	18:32	15:55	14:53
12	09:57	08:36	07:04	06:19	04:40	03:27	03:51	05:18	06:46	08:09	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:39	23:24	21:55	20:11	18:29	15:52	14:52
13	09:55	08:33	07:01	06:15	04:37	03:26	03:53	05:21	06:49	08:12	08:44	10:02
	15:28	17:03	18:26	20:54	22:23	23:40	23:22	21:52	20:08	18:26	15:49	14:51
14	09:53	08:30	06:58	06:12	04:34	03:25	03:56	05:24	06:52	08:14	08:47	10:04
	15:31	17:06	18:29	20:57	22:26	23:41	23:19	21:49	20:04	18:22	15:46	14:50
15	09:51	08:27	06:54	06:08	04:31	03:24	03:58	05:27	06:54	08:17	08:50	10:05
	15:34	17:09	18:31	21:00	22:29	23:43	23:17	21:46	20:01	18:19	15:44	14:50
16	09:49	08:23	06:51	06:05	04:28	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:03	22:32	23:44	23:15	21:42	19:57	18:16	15:41	14:50
17	09:47	08:20	06:47	06:02	04:25	03:23	04:03	05:33	07:00	08:23	08:56	10:08
	15:40	17:15	18:37	21:05	22:35	23:45	23:12	21:39	19:54	18:12	15:38	14:49
18	09:44	08:17	06:44	05:58	04:23	03:23	04:06	05:36	07:02	08:26	08:59	10:09
	15:42	17:18	18:40	21:08	22:38	23:45	23:10	21:36	19:50	18:09	15:36	14:49
19	09:42	08:14	06:41	05:55	04:20	03:22	04:09	05:39	07:05	08:29	09:02	10:10
	15:45	17:21	18:43	21:11	22:41	23:46	23:07	21:32	19:47	18:06	15:33	14:49
20	09:40	08:11	06:37	05:52	04:17	03:22	04:12	05:42	07:08	08:32	09:05	10:10
	15:48	17:24	18:46	21:14	22:44	23:46	23:04	21:29	19:44	18:03	15:30	14:49
21	09:37	08:07	06:34	05:48	04:14	03:22	04:14	05:45	07:11	08:35	09:08	10:11
	15:51	17:27	18:48	21:17	22:47	23:47	23:02	21:26	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:11	03:22	04:17	05:47	07:13	08:38	09:11	10:12
	15:54	17:30	18:51	21:20	22:50	23:47	22:59	21:22	19:37	17:56	15:26	14:50
23	09:33	08:01	06:27	05:42	04:09	03:22	04:20	05:50	07:16	08:41	09:14	10:12
	15:57	17:33	18:54	21:23	22:53	23:47	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:58	06:24	05:38	04:06	03:23	04:23	05:53	07:19	08:44	09:17	10:13
	16:00	17:36	18:57	21:26	22:55	23:47	22:54	21:16	19:30	17:50	15:21	14:51
25	09:28	07:54	06:20	05:35	04:03	03:23	04:26	05:56	07:22	07:46	09:20	10:13
	16:03	17:39	19:00	21:29	22:58	23:47	22:51	21:12	19:26	17:46	15:19	14:52
26	09:25	07:51	06:17	05:32	04:01	03:24	04:29	05:59	07:24	07:49	09:23	10:13
	16:06	17:42	19:03	21:32	23:01	23:46	22:48	21:09	19:23	16:43	15:16	14:53
27	09:22	07:48	06:13	05:28	03:58	03:25	04:31	06:02	07:27	07:52	09:25	10:13
	16:09	17:45	19:05	21:35	23:04	23:46	22:45	21:06	19:20	16:40	15:14	14:54
28	09:20	07:45	06:10	05:25	03:56	03:26	04:34	06:04	07:30	07:55	09:28	10:13
	16:13	17:48	19:08	21:38	23:06	23:45	22:42	21:02	19:16	16:37	15:12	14:55
29	09:17		07:06	05:22	03:53	03:27	04:37	06:07	07:33	07:58	09:31	10:13
	16:16		20:11	21:41	23:09	23:44	22:39	20:59	19:13	16:34	15:10	14:57
30	09:14		07:03	05:19	03:51	03:28	04:40	06:10	07:35	08:01	09:34	10:12
	16:19		20:14	21:44	23:12	23:43	22:36	20:55	19:09	16:31	15:08	14:58
31	09:11		07:00		03:49		04:43	06:13		08:04		10:12
	16:22		20:17		23:14		22:33	20:52		16:27		15:00
Potential sun hours	182	242	363	447	559	605	594	502	392	308	206	151
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)	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		

SHADOW - Calendar

Calculation: V136 x 15 x HH172 real case_forest lukeShadow receptor: E - Asuinrakennus (Sandhedsvägen 65)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:11	09:09	07:41	06:56	05:15	03:46	03:29	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16	23:42	22:30	20:48	19:06	16:24	15:06
2	10:10	09:06	07:38	06:53	05:12	03:44	03:31	04:49	06:18	07:41	08:10	09:39
	15:03	16:28	17:54	20:22	21:50	23:19	23:41	22:27	20:45	19:03	16:21	15:05
3	10:09	09:03	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:41
	15:05	16:31	17:57	20:25	21:53	23:21	23:40	22:24	20:42	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:05	03:40	03:34	04:55	06:24	07:46	08:16	09:44
	15:07	16:34	18:00	20:28	21:56	23:24	23:38	22:21	20:38	18:56	16:15	15:01
5	10:07	08:57	07:28	06:42	05:02	03:38	03:36	04:58	06:27	07:49	08:20	09:46
	15:09	16:37	18:02	20:31	21:59	23:26	23:37	22:18	20:35	18:52	16:12	15:00
6	10:06	08:54	07:24	06:39	04:59	03:36	03:38	05:01	06:29	07:52	08:23	09:48
	15:11	16:41	18:05	20:34	22:02	23:28	23:35	22:14	20:31	18:49	16:09	14:58
7	10:04	08:51	07:21	06:36	04:56	03:34	03:40	05:04	06:32	07:55	08:26	09:50
	15:14	16:44	18:08	20:37	22:05	23:30	23:34	22:11	20:28	18:46	16:06	14:57
8	10:03	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:29	09:53
	15:16	16:47	18:11	20:39	22:08	23:32	23:32	22:08	20:25	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:31	03:44	05:10	06:38	08:00	08:32	09:55
	15:18	16:50	18:14	20:42	22:11	23:34	23:30	22:05	20:21	18:39	16:00	14:55
10	10:00	08:42	07:11	06:25	04:47	03:30	03:46	05:13	06:41	08:03	08:35	09:57
	15:21	16:53	18:17	20:45	22:14	23:35	23:28	22:02	20:18	18:36	15:57	14:53
11	09:58	08:39	07:08	06:22	04:43	03:28	03:49	05:15	06:43	08:06	08:38	09:58
	15:23	16:56	18:20	20:48	22:17	23:37	23:26	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:40	03:27	03:51	05:18	06:46	08:09	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:39	23:24	21:55	20:11	18:29	15:52	14:52
13	09:55	08:33	07:01	06:15	04:37	03:26	03:53	05:21	06:49	08:12	08:44	10:02
	15:28	17:02	18:26	20:54	22:23	23:40	23:22	21:52	20:07	18:26	15:49	14:51
14	09:53	08:30	06:57	06:12	04:34	03:25	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:06	18:28	20:57	22:26	23:41	23:19	21:49	20:04	18:22	15:46	14:50
15	09:51	08:26	06:54	06:08	04:31	03:24	03:58	05:27	06:54	08:17	08:50	10:05
	15:34	17:09	18:31	21:00	22:29	23:42	23:17	21:45	20:01	18:19	15:43	14:50
16	09:49	08:23	06:51	06:05	04:28	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:32	23:43	23:15	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:25	03:23	04:03	05:33	07:00	08:23	08:56	10:07
	15:39	17:15	18:37	21:05	22:35	23:44	23:12	21:39	19:54	18:12	15:38	14:49
18	09:44	08:17	06:44	05:58	04:23	03:23	04:06	05:36	07:02	08:26	08:59	10:09
	15:42	17:18	18:40	21:08	22:38	23:45	23:10	21:36	19:50	18:09	15:36	14:49
19	09:42	08:14	06:40	05:55	04:20	03:22	04:09	05:39	07:05	08:29	09:02	10:09
	15:45	17:21	18:43	21:11	22:41	23:46	23:07	21:32	19:47	18:06	15:33	14:49
20	09:40	08:11	06:37	05:52	04:17	03:22	04:12	05:42	07:08	08:32	09:05	10:10
	15:48	17:24	18:46	21:14	22:44	23:46	23:04	21:29	19:43	18:02	15:30	14:49
21	09:37	08:07	06:34	05:48	04:14	03:22	04:14	05:44	07:11	08:35	09:08	10:11
	15:51	17:27	18:48	21:17	22:47	23:47	23:02	21:26	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:11	03:22	04:17	05:47	07:13	08:38	09:11	10:12
	15:54	17:30	18:51	21:20	22:50	23:47	22:59	21:22	19:37	17:56	15:26	14:50
23	09:33	08:01	06:27	05:42	04:09	03:22	04:20	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:47	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:58	06:23	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:17	10:13
	16:00	17:36	18:57	21:26	22:55	23:47	22:53	21:16	19:30	17:49	15:21	14:51
25	09:27	07:54	06:20	05:35	04:03	03:23	04:26	05:56	07:21	07:46	09:20	10:13
	16:03	17:39	19:00	21:29	22:58	23:46	22:51	21:12	19:26	17:46	15:19	14:52
26	09:25	07:51	06:17	05:32	04:01	03:24	04:28	05:59	07:24	07:49	09:23	10:13
	16:06	17:42	19:02	21:32	23:01	23:46	22:48	21:09	19:23	16:43	15:16	14:53
27	09:22	07:48	06:13	05:28	03:58	03:25	04:31	06:02	07:27	07:52	09:25	10:13
	16:09	17:45	19:05	21:35	23:04	23:46	22:45	21:05	19:20	16:40	15:14	14:54
28	09:20	07:44	06:10	05:25	03:56	03:26	04:34	06:04	07:30	07:55	09:28	10:13
	16:12	17:48	19:08	21:38	23:06	23:45	22:42	21:02	19:16	16:37	15:12	14:55
29	09:17		07:06	05:22	03:53	03:27	04:37	06:07	07:32	07:58	09:31	10:12
	16:16		20:11	21:41	23:09	23:44	22:39	20:59	19:13	16:34	15:10	14:57
30	09:14		07:03	05:18	03:51	03:28	04:40	06:10	07:35	08:01	09:33	10:12
	16:19		20:14	21:44	23:11	23:43	22:36	20:55	19:09	16:30	15:08	14:58
31	09:11		06:59		03:48		04:43	06:13		08:04		10:11
	16:22		20:17		23:14		22:33	20:52		16:27		14:59
Potential sun hours	182	242	363	447	559	605	594	502	392	308	206	151
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)	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: V136 x 15 x HH172 real case_forest lukeShadow receptor: F - Asuinrakennus (Mullontie 128)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:46	03:29	04:46	06:15	07:38	08:07	09:36
	15:01	16:25	17:51	20:19	21:46	23:16	23:42	22:30	20:48	19:06	16:24	15:06
2	10:09	09:05	07:37	06:52	05:12	03:44	03:31	04:49	06:18	07:40	08:10	09:38
	15:03	16:28	17:53	20:22	21:49	23:18	23:41	22:27	20:45	19:02	16:21	15:04
3	10:09	09:02	07:34	06:49	05:09	03:42	03:32	04:52	06:21	07:43	08:13	09:41
	15:05	16:31	17:56	20:25	21:52	23:21	23:39	22:23	20:41	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:05	03:40	03:34	04:55	06:24	07:46	08:16	09:43
	15:07	16:34	17:59	20:28	21:55	23:23	23:38	22:20	20:38	18:55	16:15	15:01
5	10:06	08:57	07:28	06:42	05:02	03:38	03:36	04:58	06:26	07:49	08:19	09:45
	15:09	16:37	18:02	20:31	21:59	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:36	03:38	05:01	06:29	07:52	08:22	09:48
	15:11	16:40	18:05	20:33	22:02	23:27	23:35	22:14	20:31	18:49	16:09	14:58
7	10:04	08:51	07:21	06:35	04:56	03:34	03:40	05:03	06:32	07:54	08:25	09:50
	15:13	16:44	18:08	20:36	22:05	23:29	23:33	22:11	20:28	18:45	16:06	14:57
8	10:02	08:48	07:17	06:32	04:53	03:33	03:42	05:06	06:35	07:57	08:28	09:52
	15:16	16:47	18:11	20:39	22:08	23:31	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:49	03:31	03:44	05:09	06:38	08:00	08:31	09:54
	15:18	16:50	18:14	20:42	22:11	23:33	23:29	22:05	20:21	18:39	16:00	14:54
10	09:59	08:42	07:11	06:25	04:46	03:30	03:46	05:12	06:40	08:03	08:34	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:27	22:01	20:17	18:35	15:57	14:53
11	09:58	08:39	07:07	06:22	04:43	03:28	03:48	05:15	06:43	08:06	08:38	09:58
	15:23	16:56	18:20	20:48	22:17	23:37	23:25	21:58	20:14	18:32	15:54	14:52
12	09:56	08:35	07:04	06:18	04:40	03:27	03:51	05:18	06:46	08:08	08:41	10:00
	15:26	16:59	18:22	20:51	22:20	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:32	07:01	06:15	04:37	03:26	03:53	05:21	06:48	08:11	08:44	10:01
	15:28	17:02	18:25	20:53	22:23	23:40	23:21	21:52	20:07	18:25	15:49	14:51
14	09:52	08:29	06:57	06:12	04:34	03:25	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:05	18:28	20:56	22:26	23:41	23:19	21:48	20:04	18:22	15:46	14:50
15	09:50	08:26	06:54	06:08	04:31	03:24	03:58	05:27	06:54	08:17	08:50	10:04
	15:34	17:08	18:31	20:59	22:29	23:42	23:16	21:45	20:00	18:19	15:43	14:50
16	09:48	08:23	06:50	06:05	04:28	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:36	17:11	18:34	21:02	22:32	23:43	23:14	21:42	19:57	18:15	15:41	14:49
17	09:46	08:20	06:47	06:01	04:25	03:23	04:03	05:33	06:59	08:23	08:56	10:07
	15:39	17:15	18:37	21:05	22:35	23:44	23:12	21:39	19:53	18:12	15:38	14:49
18	09:44	08:17	06:44	05:58	04:22	03:23	04:06	05:36	07:02	08:26	08:59	10:08
	15:42	17:18	18:40	21:08	22:37	23:45	23:09	21:35	19:50	18:09	15:35	14:49
19	09:42	08:13	06:40	05:55	04:20	03:22	04:09	05:39	07:05	08:28	09:02	10:09
	15:45	17:21	18:42	21:11	22:40	23:45	23:07	21:32	19:47	18:05	15:33	14:49
20	09:39	08:10	06:37	05:51	04:17	03:22	04:11	05:41	07:08	08:31	09:05	10:10
	15:48	17:24	18:45	21:14	22:43	23:46	23:04	21:29	19:43	18:02	15:30	14:49
21	09:37	08:07	06:33	05:48	04:14	03:22	04:14	05:44	07:10	08:34	09:08	10:11
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:11	03:22	04:17	05:47	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:59	21:22	19:36	17:56	15:25	14:50
23	09:32	08:01	06:27	05:41	04:08	03:22	04:20	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:52	15:23	14:51
24	09:30	07:57	06:23	05:38	04:06	03:23	04:23	05:53	07:18	08:43	09:16	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:29	17:49	15:21	14:51
25	09:27	07:54	06:20	05:35	04:03	03:23	04:25	05:56	07:21	07:46	09:19	10:12
	16:03	17:39	18:59	21:29	22:58	23:46	22:50	21:12	19:26	17:46	15:18	14:52
26	09:24	07:51	06:16	05:31	04:00	03:24	04:28	05:59	07:24	07:49	09:22	10:12
	16:06	17:42	19:02	21:32	23:00	23:46	22:47	21:08	19:23	16:43	15:16	14:53
27	09:22	07:47	06:13	05:28	03:58	03:25	04:31	06:01	07:27	07:52	09:25	10:12
	16:09	17:45	19:05	21:34	23:03	23:45	22:44	21:05	19:19	16:40	15:14	14:54
28	09:19	07:44	06:09	05:25	03:55	03:26	04:34	06:04	07:29	07:55	09:28	10:12
	16:12	17:48	19:08	21:37	23:06	23:44	22:42	21:02	19:16	16:37	15:12	14:55
29	09:16		07:06	05:22	03:53	03:27	04:37	06:07	07:32	07:58	09:30	10:12
	16:15		20:11	21:40	23:08	23:44	22:39	20:58	19:12	16:33	15:10	14:56
30	09:14		07:03	05:18	03:51	03:28	04:40	06:10	07:35	08:01	09:33	10:12
	16:18		20:13	21:43	23:11	23:43	22:36	20:55	19:09	16:30	15:08	14:58
31	09:11		06:59		03:48		04:43	06:13		08:04		10:11
	16:22		20:16		23:14		22:33	20:52		16:27		14:59
Potential sun hours	182	242	363	447	559	605	594	502	392	308	206	151
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)	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:

Merkkikallio

Licensed user:

FCG Suunnittelu ja tekniikka Oy
Osmontie 34, PO Box 950
FI-00601 Helsinki
+358104095666
Hans Vadback / hans.vadback@fcg.fi
Calculated:
10.6.2016 9:21/3.0.619

