

# Kokkopetäikön tuulipuisto

Välkeselvitys



# Muutosluettelo

Versio:	Päiväys:	Muutoksen kuvaus	Tarkastettu	Hyväksyjä
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# 1. Johdanto

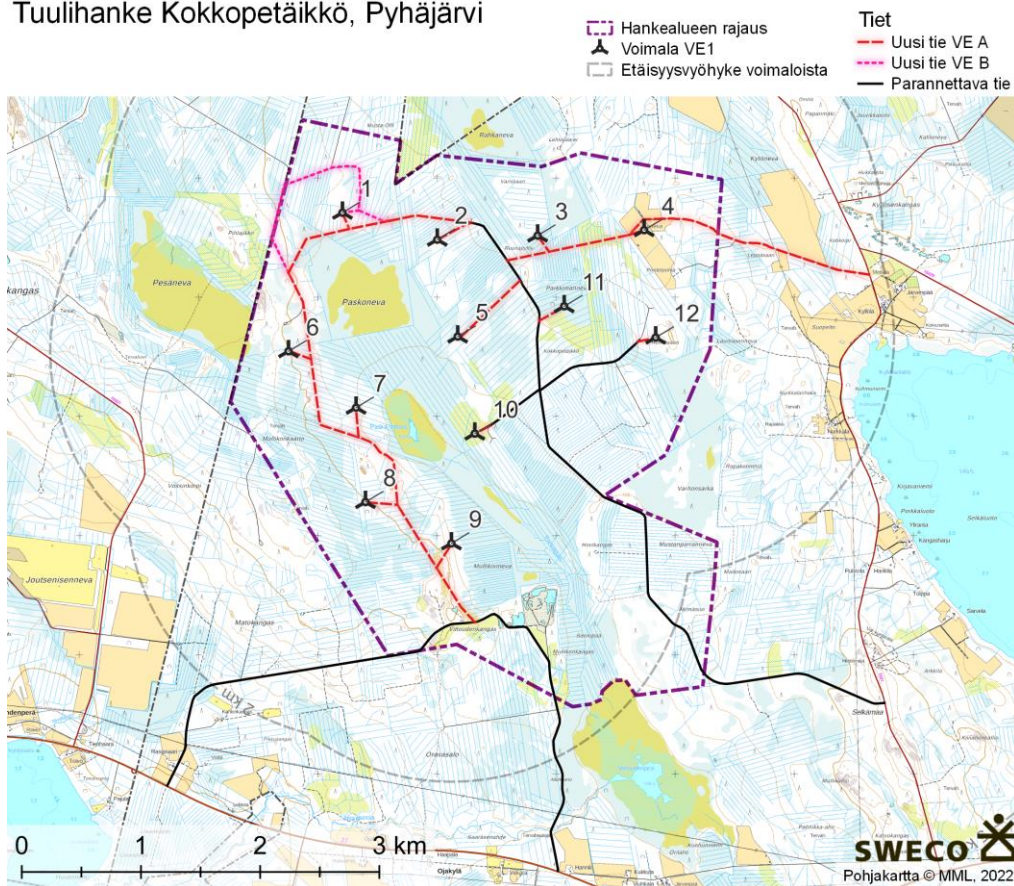
Välkeselvitys on tehty Kokkopetäikön tuulipuistolle Pyhäjärven kaupungissa. Suunniteltu hanke koostuu yhteensä 8-12 tuulivoimalasta. Välkemallinnus on tehty windPRO 3.6 -ohjelmiston SHADOW-moduulilla ympäristöministeriön ohjeistuksen mukaisesti (Ympäristöministeriö, 2016). Välkemallinnuksessa on käytetty Vestaksen V162-7.2 MW-voimalan lähtötietoja. Mallinnuksessa voimaloiden napakorkeus oli 200 m ja roottorin halkaisija 240 m. Välkevaikutukset on mallinnettu ilman puuston vaikutuksen huomioimista.

Tässä selvityksessä on tarkasteltu seuraavia hankevaihtoehtoja:

- VE1: 12 voimalaa
- VE2: 8 voimalaa

Hankevaihtoehdon VE1 voimaloiden sijainnit on esitetty kuvassa 1 ja hankevaihtoehdon VE2 voimaloiden sijainnit on esitetty kuvassa 2. Hankevaihtoehtojen voimaloiden koordinaatit on esitetty liitteiden windPRO-tulosteissa.

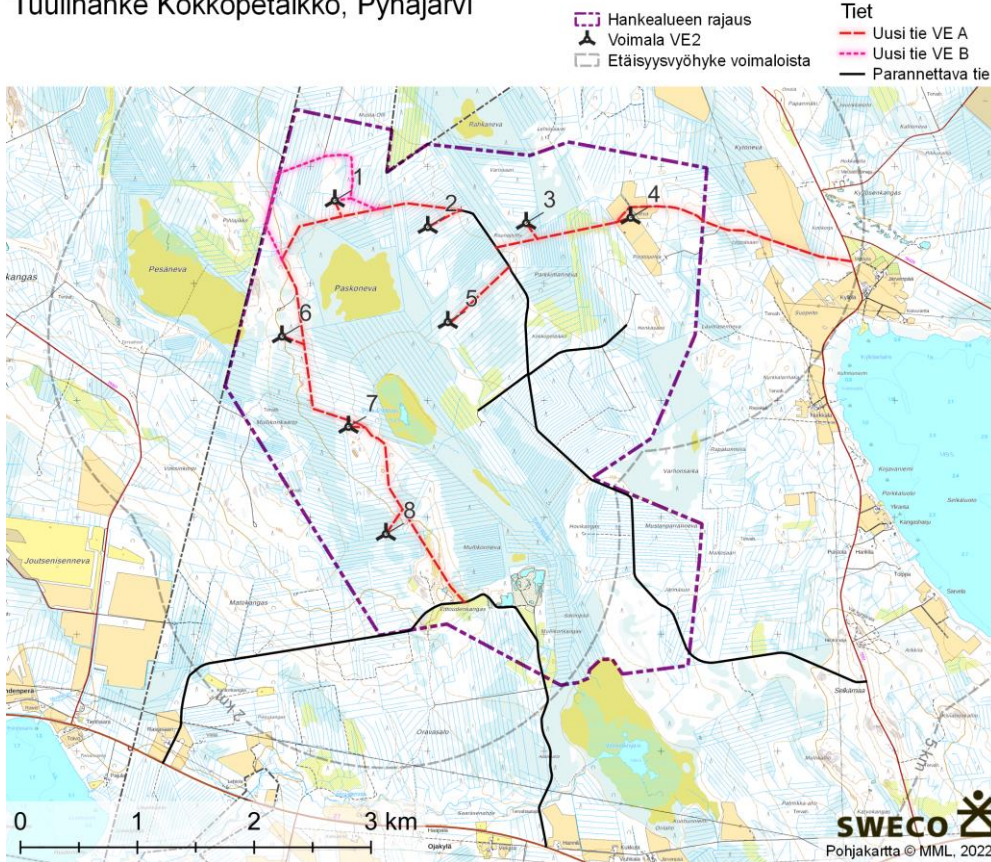
## Tuulihanke Kokkopetäikkö, Pyhäjärvi



Kuva 1. Hankevaihtoehdon VE1 voimaloiden sijainnit



## Tuulihanke Kokkopetäikkö, Pyhäjärvi



Kuva 2. Hankevaihtoehdon VE2 voimaloiden sijainnit

Tässä välkeselvityksessä on lisäksi tarkasteltu välkevaikutusten yhteisvaikutuksia kolmen Kokkopetäikön läheisen tuulivoimapuiston kanssa: Välikankaan, Murtomäki 2:n ja Riitamaa-Nurmesnevan. Välikankaan tuulivoimapuisto on rakennettu ja toiminnassa ja muut kaksi tuulivoimapuistoa ovat vielä hankekehitysvaiheessa. Yhteisvaikutusten arviointia tehtiin edellä mainittujen tuulivoimaloiden osalta sekä VE1-layoutilla että VE2-layoutilla. Välikankaan tuulivoimaloina välkemallinnuksessa käytettiin Vestaksen V150-4.2 MW:n voimaloita (napakorkeus 145 m ja roottorin halkaisija 150 m). Riitamaa-Nurmesnevan tuulivoimaloina välkemallinnuksissa käytettiin Vestaksen V162-7.2 MW:n voimalaa (napakorkeus 200 m ja roottorin halkaisija 200m). Murtomäki 2:n tuulivoimaloina välkemallinnuksessa käytettiin Siemens Gamesan SG 6.0-170 6,2 MW:n voimalaa (napakorkeus 180 m ja roottorin halkaisija 200 m).

## 2. Välke

Auringon paistaessa tuulivoimalan takaa aiheutuu valon ja varjon vilkkumista eli välkettä. Roottorin lapojen pyöriminen aiheuttaa liikkuvan varjon, joka voi tuulivoimalan koosta, sijainnista ja auringon kulmasta riippuen ulottua jopa 1-3 kilometrin päähän tuulivoimalasta. (Ympäristöministeriö, 2016)

Välkevaikutus riippuu sääoloista. Välkettä on havaittavissa vain aurinkoisina päivinä ja tiettyinä aikoina vuorokaudesta. Vaikutuksen lieventämiseksi tuulivoimalat voidaan ohjelmoida pysähtymään välkkeen kannalta kriittisiksi ajoiksi. (Ympäristöministeriö, 2016)

### 3. Välkkeen ohjearvot

Suomessa ei ole määritelty välkevaikutuksille raja-arvoa tai suositusarvoa. Ympäristöhallinnon ohjeen (Ympäristöministeriö, 2016) mukaan Suomessa voidaan soveltaa muiden maiden ohjearvoja. Esimerkiksi Ruotsissa suositusarvo on maksimissaan kahdeksan tuntia välkettä vuodessa ns. todellisessa tilanteessa (real case). Todellisessa tilanteessa on huomioitu keskimääräiset auringon paistetunnit sekä tuulen suunnan jakauma.

Lisäksi esimerkiksi Saksassa on raja-arvo 30 minuuttia päivässä sekä 30 tuntia vuodessa teoreettisessa maksimitilanteessa (worst case). Teoreettinen maksimitilanne tarkoittaa tilannetta, jossa kaikkien voimaloiden oletetaan olevan toiminnassa keskeytyksettä ja taivaan oletetaan aina olevan pilvetön. Aurinkoisina ajanjaksoina teoreettinen maksimitilanne voi toteutua päivätasolla, mutta ei vuositasolla. Tanskassa sovelletaan kymmenen tunnin vuotuisen välkkeen raja-arvoa todellisessa tilanteessa. (Ympäristöministeriö, 2016)

### 4. Lähtötiedot ja menetelmät

#### 4.1 Lähtötiedot

Tuulivoimaloiden aiheuttamien välkevaikutuksen laskennassa varjot huomioidaan, jos aurinko on yli 3 astetta horisontin yläpuolella ja varjoksi lasketaan, kun siipi peittää vähintään 20 % auringosta.

Mallinnuksessa on käytetty Vestaksen voimalaa V162-7.2 MW, jonka napakorkeus on 200 m ja roottorin halkaisija on 240 m. Tuulivoimalan lapatietojen keskiarvon avulla ohjelmisto laskee maksimietäisyyden voimaloista, jossa välkevaikutukset lasketaan.

Välkkeen mallinnuksessa on huomioitu hankealueen korkeustiedot, jotka perustuvat Maanmittauslaitoksen maastotietokannan aineistoon.

Auringon keskimääräiset paistetunnit perustuvat Jyväskylän lentoaseman sääaseman pitkäaikaisiin säätietoihin 1991-2020 (Ilmatieteen laitos, 2021). Laskentojen tuulen suuntana ja nopeusjakaumana käytettiin Ilmatieteen laitoksen Tuuliatlaksen dataa hankealueelta. Alla olevissa taulukoissa on esitetty todellisen tilanteen välkemäärän mallinnuksessa käytetyt auringonpaistetunnit (Taulukko 1) ja tuulisuusdata (Taulukko 2). Taulukossa 2 esitetyissä tuulisuusarvoissa on huomioitu Tuuliatlaksen aineistossa esitetty napakorkeuden tuotantotappioarvio (6,99 %).

Taulukko 1. Auringonpaistetunnit Jyväskylän lentoaseman sääasemalla (Ilmatieteenlaitos, 2021)

Kuukausi	Auringonpaistetunnit/kk	Auringonpaistetunnit/pv
Tammikuu	25	0,81
Helmikuu	63	2,25
Maaliskuu	136	4,39
Huhtikuu	179	5,97
Toukokuu	252	8,13
Kesäkuu	244	8,13
Heinäkuu	261	8,42
Elokuu	208	6,71
Syyskuu	123	4,10

Lokakuu	59	1,90
Marraskuu	20	0,67
Joulukuu	10	0,32

Taulukko 4. Mallinnuksessa käytetty tuulisuusdata (Ilmatieteen laitos 2009).

Ilmansuunta	Frekvenssi koko aineistolle (%)	Tuulisuus tuotantotappio huomioiden (h/v)
N	6,9	562
NNE	5,26	429
ENE	3,81	310
E	4,18	341
ESE	5,9	481
SSE	9,74	794
S	11,37	926
SSW	12,78	1041
WSW	13,15	1071
W	10,77	878
WNW	9,01	734
NNW	7,14	582

Voimaloista aiheutuvaa väkettä tarkasteltiin seitsemässä reseptoripisteessä lähellä Kokkopetäikön tuulivoimaloita. Selvityksessä tarkastellut reseptoripisteet on esitetty Taulukossa 3 ja Kuvissa 3–6.

Taulukko 3. Välkeseelvityksessä tarkastellut reseptoripisteet

Tunnus	Rakennusluokitus	Itä (ETRS-TM35 FIN)	Pohjoinen (ETRS-TM35 FIN)
A	Asuinrakennus	433 196	7 069 450
B	Lomarakennus	434 902	7 068 448
C	Asuinrakennus	435 343	7 075 466
D	Lomarakennus, johon ei löydy lupatietoa Pyhäjärven rakennusvalvonnasta	437 755	7 071 880
E	Lomarakennus	437 777	7 074 862
F	Asuinrakennus	438 345	7 071 927
G	Asuinrakennus	438 766	7 072 916

## 4.2 Menetelmät

Tuulivoimaloiden aiheuttama välke on mallinnettu windPRO 3.6 -ohjelmalla. Laskennan tarkastelukorkeutena käytettiin 1,6 metriä ja välkevaikutuksen havainnointi-ikkunan mittoina ohjelman ehdottamia oletusmittoja (1 metrin leveys ja 1 metrin korkeus). Mallinnukset tehtiin reseptoripisteiden ollessa ns. kasvihuone-tilassa, jossa rakennukseen kohdistuvaa välkettä huomioidaan ilmansuunnasta riippumatta, kun välkealue havaitaan rakennuksen kohdalla.

Maaston korkeusaineistona mallinnoissa on käytetty Maanmittauslaitoksen kymmenen metrin korkeusmallia. Maaston karkeusaineistona on käytetty *Corine Land Cover 2018:n* 100 metrin ruudukkoa. Mallinnukset tehtiin ilman puuston vaikutuksen huomioimista.