SHADOW - Calendar

Calculation: V136 x 15 x HH172 real case_forest lukeShadow receptor: G - Lomarakenus/Partiomaja (Korpilahdenkuja 134)
Assumptions for shadow calculations Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1,03 2,53 3,97 6,77 9,62 10,20 9,62 7,58 5,07 2,64 1,20 0,65

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
950 485 257 338 655 682 961 1 447 1 196 618 441 434 8 465
Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:46	03:30	04:46	06:15	07:38	08:07	09:35
	15:02	16:25	17:51	20:19	21:46	23:16	23:41	22:29	20:48	19:06	16:24	15:06
2	10:09	09:05	07:37	06:52	05:12	03:44	03:31	04:49	06:18	07:40	08:10	09:38
	15:04	16:28	17:54	20:22	21:49	23:18	23:40	22:26	20:45	19:02	16:21	15:05
3	10:08	09:02	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:40
	15:05	16:31	17:56	20:25	21:52	23:20	23:39	22:23	20:41	18:59	16:18	15:03
4	10:07	08:59	07:31	06:46	05:05	03:40	03:35	04:55	06:24	07:46	08:16	09:43
	15:07	16:34	17:59	20:28	21:55	23:23	23:38	22:20	20:38	18:55	16:15	15:01
5	10:06	08:56	07:27	06:42	05:02	03:38	03:36	04:58	06:27	07:49	08:19	09:45
	15:09	16:37	18:02	20:30	21:58	23:25	23:36	22:17	20:34	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:36	03:38	05:01	06:29	07:51	08:22	09:48
	15:12	16:41	18:05	20:33	22:01	23:27	23:34	22:14	20:31	18:49	16:09	14:58
7	10:04	08:51	07:21	06:35	04:56	03:35	03:40	05:04	06:32	07:54	08:25	09:50
	15:14	16:44	18:08	20:36	22:04	23:29	23:33	22:11	20:28	18:45	16:06	14:57
8	10:02	08:48	07:17	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:28	09:52
	15:16	16:47	18:11	20:39	22:07	23:31	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:44	05:10	06:38	08:00	08:31	09:54
	15:18	16:50	18:14	20:42	22:10	23:33	23:29	22:04	20:21	18:39	16:00	14:55
10	09:59	08:42	07:11	06:25	04:47	03:30	03:46	05:12	06:40	08:03	08:34	09:56
	15:21	16:53	18:17	20:45	22:13	23:35	23:27	22:01	20:17	18:35	15:57	14:54
11	09:57	08:38	07:07	06:22	04:43	03:29	03:49	05:15	06:43	08:06	08:37	09:58
	15:23	16:56	18:20	20:48	22:16	23:36	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:35	07:04	06:18	04:40	03:28	03:51	05:18	06:46	08:08	08:40	09:59
	15:26	16:59	18:22	20:50	22:19	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:32	07:01	06:15	04:37	03:26	03:53	05:21	06:48	08:11	08:43	10:01
	15:29	17:02	18:25	20:53	22:22	23:39	23:21	21:51	20:07	18:25	15:49	14:51
14	09:52	08:29	06:57	06:12	04:34	03:26	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:05	18:28	20:56	22:25	23:40	23:18	21:48	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:08	04:31	03:25	03:58	05:27	06:54	08:17	08:50	10:04
	15:34	17:08	18:31	20:59	22:28	23:42	23:16	21:45	20:00	18:19	15:43	14:50
16	09:48	08:23	06:50	06:05	04:28	03:24	04:01	05:30	06:57	08:20	08:53	10:05
	15:37	17:12	18:34	21:02	22:31	23:43	23:14	21:42	19:57	18:15	15:41	14:50
17	09:46	08:20	06:47	06:01	04:25	03:23	04:04	05:33	06:59	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:34	23:43	23:11	21:38	19:53	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	03:23	04:06	05:36	07:02	08:25	08:59	10:08
	15:42	17:18	18:40	21:08	22:37	23:44	23:09	21:35	19:50	18:09	15:36	14:49
19	09:41	08:13	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:28	09:02	10:09
	15:45	17:21	18:42	21:11	22:40	23:45	23:06	21:32	19:47	18:06	15:33	14:49
20	09:39	08:10	06:37	05:51	04:17	03:22	04:12	05:42	07:08	08:31	09:05	10:10
	15:48	17:24	18:45	21:14	22:43	23:45	23:04	21:28	19:43	18:02	15:30	14:50
21	09:37	08:07	06:33	05:48	04:14	03:22	04:14	05:44	07:10	08:34	09:08	10:10
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:34	08:04	06:30	05:45	04:11	03:23	04:17	05:47	07:13	08:37	09:10	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:58	21:22	19:36	17:56	15:26	14:50
23	09:32	08:00	06:27	05:41	04:09	03:23	04:20	05:50	07:16	08:40	09:13	10:11
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:18	19:33	17:53	15:23	14:51
24	09:29	07:57	06:23	05:38	04:06	03:23	04:23	05:53	07:18	08:43	09:16	10:12
	16:00	17:36	18:57	21:25	22:55	23:46	22:53	21:15	19:29	17:49	15:21	14:52
25	09:27	07:54	06:20	05:35	04:03	03:24	04:26	05:56	07:21	07:46	09:19	10:12
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26	09:24	07:51	06:16	05:31	04:01	03:24	04:29	05:59	07:24	07:49	09:22	10:12
	16:06	17:42	19:02	21:31	23:00	23:45	22:47	21:08	19:23	16:43	15:16	14:53
27	09:22	07:47	06:13	05:28	03:58	03:25	04:31	06:01	07:27	07:52	09:25	10:12
	16:09	17:45	19:05	21:34	23:03	23:45	22:44	21:05	19:19	16:40	15:14	14:54
28	09:19	07:44	06:10	05:25	03:56	03:26	04:34	06:04	07:29	07:55	09:27	10:12
	16:12	17:48	19:08	21:37	23:05	23:44	22:41	21:02	19:16	16:37	15:12	14:55
29	09:16		07:06	05:22	03:53	03:27	04:37	06:07	07:32	07:58	09:30	10:12
	16:16		20:11	21:40	23:08	23:43	22:38	20:58	19:12	16:33	15:10	14:57
30	09:14		07:03	05:18	03:51	03:29	04:40	06:10	07:35	08:01	09:33	10:11
	16:19		20:13	21:43	23:11	23:42	22:35	20:55	19:09	16:30	15:08	14:58
31	09:11		06:59		03:49		04:43	06:13		08:04		10:11
	16:22		20:16		23:13		22:32	20:51		16:27		15:00
Potential sun hours	182	243	363	447	559	604	593	502	392	308	206	152
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)	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)

SHADOW - Calendar

Calculation: V136 x 15 x HH172 real case_forest lukeShadow receptor: H - Asuinrakennus (Kotkannevantie 269)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:35
	15:02	16:25	17:51	20:19	21:46	23:15	23:41	22:29	20:48	19:06	16:24	15:07
2	10:09	09:05	07:37	06:53	05:12	03:45	03:32	04:49	06:18	07:40	08:10	09:38
	15:04	16:28	17:54	20:22	21:49	23:18	23:40	22:26	20:45	19:02	16:21	15:05
3	10:08	09:02	07:34	06:49	05:09	03:43	03:33	04:52	06:21	07:43	08:13	09:40
	15:06	16:31	17:57	20:25	21:52	23:20	23:39	22:23	20:41	18:59	16:18	15:03
4	10:07	08:59	07:31	06:46	05:06	03:41	03:35	04:55	06:24	07:46	08:16	09:43
	15:08	16:35	18:00	20:28	21:55	23:22	23:37	22:20	20:38	18:56	16:15	15:02
5	10:06	08:56	07:28	06:42	05:03	03:39	03:37	04:58	06:27	07:49	08:19	09:45
	15:10	16:38	18:02	20:30	21:58	23:25	23:36	22:17	20:34	18:52	16:12	15:00
6	10:05	08:53	07:24	06:39	04:59	03:37	03:39	05:01	06:29	07:52	08:22	09:47
	15:12	16:41	18:05	20:33	22:01	23:27	23:34	22:14	20:31	18:49	16:09	14:59
7	10:03	08:51	07:21	06:36	04:56	03:35	03:41	05:04	06:32	07:54	08:25	09:50
	15:14	16:44	18:08	20:36	22:04	23:29	23:32	22:11	20:28	18:46	16:06	14:57
8	10:02	08:48	07:17	06:32	04:53	03:34	03:43	05:07	06:35	07:57	08:28	09:52
	15:16	16:47	18:11	20:39	22:07	23:31	23:31	22:07	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:45	05:10	06:38	08:00	08:31	09:54
	15:19	16:50	18:14	20:42	22:10	23:33	23:29	22:04	20:21	18:39	16:01	14:55
10	09:59	08:41	07:11	06:25	04:47	03:31	03:47	05:13	06:40	08:03	08:34	09:56
	15:21	16:53	18:17	20:45	22:13	23:34	23:27	22:01	20:17	18:35	15:58	14:54
11	09:57	08:38	07:07	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:37	09:57
	15:24	16:56	18:20	20:48	22:16	23:36	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:35	07:04	06:19	04:41	03:28	03:52	05:19	06:46	08:08	08:40	09:59
	15:26	16:59	18:23	20:50	22:19	23:37	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:32	07:01	06:15	04:38	03:27	03:54	05:22	06:49	08:11	08:43	10:01
	15:29	17:03	18:25	20:53	22:22	23:39	23:21	21:51	20:07	18:25	15:49	14:52
14	09:52	08:29	06:57	06:12	04:35	03:26	03:56	05:24	06:51	08:14	08:46	10:02
	15:32	17:06	18:28	20:56	22:25	23:40	23:18	21:48	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:08	04:32	03:25	03:59	05:27	06:54	08:17	08:49	10:04
	15:34	17:09	18:31	20:59	22:28	23:41	23:16	21:45	20:00	18:19	15:44	14:51
16	09:48	08:23	06:50	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:52	10:05
	15:37	17:12	18:34	21:02	22:31	23:42	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:24	04:04	05:33	07:00	08:23	08:56	10:06
	15:40	17:15	18:37	21:05	22:34	23:43	23:11	21:38	19:53	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	03:23	04:07	05:36	07:02	08:26	08:59	10:08
	15:43	17:18	18:40	21:08	22:37	23:44	23:09	21:35	19:50	18:09	15:36	14:50
19	09:41	08:13	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:28	09:01	10:09
	15:46	17:21	18:42	21:11	22:40	23:44	23:06	21:32	19:47	18:06	15:33	14:50
20	09:39	08:10	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:31	09:04	10:09
	15:49	17:24	18:45	21:14	22:43	23:45	23:03	21:28	19:43	18:02	15:31	14:50
21	09:37	08:07	06:33	05:48	04:14	03:23	04:15	05:45	07:10	08:34	09:07	10:10
	15:51	17:27	18:48	21:17	22:46	23:45	23:01	21:25	19:40	17:59	15:28	14:50
22	09:34	08:04	06:30	05:45	04:12	03:23	04:18	05:47	07:13	08:37	09:10	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:58	21:22	19:36	17:56	15:26	14:51
23	09:32	08:00	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:13	10:11
	15:57	17:33	18:54	21:22	22:52	23:46	22:55	21:18	19:33	17:53	15:24	14:51
24	09:29	07:57	06:23	05:38	04:06	03:24	04:23	05:53	07:19	08:43	09:16	10:12
	16:00	17:36	18:57	21:25	22:54	23:45	22:53	21:15	19:30	17:50	15:21	14:52
25	09:27	07:54	06:20	05:35	04:04	03:24	04:26	05:56	07:21	07:46	09:19	10:12
	16:04	17:39	18:59	21:28	22:57	23:45	22:50	21:12	19:26	17:46	15:19	14:53
26	09:24	07:51	06:16	05:32	04:01	03:25	04:29	05:59	07:24	07:49	09:22	10:12
	16:07	17:42	19:02	21:31	23:00	23:45	22:47	21:08	19:23	16:43	15:17	14:54
27	09:22	07:47	06:13	05:28	03:59	03:26	04:32	06:02	07:27	07:52	09:25	10:12
	16:10	17:45	19:05	21:34	23:03	23:44	22:44	21:05	19:19	16:40	15:15	14:55
28	09:19	07:44	06:10	05:25	03:56	03:27	04:35	06:04	07:29	07:55	09:27	10:12
	16:13	17:48	19:08	21:37	23:05	23:44	22:41	21:02	19:16	16:37	15:13	14:56
29	09:16		07:06	05:22	03:54	03:28	04:38	06:07	07:32	07:58	09:30	10:11
	16:16		20:11	21:40	23:08	23:43	22:38	20:58	19:13	16:34	15:11	14:57
30	09:13		07:03	05:19	03:51	03:29	04:40	06:10	07:35	08:01	09:33	10:11
	16:19		20:14	21:43	23:10	23:42	22:35	20:55	19:09	16:31	15:09	14:59
31	09:11		06:59		03:49		04:43	06:13		08:04		10:10
	16:22		20:16		23:13		22:32	20:51		16:27		15:00
Potential sun hours	183	243	363	447	558	604	593	502	392	308	207	152
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)	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:

Merkkikallio

Licensed user:

FCG Suunnittelu ja tekniikka Oy
Osmontie 34, PO Box 950
FI-00601 Helsinki
+358104095666
Hans Vadback / hans.vadback@fcg.fi
Calculated:
10.6.2016 9:21/3.0.619

SHADOW - Calendar

Calculation: V136 x 15 x HH172 real case_forest lukeShadow receptor: I - Asuinrakennus (Klumpintie 171)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:35
	15:02	16:25	17:51	20:19	21:46	23:16	23:41	22:29	20:48	19:06	16:25	15:07
2	10:09	09:05	07:38	06:53	05:12	03:45	03:32	04:49	06:19	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:49	23:18	23:40	22:26	20:45	19:03	16:21	15:05
3	10:08	09:02	07:34	06:49	05:09	03:43	03:33	04:52	06:21	07:43	08:13	09:40
	15:06	16:32	17:57	20:25	21:52	23:20	23:39	22:23	20:41	18:59	16:18	15:03
4	10:07	09:00	07:31	06:46	05:06	03:41	03:35	04:55	06:24	07:46	08:16	09:43
	15:08	16:35	18:00	20:28	21:55	23:23	23:37	22:20	20:38	18:56	16:15	15:02
5	10:06	08:57	07:28	06:42	05:03	03:39	03:37	04:58	06:27	07:49	08:19	09:45
	15:10	16:38	18:03	20:31	21:58	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:37	03:39	05:01	06:30	07:52	08:22	09:48
	15:12	16:41	18:05	20:33	22:01	23:27	23:34	22:14	20:31	18:49	16:09	14:59
7	10:04	08:51	07:21	06:36	04:56	03:35	03:41	05:04	06:32	07:54	08:25	09:50
	15:14	16:44	18:08	20:36	22:04	23:29	23:33	22:11	20:28	18:46	16:06	14:58
8	10:02	08:48	07:18	06:32	04:53	03:34	03:43	05:07	06:35	07:57	08:28	09:52
	15:17	16:47	18:11	20:39	22:07	23:31	23:31	22:08	20:24	18:42	16:04	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:45	05:10	06:38	08:00	08:31	09:54
	15:19	16:50	18:14	20:42	22:10	23:33	23:29	22:04	20:21	18:39	16:01	14:55
10	09:59	08:42	07:11	06:25	04:47	03:31	03:47	05:13	06:41	08:03	08:34	09:56
	15:21	16:53	18:17	20:45	22:13	23:34	23:27	22:01	20:18	18:36	15:58	14:54
11	09:57	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:37	09:58
	15:24	16:56	18:20	20:48	22:16	23:36	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:41	03:28	03:52	05:19	06:46	08:09	08:41	09:59
	15:26	17:00	18:23	20:51	22:19	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:32	07:01	06:15	04:38	03:27	03:54	05:22	06:49	08:11	08:44	10:01
	15:29	17:03	18:26	20:54	22:22	23:39	23:21	21:52	20:07	18:26	15:49	14:52
14	09:52	08:29	06:57	06:12	04:35	03:26	03:56	05:25	06:51	08:14	08:47	10:03
	15:32	17:06	18:28	20:56	22:25	23:40	23:18	21:48	20:04	18:22	15:47	14:51
15	09:50	08:26	06:54	06:09	04:32	03:25	03:59	05:27	06:54	08:17	08:50	10:04
	15:34	17:09	18:31	20:59	22:28	23:41	23:16	21:45	20:00	18:19	15:44	14:51
16	09:48	08:23	06:51	06:05	04:29	03:25	04:02	05:30	06:57	08:20	08:53	10:05
	15:37	17:12	18:34	21:02	22:31	23:42	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:24	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:34	23:43	23:11	21:39	19:54	18:12	15:39	14:50
18	09:44	08:17	06:44	05:58	04:23	03:24	04:07	05:36	07:02	08:26	08:59	10:08
	15:43	17:18	18:40	21:08	22:37	23:44	23:09	21:35	19:50	18:09	15:36	14:50
19	09:41	08:14	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:46	17:21	18:43	21:11	22:40	23:45	23:06	21:32	19:47	18:06	15:33	14:50
20	09:39	08:10	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:31	09:05	10:10
	15:49	17:24	18:45	21:14	22:43	23:45	23:04	21:29	19:43	18:03	15:31	14:50
21	09:37	08:07	06:34	05:48	04:15	03:23	04:15	05:45	07:11	08:34	09:08	10:10
	15:52	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:34	08:04	06:30	05:45	04:12	03:23	04:18	05:48	07:13	08:37	09:11	10:11
	15:55	17:30	18:51	21:20	22:49	23:46	22:58	21:22	19:37	17:56	15:26	14:51
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:13	10:11
	15:58	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:24	14:51
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	16:01	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:50	15:21	14:52
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	16:07	17:42	19:02	21:32	23:00	23:45	22:47	21:09	19:23	16:43	15:17	14:54
27	09:22	07:48	06:13	05:29	03:59	03:26	04:32	06:02	07:27	07:52	09:25	10:12
	16:10	17:45	19:05	21:34	23:03	23:45	22:44	21:05	19:19	16:40	15:15	14:55
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31	09:11		07:00		03:49		04:44	06:13		08:04		10:11
	16:22		20:16		23:13		22:32	20:52		16:28		15:00
Potential sun hours	183	243	363	447	558	604	593	502	392	308	207	152
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)	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)

SHADOW - Calendar

Calculation: V136 x 15 x HH172 real case_forest lukeShadow receptor: J - Asuinrakennus (Klumpvägen 170)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

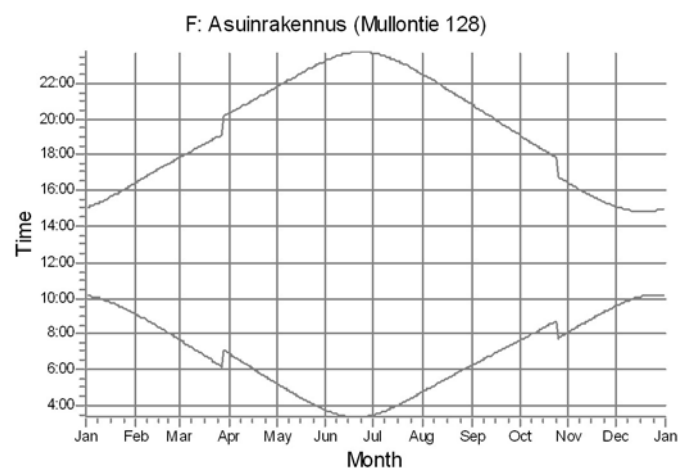
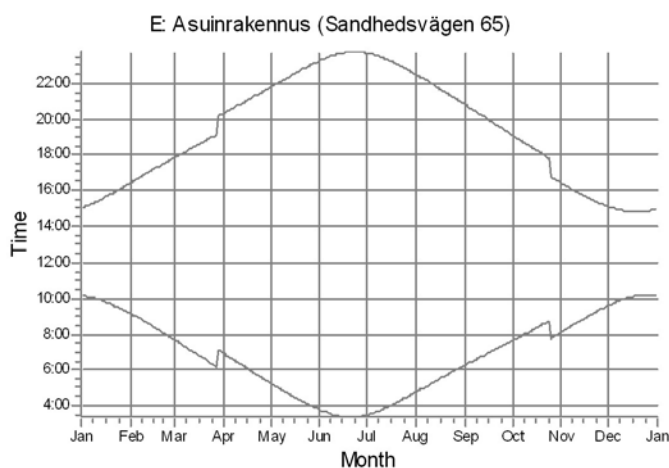
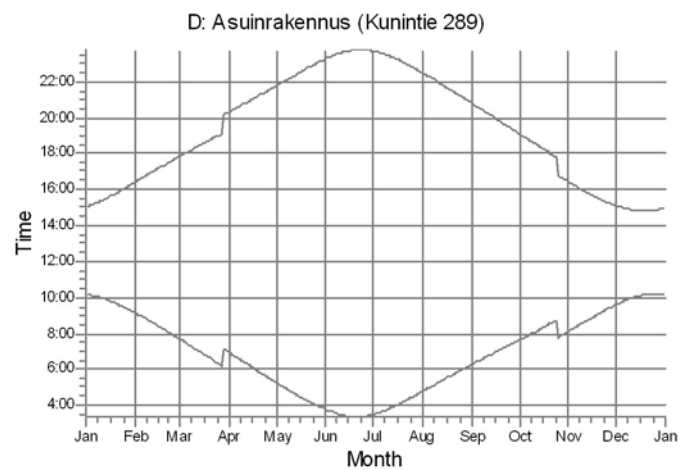
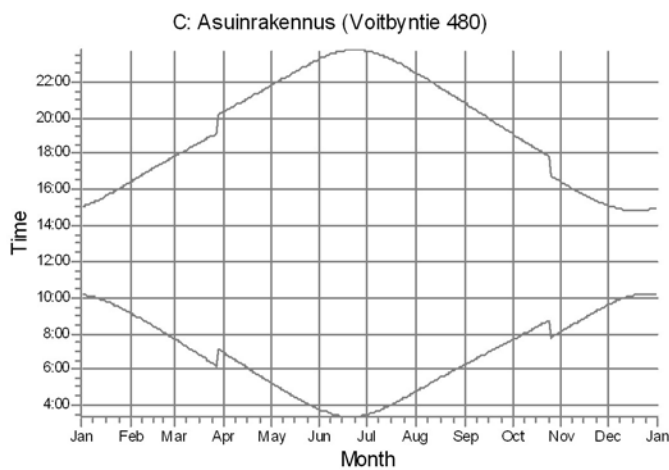
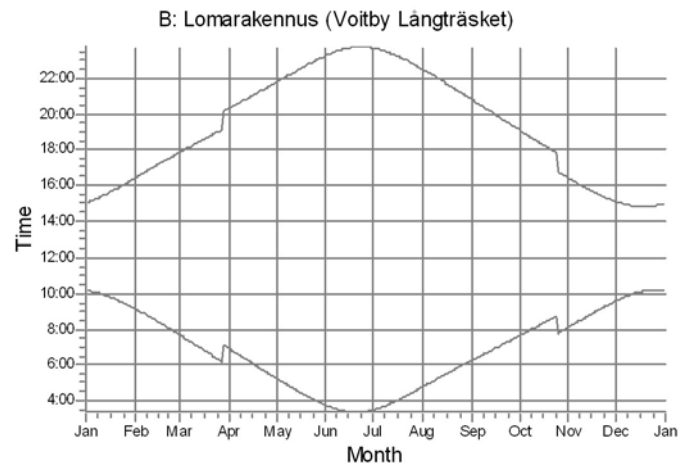
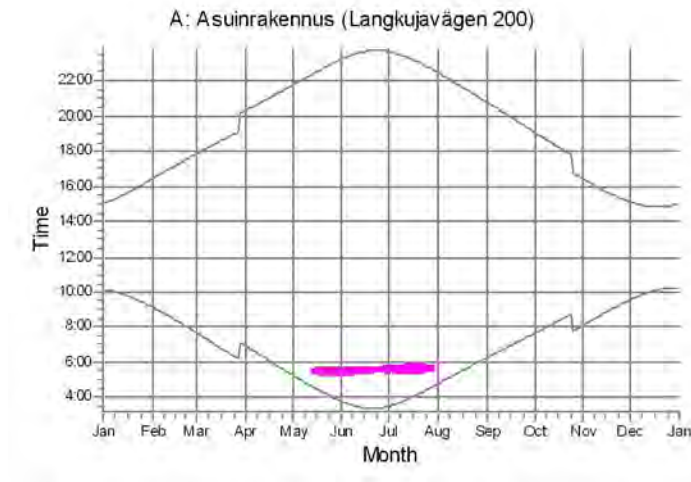
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	15:02	16:25	17:51	20:19	21:47	23:16	23:41	22:30	20:48	19:06	16:25	15:07
2	10:09	09:05	07:38	06:53	05:12	03:45	03:32	04:49	06:19	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:50	23:18	23:40	22:26	20:45	19:03	16:21	15:05
3	10:08	09:02	07:34	06:49	05:09	03:43	03:33	04:52	06:21	07:43	08:13	09:41
	15:06	16:32	17:57	20:25	21:53	23:20	23:39	22:23	20:42	18:59	16:18	15:03
4	10:07	09:00	07:31	06:46	05:06	03:41	03:35	04:55	06:24	07:46	08:16	09:43
	15:08	16:35	18:00	20:28	21:56	23:23	23:38	22:20	20:38	18:56	16:15	15:02
5	10:06	08:57	07:28	06:43	05:03	03:39	03:37	04:58	06:27	07:49	08:19	09:45
	15:10	16:38	18:03	20:31	21:59	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	05:00	03:37	03:39	05:01	06:30	07:52	08:22	09:48
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	15:14	16:44	18:08	20:36	22:05	23:29	23:33	22:11	20:28	18:46	16:06	14:58
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	15:19	16:50	18:14	20:42	22:11	23:33	23:29	22:05	20:21	18:39	16:01	14:55
10	09:59	08:42	07:11	06:26	04:47	03:31	03:47	05:13	06:41	08:03	08:35	09:56
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16	09:48	08:23	06:51	06:05	04:29	03:25	04:02	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:32	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:24	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:34	23:43	23:11	21:39	19:54	18:12	15:39	14:50
18	09:44	08:17	06:44	05:58	04:23	03:24	04:07	05:36	07:02	08:26	08:59	10:08
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	15:46	17:21	18:43	21:11	22:40	23:45	23:06	21:32	19:47	18:06	15:33	14:50
20	09:39	08:10	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:32	09:05	10:10
	15:49	17:24	18:46	21:14	22:43	23:45	23:04	21:29	19:43	18:03	15:31	14:50
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	16:19		20:14	21:44	23:11	23:42	22:36	20:55	19:09	16:31	15:09	14:59
31	09:11		07:00		03:49		04:44	06:13		08:04		10:11
	16:22		20:17		23:13		22:33	20:52		16:28		15:00
Potential sun hours	183	243	363	447	558	604	593	502	392	308	207	152
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)	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, graphical

Calculation: V136 x 15 x HH172 real case_forest luke

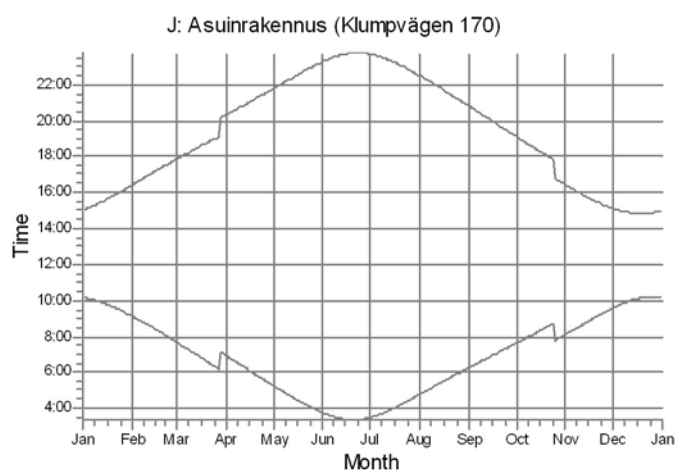
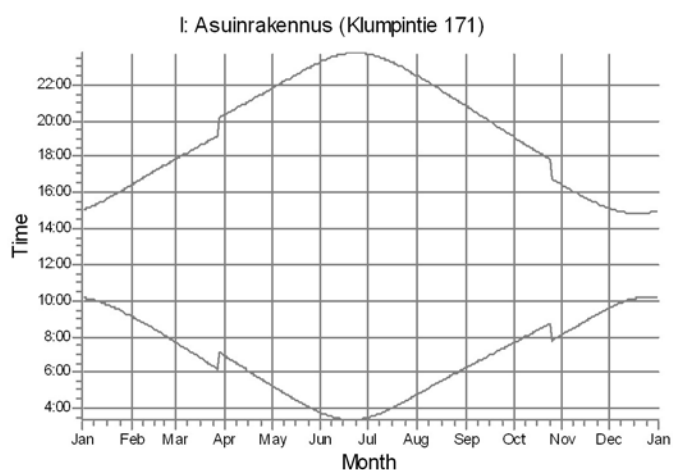
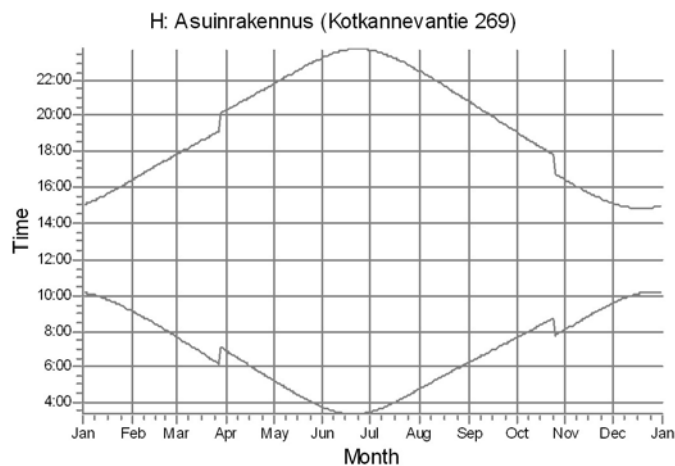
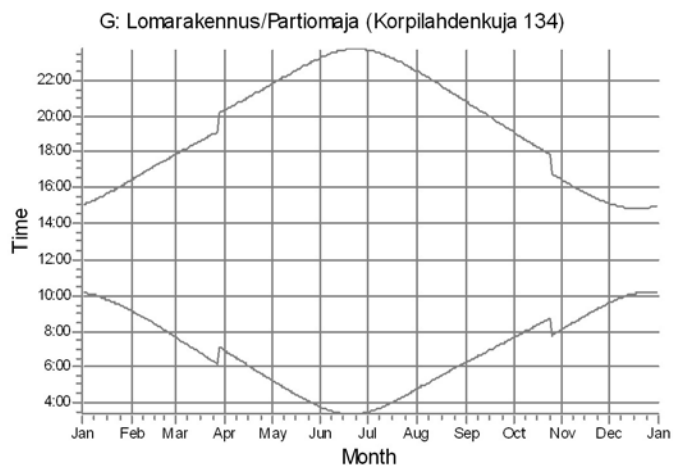


WTGs

T11: T11

SHADOW - Calendar, graphical

Calculation: V136 x 15 x HH172 real case_forest luke



WTGs

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_forest lukeWTG: T1 - T1

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:46	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:46	23:16	23:42	22:29	20:48	19:06	16:24	15:06
2	10:09	09:05	07:38	06:53	05:12	03:44	03:31	04:49	06:18	07:40	08:10	09:38
	15:04	16:28	17:54	20:22	21:49	23:18	23:40	22:26	20:45	19:02	16:21	15:05
3	10:08	09:02	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:41
	15:05	16:31	17:57	20:25	21:52	23:21	23:39	22:23	20:41	18:59	16:18	15:03
4	10:07	09:00	07:31	06:46	05:06	03:40	03:35	04:55	06:24	07:46	08:16	09:43
	15:07	16:34	17:59	20:28	21:55	23:23	23:38	22:20	20:38	18:56	16:15	15:01
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12	09:56	08:35	07:04	06:18	04:40	03:28	03:51	05:18	06:46	08:08	08:41	10:00
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21	09:37	08:07	06:33	05:48	04:14	03:22	04:14	05:44	07:10	08:34	09:08	10:10
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:11	03:23	04:17	05:47	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:58	21:22	19:36	17:56	15:26	14:50
23	09:32	08:01	06:27	05:41	04:09	03:23	04:20	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:57	06:23	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:16	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:49	15:21	14:52
25	09:27	07:54	06:20	05:35	04:03	03:24	04:26	05:56	07:21	07:46	09:19	10:12
	16:03	17:39	18:59	21:29	22:57	23:46	22:50	21:12	19:26	16:46	15:19	14:52
26	09:24	07:51	06:16	05:32	04:01	03:24	04:29	05:59	07:24	07:49	09:22	10:12
	16:06	17:42	19:02	21:32	23:00	23:45	22:47	21:08	19:23	16:43	15:16	14:53
27	09:22	07:47	06:13	05:28	03:58	03:25	04:31	06:01	07:27	07:52	09:25	10:12
	16:09	17:45	19:05	21:34	23:03	23:45	22:44	21:05	19:19	16:40	15:14	14:54
28	09:19	07:44	06:10	05:25	03:56	03:26	04:34	06:04	07:29	07:55	09:28	10:12
	16:12	17:48	19:08	21:37	23:06	23:44	22:41	21:02	19:16	16:37	15:12	14:55
29	09:16		07:06	05:22	03:53	03:27	04:37	06:07	07:32	07:58	09:30	10:12
	16:16		20:11	21:40	23:08	23:43	22:39	20:58	19:13	16:34	15:10	14:57
30	09:14		07:03	05:18	03:51	03:28	04:40	06:10	07:35	08:01	09:33	10:11
	16:19		20:14	21:43	23:11	23:43	22:36	20:55	19:09	16:30	15:08	14:58
31	09:11		06:59		03:49		04:43	06:13		08:04		10:11
	16:22		20:16		23:13		22:33	20:52		16:27		15:00
Potential sun hours	182	242	363	447	559	604	593	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_forest lukeWTG: T10 - T10