# 5. Välkevaikutukset

## 5.1 Kokkopetäikön hanke




### 5.1.1 VE1

VE1-layoutin ilman puuston vaikutusta tehdyn välkemallinnuksen todellisen määrän (h/v) ja teoreettisen maksimimäärän (h/v ja min/pv) mallinnustulokset on esitetty taulukossa 6. VE1-layoutin välkemallinnuksen todellisen määrän (h/v) mallinnuskartta on esitetty kuvassa 3.






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Välkevaikutus

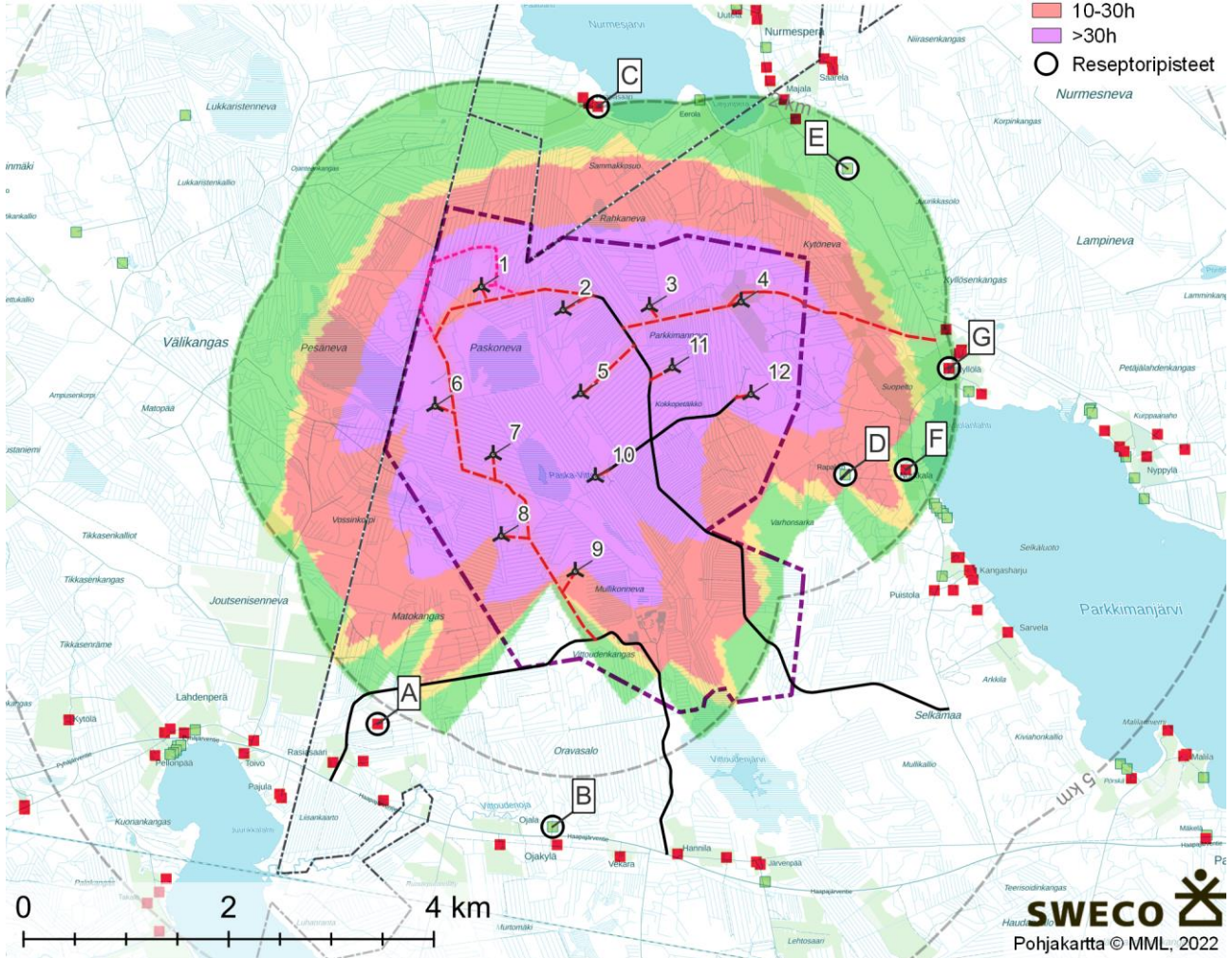
-  Hankealueen raja
-  Voimala VE1
-  Etäisyysvyöhyke voimaloista

Rakennus

-  Asuin
-  Loma
-  Purettu tai ei tietoa rakennusluvasta

Välke

- tuntia/vuodessa
-  1-8h
-  8-10h
-  10-30h
-  >30h
-  Reseptoripisteet



Kuva 3. VE1-layutin välkemallinnuksen todellinen välkemäärä ilman puuston vaikutuksen huomioimista.

Mallinnustuloksien perusteella välkkeen todellinen määrä ylittää Ruotsissa käytetyn suositusarvon (8 h/v) ainoastaan pisteessä D, jossa välkkeen todellinen määrä mallinnustuloksien perusteella on 16 tuntia ja 47 minuuttia vuodessa. Muissa tarkastelupisteissä Ruotsissa käytetty suositusarvo (8 h/v) ei ylity. (Taulukko 4)

Mallinnustuloksien perusteella teoreettinen maksimivälkemäärä ylittää Saksan raja-arvon (30 h/v) tarkastelupisteissä C ja D. Mallinnustuloksien perusteella teoreettinen maksimivälkemäärä ylittää Saksan raja-arvon (30 min/pv) tarkastelupisteissä C, D, E, F. (Taulukko 4)

Taulukko 4. VE1-layoutin välkemallinnuksen tulokset ilman puuston vaikutuksen huomioimista. Ruotsin suositusarvon ja Saksan raja-arvojen ylitykset on lihavoitu.

Tarkastelupiste	Välkkeen todellinen määrä (h/v)	Välkkeen teoreettinen maksimimäärä (h/v)	Välkkeen teoreettinen maksimimäärä (h/pv)
A	0:00	0:00	0:00
B	0:00	0:00	0:00
C	3:29	<b>47:11</b>	<b>0:59</b>
D	<b>16:47</b>	<b>67:49</b>	<b>0:53</b>
E	2:39	22:11	<b>0:34</b>
F	6:52	27:27	<b>0:35</b>
G	2:30	12:42	0:28

### 5.1.2 VE2

VE2-layoutin ilman puuston vaikutusta tehdyn välkemallinnuksen todellisen määrän (h/v) ja teoreettisen maksimimäärän (h/v ja min/pv) mallinnustulokset on esitetty taulukossa 5. VE2-layoutin välkemallinnuksen todellisen määrän (h/v) mallinnuskartta on esitetty kuvassa 4.



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Välkevaikutus

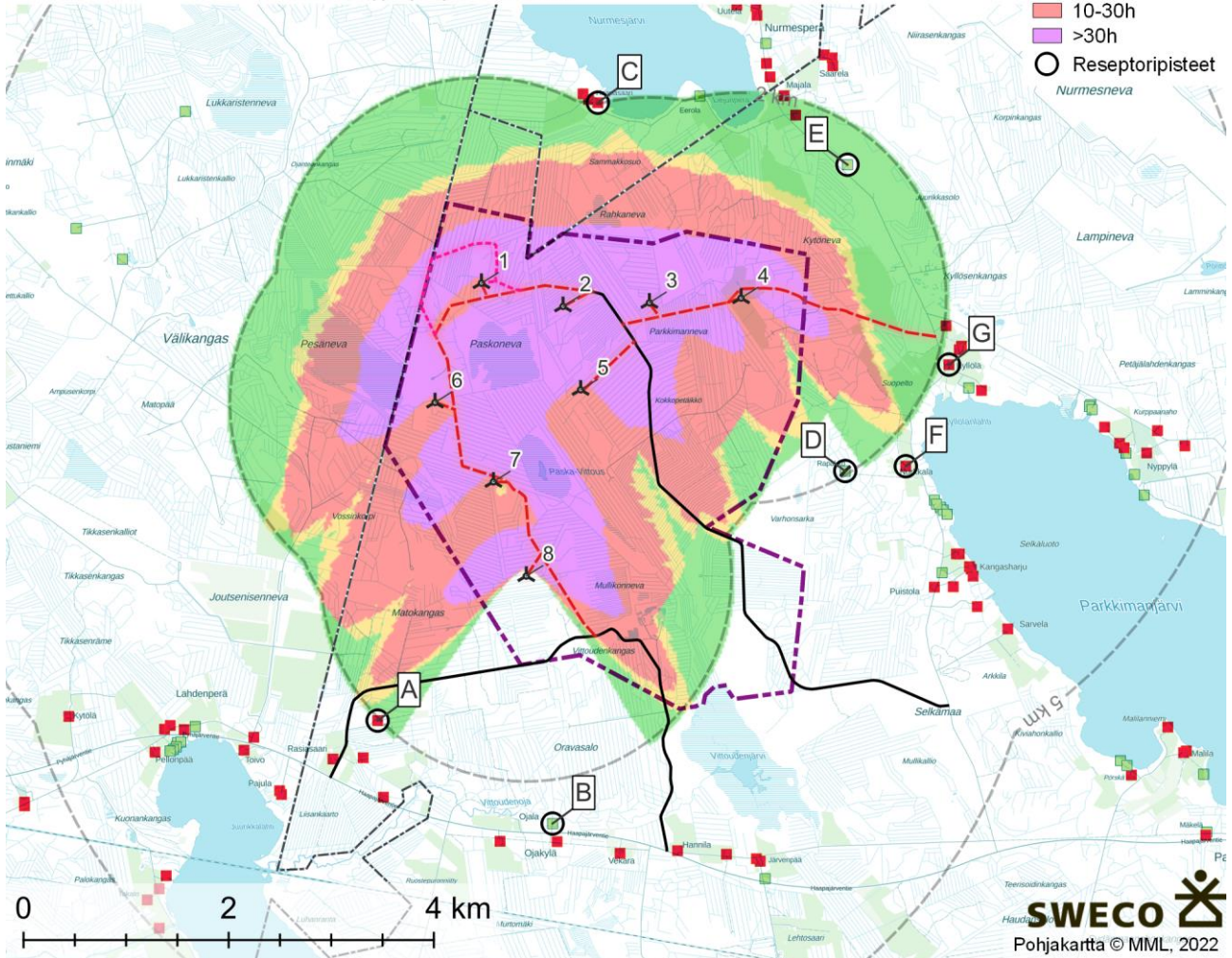
- Hankealueen raja
- Voimala VE2
- Etäisyysvyöhyke voimaloista

Rakennus

- Asuin
- Loma
- Purettu tai ei tietoa rakennusluvasta

Välke

- tuntia/vuodessa
- 1-8h
- 8-10h
- 10-30h
- >30h
- Reseptoripisteet



Kuva 4. VE2-layutin välkemallinnuksen todellinen välkemäärä ilman puuston vaikutuksen huomioimista.

Mallinnustuloksien perusteella välkkeen todellinen määrä ei ylitä Ruotsissa käytettyä suositusarvoa (8 h/v) välkemallinnuksen tarkastelupisteissä. (Taulukko 5)

Mallinnustuloksien perusteella teoreettinen maksimivälkemäärä ylittää Saksan raja-arvon (30 h/v) tarkastelupisteessä C. Mallinnustuloksien perusteella teoreettinen maksimivälkemäärä on yli Saksan raja-arvon (30 min/pv) tarkastelupisteissä C ja E (Taulukko 5).

Taulukko 5. VE2-layoutin välkemallinnuksen tulokset ilman puuston vaikutuksen huomioimista. Saksan raja-arvojen ylitykset on lihavoitu.

Tarkastelupiste	Välkkeen todellinen määrä (h/v)	Välkkeen teoreettinen maksimimäärä (h/v)	Välkkeen teoreettinen maksimimäärä (h/pv)
<b>A</b>	5:27	22:53	0:30
<b>B</b>	0:00	0:00	0:00
<b>C</b>	3:29	<b>47:11</b>	<b>0:59</b>
<b>D</b>	0:00	0:00	0:00
<b>E</b>	2:39	22:11	<b>0:34</b>
<b>F</b>	0:00	0:00	0:00
<b>G</b>	0:00	0:00	0:00

## 5.2 Yhteisvaikutukset

Kokkopetäikön tuulipuiston voimaloiden välkevaikutusten lisäksi tässä välkeselvityksessä tarkasteltiin Välikankaan, Riitamaa-Nurmesnevan ja Murtomäki 2 tuulivoimapuistojen yhteisvaikutuksia välkevaikutuksiin. Kokkopetäikön lisäksi yhteisvaikutusten arvioinnissa käytettyjen tuulivoimapuistojen tuulivoimalamäärät, napakorkeudet, roottorin halkaisijat ja voimalatyyppit on esitetty Taulukossa 6.

Yhteisvaikutusten arvioinnissa välkevaikutuksia mallinnettiin luvussa 4 esitetyin lähtötiedoin sekä menetelmin ja reseptoripisteinä käytettiin taulukossa 3 esitettyjä reseptoripisteitä. Yhteisvaikutusten arvioinnin voimaloiden sijaintikoordinaatit on esitetty liitteen 2 mallinnustulosteissa.

Taulukko 6. Yhteisvaikutusten arvioinnissa käytettyjen tuulivoimapuistojen tiedot

Tuulivoimapuisto	Tuulivoimaloiden määrä	Napakorkeus	Roottorin halkaisija	Voimalatyyppi
Kokkopetäikkö	12 (VE1)	200	240	Vestas V162 – 7.2 MW
	8 (VE2)	200	240	Vestas V162 – 7.2 MW
Välikangas	16	145	150	Vestas V150– 4.2 MW
Nurmesneva-Riitamaa	53	200	200	Vestas V162 – 7.2 MW
Murtomäki 2	17	180	200	Siemens Gamesa SG 6.0 – 170 6,2 MW

### 5.2.1 VE1

VE1-layoutin ilman puuston vaikutusta tehdyn yhteisvaikutusten välkemallinnuksen todellisen määrän (h/v) ja teoreettisen maksimimäärän (h/v ja min/pv) mallinnustulokset on esitetty taulukossa 7. VE1-layoutin yhteisvaikutusten välkemallinnuksen todellisen määrän (h/v) mallinnuskartta on esitetty kuvassa 3.