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16	23:41	22:30	20:48	19:06	16:24	15:07
2	10:09	09:05	07:38	06:53	05:12	03:45	03:32	04:49	06:18	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:50	23:18	23:40	22:26	20:45	19:02	16:21	15:05
3	10:08	09:02	07:34	06:49	05:09	03:43	03:33	04:52	06:21	07:43	08:13	09:41
	15:06	16:31	17:57	20:25	21:53	23:21	23:39	22:23	20:41	18:59	16:18	15:03
4	10:07	09:00	07:31	06:46	05:06	03:41	03:35	04:55	06:24	07:46	08:16	09:43
	15:08	16:35	18:00	20:28	21:56	23:23	23:38	22:20	20:38	18:56	16:15	15:02
5	10:06	08:57	07:28	06:42	05:03	03:39	03:37	04:58	06:27	07:49	08:19	09:45
	15:10	16:38	18:03	20:31	21:59	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:37	03:38	05:01	06:30	07:52	08:22	09:48
	15:12	16:41	18:05	20:34	22:02	23:27	23:35	22:14	20:31	18:49	16:09	14:59
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:55	08:25	09:50
	15:14	16:44	18:08	20:36	22:05	23:29	23:33	22:11	20:28	18:46	16:06	14:57
8	10:02	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:28	09:52
	15:16	16:47	18:11	20:39	22:08	23:31	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:45	05:10	06:38	08:00	08:31	09:54
	15:19	16:50	18:14	20:42	22:11	23:33	23:29	22:05	20:21	18:39	16:01	14:55
10	09:59	08:42	07:11	06:25	04:47	03:30	03:47	05:13	06:41	08:03	08:35	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:27	22:01	20:18	18:36	15:58	14:54
11	09:58	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:24	16:56	18:20	20:48	22:17	23:36	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:41	03:28	03:51	05:19	06:46	08:09	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:32	07:01	06:15	04:38	03:27	03:54	05:22	06:49	08:11	08:44	10:01
	15:29	17:03	18:26	20:54	22:23	23:39	23:21	21:52	20:07	18:26	15:49	14:51
14	09:52	08:29	06:57	06:12	04:35	03:26	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:06	18:28	20:56	22:26	23:41	23:19	21:48	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:08	04:32	03:25	03:59	05:27	06:54	08:17	08:50	10:04
	15:34	17:09	18:31	20:59	22:29	23:42	23:16	21:45	20:00	18:19	15:44	14:50
16	09:48	08:23	06:51	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:32	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:24	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:35	23:44	23:11	21:39	19:54	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	03:23	04:07	05:36	07:02	08:26	08:59	10:08
	15:43	17:18	18:40	21:08	22:37	23:44	23:09	21:35	19:50	18:09	15:36	14:50
19	09:42	08:14	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:46	17:21	18:43	21:11	22:40	23:45	23:06	21:32	19:47	18:06	15:33	14:50
20	09:39	08:10	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:31	09:05	10:10
	15:48	17:24	18:45	21:14	22:43	23:45	23:04	21:29	19:43	18:03	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:23	04:15	05:45	07:10	08:34	09:08	10:10
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:12	03:23	04:17	05:47	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:58	21:22	19:37	17:56	15:26	14:51
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:57	06:23	05:38	04:06	03:24	04:23	05:53	07:19	08:43	09:16	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:50	15:21	14:52
25	09:27	07:54	06:20	05:35	04:04	03:24	04:26	05:56	07:21	07:46	09:19	10:12
	16:03	17:39	19:00	21:29	22:57	23:46	22:50	21:12	19:26	16:46	15:19	14:53
26	09:24	07:51	06:17	05:32	04:01	03:25	04:29	05:59	07:24	07:49	09:22	10:12
	16:07	17:42	19:02	21:32	23:00	23:45	22:47	21:09	19:23	16:43	15:17	14:54
27	09:22	07:48	06:13	05:28	03:58	03:26	04:32	06:02	07:27	07:52	09:25	10:12
	16:10	17:45	19:05	21:35	23:03	23:45	22:44	21:05	19:19	16:40	15:15	14:55
28	09:19	07:44	06:10	05:25	03:56	03:27	04:35	06:04	07:30	07:55	09:28	10:12
	16:13	17:48	19:08	21:38	23:06	23:44	22:41	21:02	19:16	16:37	15:13	14:56
29	09:16		07:06	05:22	03:54	03:28	04:38	06:07	07:32	07:58	09:30	10:12
	16:16		20:11	21:41	23:08	23:43	22:39	20:58	19:13	16:34	15:11	14:57
30	09:14		07:03	05:19	03:51	03:29	04:40	06:10	07:35	08:01	09:33	10:11
	16:19		20:14	21:44	23:11	23:43	22:36	20:55	19:09	16:31	15:09	14:58
31	09:11		06:59		03:49		04:43	06:13		08:04		10:11
	16:22		20:16		23:13		22:33	20:52		16:28		15:00
Potential sun hours	183	243	363	447	559	604	593	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

Project:

Merkkikallio

Licensed user:

FCG Suunnittelu ja tekniikka Oy
Osmontie 34, PO Box 950
FI-00601 Helsinki
+358104095666
Hans Vadback / hans.vadback@fcg.fi
Calculated:
10.6.2016 9:21/3.0.619

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_forest lukeWTG: T11 - T11

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December	
1	10:10 15:02	09:08 16:25	07:41 17:51	06:56 20:19	05:15 21:47	03:47 23:16	05:21-05:42/21 23:42	03:30 22:30	05:29-05:44/15 22:30	04:46 20:48	06:16 19:06	07:38 16:24	08:07 15:07
2	10:09 15:04	09:05 16:28	07:38 17:54	06:53 20:22	05:12 21:50	03:45 23:18	05:20-05:41/21 23:40	03:32 23:40	05:30-05:45/15 22:27	04:49 20:45	06:18 19:03	07:41 16:21	08:10 15:05
3	10:08 15:06	09:03 16:31	07:34 17:57	06:49 20:25	05:09 21:53	03:42 23:21	05:21-05:41/20 23:39	03:33 23:39	05:30-05:45/15 22:23	04:52 20:42	06:21 18:59	07:43 16:18	08:13 15:03
4	10:07 15:08	09:00 16:35	07:31 18:00	06:46 20:28	05:06 21:56	03:40 23:23	05:22-05:42/20 23:38	03:35 23:38	05:29-05:46/17 22:20	04:55 20:38	06:24 18:56	07:46 16:15	08:16 15:02
5	10:06 15:10	08:57 16:38	07:28 18:03	06:42 20:31	05:03 21:59	03:39 23:25	05:22-05:41/19 23:36	03:37 23:36	05:29-05:46/17 22:17	04:58 20:35	06:27 18:52	07:49 16:12	08:19 15:00
6	10:05 15:12	08:54 16:41	07:24 18:05	06:39 20:34	04:59 22:02	03:37 23:27	05:22-05:41/19 23:35	03:38 23:35	05:29-05:47/18 22:14	05:01 20:31	06:30 18:49	07:52 16:09	08:22 14:59
7	10:04 15:14	08:51 16:44	07:21 18:08	06:36 20:36	04:56 22:05	03:35 23:29	05:23-05:41/18 23:33	03:40 23:33	05:28-05:47/19 22:11	05:04 20:28	06:32 18:46	07:55 16:06	08:25 14:57
8	10:02 15:16	08:48 16:47	07:18 18:11	06:32 20:39	04:53 22:08	03:33 23:31	05:23-05:40/17 23:31	03:42 23:31	05:29-05:48/19 22:08	05:07 20:24	06:35 18:42	07:57 16:03	08:28 14:56
9	10:01 15:19	08:45 16:50	07:14 18:14	06:29 20:42	04:50 22:11	03:32 23:33	05:24-05:40/16 23:29	03:45 23:29	05:28-05:48/20 22:05	05:10 20:21	06:38 18:39	08:00 16:01	08:32 14:55
10	09:59 15:21	08:42 16:53	07:11 18:17	06:25 20:45	04:47 22:14	03:30 23:35	05:24-05:40/16 23:27	03:47 23:27	05:28-05:49/21 22:01	05:13 20:18	06:41 18:36	08:03 16:58	08:35 14:54
11	09:58 15:24	08:39 16:56	07:08 18:20	06:22 20:48	04:44 22:17	03:29 23:36	05:26-05:40/14 23:25	03:49 23:25	05:29-05:49/20 21:58	05:16 20:14	06:43 18:32	08:06 16:55	08:38 14:53
12	09:56 15:26	08:36 16:59	07:04 18:23	06:19 20:51	04:41 22:20	03:28 23:38	05:26-05:40/14 23:23	03:51 23:23	05:29-05:50/21 21:55	05:19 20:11	06:46 18:29	08:09 16:52	08:41 14:52
13	09:54 15:29	08:33 17:03	07:01 18:26	06:15 20:54	04:38 22:23	03:27 23:39	05:26-05:39/13 23:39	03:54 23:21	05:28-05:49/21 21:52	05:22 20:07	06:49 18:26	08:11 16:49	08:44 14:51
14	09:52 15:31	08:29 17:06	06:57 18:28	06:07 20:56	06:12 22:26	03:26 23:41	05:27-05:40/13 23:19	03:56 23:19	05:28-05:50/22 21:48	05:24 20:04	06:51 18:22	08:14 16:46	08:47 14:51
15	09:50 15:34	08:26 17:09	06:54 18:31	06:09 20:59	04:32 22:29	03:25 23:42	05:27-05:39/12 23:24	03:59 23:16	05:28-05:50/22 21:45	05:27 20:01	06:54 18:19	08:17 16:44	08:50 14:50
16	09:48 15:37	08:23 17:12	06:51 18:34	06:05 21:02	04:29 22:32	03:24 23:43	05:28-05:39/11 23:43	04:01 23:14	05:28-05:50/22 21:42	05:30 19:57	06:57 18:16	08:20 16:41	08:53 14:50
17	09:46 15:40	08:20 17:15	06:47 18:37	06:02 21:05	04:26 22:35	03:24 23:44	05:28-05:39/11 23:44	04:04 23:12	05:28-05:50/22 21:39	05:33 19:54	07:00 18:12	08:23 16:38	08:56 14:50
18	09:44 15:43	08:17 17:18	06:44 18:40	05:58 21:08	04:23 22:38	03:23 23:44	05:29-05:39/10 23:44	04:07 23:09	05:28-05:50/22 21:35	05:36 19:50	07:02 18:09	08:26 16:53	08:59 14:50
19	09:42 15:46	08:14 17:21	06:40 18:43	05:55 21:11	04:20 22:40	03:23 23:45	05:29-05:39/10 23:45	04:09 23:07	05:29-05:51/22 21:32	05:39 19:47	07:05 18:06	08:29 16:53	09:02 14:50
20	09:39 15:48	08:10 17:24	06:37 18:45	05:52 21:14	04:17 22:43	03:23 23:46	05:29-05:39/10 23:46	04:12 23:04	05:29-05:51/22 21:29	05:42 19:43	07:08 18:03	08:32 16:51	09:05 14:50
21	09:37 15:51	08:07 17:27	06:34 18:48	05:48 21:17	04:14 22:46	03:23 23:46	05:30-05:39/9 23:46	04:15 23:01	05:29-05:51/22 21:25	05:45 19:40	07:11 17:59	08:34 16:58	09:08 14:50
22	09:35 15:54	08:04 17:30	06:30 18:51	05:45 21:20	04:12 22:49	03:23 23:46	05:30-05:39/9 23:46	04:17 22:59	05:29-05:50/21 21:22	05:48 19:37	07:13 17:56	08:37 16:56	09:11 14:51
23	09:32 15:57	08:01 17:33	06:27 18:54	05:42 21:23	04:09 22:52	03:23 23:46	05:30-05:40/10 23:46	04:20 22:56	05:30-05:50/20 21:19	05:50 19:33	07:16 17:53	08:40 16:53	09:14 14:51
24	09:30 16:00	07:57 17:36	06:23 18:57	05:38 21:26	04:06 22:55	03:24 23:46	05:30-05:40/10 23:46	04:23 22:53	05:31-05:50/19 21:15	05:53 19:30	07:19 17:50	08:43 16:51	09:17 14:52
25	09:27 16:03	07:54 17:39	06:20 19:00	05:35 21:29	04:04 22:58	03:24 23:46	05:31-05:41/10 23:46	04:26 22:50	05:31-05:49/18 21:12	05:56 19:26	07:21 16:46	07:46 16:19	09:19 14:53
26	09:25 16:07	07:51 17:42	06:17 19:02	05:32 21:32	04:01 23:00	03:25 23:45	05:30-05:41/11 23:45	04:29 22:47	05:32-05:48/16 21:09	05:59 19:23	07:24 16:43	07:49 16:17	09:22 14:54
27	09:22 16:10	07:48 17:45	06:13 19:05	05:28 21:35	03:58 23:03	03:26 23:45	05:30-05:42/12 23:45	04:32 22:44	05:33-05:48/15 21:05	06:02 19:20	07:27 16:40	07:52 16:15	09:25 14:55
28	09:19 16:13	07:44 17:48	06:10 19:08	05:25 21:38	03:56 23:06	03:26 23:44	05:30-05:43/13 23:44	04:35 22:42	05:34-05:46/12 21:02	06:05 19:16	07:30 16:37	07:55 16:13	09:28 14:56
29	09:17 16:16		07:06 20:11	05:22 21:41	03:54 23:08	03:28 23:43	05:29-05:42/13 23:43	04:38 22:39	05:37-05:45/8 20:58	06:07 19:13	07:32 16:34	07:58 16:11	09:30 14:57
30	09:14 16:19		07:03 20:14	05:19 21:44	03:51 23:11	03:29 23:43	05:29-05:43/14 23:43	04:40 22:36		06:10 20:55	07:35 19:09	08:01 16:31	09:33 15:09
31	09:11 16:22		07:00 20:17		03:49 23:13		05:20-05:41/21 23:13	04:43 22:33		06:13 20:52	08:04 16:28		10:11 15:00
Potential sun hours	183	243	363	447	559	604	416	593	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	337	604	416	543	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_forest lukeWTG: T12 - T12

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16	23:42	22:30	20:48	19:06	16:24	15:07
2	10:09	09:05	07:38	06:53	05:12	03:45	03:32	04:49	06:19	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:50	23:18	23:40	22:27	20:45	19:03	16:21	15:05
3	10:09	09:03	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:41
	15:06	16:31	17:57	20:25	21:53	23:21	23:39	22:24	20:42	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:06	03:40	03:35	04:55	06:24	07:46	08:16	09:43
	15:08	16:35	18:00	20:28	21:56	23:23	23:38	22:20	20:38	18:56	16:15	15:02
5	10:06	08:57	07:28	06:42	05:03	03:39	03:37	04:58	06:27	07:49	08:19	09:46
	15:10	16:38	18:03	20:31	21:59	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:37	03:38	05:01	06:30	07:52	08:22	09:48
	15:12	16:41	18:05	20:34	22:02	23:27	23:35	22:14	20:31	18:49	16:09	14:59
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:55	08:25	09:50
	15:14	16:44	18:08	20:36	22:05	23:29	23:33	22:11	20:28	18:46	16:06	14:57
8	10:03	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:29	09:52
	15:16	16:47	18:11	20:39	22:08	23:31	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:45	05:10	06:38	08:00	08:32	09:54
	15:19	16:50	18:14	20:42	22:11	23:33	23:29	22:05	20:21	18:39	16:01	14:55
10	09:59	08:42	07:11	06:25	04:47	03:30	03:47	05:13	06:41	08:03	08:35	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:27	22:01	20:18	18:36	15:58	14:54
11	09:58	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:24	16:56	18:20	20:48	22:17	23:37	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:41	03:28	03:51	05:19	06:46	08:09	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:33	07:01	06:15	04:38	03:27	03:54	05:22	06:49	08:11	08:44	10:01
	15:29	17:03	18:26	20:54	22:23	23:39	23:21	21:52	20:07	18:26	15:49	14:51
14	09:52	08:29	06:57	06:12	04:35	03:26	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:06	18:28	20:57	22:26	23:41	23:19	21:49	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:09	04:32	03:25	03:59	05:27	06:54	08:17	08:50	10:04
	15:34	17:09	18:31	20:59	22:29	23:42	23:16	21:45	20:01	18:19	15:44	14:50
16	09:48	08:23	06:51	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:32	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:24	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:35	23:44	23:12	21:39	19:54	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	03:23	04:07	05:36	07:02	08:26	08:59	10:08
	15:43	17:18	18:40	21:08	22:38	23:45	23:09	21:35	19:50	18:09	15:36	14:50
19	09:42	08:14	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:46	17:21	18:43	21:11	22:40	23:45	23:07	21:32	19:47	18:06	15:33	14:50
20	09:39	08:10	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:32	09:05	10:10
	15:48	17:24	18:45	21:14	22:43	23:46	23:04	21:29	19:43	18:03	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:23	04:15	05:45	07:11	08:34	09:08	10:11
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:12	03:23	04:17	05:47	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:59	21:22	19:37	17:56	15:26	14:51
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:57	06:23	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:17	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:50	15:21	14:52
25	09:27	07:54	06:20	05:35	04:04	03:24	04:26	05:56	07:21	07:46	09:19	10:12
	16:03	17:39	19:00	21:29	22:58	23:46	22:50	21:12	19:26	16:46	15:19	14:53
26	09:25	07:51	06:17	05:32	04:01	03:25	04:29	05:59	07:24	07:49	09:22	10:12
	16:07	17:42	19:02	21:32	23:00	23:46	22:47	21:09	19:23	16:43	15:17	14:53
27	09:22	07:48	06:13	05:28	03:58	03:25	04:32	06:02	07:27	07:52	09:25	10:12
	16:10	17:45	19:05	21:35	23:03	23:45	22:45	21:05	19:20	16:40	15:15	14:55
28	09:19	07:44	06:10	05:25	03:56	03:26	04:35	06:05	07:30	07:55	09:28	10:12
	16:13	17:48	19:08	21:38	23:06	23:44	22:42	21:02	19:16	16:37	15:12	14:56
29	09:17		07:06	05:22	03:54	03:28	04:37	06:07	07:32	07:58	09:30	10:12
	16:16		20:11	21:41	23:08	23:44	22:39	20:59	19:13	16:34	15:10	14:57
30	09:14		07:03	05:19	03:51	03:29	04:40	06:10	07:35	08:01	09:33	10:12
	16:19		20:14	21:44	23:11	23:43	22:36	20:55	19:09	16:31	15:09	14:58
31	09:11		07:00		03:49		04:43	06:13		08:04		10:11
	16:22		20:17		23:13		22:33	20:52		16:28		15:00
Potential sun hours	182	242	363	447	559	604	593	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_forest lukeWTG: T13 - T13

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16	23:42	22:30	20:48	19:06	16:24	15:07
2	10:10	09:06	07:38	06:53	05:12	03:44	03:31	04:49	06:18	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:50	23:19	23:41	22:27	20:45	19:03	16:21	15:05
3	10:09	09:03	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:41
	15:06	16:31	17:57	20:25	21:53	23:21	23:39	22:24	20:42	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:06	03:40	03:35	04:55	06:24	07:46	08:16	09:43
	15:07	16:35	18:00	20:28	21:56	23:23	23:38	22:21	20:38	18:56	16:15	15:02
5	10:07	08:57	07:28	06:42	05:02	03:38	03:36	04:58	06:27	07:49	08:19	09:46
	15:10	16:38	18:03	20:31	21:59	23:25	23:37	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:37	03:38	05:01	06:30	07:52	08:22	09:48
	15:12	16:41	18:05	20:34	22:02	23:27	23:35	22:14	20:31	18:49	16:09	14:59
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:55	08:26	09:50
	15:14	16:44	18:08	20:36	22:05	23:30	23:33	22:11	20:28	18:46	16:06	14:57
8	10:03	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:29	09:52
	15:16	16:47	18:11	20:39	22:08	23:31	23:31	22:08	20:25	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:44	05:10	06:38	08:00	08:32	09:54
	15:19	16:50	18:14	20:42	22:11	23:33	23:30	22:05	20:21	18:39	16:00	14:55
10	10:00	08:42	07:11	06:25	04:47	03:30	03:47	05:13	06:41	08:03	08:35	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:28	22:02	20:18	18:36	15:58	14:54
11	09:58	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:24	16:56	18:20	20:48	22:17	23:37	23:26	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:41	03:28	03:51	05:19	06:46	08:09	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:33	07:01	06:15	04:38	03:27	03:54	05:21	06:49	08:12	08:44	10:02
	15:29	17:03	18:26	20:54	22:23	23:40	23:21	21:52	20:07	18:26	15:49	14:51
14	09:52	08:30	06:57	06:12	04:35	03:26	03:56	05:24	06:52	08:14	08:47	10:03
	15:31	17:06	18:28	20:57	22:26	23:41	23:19	21:49	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:08	04:32	03:25	03:59	05:27	06:54	08:17	08:50	10:05
	15:34	17:09	18:31	20:59	22:29	23:42	23:17	21:45	20:01	18:19	15:44	14:50
16	09:48	08:23	06:51	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:32	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:23	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:35	23:44	23:12	21:39	19:54	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	03:23	04:06	05:36	07:02	08:26	08:59	10:08
	15:43	17:18	18:40	21:08	22:38	23:45	23:09	21:35	19:50	18:09	15:36	14:50
19	09:42	08:14	06:41	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:45	17:21	18:43	21:11	22:41	23:45	23:07	21:32	19:47	18:06	15:33	14:50
20	09:40	08:10	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:32	09:05	10:10
	15:48	17:24	18:46	21:14	22:44	23:46	23:04	21:29	19:43	18:03	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:23	04:15	05:45	07:11	08:35	09:08	10:11
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:12	03:23	04:17	05:47	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:59	21:22	19:37	17:56	15:26	14:50
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:58	06:23	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:17	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:50	15:21	14:52
25	09:27	07:54	06:20	05:35	04:03	03:24	04:26	05:56	07:21	07:46	09:20	10:12
	16:03	17:39	19:00	21:29	22:58	23:46	22:50	21:12	19:26	16:46	15:19	14:52
26	09:25	07:51	06:17	05:32	04:01	03:25	04:29	05:59	07:24	07:49	09:22	10:13
	16:06	17:42	19:02	21:32	23:01	23:46	22:48	21:09	19:23	16:43	15:17	14:53
27	09:22	07:48	06:13	05:28	03:58	03:25	04:32	06:02	07:27	07:52	09:25	10:13
	16:10	17:45	19:05	21:35	23:03	23:45	22:45	21:05	19:20	16:40	15:14	14:54
28	09:19	07:44	06:10	05:25	03:56	03:26	04:35	06:05	07:30	07:55	09:28	10:12
	16:13	17:48	19:08	21:38	23:06	23:45	22:42	21:02	19:16	16:37	15:12	14:56
29	09:17		07:06	05:22	03:53	03:27	04:37	06:07	07:32	07:58	09:31	10:12
	16:16		20:11	21:41	23:09	23:44	22:39	20:59	19:13	16:34	15:10	14:57
30	09:14		07:03	05:19	03:51	03:29	04:40	06:10	07:35	08:01	09:33	10:12
	16:19		20:14	21:44	23:11	23:43	22:36	20:55	19:09	16:31	15:08	14:58
31	09:11		07:00		03:49		04:43	06:13		08:04		10:11
	16:22		20:17		23:14		22:33	20:52		16:28		15:00
Potential sun hours	182	242	363	447	559	604	594	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_forest lukeWTG: T14 - T14

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16	23:42	22:30	20:48	19:06	16:24	15:07
2	10:10	09:06	07:38	06:53	05:12	03:44	03:31	04:49	06:18	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:50	23:19	23:41	22:27	20:45	19:03	16:21	15:05
3	10:09	09:03	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:41
	15:05	16:31	17:57	20:25	21:53	23:21	23:40	22:24	20:42	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:06	03:40	03:35	04:55	06:24	07:46	08:16	09:43
	15:07	16:34	18:00	20:28	21:56	23:23	23:38	22:21	20:38	18:56	16:15	15:01
5	10:07	08:57	07:28	06:42	05:02	03:38	03:36	04:58	06:27	07:49	08:19	09:46
	15:09	16:38	18:03	20:31	21:59	23:25	23:37	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:37	03:38	05:01	06:30	07:52	08:23	09:48
	15:12	16:41	18:05	20:34	22:02	23:28	23:35	22:14	20:31	18:49	16:09	14:58
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:55	08:26	09:50
	15:14	16:44	18:08	20:37	22:05	23:30	23:33	22:11	20:28	18:46	16:06	14:57
8	10:03	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:29	09:52
	15:16	16:47	18:11	20:39	22:08	23:32	23:32	22:08	20:25	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:44	05:10	06:38	08:00	08:32	09:54
	15:18	16:50	18:14	20:42	22:11	23:33	23:30	22:05	20:21	18:39	16:00	14:55
10	10:00	08:42	07:11	06:25	04:47	03:30	03:47	05:13	06:41	08:03	08:35	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:28	22:02	20:18	18:36	15:58	14:54
11	09:58	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:23	16:56	18:20	20:48	22:17	23:37	23:26	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:41	03:28	03:51	05:19	06:46	08:09	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:38	23:24	21:55	20:11	18:29	15:52	14:52
13	09:54	08:33	07:01	06:15	04:38	03:26	03:54	05:21	06:49	08:12	08:44	10:02
	15:29	17:03	18:26	20:54	22:23	23:40	23:21	21:52	20:07	18:26	15:49	14:51
14	09:52	08:30	06:58	06:12	04:35	03:26	03:56	05:24	06:52	08:14	08:47	10:03
	15:31	17:06	18:28	20:57	22:26	23:41	23:19	21:49	20:04	18:22	15:46	14:51
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16	09:48	08:23	06:51	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:32	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:23	04:04	05:33	07:00	08:23	08:56	10:07
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	15:43	17:18	18:40	21:08	22:38	23:45	23:09	21:35	19:50	18:09	15:36	14:50
19	09:42	08:14	06:41	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:45	17:21	18:43	21:11	22:41	23:45	23:07	21:32	19:47	18:06	15:33	14:50
20	09:40	08:11	06:37	05:52	04:17	03:22	04:12	05:42	07:08	08:32	09:05	10:10
	15:48	17:24	18:46	21:14	22:44	23:46	23:04	21:29	19:43	18:03	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:22	04:15	05:45	07:11	08:35	09:08	10:11
	15:51	17:27	18:48	21:17	22:47	23:46	23:02	21:26	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:11	03:23	04:17	05:47	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:59	21:22	19:37	17:56	15:26	14:50
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:47	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:58	06:23	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:17	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:50	15:21	14:52
25	09:27	07:54	06:20	05:35	04:03	03:24	04:26	05:56	07:21	07:46	09:20	10:13
	16:03	17:39	19:00	21:29	22:58	23:46	22:50	21:12	19:26	16:46	15:19	14:52
26	09:25	07:51	06:17	05:32	04:01	03:24	04:29	05:59	07:24	07:49	09:22	10:13
	16:06	17:42	19:02	21:32	23:01	23:46	22:48	21:09	19:23	16:43	15:17	14:53
27	09:22	07:48	06:13	05:28	03:58	03:25	04:32	06:02	07:27	07:52	09:25	10:13
	16:10	17:45	19:05	21:35	23:03	23:45	22:45	21:05	19:20	16:40	15:14	14:54
28	09:19	07:44	06:10	05:25	03:56	03:26	04:34	06:04	07:30	07:55	09:28	10:12
	16:13	17:48	19:08	21:38	23:06	23:45	22:42	21:02	19:16	16:37	15:12	14:56
29	09:17		07:06	05:22	03:53	03:27	04:37	06:07	07:32	07:58	09:31	10:12
	16:16		20:11	21:41	23:09	23:44	22:39	20:59	19:13	16:34	15:10	14:57
30	09:14		07:03	05:19	03:51	03:29	04:40	06:10	07:35	08:01	09:33	10:12
	16:19		20:14	21:44	23:11	23:43	22:36	20:55	19:09	16:31	15:08	14:58
31	09:11		07:00		03:49		04:43	06:13		08:04		10:11
	16:22		20:17		23:14		22:33	20:52		16:27		15:00
Potential sun hours	182	242	363	447	559	604	594	502	392	308	206	151
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_forest lukeWTG: T15 - T15

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16	23:42	22:30	20:48	19:06	16:24	15:07
2	10:10	09:06	07:38	06:53	05:12	03:45	03:32	04:49	06:19	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:50	23:18	23:41	22:27	20:45	19:03	16:21	15:05
3	10:09	09:03	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:44	08:13	09:41
	15:06	16:31	17:57	20:25	21:53	23:21	23:39	22:24	20:42	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:06	03:40	03:35	04:55	06:24	07:46	08:16	09:43
	15:08	16:35	18:00	20:28	21:56	23:23	23:38	22:21	20:38	18:56	16:15	15:02
5	10:07	08:57	07:28	06:43	05:03	03:39	03:37	04:58	06:27	07:49	08:19	09:46
	15:10	16:38	18:03	20:31	21:59	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:37	03:38	05:01	06:30	07:52	08:22	09:48
	15:12	16:41	18:06	20:34	22:02	23:27	23:35	22:14	20:31	18:49	16:09	14:59
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:55	08:26	09:50
	15:14	16:44	18:08	20:36	22:05	23:29	23:33	22:11	20:28	18:46	16:06	14:57
8	10:03	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:29	09:52
	15:16	16:47	18:11	20:39	22:08	23:31	23:31	22:08	20:25	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:45	05:10	06:38	08:00	08:32	09:54
	15:19	16:50	18:14	20:42	22:11	23:33	23:29	22:05	20:21	18:39	16:01	14:55
10	10:00	08:42	07:11	06:25	04:47	03:30	03:47	05:13	06:41	08:03	08:35	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:28	22:02	20:18	18:36	15:58	14:54
11	09:58	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:24	16:56	18:20	20:48	22:17	23:37	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:41	03:28	03:51	05:19	06:46	08:09	08:41	10:00
	15:26	17:00	18:23	20:51	22:20	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:33	07:01	06:15	04:38	03:27	03:54	05:22	06:49	08:12	08:44	10:02
	15:29	17:03	18:26	20:54	22:23	23:40	23:21	21:52	20:07	18:26	15:49	14:51
14	09:52	08:30	06:58	06:12	04:35	03:26	03:56	05:24	06:52	08:14	08:47	10:03
	15:31	17:06	18:29	20:57	22:26	23:41	23:19	21:49	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:09	04:32	03:25	03:59	05:27	06:54	08:17	08:50	10:05
	15:34	17:09	18:31	20:59	22:29	23:42	23:17	21:45	20:01	18:19	15:44	14:50
16	09:48	08:23	06:51	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:32	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:24	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:35	23:44	23:12	21:39	19:54	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	03:23	04:07	05:36	07:02	08:26	08:59	10:08
	15:43	17:18	18:40	21:08	22:38	23:45	23:09	21:35	19:50	18:09	15:36	14:50
19	09:42	08:14	06:41	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:46	17:21	18:43	21:11	22:41	23:45	23:07	21:32	19:47	18:06	15:33	14:50
20	09:40	08:10	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:32	09:05	10:10
	15:48	17:24	18:46	21:14	22:43	23:46	23:04	21:29	19:43	18:03	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:23	04:15	05:45	07:11	08:35	09:08	10:11
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:12	03:23	04:17	05:48	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:59	21:22	19:37	17:56	15:26	14:51
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:58	06:23	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:17	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:50	15:21	14:52
25	09:27	07:54	06:20	05:35	04:04	03:24	04:26	05:56	07:22	07:46	09:19	10:12
	16:03	17:39	19:00	21:29	22:58	23:46	22:50	21:12	19:26	16:46	15:19	14:53
26	09:25	07:51	06:17	05:32	04:01	03:25	04:29	05:59	07:24	07:49	09:22	10:12
	16:07	17:42	19:02	21:32	23:00	23:46	22:47	21:09	19:23	16:43	15:17	14:54
27	09:22	07:48	06:13	05:28	03:58	03:25	04:32	06:02	07:27	07:52	09:25	10:12
	16:10	17:45	19:05	21:35	23:03	23:45	22:45	21:05	19:20	16:40	15:15	14:55
28	09:19	07:44	06:10	05:25	03:56	03:26	04:35	06:05	07:30	07:55	09:28	10:12
	16:13	17:48	19:08	21:38	23:06	23:44	22:42	21:02	19:16	16:37	15:13	14:56
29	09:17		07:06	05:22	03:54	03:28	04:38	06:07	07:32	07:58	09:31	10:12
	16:16		20:11	21:41	23:08	23:44	22:39	20:59	19:13	16:34	15:11	14:57
30	09:14		07:03	05:19	03:51	03:29	04:40	06:10	07:35	08:01	09:33	10:12
	16:19		20:14	21:44	23:11	23:43	22:36	20:55	19:09	16:31	15:09	14:58
31	09:11		07:00		03:49		04:43	06:13		08:04		10:11
	16:22		20:17		23:14		22:33	20:52		16:28		15:00
Potential sun hours	182	242	363	447	559	604	593	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_forest lukeWTG: T2 - T2

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:46	23:16	23:42	22:30	20:48	19:06	16:24	15:07
2	10:09	09:05	07:38	06:53	05:12	03:44	03:31	04:49	06:18	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:49	23:18	23:40	22:26	20:45	19:02	16:21	15:05
3	10:08	09:02	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:41
	15:05	16:31	17:57	20:25	21:52	23:21	23:39	22:23	20:41	18:59	16:18	15:03
4	10:07	09:00	07:31	06:46	05:06	03:40	03:35	04:55	06:24	07:46	08:16	09:43
	15:07	16:34	17:59	20:28	21:55	23:23	23:38	22:20	20:38	18:56	16:15	15:01
5	10:06	08:57	07:28	06:42	05:02	03:38	03:36	04:58	06:27	07:49	08:19	09:45
	15:09	16:38	18:02	20:31	21:58	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:37	03:38	05:01	06:29	07:52	08:22	09:48
	15:12	16:41	18:05	20:33	22:02	23:27	23:35	22:14	20:31	18:49	16:09	14:58
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:54	08:25	09:50
	15:14	16:44	18:08	20:36	22:05	23:29	23:33	22:11	20:28	18:46	16:06	14:57
8	10:02	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:28	09:52
	15:16	16:47	18:11	20:39	22:08	23:31	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:44	05:10	06:38	08:00	08:31	09:54
	15:18	16:50	18:14	20:42	22:11	23:33	23:29	22:05	20:21	18:39	16:00	14:55
10	09:59	08:42	07:11	06:25	04:47	03:30	03:47	05:13	06:40	08:03	08:34	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:27	22:01	20:18	18:35	15:57	14:54
11	09:58	08:39	07:07	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:23	16:56	18:20	20:48	22:17	23:36	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:41	03:28	03:51	05:18	06:46	08:08	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:32	07:01	06:15	04:37	03:27	03:54	05:21	06:49	08:11	08:44	10:01
	15:29	17:02	18:25	20:54	22:23	23:39	23:21	21:52	20:07	18:25	15:49	14:51
14	09:52	08:29	06:57	06:12	04:34	03:26	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:06	18:28	20:56	22:26	23:41	23:19	21:48	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:08	04:31	03:25	03:59	05:27	06:54	08:17	08:50	10:04
	15:34	17:09	18:31	20:59	22:29	23:42	23:16	21:45	20:00	18:19	15:44	14:50
16	09:48	08:23	06:51	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:32	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:23	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:34	23:44	23:12	21:39	19:54	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	03:23	04:06	05:36	07:02	08:26	08:59	10:08
	15:42	17:18	18:40	21:08	22:37	23:44	23:09	21:35	19:50	18:09	15:36	14:50
19	09:42	08:13	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:45	17:21	18:43	21:11	22:40	23:45	23:06	21:32	19:47	18:06	15:33	14:50
20	09:39	08:10	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:31	09:05	10:10
	15:48	17:24	18:45	21:14	22:43	23:46	23:04	21:29	19:43	18:02	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:23	04:15	05:44	07:10	08:34	09:08	10:11
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:11	03:23	04:17	05:47	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:58	21:22	19:36	17:56	15:26	14:50
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:57	06:23	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:16	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:49	15:21	14:52
25	09:27	07:54	06:20	05:35	04:03	03:24	04:26	05:56	07:21	07:46	09:19	10:12
	16:03	17:39	18:59	21:29	22:57	23:46	22:50	21:12	19:26	16:46	15:19	14:52
26	09:24	07:51	06:16	05:32	04:01	03:25	04:29	05:59	07:24	07:49	09:22	10:12
	16:06	17:42	19:02	21:32	23:00	23:45	22:47	21:09	19:23	16:43	15:17	14:53
27	09:22	07:47	06:13	05:28	03:58	03:25	04:32	06:02	07:27	07:52	09:25	10:12
	16:09	17:45	19:05	21:35	23:03	23:45	22:44	21:05	19:19	16:40	15:14	14:54
28	09:19	07:44	06:10	05:25	03:56	03:26	04:34	06:04	07:30	07:55	09:28	10:12
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29	09:16		07:06	05:22	03:53	03:27	04:37	06:07	07:32	07:58	09:30	10:12
	16:16		20:11	21:40	23:08	23:43	22:39	20:58	19:13	16:34	15:10	14:57
30	09:14		07:03	05:18	03:51	03:29	04:40	06:10	07:35	08:01	09:33	10:11
	16:19		20:14	21:43	23:11	23:43	22:36	20:55	19:09	16:30	15:08	14:58
31	09:11		06:59		03:49		04:43	06:13		08:04		10:11
	16:22		20:16		23:13		22:33	20:52		16:27		15:00
Potential sun hours	182	242	363	447	559	604	593	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_forest lukeWTG: T3 - T3