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## Välkevaikutus yhteisvaikutukset

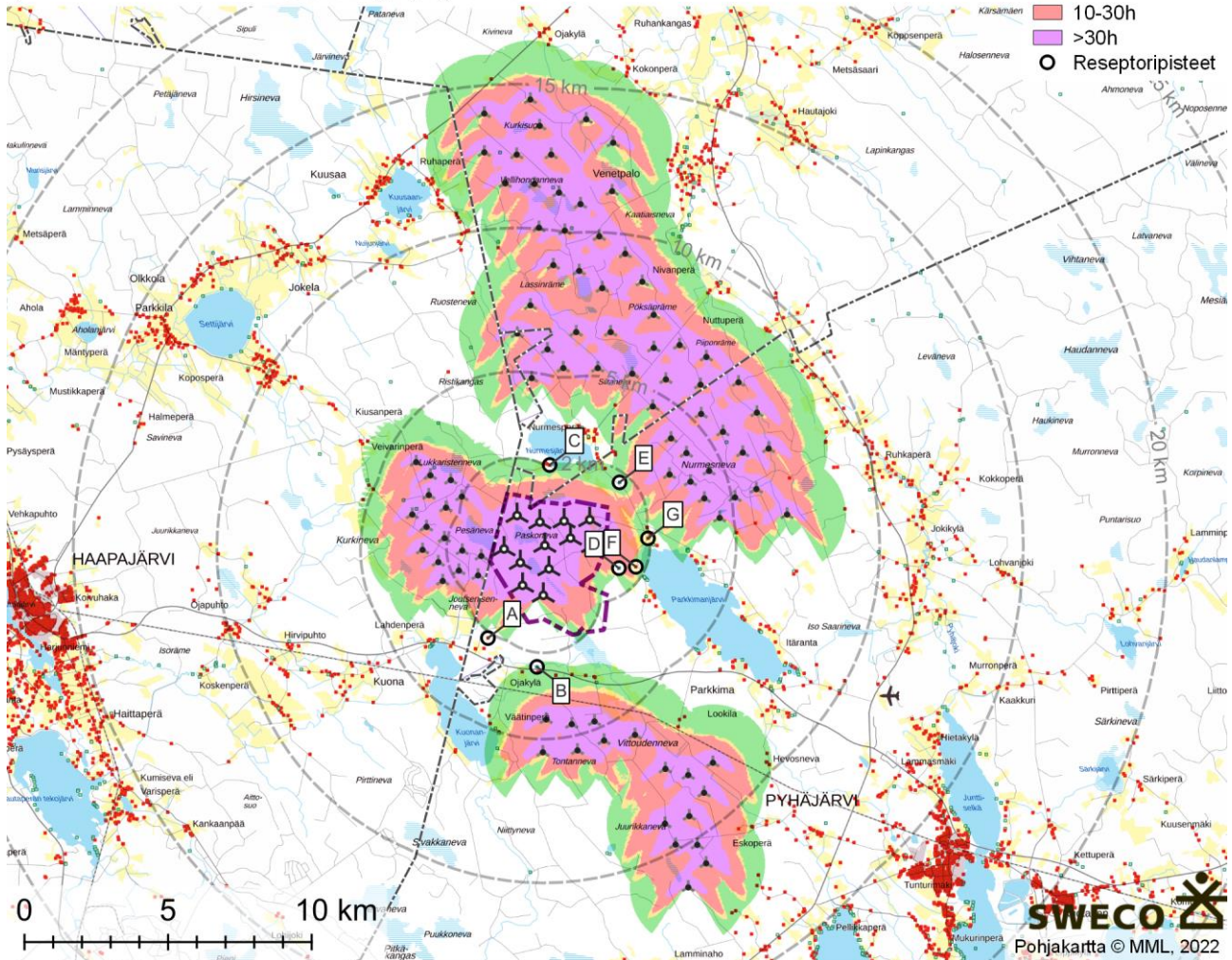
- Hankealueen raja
- Voimala VE1
- Etäisyysvyöhyke voimaloista

## Rakennus

- Asuin
- Loma
- Tuulivoimala

## Välke

- tuntia/vuodessa
- 1-8h
- 8-10h
- 10-30h
- >30h
- Reseptoripisteet



Kuva 3. VE1-laitos yhteisvaikutusten välkemallinnuksen todellinen välkemäärä ilman puuston vaikutuksen huomioimista.

Yhteisvaikutusten mallinnustuloksien perusteella välkkeen todellinen määrä ylittää Ruotsissa käytetyn suositusarvon (8 h/v) ainoastaan pisteessä D, jossa välkkeen todellinen määrä mallinnustuloksien perusteella on 16 tuntia ja 47 minuuttia vuodessa. Muissa tarkastelupisteissä Ruotsissa käytetty todellisen välkemäärän suositusarvo (8 h/v) ei ylitä. (Taulukko 7)

Yhteisvaikutusten mallinnustuloksien perusteella teoreettinen maksimivälkemäärä ylittää Saksan raja-arvon (30 h/v) tarkastelupisteissä C, D ja E. Yhteisvaikutusten mallinnustulosten perusteella teoreettinen maksimivälkemäärä ylittää Saksan raja-arvon (30 min/pv) tarkastelupisteissä C, D, E ja F. (Taulukko 7)

Taulukko 7. VE1-layoutin yhteisvaikutusten välkemallinnuksen tulokset ilman puuston vaikutuksen huomioimista. Ruotsin suositusarvon ja Saksan raja-arvojen ylitykset on lihavoitu.

Tarkastelupiste	Välkkeen todellinen määrä (h/v)	Välkkeen teoreettinen maksimimäärä (h/v)	Välkkeen teoreettinen maksimimäärä (h/pv)
A	0:00	0:00	0:00
B	1:29	20:33	0:26
C	3:29	<b>47:11</b>	<b>0:59</b>
D	<b>16:47</b>	<b>67:49</b>	<b>0:53</b>
E	5:35	<b>35:01</b>	<b>0:34</b>
F	6:52	27:27	<b>0:35</b>
G	2:30	12:42	0:28

Yhteisvaikutusten välkemallinnustulosten perusteella mallinnetut välkemäärät kasvavat tarkastelupisteissä B ja E verrattuna pelkän Kokkopetäikön VE1-layoutin välkemallinnustuloksiin. Yhteisvaikutuksista johtuen tarkastelupisteessä E ylittyy Saksan raja-arvo teoreettiselle maksimivälkemäärälle (30 h/v), joka ei ylity pelkän Kokkopetäikön VE1-layoutin mallinnuksessa. Mallinnustuloksen perusteella tarkastelupisteessä B ei tarkastellut suositus- ja ohjearvot ylity yhteisvaikutusten välkemallinnuksessa tai pelkän Kokkopetäikön VE1-layoutin mallinnuksessa.

## 5.2.2 VE2

VE2-layoutin ilman puuston vaikutusta tehdyn yhteisvaikutusten välkemallinnuksen todellisen määrän (h/v) ja teoreettisen maksimimäärän (h/v ja min/pv) mallinnustulokset on esitetty taulukossa 8. VE2-layoutin yhteisvaikutusten välkemallinnuksen todellisen määrän (h/v) mallinnuskartta on esitetty kuvassa 4.



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## Välkevaikutus yhteisvaikutukset

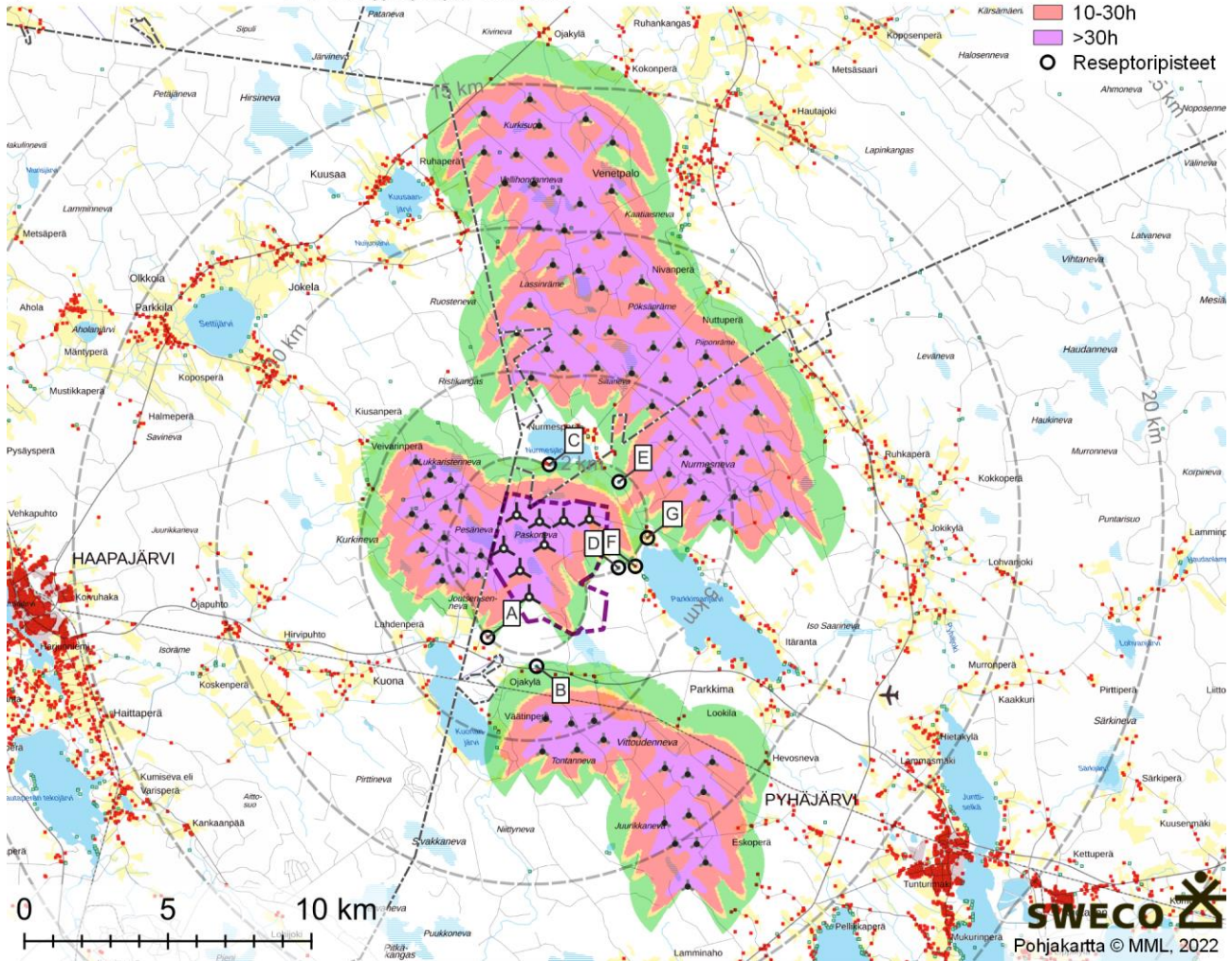
- Hankealueen raja
- Voimala VE2
- Etäisyysvyöhyke voimaloista

## Rakennus

- Asuin
- Loma
- Tuulivoimala

## Välke

- tuntia/vuodessa
- 1-8h
- 8-10h
- 10-30h
- >30h
- Reseptoripisteet



Kuva 4. VE2-laitus yhteisvaikutusten välkemallinnuksen todellinen välkemäärä ilman puuston vaikutuksen huomioimista.

Yhteisvaikutusten mallinnustuloksien perusteella välkkeen todellinen määrä ei ylitä Ruotsissa käytettyä suositusarvoa (8 h/v) yhdessäkään mallinnuksen tarkastelupisteessä. (Taulukko 8)

Yhteisvaikutusten mallinnustuloksien perusteella teoreettinen maksimivälkemäärä ylitteää Saksan raja-arvon (30 h/v) tarkastelupisteissä C ja E. Yhteisvaikutusten mallinnustulosten perusteella teoreettinen maksimivälkemäärä on yli Saksan raja-arvon (30 min/pv) tarkastelupisteissä C ja E. (Taulukko 8)

Taulukko 8. VE2-layoutin yhteisvaikutusten välkemallinnuksen tulokset ilman puuston vaikutuksen huomioimista. Ruotsin suositusarvon ja Saksan raja-arvojen ylitykset on lihavoitu.

Tarkastelupiste	Välkkeen todellinen määrä (h/v)	Välkkeen teoreettinen maksimimäärä (h/v)	Välkkeen teoreettinen maksimimäärä (h/pv)
A	5:27	22:53	0:30
B	1:29	20:33	0:26
C	3:29	<b>47:11</b>	<b>0:59</b>
D	0:00	0:00	0:00
E	5:35	<b>35:01</b>	<b>0:34</b>
F	0:00	0:00	0:00
G	0:00	0:00	0:00

Yhteisvaikutusten välkemallinnustulosten perusteella mallinnetut välkemäärät kasvavat tarkastelupisteissä B ja E verrattuna pelkän Kokkopetäikön VE2-layoutin välkemallinnustuloksiin. Yhteisvaikutuksista johtuen tarkastelupisteessä E ylittyy Saksan raja-arvo teoreettiselle maksimivälkemäärälle (30 h/v), mikä ei ylity pelkän Kokkopetäikön VE2-layoutin mallinnuksessa. Mallinnustuloksen perusteella tarkastelupisteessä B ei tarkastellut suositus- ja ohjearvot ylity yhteisvaikutusten välkemallinnuksessa tai pelkän Kokkopetäikön VE2-layoutin mallinnuksessa.

### 5.3 Epävarmuustekijät

Todellisen välkevaikutuksen mallinnus (real case) edustaa keskimääräistä varjostustilannetta, jossa pohjana on käytetty pitkän ajan tilastollisia sääarvoja. Mikäli sääolosuhteet poikkeavat merkittävästi tilastoiduista arvoista, myös välkkeen määrä saattaa poiketa mallinnetusta. Myös epävarmuus oletetuista tuulensunnista voi vaikuttaa mallinnustulokseen.

Mallinnuksissa reseptoripisteissä käytettiin nk. kasvihuone -oletusta, jossa rakennukseen kohdistuvaa välkettä tarkastellaan kaikista suunnista. Todellisessa tilanteessa sisätiloihin muodostuu mahdollisesti välkettä vain niihin huoneisiin, joissa on ikkunoita tuulivoimaloita kohden.

Tuulivoimaloiden käyttöaste eli aika, jolloin voimalat pyörivät ja tuottavat sähköä, vaikuttaa merkittävästi välkkeen syntymiseen. Käyttöasteen pieneneminen saattaa vähentää välkettä yksittäisessä pisteessä.

Välkemallinnus on tehty ilman puuston vaikutuksen huomioimista. Puusto rajoittaa rakennuksiin kohdistuvaa välkevaikutusta, minkä takia mallinnus ilman puustoa kuvastaa todennäköisesti todellista suurempaa välkevaikutusta.

## 6. Yhteenveto

Välkeselvitys tehtiin Kokkopetäikön tuulivoimapuistolle Pyhäjärvelle. Välkemallinnukset tehtiin VE1-layoutille (12 voimalaa) ja VE2-layoutille (8 voimalaa). Mallinnukset tehtiin ilman puuston vaikutuksen huomioimista. Mallinnuksessa Kokkopetäikön voimaloiden napakorkeus oli 200 m ja roottorin halkaisija 240 m.

Mallinnustulosten perusteella todellinen välkemäärä ylittää Ruotsin suositusarvon (8 h/v) VE1-layoutin mallinnuksessa rakennuksessa D, johon ei Pyhäjärven rakennusvalvonnasta löydy lupatietoja. VE2-layoutin mallinnuksessa todellisen välkemäärän Ruotsin suositusarvo 8 h/v ei ylity tarkastelurakennuksien kohdalla.



Mallinnustulosten perusteella teoreettinen maksimivälke ylittää Saksan raja-arvon (30 h/v) VE1-layoutin mallinnuksessa tarkastelurakennuksissa C ja D sekä VE2-layoutin mallinnuksessa tarkastelurakennuksessa C. Mallinnustulosten perusteella teoreettinen maksimivälke ylittää Saksan raja-arvon (30 min/pv) VE1-layoutin mallinnuksessa tarkastelurakennuksissa C,D,E ja F sekä VE2-layoutin mallinnuksessa tarkastelurakennuksissa C ja E.

Lisäksi välkeselvityksessä tarkasteltiin välkemäärän osalta yhteisvaikutuksia kolmen Kokkopetäikön läheisen tuulivoimapuiston kanssa: Välikankaan (145 m napakorkeus ja 150 roottorin halkaisija), Murtomäki 2:n (180 m napakorkeus ja roottorin halkaisija 200 m) ja Riitamaa-Nurmesnevan (200 m napakorkeus ja 200 m roottorin halkaisija). Yhteisvaikutusten mallinnukset tehtiin ilman puuston vaikutuksen huomioimista.

Yhteisvaikutusmallinnustulosten perusteella todellinen välkemäärä ylittää Ruotsin suositusarvon (8 h/v) VE1-layoutin yhteisvaikutusmallinnuksessa tarkastelurakennuksessa D. VE2-layoutin yhteisvaikutusmallinnuksessa todellisen välkemäärän Ruotsin suositusarvo 8 h/v ei ylity tarkastelurakennuksissa.

Yhteisvaikutusmallinnustulosten perusteella teoreettinen maksimivälkemäärä ylittää Saksan raja-arvon (30 h/v) VE1-layoutin yhteisvaikutusmallinnuksessa tarkastelurakennuksissa C,D ja E sekä VE2-layoutin yhteisvaikutusmallinnuksessa tarkastelurakennuksissa C ja F. Yhteisvaikutusmallinnustulosten perusteella teoreettinen maksimivälkemäärä ylittää Saksan raja-arvon (30 min/pv) VE1-layoutin mallinnuksessa tarkastelurakennuksissa C,D,E ja F sekä VE2-layoutin yhteisvaikutusmallinnuksessa tarkastelurakennuksissa C ja E.

## 7. Lähteet

Ilmatieteen laitos, 2009. Suomen Tuuliatlas. Tuulisuustiedot koordinaattipisteessä Lat. 63.76821, Long. 25.68664. <http://tuuliatlas.fmi.fi/fi/> (Luettu 16.12.2022).

Ilmatieteen laitos, 2021. Tilastoja Suomen ilmastosta ja merestä 1991–2020. Raportteja 8/2021.

Ympäristöministeriö, 2016. Tuulivoimarakentamisen suunnittelu Päivitys 2016. Ympäristöministeriö, Ympäristöhallinnon ohjeita 5/2016, <http://urn.fi/URN:ISBN:978-952-11-4634-3>.

# LIITE 1. Hankevaihtoehtojen VE1 ja VE2 välkemallinnusten windPRO-tulosteita

## SHADOW - Main Result

Calculation: Kokkopetaikkö\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2023

### 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  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

Operational time  
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

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: Elevation Grid Data Object: kokkopetaikko\_EMDGrid\_4.  
Receptor grid resolution: 1,0 m

All coordinates are in  
Finish TM ETRS-TM35FIN-ETRS89

### WTGs

	East	North	Z	Row data/Description	WTG type				Shadow data			
					Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM [RPM]
10_VE1	435 319	7 071 856	153,5	VESTAS V162-7.2 7200 240.0...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
11_VE1	436 069	7 072 925	155,6	VESTAS V162-7.2 7200 240.0...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
12_VE1	436 836	7 072 662	157,3	VESTAS V162-7.2 7200 240.0...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
1_VE1	434 208	7 073 709	157,4	VESTAS V162-7.2 7200 240.0...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
2_VE1	435 004	7 073 483	155,6	VESTAS V162-7.2 7200 240.0...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
3_VE1	435 846	7 073 518	154,5	VESTAS V162-7.2 7200 240.0...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
4_VE1	436 739	7 073 563	154,7	VESTAS V162-7.2 7200 240.0...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
5_VE1	435 175	7 072 670	156,0	VESTAS V162-7.2 7200 240.0...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
6_VE1	433 756	7 072 547	160,5	VESTAS V162-7.2 7200 240.0...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
7_VE1	434 322	7 072 074	156,1	VESTAS V162-7.2 7200 240.0...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
8_VE1	434 401	7 071 282	159,7	VESTAS V162-7.2 7200 240.0...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
9_VE1	435 123	7 070 935	155,5	VESTAS V162-7.2 7200 240.0...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5

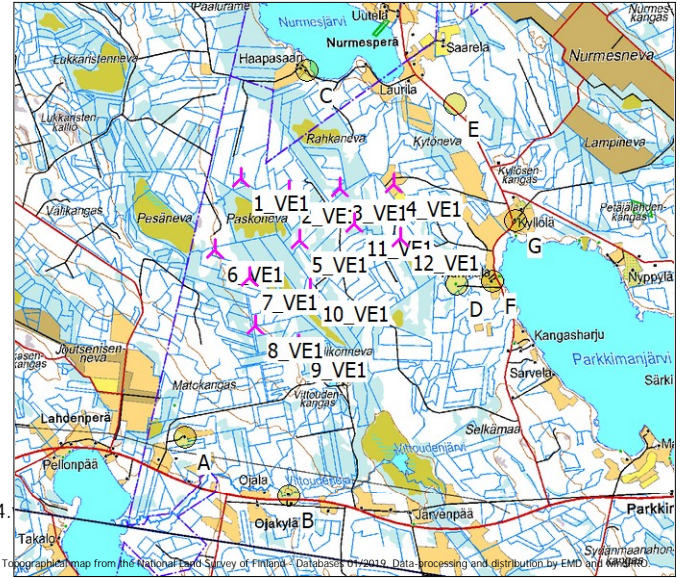
### Shadow receptor-Input

No.	East	North	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
	[m]	[m]	[m]	[m]	[m]	[m]	[°]		[m]
A	433 196	7 069 450	142,9	1,0	1,0	1,0	90,0	"Green house mode"	2,0
B	434 902	7 068 448	149,9	1,0	1,0	1,0	90,0	"Green house mode"	2,0
C	435 343	7 075 466	151,2	1,0	1,0	1,0	90,0	"Green house mode"	2,0
D	437 755	7 071 880	157,4	1,0	1,0	1,0	90,0	"Green house mode"	2,0
E	437 777	7 074 862	158,4	1,0	1,0	1,0	90,0	"Green house mode"	2,0
F	438 345	7 071 927	153,2	1,0	1,0	1,0	90,0	"Green house mode"	2,0
G	438 766	7 072 916	153,8	1,0	1,0	1,0	90,0	"Green house mode"	2,0

### Calculation Results

No.	Shadow, worst case			Shadow, expected values	
	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]	Shadow hours per year [h/year]
A	0:00	0	0:00	0:00	0:00
B	0:00	0	0:00	0:00	0:00
C	47:11	70	0:59	3:29	3:29
D	67:49	104	0:53	16:47	16:47

To be continued on next page...



## SHADOW - Main Result

Calculation: Kokkopetaikkö\_VE1\_Välkemallinnus\_ilman puustoa\_11.01.2023

...continued from previous page

No.	Shadow, worst case		Shadow, expected values	
	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
E	22:11	50	0:34	2:39
F	27:27	62	0:35	6:52
G	12:42	36	0:28	2:30

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

No.	Name	Worst case [h/year]	Expected [h/year]
10_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (87)	0:00	0:00
11_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (86)	20:51	5:20
12_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (84)	87:07	20:49
1_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (78)	0:00	0:00
2_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (80)	25:06	1:49
3_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (89)	22:05	1:40
4_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (83)	22:11	2:39
5_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (81)	0:00	0:00
6_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (79)	0:00	0:00
7_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (82)	0:00	0:00
8_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (85)	0:00	0:00
9_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (88)	0:00	0:00

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

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

## SHADOW - Calendar

Calculation: Kokkopetaikko\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2023 Shadow receptor: A - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (13)  
Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

## Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.04	08.58	07.28	06.40	04.56	03.22	03.03	04.25	05.59	07.24	07.56	09.28
	14.38	16.06	17.34	20.06	21.36	23.11	23.39	22.21	20.36	18.51	16.06	14.44
2	10.04	08.55	07.25	06.37	04.53	03.20	03.05	04.29	06.02	07.26	07.59	09.31
	14.40	16.09	17.37	20.09	21.39	23.14	23.38	22.18	20.32	18.47	16.03	14.43
3	10.03	08.52	07.21	06.33	04.50	03.18	03.06	04.32	06.04	07.29	08.02	09.34
	14.42	16.12	17.40	20.12	21.42	23.16	23.36	22.14	20.29	18.44	16.00	14.41
4	10.01	08.49	07.18	06.30	04.46	03.15	03.08	04.35	06.07	07.32	08.05	09.36
	14.44	16.15	17.44	20.15	21.46	23.19	23.35	22.11	20.25	18.40	15.57	14.39
5	10.00	08.46	07.14	06.26	04.43	03.13	03.10	04.38	06.10	07.35	08.08	09.39
	14.46	16.19	17.47	20.17	21.49	23.21	23.33	22.08	20.22	18.37	15.54	14.37
6	09.59	08.43	07.11	06.23	04.40	03.11	03.12	04.41	06.13	07.38	08.12	09.41
	14.49	16.22	17.50	20.20	21.52	23.24	23.31	22.05	20.18	18.33	15.51	14.36
7	09.57	08.40	07.07	06.19	04.36	03.09	03.14	04.44	06.16	07.41	08.15	09.44
	14.51	16.25	17.53	20.23	21.55	23.26	23.29	22.01	20.15	18.30	15.47	14.34
8	09.56	08.37	07.04	06.16	04.33	03.07	03.17	04.47	06.19	07.44	08.18	09.46
	14.53	16.28	17.55	20.26	21.58	23.28	23.27	21.58	20.11	18.26	15.44	14.33
9	09.54	08.34	07.01	06.12	04.30	03.06	03.19	04.50	06.22	07.47	08.21	09.48
	14.56	16.32	17.58	20.29	22.01	23.30	23.25	21.55	20.08	18.23	15.41	14.32
10	09.52	08.31	06.57	06.09	04.27	03.04	03.21	04.53	06.24	07.49	08.24	09.50
	14.58	16.35	18.01	20.32	22.05	23.32	23.23	21.51	20.04	18.20	15.38	14.30
11	09.51	08.27	06.54	06.05	04.23	03.02	03.24	04.56	06.27	07.52	08.27	09.52
	15.01	16.38	18.04	20.35	22.08	23.34	23.21	21.48	20.01	18.16	15.35	14.29
12	09.49	08.24	06.50	06.02	04.20	03.01	03.26	04.59	06.30	07.55	08.31	09.54
	15.04	16.41	18.07	20.38	22.11	23.36	23.18	21.45	19.57	18.13	15.32	14.28
13	09.47	08.21	06.47	05.58	04.17	03.00	03.29	05.02	06.33	07.58	08.34	09.56
	15.07	16.45	18.10	20.41	22.14	23.37	23.16	21.41	19.54	18.09	15.30	14.28
14	09.45	08.18	06.43	05.55	04.14	02.58	03.32	05.05	06.36	08.01	08.37	09.57
	15.09	16.48	18.13	20.44	22.17	23.39	23.13	21.38	19.50	18.06	15.27	14.27
15	09.43	08.15	06.40	05.51	04.11	02.57	03.35	05.08	06.38	08.04	08.40	09.59
	15.12	16.51	18.16	20.47	22.20	23.40	23.11	21.34	19.47	18.02	15.24	14.26
16	09.40	08.11	06.36	05.48	04.07	02.56	03.37	05.11	06.41	08.07	08.43	10.00
	15.15	16.54	18.19	20.50	22.23	23.41	23.08	21.31	19.43	17.59	15.21	14.26
17	09.38	08.08	06.33	05.44	04.04	02.55	03.40	05.15	06.44	08.10	08.47	10.02
	15.18	16.57	18.22	20.53	22.27	23.42	23.06	21.28	19.40	17.56	15.18	14.26
18	09.36	08.05	06.29	05.41	04.01	02.55	03.43	05.18	06.47	08.13	08.50	10.03
	15.21	17.00	18.25	20.56	22.30	23.43	23.03	21.24	19.36	17.52	15.15	14.25
19	09.33	08.01	06.26	05.37	03.58	02.55	03.46	05.21	06.50	08.16	08.53	10.04
	15.24	17.04	18.28	20.59	22.33	23.44	23.00	21.21	19.33	17.49	15.13	14.25
20	09.31	07.58	06.22	05.34	03.55	02.55	03.49	05.23	06.53	08.19	08.56	10.05
	15.27	17.07	18.31	21.02	22.36	23.44	22.57	21.17	19.29	17.46	15.10	14.26
21	09.28	07.55	06.19	05.31	03.52	02.55	03.52	05.26	06.55	08.22	08.59	10.05
	15.30	17.10	18.34	21.05	22.39	23.44	22.54	21.14	19.26	17.42	15.07	14.26
22	09.26	07.52	06.15	05.27	03.49	02.55	03.55	05.29	06.58	08.25	09.02	10.06
	15.34	17.13	18.37	21.08	22.42	23.45	22.52	21.10	19.22	17.39	15.05	14.26
23	09.23	07.48	06.12	05.24	03.46	02.56	03.58	05.32	07.01	08.28	09.05	10.06
	15.37	17.16	18.40	21.11	22.45	23.45	22.49	21.07	19.19	17.36	15.02	14.27
24	09.21	07.45	06.08	05.20	03.44	02.56	04.01	05.35	07.04	08.31	09.08	10.07
	15.40	17.19	18.42	21.14	22.48	23.44	22.46	21.04	19.15	17.32	15.00	14.27
25	09.18	07.41	06.05	05.17	03.41	02.57	04.04	05.38	07.07	07.34	09.11	10.07
	15.43	17.22	18.45	21.17	22.51	23.44	22.43	21.00	19.12	16.29	14.58	14.28
26	09.15	07.38	06.01	05.13	03.38	02.58	04.07	05.41	07.09	07.37	09.14	10.07
	15.46	17.25	18.48	21.21	22.54	23.44	22.40	20.57	19.08	16.26	14.55	14.29
27	09.13	07.35	05.58	05.10	03.35	02.59	04.10	05.44	07.12	07.40	09.17	10.07
	15.50	17.28	18.51	21.24	22.57	23.43	22.37	20.53	19.05	16.22	14.53	14.30
28	09.10	07.31	05.54	05.07	03.32	03.00	04.13	05.47	07.15	07.43	09.20	10.07
	15.53	17.31	18.54	21.27	23.00	23.42	22.33	20.50	19.01	16.19	14.51	14.32
29	09.07		06.51	05.03	03.30	03.00	04.16	05.50	07.18	07.46	09.23	10.06
	15.56		19.57	21.30	23.03	23.41	22.30	20.46	18.58	16.16	14.49	14.33
30	09.04		06.47	05.00	03.27	03.01	04.19	05.53	07.21	07.50	09.26	10.06
	15.59		20.00	21.33	23.06	23.40	22.27	20.43	18.54	16.13	14.46	14.34
31	09.01		06.44		03.25		04.22	05.56		07.53		10.05
	16.02		20.03		23.08		22.24	20.39		16.09		14.36
Potential sun hours	175	240	363	450	565	616	603	506	393	306	201	142
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: Kokkopetaikko\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2023 Shadow receptor: B - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (12)  
Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

## Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.04	08.58	07.28	06.40	04.56	03.22	03.03	04.25	05.59	07.23	07.56	09.28
	14.38	16.06	17.34	20.06	21.36	23.11	23.39	22.21	20.36	18.51	16.06	14.44
2	10.03	08.55	07.24	06.37	04.53	03.20	03.05	04.28	06.01	07.26	07.59	09.31
	14.40	16.09	17.37	20.09	21.39	23.13	23.37	22.17	20.32	18.47	16.03	14.42
3	10.02	08.52	07.21	06.33	04.50	03.18	03.06	04.32	06.04	07.29	08.02	09.33
	14.42	16.12	17.40	20.11	21.42	23.16	23.36	22.14	20.29	18.44	16.00	14.41
4	10.01	08.49	07.18	06.30	04.46	03.15	03.08	04.35	06.07	07.32	08.05	09.36
	14.44	16.15	17.43	20.14	21.45	23.18	23.34	22.11	20.25	18.40	15.57	14.39
5	10.00	08.46	07.14	06.26	04.43	03.13	03.10	04.38	06.10	07.35	08.08	09.39
	14.46	16.19	17.46	20.17	21.48	23.21	23.33	22.08	20.22	18.37	15.54	14.37
6	09.59	08.43	07.11	06.23	04.40	03.11	03.12	04.41	06.13	07.38	08.11	09.41
	14.49	16.22	17.49	20.20	21.52	23.23	23.31	22.04	20.18	18.33	15.50	14.36
7	09.57	08.40	07.07	06.19	04.36	03.09	03.14	04.44	06.16	07.41	08.15	09.43
	14.51	16.25	17.52	20.23	21.55	23.26	23.29	22.01	20.15	18.30	15.47	14.34
8	09.56	08.37	07.04	06.16	04.33	03.07	03.17	04.47	06.19	07.43	08.18	09.46
	14.53	16.28	17.55	20.26	21.58	23.28	23.27	21.58	20.11	18.26	15.44	14.33
9	09.54	08.34	07.00	06.12	04.30	03.06	03.19	04.50	06.21	07.46	08.21	09.48
	14.56	16.32	17.58	20.29	22.01	23.30	23.25	21.54	20.08	18.23	15.41	14.32
10	09.52	08.30	06.57	06.09	04.27	03.04	03.21	04.53	06.24	07.49	08.24	09.50
	14.58	16.35	18.01	20.32	22.04	23.32	23.23	21.51	20.04	18.19	15.38	14.30
11	09.50	08.27	06.53	06.05	04.23	03.02	03.24	04.56	06.27	07.52	08.27	09.52
	15.01	16.38	18.04	20.35	22.07	23.33	23.20	21.48	20.01	18.16	15.35	14.29
12	09.49	08.24	06.50	06.02	04.20	03.01	03.26	04.59	06.30	07.55	08.30	09.54
	15.04	16.41	18.07	20.38	22.11	23.35	23.18	21.44	19.57	18.13	15.32	14.28
13	09.47	08.21	06.47	05.58	04.17	03.00	03.29	05.02	06.33	07.58	08.34	09.55
	15.07	16.44	18.10	20.41	22.14	23.37	23.16	21.41	19.54	18.09	15.29	14.28
14	09.44	08.18	06.43	05.55	04.14	02.58	03.32	05.05	06.36	08.01	08.37	09.57
	15.09	16.48	18.13	20.44	22.17	23.38	23.13	21.38	19.50	18.06	15.27	14.27
15	09.42	08.14	06.40	05.51	04.11	02.57	03.35	05.08	06.38	08.04	08.40	09.59
	15.12	16.51	18.16	20.47	22.20	23.39	23.11	21.34	19.47	18.02	15.24	14.26
16	09.40	08.11	06.36	05.48	04.07	02.56	03.37	05.11	06.41	08.07	08.43	10.00
	15.15	16.54	18.19	20.50	22.23	23.41	23.08	21.31	19.43	17.59	15.21	14.26
17	09.38	08.08	06.33	05.44	04.04	02.55	03.40	05.14	06.44	08.10	08.46	10.01
	15.18	16.57	18.22	20.53	22.26	23.42	23.05	21.27	19.39	17.56	15.18	14.26
18	09.36	08.05	06.29	05.41	04.01	02.55	03.43	05.17	06.47	08.13	08.49	10.02
	15.21	17.00	18.25	20.56	22.29	23.42	23.03	21.24	19.36	17.52	15.15	14.25
19	09.33	08.01	06.26	05.37	03.58	02.55	03.46	05.20	06.50	08.16	08.53	10.03
	15.24	17.03	18.28	20.59	22.33	23.43	23.00	21.21	19.32	17.49	15.13	14.25
20	09.31	07.58	06.22	05.34	03.55	02.55	03.49	05.23	06.52	08.19	08.56	10.04
	15.27	17.07	18.31	21.02	22.36	23.44	22.57	21.17	19.29	17.45	15.10	14.26
21	09.28	07.55	06.19	05.30	03.52	02.55	03.52	05.26	06.55	08.22	08.59	10.05
	15.30	17.10	18.34	21.05	22.39	23.44	22.54	21.14	19.25	17.42	15.07	14.26
22	09.26	07.51	06.15	05.27	03.49	02.55	03.55	05.29	06.58	08.25	09.02	10.06
	15.34	17.13	18.36	21.08	22.42	23.44	22.51	21.10	19.22	17.39	15.05	14.26
23	09.23	07.48	06.12	05.24	03.46	02.56	03.58	05.32	07.01	08.28	09.05	10.06
	15.37	17.16	18.39	21.11	22.45	23.44	22.48	21.07	19.18	17.35	15.02	14.27
24	09.20	07.45	06.08	05.20	03.43	02.56	04.01	05.35	07.04	08.31	09.08	10.07
	15.40	17.19	18.42	21.14	22.48	23.44	22.45	21.03	19.15	17.32	15.00	14.27
25	09.18	07.41	06.05	05.17	03.41	02.57	04.04	05.38	07.06	07.34	09.11	10.07
	15.43	17.22	18.45	21.17	22.51	23.44	22.42	21.00	19.11	16.29	14.58	14.28
26	09.15	07.38	06.01	05.13	03.38	02.58	04.07	05.41	07.09	07.37	09.14	10.07
	15.46	17.25	18.48	21.20	22.54	23.43	22.39	20.56	19.08	16.26	14.55	14.29
27	09.12	07.35	05.58	05.10	03.35	02.59	04.10	05.44	07.12	07.40	09.17	10.07
	15.49	17.28	18.51	21.23	22.57	23.43	22.36	20.53	19.04	16.22	14.53	14.30
28	09.10	07.31	05.54	05.06	03.32	03.00	04.13	05.47	07.15	07.43	09.20	10.07
	15.53	17.31	18.54	21.27	23.00	23.42	22.33	20.50	19.01	16.19	14.51	14.32
29	09.07		06.51	05.03	03.30	03.00	04.16	05.50	07.18	07.46	09.23	10.06
	15.56		19.57	21.30	23.03	23.41	22.30	20.46	18.58	16.16	14.49	14.33
30	09.04		06.47	05.00	03.27	03.01	04.19	05.53	07.21	07.49	09.25	10.06
	15.59		20.00	21.33	23.05	23.40	22.27	20.43	18.54	16.13	14.46	14.34
31	09.01		06.44		03.25		04.22	05.56		07.53		10.05
	16.02		20.03		23.08		22.24	20.39		16.09		14.36
Potential sun hours	175	240	363	450	565	616	603	506	393	306	201	143
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: Kokkopetaikko\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2023  
Assumptions for shadow calculations

Shadow receptor: C - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (17)  
Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June				
1	10.05	12.48 (2_VE1)	08.58	11.13 (3_VE1)	07.28	06.40	04.56	03.21		
	14.37	1	12.49 (2_VE1)	16.05	33	13.12 (2_VE1)	17.34	20.06	21.36	23.12
2	10.04	12.48 (2_VE1)	08.55	11.15 (3_VE1)	07.24	06.36	04.52	03.19		
	14.39	8	12.56 (2_VE1)	16.08	23	13.09 (2_VE1)	17.37	20.09	21.39	23.14
3	10.03	12.47 (2_VE1)	08.52	11.17 (3_VE1)	07.21	06.33	04.49	03.16		
	14.41	14	13.01 (2_VE1)	16.12	14	11.31 (3_VE1)	17.40	20.12	21.43	23.17
4	10.02	12.48 (2_VE1)	08.49	11.20 (3_VE1)	07.18	06.29	04.46	03.14		
	14.43	19	13.07 (2_VE1)	16.15	8	11.28 (3_VE1)	17.43	20.14	21.46	23.20
5	10.01	12.47 (2_VE1)	08.46	11.14	07.14	06.26	04.42	03.12		
	14.45	21	13.08 (2_VE1)	16.18	17.46	20.17	21.49	23.22		
6	09.59	12.48 (2_VE1)	08.43	11.11	07.11	06.22	04.39	03.10		
	14.48	21	13.09 (2_VE1)	16.21	17.49	20.20	21.52	23.24		
7	09.58	11.21 (3_VE1)	08.40	11.07	07.07	06.19	04.36	03.08		
	14.50	25	13.09 (2_VE1)	16.25	17.52	20.23	21.55	23.27		
8	09.56	11.17 (3_VE1)	08.37	11.04	07.04	06.15	04.32	03.06		
	14.52	31	13.10 (2_VE1)	16.28	17.55	20.26	21.58	23.29		
9	09.55	11.13 (3_VE1)	08.34	11.00	07.00	06.12	04.29	03.04		
	14.55	37	13.11 (2_VE1)	16.31	17.58	20.29	22.02	23.31		
10	09.53	11.09 (3_VE1)	08.31	10.57	06.57	06.08	04.26	03.03		
	14.58	43	13.12 (2_VE1)	16.34	18.01	20.32	22.05	23.33		
11	09.51	11.07 (3_VE1)	08.28	10.53	06.53	06.05	04.23	03.01		
	15.00	47	13.13 (2_VE1)	16.38	18.04	20.35	22.08	23.35		
12	09.49	11.07 (3_VE1)	08.24	10.50	06.50	06.01	04.19	03.00		
	15.03	49	13.14 (2_VE1)	16.41	18.07	20.38	22.11	23.36		
13	09.47	11.07 (3_VE1)	08.21	10.47	06.47	05.58	04.16	02.57		
	15.06	51	13.15 (2_VE1)	16.44	18.10	20.41	22.14	23.38		
14	09.45	11.07 (3_VE1)	08.18	10.43	06.43	05.54	04.13	02.56		
	15.09	52	13.15 (2_VE1)	16.47	18.13	20.44	22.18	23.40		
15	09.43	11.07 (3_VE1)	08.15	10.40	06.40	05.51	04.10	02.55		
	15.12	53	13.16 (2_VE1)	16.51	18.16	20.47	22.21	23.41		
16	09.41	11.07 (3_VE1)	08.11	10.36	06.36	05.47	04.07	02.55		
	15.14	54	13.16 (2_VE1)	16.54	18.19	20.50	22.24	23.42		
17	09.39	11.06 (3_VE1)	08.08	10.33	06.33	05.44	04.04	02.54		
	15.17	57	13.17 (2_VE1)	16.57	18.22	20.53	22.27	23.43		
18	09.36	11.06 (3_VE1)	08.05	10.29	06.29	05.41	04.01	02.54		
	15.20	57	13.17 (2_VE1)	17.00	18.25	20.56	22.30	23.44		
19	09.34	11.06 (3_VE1)	08.02	10.26	06.26	05.37	03.57	02.53		
	15.24	57	13.17 (2_VE1)	17.03	18.28	20.59	22.33	23.45		
20	09.31	11.06 (3_VE1)	07.58	10.22	06.22	05.34	03.54	02.53		
	15.27	59	13.18 (2_VE1)	17.06	18.31	21.02	22.36	23.45		
21	09.29	11.07 (3_VE1)	07.55	10.19	06.19	05.30	03.51	02.53		
	15.30	58	13.19 (2_VE1)	17.09	18.34	21.05	22.40	23.45		
22	09.26	11.07 (3_VE1)	07.52	10.15	06.15	05.27	03.48	02.54		
	15.33	58	13.19 (2_VE1)	17.13	18.36	21.08	22.43	23.46		
23	09.24	11.07 (3_VE1)	07.48	10.12	06.12	05.23	03.46	02.54		
	15.36	57	13.18 (2_VE1)	17.16	18.39	21.11	22.46	23.46		
24	09.21	11.07 (3_VE1)	07.45	10.08	06.08	05.20	03.43	02.55		
	15.39	57	13.18 (2_VE1)	17.19	18.42	21.15	22.49	23.46		
25	09.18	11.08 (3_VE1)	07.41	10.05	06.05	05.16	03.40	02.55		
	15.42	55	13.18 (2_VE1)	17.22	18.45	21.18	22.52	23.45		
26	09.16	11.09 (3_VE1)	07.38	10.01	06.01	05.13	03.37	02.56		
	15.46	55	13.19 (2_VE1)	17.25	18.48	21.21	22.55	23.45		
27	09.13	11.09 (3_VE1)	07.35	9.58	05.58	05.09	03.34	02.57		
	15.49	53	13.18 (2_VE1)	17.28	18.51	21.24	22.58	23.44		
28	09.10	11.10 (3_VE1)	07.31	9.54	05.54	05.06	03.31	02.59		
	15.52	50	13.17 (2_VE1)	17.31	18.54	21.27	23.01	23.43		
29	09.07	11.10 (3_VE1)	07.27	9.51	06.51	05.03	03.29	03.00		
	15.55	48	13.16 (2_VE1)	17.34	19.57	21.30	23.03	23.42		
30	09.04	11.12 (3_VE1)	07.23	9.47	06.47	04.59	03.26	03.00		
	15.59	44	13.16 (2_VE1)	17.37	20.00	21.33	23.06	23.41		
31	09.01	11.12 (3_VE1)	07.19	9.44	06.44	04.56	03.24	03.00		
	16.02	40	13.15 (2_VE1)	17.40	20.03	21.36	23.09	23.41		
Potential sun hours	175	239	363	450	566	617				
Total, worst case	1331	78								
Sun reduction	0,14	0,26								
Oper. time red.	0,93	0,93								
Wind dir. red.	0,65	0,65								
Total reduction	0,09	0,16								
Total, real	116	12								