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:46	23:16	23:41	22:29	20:48	19:06	16:24	15:07
2	10:09	09:05	07:38	06:53	05:12	03:45	03:32	04:49	06:18	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:49	23:18	23:40	22:26	20:45	19:02	16:21	15:05
3	10:08	09:02	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:41
	15:06	16:31	17:57	20:25	21:52	23:21	23:39	22:23	20:41	18:59	16:18	15:03
4	10:07	09:00	07:31	06:46	05:06	03:40	03:35	04:55	06:24	07:46	08:16	09:43
	15:08	16:34	18:00	20:28	21:55	23:23	23:38	22:20	20:38	18:56	16:15	15:02
5	10:06	08:57	07:28	06:42	05:02	03:39	03:37	04:58	06:27	07:49	08:19	09:45
	15:10	16:38	18:02	20:31	21:58	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:37	03:38	05:01	06:29	07:52	08:22	09:48
	15:12	16:41	18:05	20:33	22:01	23:27	23:35	22:14	20:31	18:49	16:09	14:59
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:54	08:25	09:50
	15:14	16:44	18:08	20:36	22:04	23:29	23:33	22:11	20:28	18:46	16:06	14:57
8	10:02	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:28	09:52
	15:16	16:47	18:11	20:39	22:08	23:31	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:45	05:10	06:38	08:00	08:31	09:54
	15:19	16:50	18:14	20:42	22:11	23:33	23:29	22:05	20:21	18:39	16:00	14:55
10	09:59	08:42	07:11	06:25	04:47	03:30	03:47	05:13	06:40	08:03	08:34	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:27	22:01	20:18	18:35	15:58	14:54
11	09:58	08:39	07:07	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:24	16:56	18:20	20:48	22:17	23:36	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:41	03:28	03:51	05:19	06:46	08:08	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:32	07:01	06:15	04:38	03:27	03:54	05:21	06:49	08:11	08:44	10:01
	15:29	17:03	18:26	20:54	22:23	23:39	23:21	21:52	20:07	18:25	15:49	14:51
14	09:52	08:29	06:57	06:12	04:35	03:26	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:06	18:28	20:56	22:26	23:40	23:19	21:48	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:08	04:32	03:25	03:59	05:27	06:54	08:17	08:50	10:04
	15:34	17:09	18:31	20:59	22:29	23:42	23:16	21:45	20:00	18:19	15:44	14:50
16	09:48	08:23	06:51	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:31	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:24	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:34	23:44	23:11	21:39	19:54	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	03:23	04:06	05:36	07:02	08:26	08:59	10:08
	15:43	17:18	18:40	21:08	22:37	23:44	23:09	21:35	19:50	18:09	15:36	14:50
19	09:42	08:13	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:45	17:21	18:43	21:11	22:40	23:45	23:06	21:32	19:47	18:06	15:33	14:50
20	09:39	08:10	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:31	09:05	10:10
	15:48	17:24	18:45	21:14	22:43	23:45	23:04	21:29	19:43	18:02	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:23	04:15	05:45	07:10	08:34	09:08	10:10
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:12	03:23	04:17	05:47	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:58	21:22	19:36	17:56	15:26	14:51
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:13	10:12
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:57	06:23	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:16	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:50	15:21	14:52
25	09:27	07:54	06:20	05:35	04:04	03:24	04:26	05:56	07:21	07:46	09:19	10:12
	16:03	17:39	18:59	21:29	22:57	23:46	22:50	21:12	19:26	16:46	15:19	14:53
26	09:24	07:51	06:17	05:32	04:01	03:25	04:29	05:59	07:24	07:49	09:22	10:12
	16:06	17:42	19:02	21:32	23:00	23:45	22:47	21:09	19:23	16:43	15:17	14:53
27	09:22	07:48	06:13	05:28	03:58	03:26	04:32	06:02	07:27	07:52	09:25	10:12
	16:10	17:45	19:05	21:34	23:03	23:45	22:44	21:05	19:19	16:40	15:15	14:55
28	09:19	07:44	06:10	05:25	03:56	03:26	04:35	06:04	07:30	07:55	09:28	10:12
	16:13	17:48	19:08	21:37	23:06	23:44	22:41	21:02	19:16	16:37	15:12	14:56
29	09:16		07:06	05:22	03:54	03:28	04:37	06:07	07:32	07:58	09:30	10:12
	16:16		20:11	21:40	23:08	23:43	22:38	20:58	19:13	16:34	15:10	14:57
30	09:14		07:03	05:19	03:51	03:29	04:40	06:10	07:35	08:01	09:33	10:11
	16:19		20:14	21:43	23:11	23:42	22:36	20:55	19:09	16:31	15:09	14:58
31	09:11		06:59		03:49		04:43	06:13		08:04		10:11
	16:22		20:16		23:13		22:33	20:52		16:27		15:00
Potential sun hours	183	243	363	447	559	604	593	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_forest lukeWTG: T4 - T4

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:35
	15:02	16:25	17:51	20:19	21:46	23:16	23:41	22:29	20:48	19:06	16:24	15:07
2	10:09	09:05	07:38	06:53	05:12	03:45	03:32	04:49	06:18	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:49	23:18	23:40	22:26	20:45	19:02	16:21	15:05
3	10:08	09:02	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:40
	15:06	16:31	17:57	20:25	21:52	23:20	23:39	22:23	20:41	18:59	16:18	15:03
4	10:07	08:59	07:31	06:46	05:06	03:40	03:35	04:55	06:24	07:46	08:16	09:43
	15:08	16:34	17:59	20:28	21:55	23:23	23:37	22:20	20:38	18:56	16:15	15:02
5	10:06	08:57	07:28	06:42	05:02	03:39	03:37	04:58	06:27	07:49	08:19	09:45
	15:10	16:38	18:02	20:31	21:58	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:37	03:38	05:01	06:29	07:52	08:22	09:48
	15:12	16:41	18:05	20:33	22:01	23:27	23:34	22:14	20:31	18:49	16:09	14:59
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:54	08:25	09:50
	15:14	16:44	18:08	20:36	22:04	23:29	23:33	22:11	20:28	18:46	16:06	14:57
8	10:02	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:28	09:52
	15:16	16:47	18:11	20:39	22:07	23:31	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:45	05:10	06:38	08:00	08:31	09:54
	15:19	16:50	18:14	20:42	22:10	23:33	23:29	22:04	20:21	18:39	16:00	14:55
10	09:59	08:42	07:11	06:25	04:47	03:30	03:47	05:13	06:40	08:03	08:34	09:56
	15:21	16:53	18:17	20:45	22:13	23:35	23:27	22:01	20:17	18:35	15:58	14:54
11	09:57	08:39	07:07	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:37	09:58
	15:24	16:56	18:20	20:48	22:16	23:36	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:35	07:04	06:19	04:41	03:28	03:51	05:19	06:46	08:08	08:40	09:59
	15:26	16:59	18:23	20:51	22:19	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:32	07:01	06:15	04:38	03:27	03:54	05:21	06:49	08:11	08:44	10:01
	15:29	17:02	18:25	20:53	22:22	23:39	23:21	21:52	20:07	18:25	15:49	14:51
14	09:52	08:29	06:57	06:12	04:35	03:26	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:06	18:28	20:56	22:25	23:40	23:18	21:48	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:08	04:32	03:25	03:59	05:27	06:54	08:17	08:50	10:04
	15:34	17:09	18:31	20:59	22:28	23:41	23:16	21:45	20:00	18:19	15:44	14:50
16	09:48	08:23	06:51	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:53	10:05
	15:37	17:12	18:34	21:02	22:31	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:24	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:34	23:43	23:11	21:38	19:54	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	03:23	04:07	05:36	07:02	08:26	08:59	10:08
	15:43	17:18	18:40	21:08	22:37	23:44	23:09	21:35	19:50	18:09	15:36	14:50
19	09:41	08:13	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:28	09:02	10:09
	15:45	17:21	18:43	21:11	22:40	23:45	23:06	21:32	19:47	18:06	15:33	14:50
20	09:39	08:10	06:37	05:52	04:17	03:23	04:12	05:42	07:08	08:31	09:05	10:10
	15:48	17:24	18:45	21:14	22:43	23:45	23:04	21:29	19:43	18:02	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:23	04:15	05:45	07:10	08:34	09:08	10:10
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:34	08:04	06:30	05:45	04:12	03:23	04:17	05:47	07:13	08:37	09:10	10:11
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24	09:29	07:57	06:23	05:38	04:06	03:24	04:23	05:53	07:19	08:43	09:16	10:12
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25	09:27	07:54	06:20	05:35	04:04	03:24	04:26	05:56	07:21	07:46	09:19	10:12
	16:03	17:39	18:59	21:28	22:57	23:46	22:50	21:12	19:26	16:46	15:19	14:53
26	09:24	07:51	06:16	05:32	04:01	03:25	04:29	05:59	07:24	07:49	09:22	10:12
	16:06	17:42	19:02	21:31	23:00	23:45	22:47	21:08	19:23	16:43	15:17	14:53
27	09:22	07:47	06:13	05:28	03:58	03:26	04:32	06:02	07:27	07:52	09:25	10:12
	16:10	17:45	19:05	21:34	23:03	23:45	22:44	21:05	19:19	16:40	15:15	14:55
28	09:19	07:44	06:10	05:25	03:56	03:26	04:35	06:04	07:30	07:55	09:27	10:12
	16:13	17:48	19:08	21:37	23:05	23:44	22:41	21:02	19:16	16:37	15:12	14:56
29	09:16		07:06	05:22	03:54	03:28	04:37	06:07	07:32	07:58	09:30	10:12
	16:16		20:11	21:40	23:08	23:43	22:38	20:58	19:13	16:34	15:10	14:57
30	09:14		07:03	05:19	03:51	03:29	04:40	06:10	07:35	08:01	09:33	10:11
	16:19		20:14	21:43	23:11	23:42	22:35	20:55	19:09	16:31	15:09	14:58
31	09:11		06:59		03:49		04:43	06:13		08:04		10:11
	16:22		20:16		23:13		22:32	20:52		16:27		15:00
Potential sun hours	183	243	363	447	559	604	593	502	392	308	207	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_forest lukeWTG: T5 - T5

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16	23:42	22:30	20:48	19:06	16:24	15:07
2	10:09	09:05	07:38	06:53	05:12	03:44	03:31	04:49	06:18	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:50	23:18	23:40	22:27	20:45	19:02	16:21	15:05
3	10:09	09:02	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:41
	15:05	16:31	17:57	20:25	21:53	23:21	23:39	22:23	20:41	18:59	16:18	15:03
4	10:07	09:00	07:31	06:46	05:06	03:40	03:35	04:55	06:24	07:46	08:16	09:43
	15:07	16:34	18:00	20:28	21:56	23:23	23:38	22:20	20:38	18:56	16:15	15:01
5	10:06	08:57	07:28	06:42	05:02	03:38	03:36	04:58	06:27	07:49	08:19	09:45
	15:09	16:38	18:02	20:31	21:59	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:37	03:38	05:01	06:29	07:52	08:22	09:48
	15:12	16:41	18:05	20:33	22:02	23:27	23:35	22:14	20:31	18:49	16:09	14:58
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:54	08:25	09:50
	15:14	16:44	18:08	20:36	22:05	23:29	23:33	22:11	20:28	18:46	16:06	14:57
8	10:02	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:28	09:52
	15:16	16:47	18:11	20:39	22:08	23:31	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:44	05:10	06:38	08:00	08:31	09:54
	15:18	16:50	18:14	20:42	22:11	23:33	23:29	22:05	20:21	18:39	16:00	14:55
10	09:59	08:42	07:11	06:25	04:47	03:30	03:47	05:13	06:40	08:03	08:35	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:27	22:01	20:18	18:35	15:57	14:54
11	09:58	08:39	07:07	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:23	16:56	18:20	20:48	22:17	23:36	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:41	03:28	03:51	05:18	06:46	08:09	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:32	07:01	06:15	04:37	03:27	03:54	05:21	06:49	08:11	08:44	10:01
	15:29	17:02	18:26	20:54	22:23	23:39	23:21	21:52	20:07	18:25	15:49	14:51
14	09:52	08:29	06:57	06:12	04:34	03:26	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:06	18:28	20:56	22:26	23:41	23:19	21:48	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:08	04:31	03:25	03:59	05:27	06:54	08:17	08:50	10:04
	15:34	17:09	18:31	20:59	22:29	23:42	23:16	21:45	20:00	18:19	15:44	14:50
16	09:48	08:23	06:51	06:05	04:29	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:32	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:23	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:35	23:44	23:12	21:39	19:54	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	03:23	04:06	05:36	07:02	08:26	08:59	10:08
	15:42	17:18	18:40	21:08	22:38	23:45	23:09	21:35	19:50	18:09	15:36	14:50
19	09:42	08:14	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:45	17:21	18:43	21:11	22:40	23:45	23:07	21:32	19:47	18:06	15:33	14:50
20	09:39	08:10	06:37	05:52	04:17	03:22	04:12	05:42	07:08	08:31	09:05	10:10
	15:48	17:24	18:45	21:14	22:43	23:46	23:04	21:29	19:43	18:02	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:22	04:15	05:45	07:10	08:34	09:08	10:11
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:11	03:23	04:17	05:47	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:59	21:22	19:36	17:56	15:26	14:50
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:57	06:23	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:16	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:49	15:21	14:52
25	09:27	07:54	06:20	05:35	04:03	03:24	04:26	05:56	07:21	07:46	09:19	10:12
	16:03	17:39	18:59	21:29	22:58	23:46	22:50	21:12	19:26	16:46	15:19	14:52
26	09:25	07:51	06:16	05:32	04:01	03:24	04:29	05:59	07:24	07:49	09:22	10:12
	16:06	17:42	19:02	21:32	23:00	23:45	22:47	21:09	19:23	16:43	15:17	14:53
27	09:22	07:48	06:13	05:28	03:58	03:25	04:32	06:02	07:27	07:52	09:25	10:12
	16:09	17:45	19:05	21:35	23:03	23:45	22:44	21:05	19:19	16:40	15:14	14:54
28	09:19	07:44	06:10	05:25	03:56	03:26	04:34	06:04	07:30	07:55	09:28	10:12
	16:13	17:48	19:08	21:38	23:06	23:44	22:42	21:02	19:16	16:37	15:12	14:56
29	09:17		07:06	05:22	03:53	03:27	04:37	06:07	07:32	07:58	09:30	10:12
	16:16		20:11	21:41	23:08	23:44	22:39	20:58	19:13	16:34	15:10	14:57
30	09:14		07:03	05:18	03:51	03:29	04:40	06:10	07:35	08:01	09:33	10:11
	16:19		20:14	21:44	23:11	23:43	22:36	20:55	19:09	16:31	15:08	14:58
31	09:11		06:59		03:49		04:43	06:13		08:04		10:11
	16:22		20:16		23:13		22:33	20:52		16:27		15:00
Potential sun hours	182	242	363	447	559	604	593	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_forest lukeWTG: T6 - T6

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:46	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16	23:42	22:30	20:48	19:06	16:24	15:07
2	10:09	09:05	07:38	06:53	05:12	03:44	03:31	04:49	06:18	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:50	23:18	23:41	22:27	20:45	19:02	16:21	15:05
3	10:09	09:03	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:41
	15:05	16:31	17:57	20:25	21:53	23:21	23:39	22:24	20:41	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:06	03:40	03:34	04:55	06:24	07:46	08:16	09:43
	15:07	16:34	18:00	20:28	21:56	23:23	23:38	22:20	20:38	18:56	16:15	15:01
5	10:06	08:57	07:28	06:42	05:02	03:38	03:36	04:58	06:27	07:49	08:19	09:46
	15:09	16:38	18:02	20:31	21:59	23:25	23:36	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:36	03:38	05:01	06:29	07:52	08:22	09:48
	15:12	16:41	18:05	20:34	22:02	23:27	23:35	22:14	20:31	18:49	16:09	14:58
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:54	08:25	09:50
	15:14	16:44	18:08	20:36	22:05	23:29	23:33	22:11	20:28	18:46	16:06	14:57
8	10:03	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:28	09:52
	15:16	16:47	18:11	20:39	22:08	23:31	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:32	03:44	05:10	06:38	08:00	08:32	09:54
	15:18	16:50	18:14	20:42	22:11	23:33	23:29	22:05	20:21	18:39	16:00	14:55
10	09:59	08:42	07:11	06:25	04:47	03:30	03:46	05:13	06:40	08:03	08:35	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:27	22:01	20:18	18:35	15:57	14:54
11	09:58	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:23	16:56	18:20	20:48	22:17	23:37	23:25	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:40	03:28	03:51	05:18	06:46	08:09	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:33	07:01	06:15	04:37	03:26	03:53	05:21	06:49	08:11	08:44	10:01
	15:29	17:02	18:26	20:54	22:23	23:39	23:21	21:52	20:07	18:25	15:49	14:51
14	09:52	08:29	06:57	06:12	04:34	03:25	03:56	05:24	06:51	08:14	08:47	10:03
	15:31	17:06	18:28	20:56	22:26	23:41	23:19	21:48	20:04	18:22	15:46	14:51
15	09:50	08:26	06:54	06:08	04:31	03:25	03:58	05:27	06:54	08:17	08:50	10:04
	15:34	17:09	18:31	20:59	22:29	23:42	23:16	21:45	20:00	18:19	15:44	14:50
16	09:48	08:23	06:51	06:05	04:28	03:24	04:01	05:30	06:57	08:20	08:53	10:06
	15:37	17:12	18:34	21:02	22:32	23:43	23:14	21:42	19:57	18:16	15:41	14:50
17	09:46	08:20	06:47	06:02	04:26	03:23	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:35	23:44	23:12	21:39	19:54	18:12	15:38	14:50
18	09:44	08:17	06:44	05:58	04:23	03:23	04:06	05:36	07:02	08:26	08:59	10:08
	15:42	17:18	18:40	21:08	22:38	23:45	23:09	21:35	19:50	18:09	15:36	14:49
19	09:42	08:14	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:45	17:21	18:43	21:11	22:40	23:45	23:07	21:32	19:47	18:06	15:33	14:49
20	09:39	08:10	06:37	05:52	04:17	03:22	04:12	05:42	07:08	08:31	09:05	10:10
	15:48	17:24	18:45	21:14	22:43	23:46	23:04	21:29	19:43	18:02	15:31	14:50
21	09:37	08:07	06:34	05:48	04:14	03:22	04:14	05:44	07:10	08:34	09:08	10:11
	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
22	09:35	08:04	06:30	05:45	04:11	03:23	04:17	05:47	07:13	08:37	09:11	10:11
	15:54	17:30	18:51	21:20	22:49	23:46	22:59	21:22	19:36	17:56	15:26	14:50
23	09:32	08:01	06:27	05:42	04:09	03:23	04:20	05:50	07:16	08:40	09:14	10:12
	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:57	06:23	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:17	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:49	15:21	14:52
25	09:27	07:54	06:20	05:35	04:03	03:24	04:26	05:56	07:21	07:46	09:19	10:12
	16:03	17:39	19:00	21:29	22:58	23:46	22:50	21:12	19:26	16:46	15:19	14:52
26	09:25	07:51	06:16	05:32	04:01	03:24	04:29	05:59	07:24	07:49	09:22	10:12
	16:06	17:42	19:02	21:32	23:00	23:46	22:47	21:09	19:23	16:43	15:17	14:53
27	09:22	07:48	06:13	05:28	03:58	03:25	04:31	06:02	07:27	07:52	09:25	10:12
	16:09	17:45	19:05	21:35	23:03	23:45	22:45	21:05	19:19	16:40	15:14	14:54
28	09:19	07:44	06:10	05:25	03:56	03:26	04:34	06:04	07:30	07:55	09:28	10:12
	16:13	17:48	19:08	21:38	23:06	23:44	22:42	21:02	19:16	16:37	15:12	14:55
29	09:17		07:06	05:22	03:53	03:27	04:37	06:07	07:32	07:58	09:30	10:12
	16:16		20:11	21:41	23:08	23:44	22:39	20:58	19:13	16:34	15:10	14:57
30	09:14		07:03	05:18	03:51	03:28	04:40	06:10	07:35	08:01	09:33	10:12
	16:19		20:14	21:44	23:11	23:43	22:36	20:55	19:09	16:30	15:08	14:58
31	09:11		06:59		03:49		04:43	06:13		08:04		10:11
	16:22		20:16		23:14		22:33	20:52		16:27		15:00
Potential sun hours	182	242	363	447	559	604	594	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_forest lukeWTG: T7 - T7

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:46	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16	23:42	22:30	20:48	19:06	16:24	15:07
2	10:10	09:05	07:38	06:53	05:12	03:44	03:31	04:49	06:18	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:50	23:18	23:41	22:27	20:45	19:02	16:21	15:05
3	10:09	09:03	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:41
	15:05	16:31	17:57	20:25	21:53	23:21	23:39	22:24	20:42	18:59	16:18	15:03
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	15:07	16:34	18:00	20:28	21:56	23:23	23:38	22:20	20:38	18:56	16:15	15:01
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	15:09	16:38	18:02	20:31	21:59	23:25	23:36	22:17	20:35	18:52	16:12	15:00
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	15:16	16:47	18:11	20:39	22:08	23:31	23:31	22:08	20:24	18:42	16:03	14:56
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18	09:44	08:17	06:44	05:58	04:23	03:23	04:06	05:36	07:02	08:26	08:59	10:08
	15:42	17:18	18:40	21:08	22:38	23:45	23:09	21:35	19:50	18:09	15:36	14:49
19	09:42	08:14	06:40	05:55	04:20	03:23	04:09	05:39	07:05	08:29	09:02	10:09
	15:45	17:21	18:43	21:11	22:41	23:45	23:07	21:32	19:47	18:06	15:33	14:49
20	09:39	08:10	06:37	05:52	04:17	03:22	04:12	05:42	07:08	08:32	09:05	10:10
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22	09:35	08:04	06:30	05:45	04:11	03:23	04:17	05:47	07:13	08:37	09:11	10:11
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	15:57	17:33	18:54	21:23	22:52	23:46	22:56	21:19	19:33	17:53	15:23	14:51
24	09:30	07:57	06:23	05:38	04:06	03:23	04:23	05:53	07:19	08:43	09:17	10:12
	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:50	15:21	14:52
25	09:27	07:54	06:20	05:35	04:03	03:24	04:26	05:56	07:21	07:46	09:19	10:12
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26	09:25	07:51	06:17	05:32	04:01	03:24	04:29	05:59	07:24	07:49	09:22	10:12
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31	09:11		06:59		03:49		04:43	06:13		08:04		10:11
	16:22		20:17		23:14		22:33	20:52		16:27		15:00
Potential sun hours	182	242	363	447	559	604	594	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_forest lukeWTG: T8 - T8

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

	January	February	March	April	May	June	July	August	September	October	November	December
1	10:10	09:08	07:41	06:56	05:15	03:46	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16	23:42	22:30	20:48	19:06	16:24	15:06
2	10:10	09:06	07:38	06:53	05:12	03:44	03:31	04:49	06:18	07:41	08:10	09:38
	15:03	16:28	17:54	20:22	21:50	23:19	23:41	22:27	20:45	19:02	16:21	15:05
3	10:09	09:03	07:34	06:49	05:09	03:42	03:33	04:52	06:21	07:43	08:13	09:41
	15:05	16:31	17:57	20:25	21:53	23:21	23:39	22:24	20:42	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:06	03:40	03:34	04:55	06:24	07:46	08:16	09:43
	15:07	16:34	18:00	20:28	21:56	23:23	23:38	22:21	20:38	18:56	16:15	15:01
5	10:07	08:57	07:28	06:42	05:02	03:38	03:36	04:58	06:27	07:49	08:19	09:46
	15:09	16:38	18:02	20:31	21:59	23:25	23:37	22:17	20:35	18:52	16:12	15:00
6	10:05	08:54	07:24	06:39	04:59	03:36	03:38	05:01	06:29	07:52	08:22	09:48
	15:11	16:41	18:05	20:34	22:02	23:28	23:35	22:14	20:31	18:49	16:09	14:58
7	10:04	08:51	07:21	06:36	04:56	03:35	03:40	05:04	06:32	07:55	08:26	09:50
	15:14	16:44	18:08	20:36	22:05	23:30	23:33	22:11	20:28	18:46	16:06	14:57
8	10:03	08:48	07:18	06:32	04:53	03:33	03:42	05:07	06:35	07:57	08:29	09:52
	15:16	16:47	18:11	20:39	22:08	23:32	23:31	22:08	20:24	18:42	16:03	14:56
9	10:01	08:45	07:14	06:29	04:50	03:31	03:44	05:10	06:38	08:00	08:32	09:54
	15:18	16:50	18:14	20:42	22:11	23:33	23:30	22:05	20:21	18:39	16:00	14:55
10	10:00	08:42	07:11	06:25	04:47	03:30	03:46	05:13	06:40	08:03	08:35	09:56
	15:21	16:53	18:17	20:45	22:14	23:35	23:28	22:02	20:18	18:36	15:57	14:54
11	09:58	08:39	07:08	06:22	04:44	03:29	03:49	05:16	06:43	08:06	08:38	09:58
	15:23	16:56	18:20	20:48	22:17	23:37	23:26	21:58	20:14	18:32	15:55	14:53
12	09:56	08:36	07:04	06:19	04:40	03:27	03:51	05:18	06:46	08:09	08:41	10:00
	15:26	16:59	18:23	20:51	22:20	23:38	23:23	21:55	20:11	18:29	15:52	14:52
13	09:54	08:33	07:01	06:15	04:37	03:26	03:53	05:21	06:49	08:11	08:44	10:02
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17	09:46	08:20	06:47	06:02	04:26	03:23	04:04	05:33	07:00	08:23	08:56	10:07
	15:40	17:15	18:37	21:05	22:35	23:44	23:12	21:39	19:54	18:12	15:38	14:49
18	09:44	08:17	06:44	05:58	04:23	03:23	04:06	05:36	07:02	08:26	08:59	10:08
	15:42	17:18	18:40	21:08	22:38	23:45	23:09	21:35	19:50	18:09	15:36	14:49
19	09:42	08:14	06:40	05:55	04:20	03:22	04:09	05:39	07:05	08:29	09:02	10:09
	15:45	17:21	18:43	21:11	22:41	23:45	23:07	21:32	19:47	18:06	15:33	14:49
20	09:40	08:10	06:37	05:52	04:17	03:22	04:12	05:42	07:08	08:32	09:05	10:10
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	15:51	17:27	18:48	21:17	22:46	23:46	23:01	21:25	19:40	17:59	15:28	14:50
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	15:54	17:30	18:51	21:20	22:49	23:46	22:59	21:22	19:37	17:56	15:26	14:50
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	16:00	17:36	18:57	21:26	22:55	23:46	22:53	21:15	19:30	17:50	15:21	14:51
25	09:27	07:54	06:20	05:35	04:03	03:24	04:26	05:56	07:21	07:46	09:20	10:12
	16:03	17:39	19:00	21:29	22:58	23:46	22:50	21:12	19:26	16:46	15:19	14:52
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29	09:17		07:06	05:22	03:53	03:27	04:37	06:07	07:32	07:58	09:31	10:12
	16:16		20:11	21:41	23:09	23:44	22:39	20:59	19:13	16:34	15:10	14:57
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31	09:11		06:59		03:49		04:43	06:13		08:04		10:11
	16:22		20:17		23:14		22:33	20:52		16:27		15:00
Potential sun hours	182	242	363	447	559	604	594	502	392	308	206	151
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG

Calculation: V136 x 15 x HH172 real case_forest lukeWTG: T9 - T9

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,03	2,53	3,97	6,77	9,62	10,20	9,62	7,58	5,07	2,64	1,20	0,65

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
950	485	257	338	655	682	961	1 447	1 196	618	441	434	8 465

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

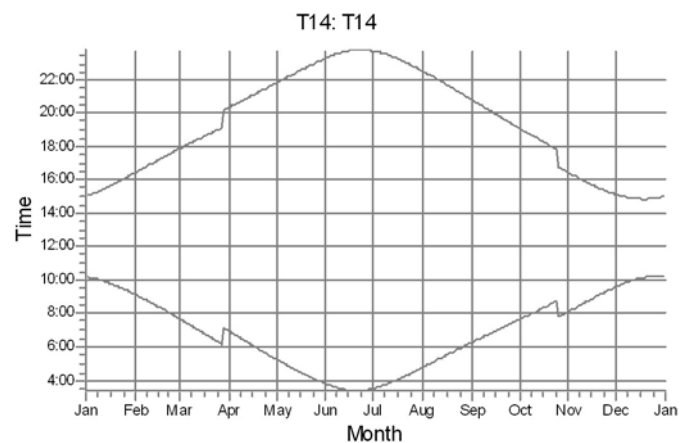
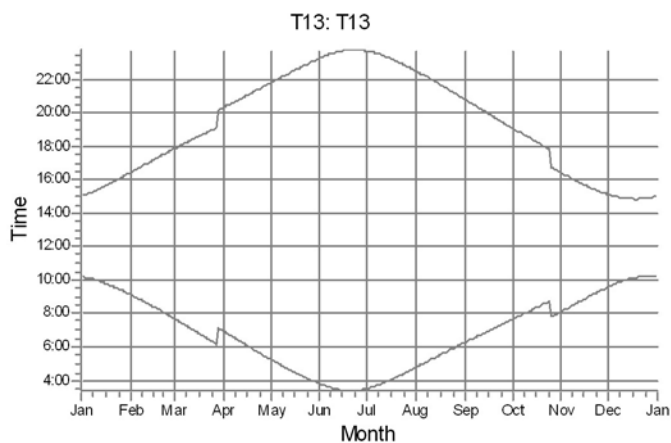
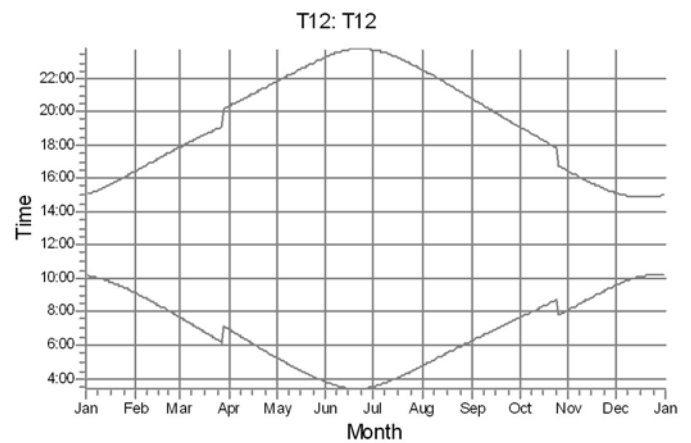
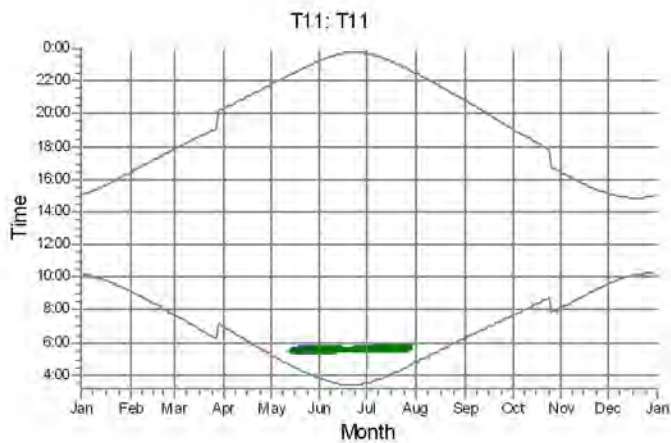
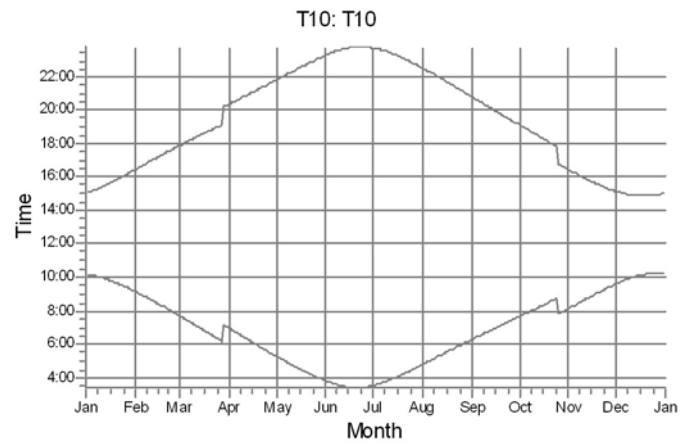
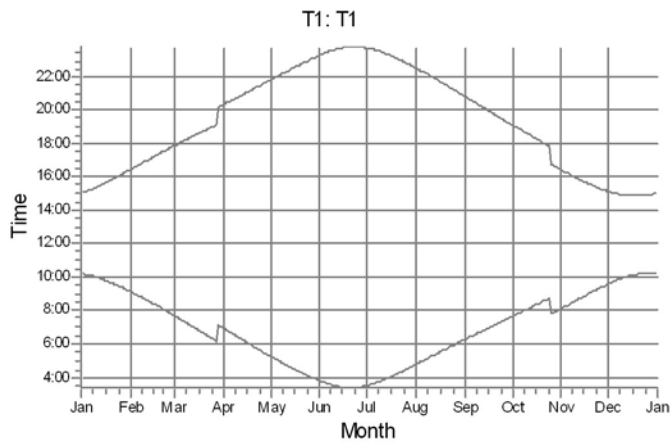
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1	10:10	09:08	07:41	06:56	05:15	03:47	03:30	04:46	06:16	07:38	08:07	09:36
	15:02	16:25	17:51	20:19	21:47	23:16	23:42	22:30	20:48	19:06	16:24	15:07
2	10:09	09:05	07:38	06:53	05:12	03:44	03:31	04:49	06:18	07:41	08:10	09:38
	15:04	16:28	17:54	20:22	21:50	23:18	23:41	22:27	20:45	19:02	16:21	15:05
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	15:06	16:31	17:57	20:25	21:53	23:21	23:39	22:24	20:42	18:59	16:18	15:03
4	10:08	09:00	07:31	06:46	05:06	03:40	03:35	04:55	06:24	07:46	08:16	09:43
	15:07	16:34	18:00	20:28	21:56	23:23	23:38	22:20	20:38	18:56	16:15	15:02
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10	09:59	08:42	07:11	06:25	04:47	03:30	03:47	05:13	06:41	08:03	08:35	09:56
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	16:22		20:17		23:14		22:33	20:52		16:27		15:00
Potential sun hours	182	242	363	447	559	604	593	502	392	308	206	152
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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	Last time (hh:mm) with flicker	Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	Minutes with flicker