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: Kokkopetaikko\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2023 Shadow receptor: C - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (17)  
Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	July	August	September	October	November	December	
1	03.02	04.25	05.58	07.23	07.56	09.29	10.49 (3_VE1)
	23.40	22.21	20.36	18.50	16.06	14.44	47 12.55 (2_VE1)
2	03.03	04.28	06.01	07.26	07.59	09.32	10.51 (3_VE1)
	23.39	22.18	20.32	18.47	16.03	14.42	44 12.55 (2_VE1)
3	03.05	04.31	06.04	07.29	08.02	09.34	10.56 (3_VE1)
	23.37	22.15	20.29	18.44	15.59	14.40	38 12.55 (2_VE1)
4	03.07	04.34	06.07	07.32	08.05	09.37	11.01 (3_VE1)
	23.36	22.11	20.25	18.40	15.56	14.38	32 12.55 (2_VE1)
5	03.09	04.37	06.10	07.35	08.09	09.39	11.06 (3_VE1)
	23.34	22.08	20.22	18.37	15.53	14.36	26 12.55 (2_VE1)
6	03.11	04.40	06.13	07.38	08.12	09.42	12.33 (2_VE1)
	23.32	22.05	20.18	18.33	15.50	14.35	22 12.55 (2_VE1)
7	03.13	04.43	06.16	07.41	08.15	10.50 (3_VE1)	09.44 12.34 (2_VE1)
	23.30	22.02	20.15	18.30	15.47	9 10.59 (3_VE1)	14.33 20 12.54 (2_VE1)
8	03.15	04.46	06.18	07.44	08.18	10.47 (3_VE1)	09.46 12.35 (2_VE1)
	23.28	21.58	20.11	18.26	15.44	14 11.01 (3_VE1)	14.32 20 12.55 (2_VE1)
9	03.18	04.50	06.21	07.46	08.21	10.45 (3_VE1)	09.49 12.36 (2_VE1)
	23.26	21.55	20.08	18.23	15.41	25 12.40 (2_VE1)	14.31 14 12.50 (2_VE1)
10	03.20	04.53	06.24	07.49	08.25	10.44 (3_VE1)	09.51 12.37 (2_VE1)
	23.24	21.52	20.04	18.19	15.38	34 12.43 (2_VE1)	14.29 8 12.45 (2_VE1)
11	03.23	04.56	06.27	07.52	08.28	10.43 (3_VE1)	09.53 12.38 (2_VE1)
	23.21	21.48	20.01	18.16	15.35	40 12.45 (2_VE1)	14.28 2 12.40 (2_VE1)
12	03.25	04.59	06.30	07.55	08.31	10.42 (3_VE1)	09.55
	23.19	21.45	19.57	18.12	15.32	45 12.47 (2_VE1)	14.27
13	03.28	05.02	06.33	07.58	08.34	10.42 (3_VE1)	09.56
	23.17	21.41	19.54	18.09	15.29	48 12.48 (2_VE1)	14.27
14	03.31	05.05	06.35	08.01	08.37	10.41 (3_VE1)	09.58
	23.14	21.38	19.50	18.06	15.26	51 12.49 (2_VE1)	14.26
15	03.34	05.08	06.38	08.04	08.40	10.42 (3_VE1)	10.00
	23.12	21.35	19.47	18.02	15.23	53 12.51 (2_VE1)	14.25
16	03.36	05.11	06.41	08.07	08.44	10.42 (3_VE1)	10.01
	23.09	21.31	19.43	17.59	15.20	54 12.51 (2_VE1)	14.25
17	03.39	05.14	06.44	08.10	08.47	10.42 (3_VE1)	10.02
	23.06	21.28	19.40	17.55	15.18	55 12.52 (2_VE1)	14.25
18	03.42	05.17	06.47	08.13	08.50	10.41 (3_VE1)	10.03
	23.03	21.24	19.36	17.52	15.15	57 12.52 (2_VE1)	14.24
19	03.45	05.20	06.50	08.16	08.53	10.41 (3_VE1)	10.04
	23.01	21.21	19.33	17.49	15.12	57 12.52 (2_VE1)	14.24
20	03.48	05.23	06.52	08.19	08.56	10.42 (3_VE1)	10.05
	22.58	21.18	19.29	17.45	15.09	58 12.54 (2_VE1)	14.25
21	03.51	05.26	06.55	08.22	08.59	10.42 (3_VE1)	10.06
	22.55	21.14	19.25	17.42	15.07	58 12.54 (2_VE1)	14.25
22	03.54	05.29	06.58	08.25	09.02	10.42 (3_VE1)	10.07
	22.52	21.11	19.22	17.39	15.04	59 12.54 (2_VE1)	14.25
23	03.57	05.32	07.01	08.28	09.06	10.43 (3_VE1)	10.07
	22.49	21.07	19.18	17.35	15.02	58 12.54 (2_VE1)	14.26
24	04.00	05.35	07.04	08.31	09.09	10.44 (3_VE1)	10.08
	22.46	21.04	19.15	17.32	14.59	56 12.54 (2_VE1)	14.26
25	04.03	05.38	07.06	07.34	09.12	10.45 (3_VE1)	10.08
	22.43	21.00	19.11	16.29	14.57	56 12.55 (2_VE1)	14.27
26	04.06	05.41	07.09	07.37	09.15	10.45 (3_VE1)	10.08
	22.40	20.57	19.08	16.25	14.54	55 12.55 (2_VE1)	14.28
27	04.09	05.44	07.12	07.40	09.18	10.46 (3_VE1)	10.08
	22.37	20.53	19.04	16.22	14.52	54 12.55 (2_VE1)	14.29
28	04.12	05.47	07.15	07.43	09.20	10.46 (3_VE1)	10.07
	22.34	20.50	19.01	16.19	14.50	53 12.55 (2_VE1)	14.31
29	04.15	05.50	07.18	07.47	09.23	10.47 (3_VE1)	10.07
	22.31	20.46	18.57	16.15	14.48	51 12.55 (2_VE1)	14.32
30	04.18	05.53	07.21	07.50	09.26	10.48 (3_VE1)	10.07
	22.28	20.43	18.54	16.12	14.46	49 12.55 (2_VE1)	14.33
31	04.22	05.55		07.53			10.06
	22.24	20.39		16.09			14.35
Potential sun hours	604	506	393	306	201		142
Total, worst case					1149		273
Sun reduction					0,10		0,07
Oper. time red.					0,93		0,93
Wind dir. red.					0,65		0,65
Total reduction					0,06		0,04
Total, real					70		12

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

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

## SHADOW - Calendar

Calculation: Kokkopetaikko\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2023 Shadow receptor: D - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (18)  
Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June	
1	10.04	08.58	07.28	06.40	04.56	20.50 (11_VE1)	03.22
	14.38	16.05	17.34	20.05	21.36	3 20.53 (11_VE1)	23.11
2	10.04	08.55	07.24	06.36	04.53	20.48 (11_VE1)	03.19
	14.39	16.08	17.37	20.08	21.39	8 20.56 (11_VE1)	23.14
3	10.03	08.52	07.21	06.33	04.49	20.46 (11_VE1)	03.17
	14.41	16.12	17.40	20.11	21.42	12 20.58 (11_VE1)	23.16
4	10.01	08.49	07.17	06.29	04.46	20.45 (11_VE1)	03.15
	14.43	16.15	17.43	20.14	21.45	16 21.01 (11_VE1)	23.19
5	10.00	08.46	07.14	06.26	04.42	20.43 (11_VE1)	03.12
	14.46	16.18	17.46	20.17	21.49	21 21.04 (11_VE1)	23.21
6	09.59	08.43	07.11	06.22	04.39	20.43 (11_VE1)	03.10
	14.48	16.21	17.49	20.20	21.52	24 21.07 (11_VE1)	23.24
7	09.57	08.40	07.07	06.19	04.36	20.43 (11_VE1)	03.08
	14.50	16.25	17.52	20.23	21.55	26 21.09 (11_VE1)	23.26
8	09.56	08.37	07.04	06.15	04.33	20.42 (11_VE1)	03.06
	14.53	16.28	17.55	20.26	21.58	27 21.09 (11_VE1)	23.28
9	09.54	08.34	07.00	06.12	04.29	20.41 (11_VE1)	03.05
	14.55	16.31	17.58	20.29	22.01	28 21.09 (11_VE1)	23.30
10	09.52	08.30	06.57	06.08	04.26	20.41 (11_VE1)	03.03
	14.58	16.34	18.01	20.32	22.04	28 21.09 (11_VE1)	23.32
11	09.51	08.27	06.53	06.05	04.23	20.41 (11_VE1)	03.02
	15.00	16.38	18.04	20.35	22.08	29 21.10 (11_VE1)	23.34
12	09.49	08.24	06.50	06.01	04.20	20.41 (11_VE1)	03.00
	15.03	16.41	18.07	20.38	22.11	29 21.10 (11_VE1)	23.36
13	09.47	08.21	06.46	05.58	04.16	20.40 (11_VE1)	02.58
	15.06	16.44	18.10	20.41	22.14	30 21.10 (11_VE1)	23.37
14	09.45	08.18	06.43	05.54	04.13	20.41 (11_VE1)	02.57
	15.09	16.47	18.13	20.44	22.17	29 21.10 (11_VE1)	23.39
15	09.43	08.14	06.39	05.51	04.10	20.41 (11_VE1)	02.56
	15.12	16.50	18.16	20.47	22.20	29 21.10 (11_VE1)	23.40
16	09.40	08.11	06.36	05.47	04.07	20.42 (11_VE1)	02.55
	15.15	16.54	18.19	20.50	22.23	28 21.10 (11_VE1)	23.41
17	09.38	08.08	06.32	05.44	04.04	20.41 (11_VE1)	02.55
	15.18	16.57	18.22	20.53	22.26	32 21.25 (12_VE1)	23.42
18	09.36	08.05	06.29	05.40	04.01	20.42 (11_VE1)	02.54
	15.21	17.00	18.25	20.56	22.30	42 21.31 (12_VE1)	23.43
19	09.33	08.01	06.25	05.37	03.58	20.42 (11_VE1)	02.54
	15.24	17.03	18.28	20.59	22.33	46 21.33 (12_VE1)	23.44
20	09.31	07.58	06.22	05.34	03.55	20.43 (11_VE1)	02.54
	15.27	17.06	18.30	21.02	22.36	48 21.35 (12_VE1)	23.44
21	09.28	07.55	06.18	05.30	03.52	20.44 (11_VE1)	02.54
	15.30	17.09	18.33	21.05	22.39	50 21.37 (12_VE1)	23.45
22	09.26	07.51	06.15	05.27	03.49	20.44 (11_VE1)	02.54
	15.33	17.12	18.36	21.08	22.42	51 21.37 (12_VE1)	23.45
23	09.23	07.48	06.11	05.23	03.46	20.45 (11_VE1)	02.55
	15.36	17.16	18.39	21.11	22.45	52 21.39 (12_VE1)	23.45
24	09.21	07.45	06.08	05.20	03.43	20.46 (11_VE1)	02.55
	15.39	17.19	18.42	21.14	22.48	53 21.40 (12_VE1)	23.45
25	09.18	07.41	06.04	05.16	03.40	20.47 (11_VE1)	02.56
	15.43	17.22	18.45	21.17	22.51	53 21.41 (12_VE1)	23.44
26	09.15	07.38	06.01	05.13	03.37	20.48 (11_VE1)	02.57
	15.46	17.25	18.48	21.20	22.54	52 21.42 (12_VE1)	23.44
27	09.12	07.34	05.57	05.09	03.34	20.50 (11_VE1)	02.58
	15.49	17.28	18.51	21.23	22.57	51 21.43 (12_VE1)	23.43
28	09.10	07.31	05.54	05.06	03.32	20.51 (11_VE1)	02.59
	15.52	17.31	18.54	21.27	23.00	48 21.43 (12_VE1)	23.42
29	09.07		06.50	05.03	03.29	20.54 (11_VE1)	03.01
	15.55		19.57	21.30	23.03	45 21.44 (12_VE1)	23.41
30	09.04		06.47	04.59	03.27	21.03 (12_VE1)	03.01
	15.59		20.00	21.33	23.06	41 21.44 (12_VE1)	23.40
31	09.01		06.43		03.24	21.04 (12_VE1)	
	16.02		20.02		23.08	41 21.45 (12_VE1)	
Potential sun hours	175	239	363	450	566		617
Total, worst case					1072		1398
Sun reduction					0,45		0,40
Oper. time red.					0,93		0,93
Wind dir. red.					0,63		0,63
Total reduction					0,26		0,23
Total, real					281		324