SHADOW - Calendar per WTG, graphical

Calculation: V136 x 15 x HH172 real case_forest luke



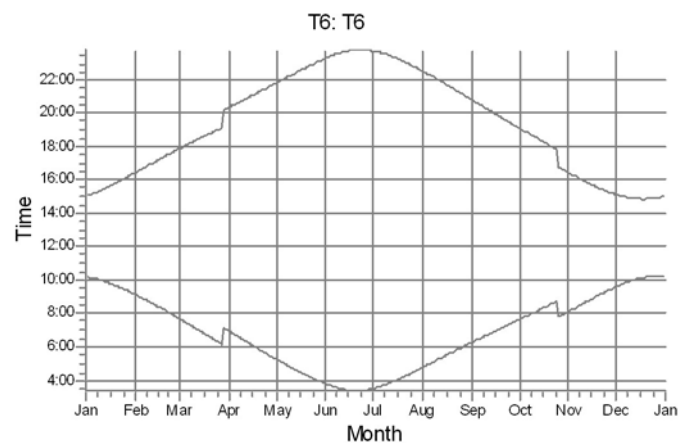
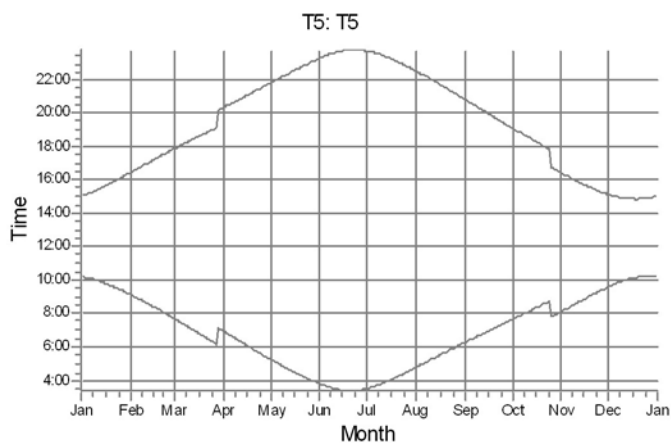
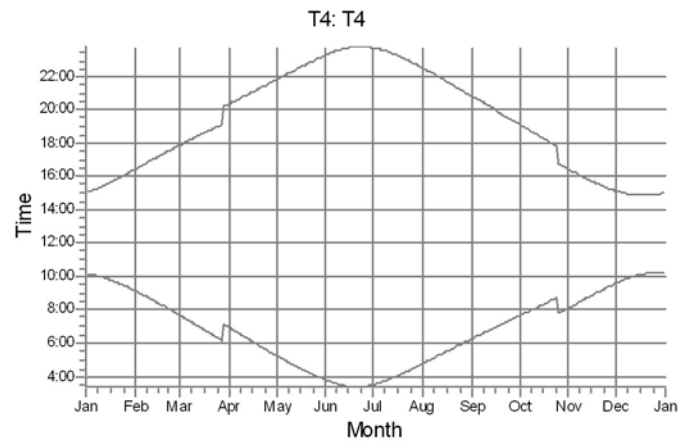
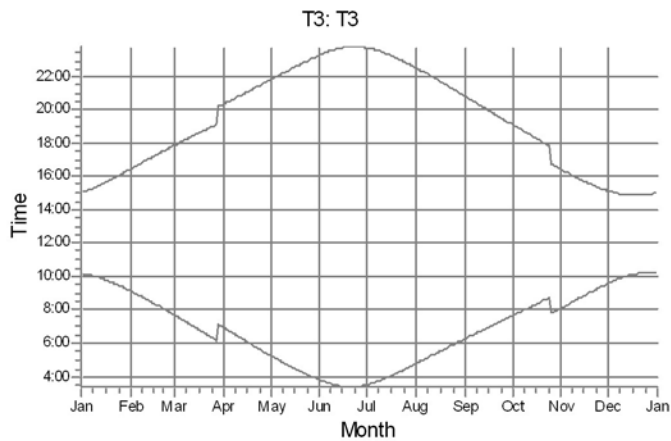
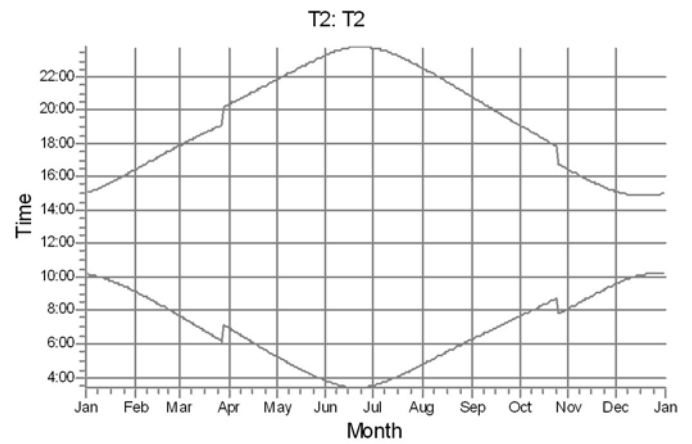
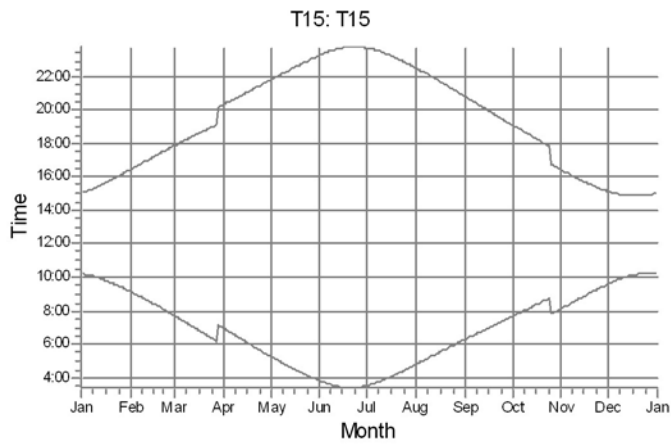
Shadow receptors



A: Asuinrakennus (Langkujavägen 200)

SHADOW - Calendar per WTG, graphical

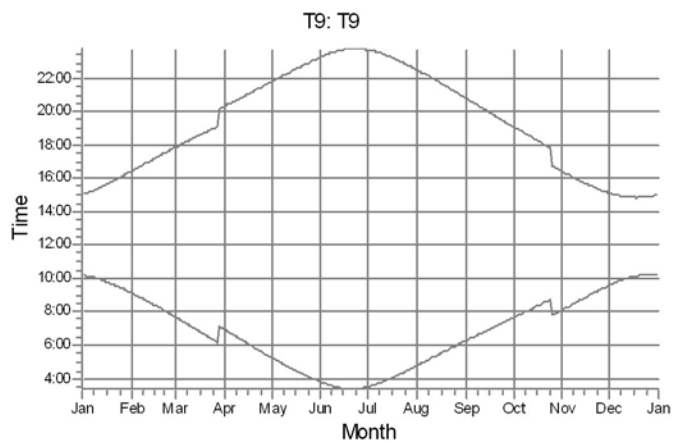
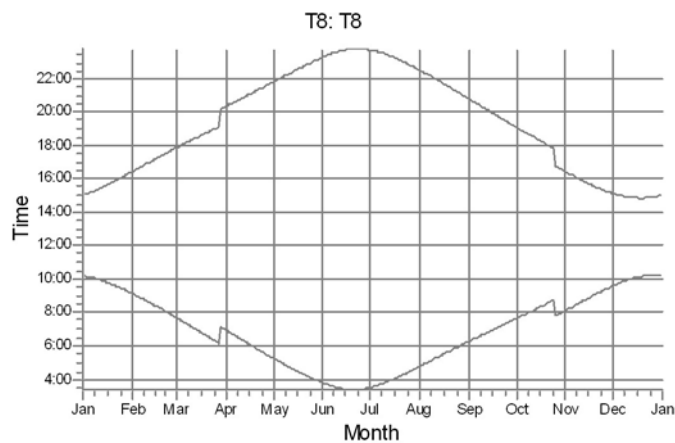
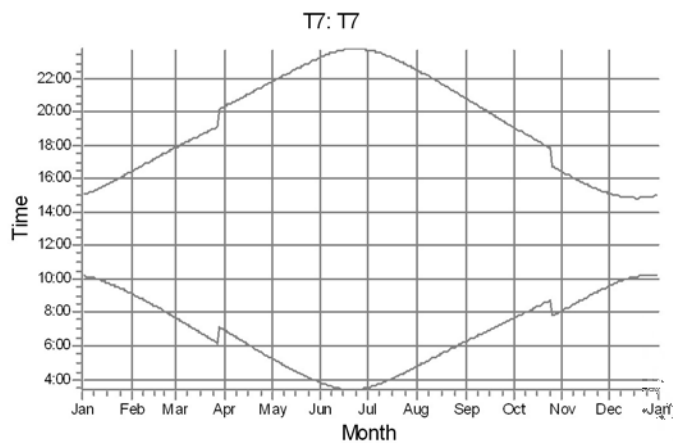
Calculation: V136 x 15 x HH172 real case_forest luke



Shadow receptors

SHADOW - Calendar per WTG, graphical

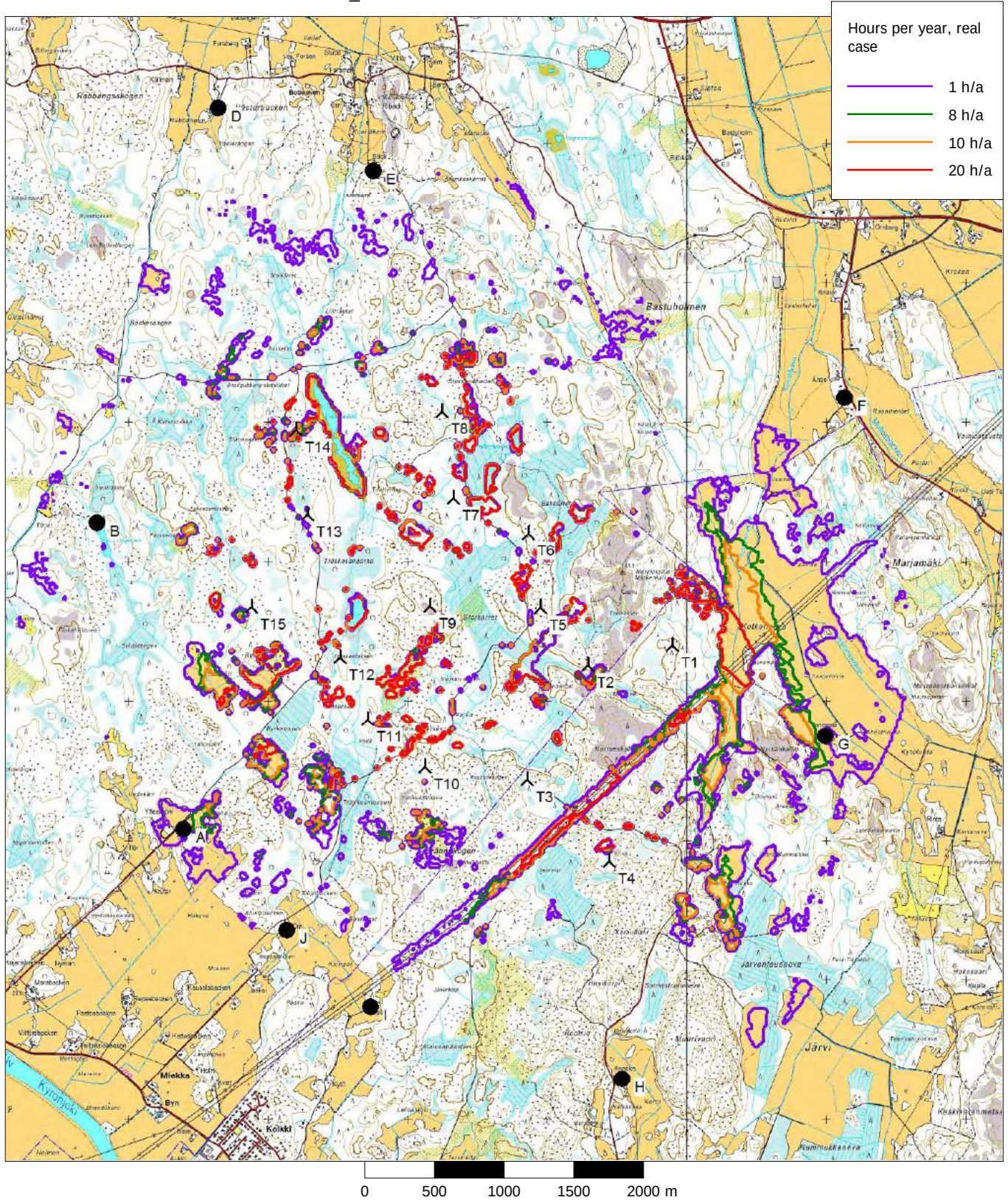
Calculation: V136 x 15 x HH172 real case_forest luke

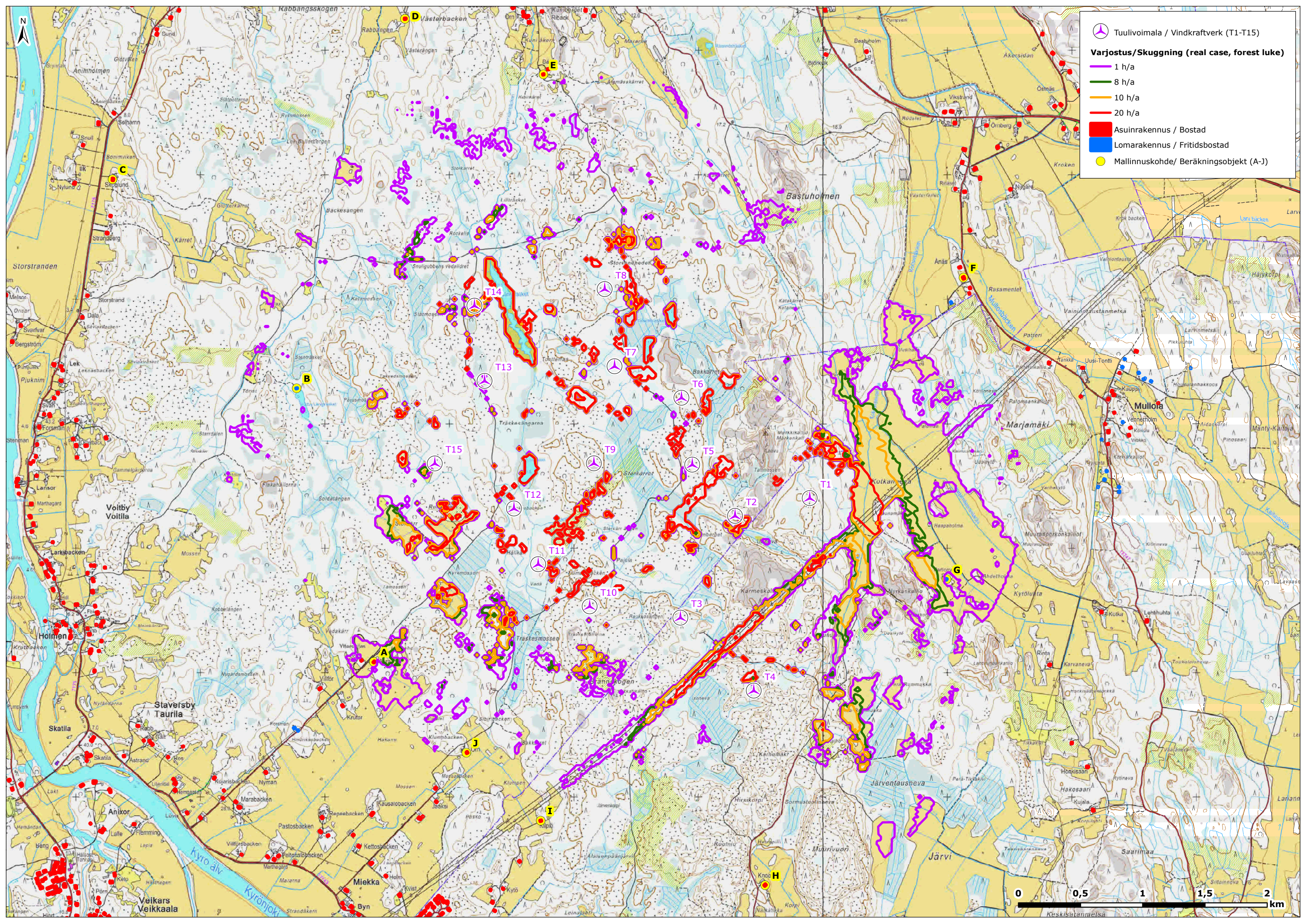


Shadow receptors

SHADOW - Map

Calculation: V136 x 15 x HH172 real case_forest luke





 Tuulivoimala / Vindkraftverk (T1-T15)

Varjostus/Skuggning (real case, forest luke)

 1 h/a

 8 h/a

 10 h/a

 20 h/a

 Asuinrakennus / Bostad

 Lomarakennus / Fritidsbostad

 Mallinnuskohde/ Beräkningsobjekt (A-J)