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: Kokkopetaikko\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2023 Shadow receptor: D - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (18) Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	July	August	September	October	November	December				
1	03.02	21.07 (12_VE1)	04.25	20.51 (11_VE1)	05.58	07.23	07.56	09.28		
	23.39	47	21.54 (12_VE1)	22.21	29	21.20 (11_VE1)	20.35	18.50	16.06	14.44
2	03.04	21.07 (12_VE1)	04.28	20.51 (11_VE1)	06.01	07.26	07.59	09.31		
	23.38	47	21.54 (12_VE1)	22.17	29	21.20 (11_VE1)	20.32	18.47	16.03	14.42
3	03.05	21.07 (12_VE1)	04.31	20.52 (11_VE1)	06.04	07.29	08.02	09.34		
	23.36	47	21.54 (12_VE1)	22.14	28	21.20 (11_VE1)	20.28	18.43	15.59	14.40
4	03.07	21.08 (12_VE1)	04.34	20.51 (11_VE1)	06.07	07.32	08.05	09.36		
	23.35	46	21.54 (12_VE1)	22.11	28	21.19 (11_VE1)	20.25	18.40	15.56	14.38
5	03.09	21.08 (12_VE1)	04.37	20.52 (11_VE1)	06.10	07.35	08.08	09.39		
	23.33	46	21.54 (12_VE1)	22.08	27	21.19 (11_VE1)	20.21	18.36	15.53	14.37
6	03.11	21.09 (12_VE1)	04.40	20.52 (11_VE1)	06.13	07.38	08.11	09.41		
	23.31	46	21.55 (12_VE1)	22.04	26	21.18 (11_VE1)	20.18	18.33	15.50	14.35
7	03.14	21.09 (12_VE1)	04.43	20.53 (11_VE1)	06.15	07.40	08.15	09.44		
	23.29	45	21.54 (12_VE1)	22.01	22	21.15 (11_VE1)	20.14	18.29	15.47	14.33
8	03.16	21.10 (12_VE1)	04.47	20.54 (11_VE1)	06.18	07.43	08.18	09.46		
	23.27	44	21.54 (12_VE1)	21.58	19	21.13 (11_VE1)	20.11	18.26	15.44	14.32
9	03.18	21.09 (12_VE1)	04.50	20.54 (11_VE1)	06.21	07.46	08.21	09.48		
	23.25	44	21.53 (12_VE1)	21.54	15	21.09 (11_VE1)	20.07	18.23	15.41	14.31
10	03.21	21.10 (12_VE1)	04.53	20.55 (11_VE1)	06.24	07.49	08.24	09.50		
	23.23	44	21.54 (12_VE1)	21.51	12	21.07 (11_VE1)	20.04	18.19	15.38	14.30
11	03.23	21.11 (12_VE1)	04.56	20.57 (11_VE1)	06.27	07.52	08.27	09.52		
	23.21	43	21.54 (12_VE1)	21.48	7	21.04 (11_VE1)	20.00	18.16	15.35	14.29
12	03.26	21.11 (12_VE1)	04.59	20.59 (11_VE1)	06.30	07.55	08.30	09.54		
	23.18	42	21.53 (12_VE1)	21.44	1	21.00 (11_VE1)	19.57	18.12	15.32	14.28
13	03.28	21.12 (12_VE1)	05.02	20.62	06.32	07.58	08.34	09.56		
	23.16	41	21.53 (12_VE1)	21.41		19.53	18.09	15.29	14.27	
14	03.31	21.13 (12_VE1)	05.05	20.63	06.35	08.01	08.37	09.57		
	23.13	40	21.53 (12_VE1)	21.38		19.50	18.05	15.26	14.26	
15	03.34	21.01 (11_VE1)	05.08	20.63	06.38	08.04	08.40	09.59		
	23.11	47	21.52 (12_VE1)	21.34		19.46	18.02	15.23	14.26	
16	03.37	20.59 (11_VE1)	05.11	20.61	06.41	08.07	08.43	10.00		
	23.08	50	21.52 (12_VE1)	21.31		19.43	17.59	15.20	14.25	
17	03.39	20.58 (11_VE1)	05.14	20.64	06.44	08.10	08.46	10.02		
	23.06	51	21.51 (12_VE1)	21.27		19.39	17.55	15.18	14.25	
18	03.42	20.57 (11_VE1)	05.17	20.67	06.47	08.13	08.49	10.03		
	23.03	52	21.50 (12_VE1)	21.24		19.36	17.52	15.15	14.25	
19	03.45	20.56 (11_VE1)	05.20	20.69	06.49	08.16	08.53	10.04		
	23.00	53	21.51 (12_VE1)	21.21		19.32	17.48	15.12	14.25	
20	03.48	20.55 (11_VE1)	05.23	20.65	06.52	08.19	08.56	10.05		
	22.57	53	21.49 (12_VE1)	21.17		19.29	17.45	15.10	14.25	
21	03.51	20.54 (11_VE1)	05.26	20.65	06.55	08.22	08.59	10.05		
	22.54	53	21.48 (12_VE1)	21.14		19.25	17.42	15.07	14.25	
22	03.54	20.54 (11_VE1)	05.29	20.68	06.58	08.25	09.02	10.06		
	22.51	52	21.48 (12_VE1)	21.10		19.22	17.38	15.04	14.25	
23	03.57	20.54 (11_VE1)	05.32	20.70	07.01	08.28	09.05	10.06		
	22.49	49	21.46 (12_VE1)	21.07		19.18	17.35	15.02	14.26	
24	04.00	20.53 (11_VE1)	05.35	20.73	07.03	08.31	09.08	10.07		
	22.46	47	21.44 (12_VE1)	21.03		19.15	17.32	14.59	14.27	
25	04.03	20.53 (11_VE1)	05.38	20.76	07.06	07.34	09.11	10.07		
	22.43	44	21.43 (12_VE1)	21.00		19.11	16.28	14.57	14.28	
26	04.06	20.52 (11_VE1)	05.41	20.79	07.09	07.37	09.14	10.07		
	22.39	38	21.39 (12_VE1)	20.56		19.08	16.25	14.55	14.29	
27	04.09	20.52 (11_VE1)	05.44	20.77	07.12	07.40	09.17	10.07		
	22.36	28	21.20 (11_VE1)	20.53		19.04	16.22	14.52	14.30	
28	04.12	20.51 (11_VE1)	05.47	20.75	07.15	07.43	09.20	10.07		
	22.33	29	21.20 (11_VE1)	20.49		19.01	16.19	14.50	14.31	
29	04.16	20.52 (11_VE1)	05.50	20.78	07.18	07.46	09.23	10.06		
	22.30	29	21.21 (11_VE1)	20.46		18.57	16.15	14.48	14.32	
30	04.19	20.51 (11_VE1)	05.52	20.79	07.20	07.49	09.26	10.06		
	22.27	29	21.20 (11_VE1)	20.42		18.54	16.12	14.46	14.34	
31	04.22	20.51 (11_VE1)	05.55	20.81	07.23	07.52	09.29	10.05		
	22.24	30	21.21 (11_VE1)	20.39		18.51	16.09	14.45	14.35	
Potential sun hours	603		506	393	306	201	142			
Total, worst case	1356		243							
Sun reduction	0,43		0,41							
Oper. time red.	0,93		0,93							
Wind dir. red.	0,63		0,63							
Total reduction	0,25		0,24							
Total, real	344		59							

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

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

## SHADOW - Calendar

Calculation: Kokkopetaikko\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2023 Shadow receptor: E - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (19)  
Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June	July	August	September	October	November	December		
1	10.05 14.37	08.58 16.05	14.52 (4_VE1) 15.15 (4_VE1)	07.28 17.34	06.40 20.05	04.56 21.36	03.21 23.12	03.01 23.40	04.25 22.21	05.58 20.36	07.23 18.50	07.56 16.06	14.18 (4_VE1) 14.52 (4_VE1)	09.29 14.43
2	10.04 14.39	08.55 16.08	14.51 (4_VE1) 15.17 (4_VE1)	07.24 17.37	06.36 20.08	04.52 21.39	03.19 23.14	03.03 23.38	04.28 22.18	06.01 20.32	07.26 18.47	07.59 16.02	14.17 (4_VE1) 14.51 (4_VE1)	09.31 14.42
3	10.03 14.41	08.52 16.12	14.50 (4_VE1) 15.18 (4_VE1)	07.21 17.40	06.33 20.11	04.49 21.42	03.16 23.17	03.05 23.37	04.31 22.14	06.04 20.29	07.29 18.43	08.02 15.59	14.18 (4_VE1) 14.51 (4_VE1)	09.34 14.40
4	10.02 14.43	08.49 16.15	14.50 (4_VE1) 15.19 (4_VE1)	07.17 17.43	06.29 20.14	04.46 21.46	03.14 23.19	03.07 23.35	04.34 22.11	06.07 20.25	07.32 18.40	08.05 15.56	14.18 (4_VE1) 14.51 (4_VE1)	09.37 14.38
5	10.01 14.45	08.46 16.18	14.49 (4_VE1) 15.20 (4_VE1)	07.14 17.46	06.26 20.17	04.42 21.49	03.12 23.22	03.09 23.34	04.37 22.08	06.10 20.22	07.35 18.36	08.08 15.53	14.19 (4_VE1) 14.51 (4_VE1)	09.39 14.36
6	09.59 14.48	08.43 16.21	14.48 (4_VE1) 15.20 (4_VE1)	07.11 17.49	06.22 20.20	04.39 21.52	03.10 23.24	03.11 23.32	04.40 22.05	06.13 20.18	07.38 18.33	08.12 15.50	14.20 (4_VE1) 14.50 (4_VE1)	09.42 14.35
7	09.58 14.50	08.40 16.25	14.49 (4_VE1) 15.21 (4_VE1)	07.07 17.52	06.19 20.23	04.36 21.55	03.08 23.26	03.13 23.30	04.43 22.01	06.15 20.15	07.40 18.29	08.15 15.47	14.20 (4_VE1) 14.49 (4_VE1)	09.44 14.33
8	09.56 14.52	08.37 16.28	14.48 (4_VE1) 15.22 (4_VE1)	07.04 17.55	06.15 20.26	04.32 21.58	03.06 23.29	03.15 23.28	04.46 21.58	06.18 20.11	07.43 18.26	08.18 15.44	14.21 (4_VE1) 14.48 (4_VE1)	09.46 14.32
9	09.55 14.55	08.34 16.31	14.48 (4_VE1) 15.21 (4_VE1)	07.00 17.58	06.12 20.29	04.29 22.01	03.04 23.31	03.18 23.26	04.49 21.55	06.21 20.07	07.46 18.23	08.21 15.41	14.22 (4_VE1) 14.47 (4_VE1)	09.48 14.30
10	09.53 14.57	08.31 16.34	14.48 (4_VE1) 15.22 (4_VE1)	06.57 18.01	06.08 20.32	04.26 22.05	03.03 23.33	03.20 23.23	04.52 21.51	06.24 20.04	07.49 18.19	08.24 15.38	14.23 (4_VE1) 14.46 (4_VE1)	09.50 14.29
11	09.51 15.00	08.27 16.38	14.48 (4_VE1) 15.22 (4_VE1)	06.53 18.04	06.05 20.35	04.23 22.08	03.01 23.34	03.23 23.21	04.56 21.48	06.27 20.00	07.52 18.16	08.28 15.35	14.25 (4_VE1) 14.42 (4_VE1)	09.52 14.28
12	09.49 15.03	08.24 16.41	14.48 (4_VE1) 15.22 (4_VE1)	06.50 18.07	06.01 20.38	04.19 22.11	03.00 23.36	03.25 23.19	04.59 21.45	06.30 19.57	07.55 18.12	08.31 15.32	14.26 (4_VE1) 14.38 (4_VE1)	09.54 14.27
13	09.47 15.06	08.21 16.44	14.49 (4_VE1) 15.22 (4_VE1)	06.46 18.10	05.58 20.41	04.16 22.14	02.57 23.38	03.28 23.16	05.02 21.41	06.32 19.53	07.58 18.09	08.34 15.29	14.29 (4_VE1) 14.34 (4_VE1)	09.56 14.26
14	09.45 15.08	08.18 16.47	14.49 (4_VE1) 15.22 (4_VE1)	06.43 18.13	05.54 20.44	04.13 22.17	02.56 23.39	03.31 23.14	05.05 21.38	06.35 19.50	08.01 18.05	08.37 15.26	14.29 (4_VE1) 14.34 (4_VE1)	09.58 14.26
15	09.43 15.11	08.14 16.50	14.49 (4_VE1) 15.21 (4_VE1)	06.39 18.16	05.51 20.47	04.10 22.20	02.55 23.41	03.33 23.11	05.08 21.34	06.38 19.46	08.04 18.02	08.40 15.23	14.29 (4_VE1) 14.34 (4_VE1)	09.59 14.25
16	09.41 15.14	08.11 16.54	14.50 (4_VE1) 15.21 (4_VE1)	06.36 18.19	05.47 20.50	04.07 22.24	02.55 23.42	03.36 23.09	05.11 21.31	06.41 19.43	08.07 17.59	08.43 15.20	14.29 (4_VE1) 14.34 (4_VE1)	09.59 14.25
17	09.38 15.17	08.08 16.57	14.51 (4_VE1) 15.20 (4_VE1)	06.32 18.22	05.44 20.53	04.03 22.27	02.54 23.43	03.39 23.06	05.14 21.28	06.44 19.39	08.10 17.55	08.47 15.17	14.29 (4_VE1) 14.34 (4_VE1)	09.59 14.25
18	09.36 15.20	08.05 17.00	14.51 (4_VE1) 15.18 (4_VE1)	06.29 18.25	05.40 20.56	04.00 22.30	02.54 23.44	03.42 23.03	05.17 21.24	06.47 19.36	08.13 17.52	08.50 15.15	14.29 (4_VE1) 14.34 (4_VE1)	09.59 14.24
19	09.34 15.23	08.01 17.03	14.53 (4_VE1) 15.18 (4_VE1)	06.25 18.28	05.37 20.59	03.57 22.33	02.53 23.44	03.45 23.00	05.20 21.21	06.49 19.32	08.16 17.48	08.53 15.12	14.29 (4_VE1) 14.34 (4_VE1)	09.59 14.24
20	09.31 15.26	07.58 17.06	14.54 (4_VE1) 15.16 (4_VE1)	06.22 18.30	05.33 21.02	03.54 22.36	02.53 23.45	03.48 22.58	05.23 21.17	06.52 19.29	08.19 17.45	08.56 15.09	14.29 (4_VE1) 14.34 (4_VE1)	09.59 14.24
21	09.29 15.30	07.55 17.09	14.56 (4_VE1) 15.13 (4_VE1)	06.18 18.33	05.30 21.05	03.51 22.39	02.53 23.45	03.51 22.55	05.26 21.14	06.55 19.25	08.22 17.42	08.59 15.07	14.29 (4_VE1) 14.34 (4_VE1)	09.59 14.25
22	09.26 15.33	07.51 17.12	15.00 (4_VE1) 15.10 (4_VE1)	06.15 18.36	05.26 21.08	03.48 22.42	02.54 23.45	03.54 22.52	05.29 21.10	06.58 19.22	08.25 17.38	08.59 15.04	14.29 (4_VE1) 14.34 (4_VE1)	09.59 14.25
23	09.23 15.36	07.48 17.15	15.00 (4_VE1) 15.10 (4_VE1)	06.11 18.39	05.23 21.11	03.45 22.45	02.54 23.45	03.57 22.49	05.32 21.07	07.01 19.18	08.28 17.35	08.59 15.02	14.29 (4_VE1) 14.34 (4_VE1)	09.59 14.26
24	09.21 15.39	07.45 17.19	15.00 (4_VE1) 15.10 (4_VE1)	06.08 18.42	05.20 21.14	03.42 22.48	02.55 23.45	04.00 22.46	05.35 21.03	07.03 19.15	08.31 17.32	08.59 15.01	14.29 (4_VE1) 14.34 (4_VE1)	09.59 14.26
25	09.18 15.42	07.41 17.22	15.00 (4_VE1) 15.10 (4_VE1)	06.04 18.45	05.16 21.17	03.40 22.51	02.55 23.45	04.03 22.43	05.38 21.00	07.06 19.11	08.34 17.28	08.59 14.57	14.29 (4_VE1) 14.34 (4_VE1)	09.59 14.27
26	09.15 15.45	07.38 17.25	15.00 (4_VE1) 15.10 (4_VE1)	06.01 18.48	05.13 21.21	03.37 22.54	02.56 23.44	04.06 22.40	05.41 20.57	07.09 19.08	08.37 17.25	08.59 14.54	14.29 (4_VE1) 14.34 (4_VE1)	09.59 14.28
27	09.13 15.49	07.34 17.28	15.00 (4_VE1) 15.10 (4_VE1)	05.57 18.51	05.09 21.24	03.34 22.57	02.57 23.44	04.09 22.37	05.44 20.53	07.12 19.04	08.40 17.22	08.59 14.52	14.29 (4_VE1) 14.34 (4_VE1)	09.59 14.29
28	09.10 15.52	07.31 17.31	15.00 (4_VE1) 15.10 (4_VE1)	05.54 18.54	05.06 21.27	03.31 23.00	02.59 23.43	04.12 22.34	05.47 20.50	07.15 19.01	08.43 17.19	08.59 14.50	14.29 (4_VE1) 14.34 (4_VE1)	09.59 14.30
29	09.07 15.55	14.57 (4_VE1) 15.03 (4_VE1)	15.00 (4_VE1) 15.10 (4_VE1)	05.50 19.57	05.02 21.30	03.29 23.03	03.00 23.42	04.15 22.30	05.49 20.46	07.18 18.57	08.46 17.15	08.59 14.48	14.29 (4_VE1) 14.34 (4_VE1)	09.59 14.32
30	09.04 15.58	14.55 (4_VE1) 15.07 (4_VE1)	15.00 (4_VE1) 15.10 (4_VE1)	06.47 20.00	04.59 21.33	03.26 23.06	03.00 23.41	04.18 22.27	05.52 20.43	07.20 18.54	08.49 17.12	08.59 14.45	14.29 (4_VE1) 14.34 (4_VE1)	09.59 14.33
31	09.01 16.02	14.54 (4_VE1) 15.11 (4_VE1)	15.00 (4_VE1) 15.10 (4_VE1)	06.43 20.03	06.43 21.03	03.24 23.09	03.24 23.41	04.21 22.24	05.55 20.39	07.53 16.09	08.59 14.51 (4_VE1)	08.59 14.45	14.29 (4_VE1) 14.34 (4_VE1)	09.59 14.35
Potential sun hours	175	239	363	450	566	617	604	506	393	306	201	142		
Total, worst case	35	629	629	629	629	629	629	629	629	629	629	629	334	
Sun reduction	0.14	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.10		
Oper. time red.	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93		
Wind dir. red.	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64		
Total reduction	0.09	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.06		
Total, real	3	99	99	99	99	99	99	99	99	99	99	20		

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

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

## SHADOW - Calendar

Calculation: Kokkopetaikko\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2023 Shadow receptor: F - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (14)  
Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June
1	10.04	08.58	07.28	06.40	04.56	20.17 (12_VE1) 03.21
	14.37	16.05	17.34	20.05	21.36	30 20.47 (12_VE1) 23.11
2	10.04	08.55	07.24	06.36	04.52	20.16 (12_VE1) 03.19
	14.39	16.08	17.37	20.08	21.39	31 20.47 (12_VE1) 23.14
3	10.02	08.52	07.21	06.33	04.49	20.15 (12_VE1) 03.17
	14.41	16.12	17.40	20.11	21.42	33 20.48 (12_VE1) 23.16
4	10.01	08.49	07.17	06.29	04.46	20.15 (12_VE1) 03.15
	14.43	16.15	17.43	20.14	21.45	33 20.48 (12_VE1) 23.19
5	10.00	08.46	07.14	06.26	04.42	20.14 (12_VE1) 03.12
	14.46	16.18	17.46	20.17	21.48	34 20.48 (12_VE1) 23.21
6	09.59	08.43	07.10	06.22	04.39	20.15 (12_VE1) 03.10
	14.48	16.21	17.49	20.20	21.52	34 20.49 (12_VE1) 23.24
7	09.57	08.40	07.07	06.19	04.36	20.15 (12_VE1) 03.08
	14.50	16.25	17.52	20.23	21.55	34 20.49 (12_VE1) 23.26
8	09.56	08.37	07.04	06.15	04.33	20.14 (12_VE1) 03.06
	14.53	16.28	17.55	20.26	21.58	35 20.49 (12_VE1) 23.28
9	09.54	08.33	07.00	06.12	04.29	20.14 (12_VE1) 03.05
	14.55	16.31	17.58	20.29	22.01	34 20.48 (12_VE1) 23.30
10	09.52	08.30	06.57	06.08	04.26	20.14 (12_VE1) 03.03
	14.58	16.34	18.01	20.32	22.04	34 20.48 (12_VE1) 23.32
11	09.51	08.27	06.53	06.05	04.23	20.15 (12_VE1) 03.01
	15.00	16.38	18.04	20.35	22.07	33 20.48 (12_VE1) 23.34
12	09.49	08.24	06.50	06.01	04.20	20.15 (12_VE1) 03.00
	15.03	16.41	18.07	20.38	22.11	33 20.48 (12_VE1) 23.36
13	09.47	08.21	06.46	05.58	04.16	20.15 (12_VE1) 02.58
	15.06	16.44	18.10	20.41	22.14	32 20.47 (12_VE1) 23.37
14	09.45	08.18	06.43	05.54	04.13	20.16 (12_VE1) 02.57
	15.09	16.47	18.13	20.44	22.17	31 20.47 (12_VE1) 23.39
15	09.42	08.14	06.39	05.51	04.10	20.16 (12_VE1) 02.56
	15.12	16.50	18.16	20.47	22.20	30 20.46 (12_VE1) 23.40
16	09.40	08.11	06.36	05.47	04.07	20.17 (12_VE1) 02.55
	15.15	16.54	18.19	20.50	22.23	29 20.46 (12_VE1) 23.41
17	09.38	08.08	06.32	05.44	04.04	20.17 (12_VE1) 02.54
	15.18	16.57	18.22	20.53	22.26	28 20.45 (12_VE1) 23.42
18	09.36	08.04	06.29	05.40	04.01	20.18 (12_VE1) 02.54
	15.21	17.00	18.25	20.56	22.30	27 20.45 (12_VE1) 23.43
19	09.33	08.01	06.25	05.37	03.58	20.19 (12_VE1) 02.54
	15.24	17.03	18.27	20.59	22.33	25 20.44 (12_VE1) 23.44
20	09.31	07.58	06.22	05.33	03.55	20.20 (12_VE1) 02.54
	15.27	17.06	18.30	21.02	22.36	23 20.43 (12_VE1) 23.44
21	09.28	07.55	06.18	05.30	03.52	20.21 (12_VE1) 02.54
	15.30	17.09	18.33	21.05	22.39	21 20.42 (12_VE1) 23.44
22	09.26	07.51	06.15	05.27	03.49	20.22 (12_VE1) 02.54
	15.33	17.12	18.36	21.08	22.42	19 20.41 (12_VE1) 23.45
23	09.23	07.48	06.11	05.23	03.46	20.24 (12_VE1) 02.55
	15.36	17.16	18.39	21.11	22.45	15 20.39 (12_VE1) 23.45
24	09.21	07.44	06.08	05.20	03.43	20.26 (12_VE1) 02.55
	15.39	17.19	18.42	21.14	22.48	12 20.38 (12_VE1) 23.45
25	09.18	07.41	06.04	05.16	03.40	20.29 (12_VE1) 02.56
	15.42	17.22	18.45	21.17	10 20.37 (12_VE1) 22.51	6 20.35 (12_VE1) 23.44
26	09.15	07.38	06.01	05.13	03.37	20.24 (12_VE1) 02.57
	15.46	17.25	18.48	21.20	16 20.40 (12_VE1) 22.54	23.44
27	09.12	07.34	05.57	05.09	03.34	20.21 (12_VE1) 02.58
	15.49	17.28	18.51	21.23	21 20.42 (12_VE1) 22.57	23.43
28	09.10	07.31	05.54	05.06	03.32	20.20 (12_VE1) 02.59
	15.52	17.31	18.54	21.27	24 20.44 (12_VE1) 23.00	23.42
29	09.07		05.50	05.03	03.29	20.19 (12_VE1) 02.59
	15.55		19.57	21.30	26 20.45 (12_VE1) 23.03	23.41
30	09.04		06.47	04.59	03.26	20.18 (12_VE1) 02.59
	15.59		20.00	21.33	28 20.46 (12_VE1) 23.06	23.40
31	09.01		06.43		03.24	
	16.02		20.02		23.08	
Potential sun hours	175	239	363	450	566	617
Total, worst case				125		696
Sun reduction				0,40		0,45
Oper. time red.				0,93		0,93
Wind dir. red.				0,63		0,63
Total reduction				0,23		0,26
Total, real				29		181

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: Kokkopetaikko\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2023 Shadow receptor: F - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (14) Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

July		August		September		October		November		December	
1	03.02	04.25		20.25 (12_VE1)	05.58	07.23	07.56	09.28			
	23.39	22.21	33	20.58 (12_VE1)	20.35	18.50	16.06	14.44			
2	03.04	04.28		20.25 (12_VE1)	06.01	07.26	07.59	09.31			
	23.38	22.17	33	20.58 (12_VE1)	20.32	18.47	16.03	14.42			
3	03.05	04.31		20.25 (12_VE1)	06.04	07.29	08.02	09.34			
	23.36	22.14	34	20.59 (12_VE1)	20.28	18.43	15.59	14.40			
4	03.07	04.34		20.24 (12_VE1)	06.07	07.32	08.05	09.36			
	23.35	22.11	34	20.58 (12_VE1)	20.25	18.40	15.56	14.38			
5	03.09	04.37		20.24 (12_VE1)	06.10	07.35	08.08	09.39			
	23.33	22.08	35	20.59 (12_VE1)	20.21	18.36	15.53	14.37			
6	03.11	04.40		20.24 (12_VE1)	06.13	07.37	08.11	09.41			
	23.31	22.04	34	20.58 (12_VE1)	20.18	18.33	15.50	14.35			
7	03.14	04.43		20.24 (12_VE1)	06.15	07.40	08.15	09.43			
	23.29	22.01	34	20.58 (12_VE1)	20.14	18.29	15.47	14.33			
8	03.16	04.46		20.25 (12_VE1)	06.18	07.43	08.18	09.46			
	23.27	21.58	33	20.58 (12_VE1)	20.11	18.26	15.44	14.32			
9	03.18	04.50		20.24 (12_VE1)	06.21	07.46	08.21	09.48			
	23.25	21.54	33	20.57 (12_VE1)	20.07	18.23	15.41	14.31			
10	03.21	04.53		20.25 (12_VE1)	06.24	07.49	08.24	09.50			
	23.23	21.51	32	20.57 (12_VE1)	20.04	18.19	15.38	14.30			
11	03.23	04.56		20.25 (12_VE1)	06.27	07.52	08.27	09.52			
	23.21	21.48	31	20.56 (12_VE1)	20.00	18.16	15.35	14.29			
12	03.26	04.59		20.25 (12_VE1)	06.30	07.55	08.30	09.54			
	23.18	21.44	30	20.55 (12_VE1)	19.57	18.12	15.32	14.28			
13	03.28	05.02		20.26 (12_VE1)	06.32	07.58	08.34	09.56			
	23.16	21.41	28	20.54 (12_VE1)	19.53	18.09	15.29	14.27			
14	03.31	05.05		20.27 (12_VE1)	06.35	08.01	08.37	09.57			
	23.13	21.38	26	20.53 (12_VE1)	19.50	18.05	15.26	14.26			
15	03.34	05.08		20.28 (12_VE1)	06.38	08.04	08.40	09.59			
	23.11	21.34	23	20.51 (12_VE1)	19.46	18.02	15.23	14.26			
16	03.37	05.11		20.29 (12_VE1)	06.41	08.07	08.43	10.00			
	23.08	21.31	20	20.49 (12_VE1)	19.43	17.59	15.20	14.25			
17	03.39	05.14		20.31 (12_VE1)	06.44	08.10	08.46	10.02			
	23.06	21.27	15	20.46 (12_VE1)	19.39	17.55	15.18	14.25			
18	03.42	05.17		20.34 (12_VE1)	06.46	08.13	08.49	10.03			
	23.03	21.24	9	20.43 (12_VE1)	19.36	17.52	15.15	14.25			
19	03.45	20.37 (12_VE1)	05.20		06.49	08.16	08.53	10.04			
	23.00	20.47 (12_VE1)	21.21		19.32	17.48	15.12	14.25			
20	03.48	20.35 (12_VE1)	05.23		06.52	08.19	08.56	10.05			
	22.57	20.49 (12_VE1)	21.17		19.29	17.45	15.09	14.25			
21	03.51	20.33 (12_VE1)	05.26		06.55	08.22	08.59	10.05			
	22.54	20.50 (12_VE1)	21.14		19.25	17.42	15.07	14.25			
22	03.54	20.31 (12_VE1)	05.29		06.58	08.25	09.02	10.06			
	22.51	20.51 (12_VE1)	21.10		19.22	17.38	15.04	14.25			
23	03.57	20.31 (12_VE1)	05.32		07.01	08.28	09.05	10.06			
	22.48	20.53 (12_VE1)	21.07		19.18	17.35	15.02	14.26			
24	04.00	20.30 (12_VE1)	05.35		07.03	08.31	09.08	10.07			
	22.45	20.53 (12_VE1)	21.03		19.15	17.32	14.59	14.27			
25	04.03	20.29 (12_VE1)	05.38		07.06	07.34	09.11	10.07			
	22.42	20.55 (12_VE1)	21.00		19.11	16.28	14.57	14.27			
26	04.06	20.28 (12_VE1)	05.41		07.09	07.37	09.14	10.07			
	22.39	20.55 (12_VE1)	20.56		19.08	16.25	14.55	14.28			
27	04.09	20.28 (12_VE1)	05.44		07.12	07.40	09.17	10.07			
	22.36	20.56 (12_VE1)	20.53		19.04	16.22	14.52	14.30			
28	04.12	20.27 (12_VE1)	05.47		07.15	07.43	09.20	10.07			
	22.33	20.56 (12_VE1)	20.49		19.01	16.19	14.50	14.31			
29	04.15	20.27 (12_VE1)	05.49		07.18	07.46	09.23	10.06			
	22.30	20.57 (12_VE1)	20.46		18.57	16.15	14.48	14.32			
30	04.19	20.26 (12_VE1)	05.52		07.20	07.49	09.26	10.06			
	22.27	20.57 (12_VE1)	20.42		18.54	16.12	14.46	14.34			
31	04.22	20.26 (12_VE1)	05.55			07.52		10.05			
	22.24	20.58 (12_VE1)	20.39			16.09		14.35			
Potential sun hours	603		506		393	306	201	142			
Total, worst case		309		517							
Sun reduction		0,43		0,41							
Oper. time red.		0,93		0,93							
Wind dir. red.		0,63		0,63							
Total reduction		0,25		0,24							
Total, real		78		124							

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

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

Calculation: Kokkopetaikko\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2023 Shadow receptor: G - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (15) Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June	July	August	September	October	November	December	
1	10:05 14:37	08:58 16:05	07:28 17:34	06:40 20:05	18.32 (12_VE1) 18.47 (12_VE1)	04:56 21:36	03:21 23:11	03:02 23:39	04:25 22:21	05:58 20:35	07:23 18:50	07:56 16:06	09:28 14:44
2	10:04 14:39	08:55 16:08	07:24 17:37	06:36 20:08	18.36 (12_VE1) 18.43 (12_VE1)	04:52 21:39	03:19 23:14	03:03 23:38	04:28 22:17	06:01 20:32	07:26 18:47	07:59 16:02	09:31 14:42
3	10:03 14:41	08:52 16:12	07:21 17:40	06:33 20:11		04:49 23:16	03:17 23:36	03:05 23:36	04:31 22:14	06:04 20:28	07:29 18:43	08:02 15:59	09:34 14:40
4	10:01 14:43	08:49 16:15	07:17 17:43	06:29 20:14		04:46 21:45	03:14 23:19	03:07 23:35	04:34 22:11	06:07 20:25	07:32 18:40	08:05 15:56	09:36 14:38
5	10:00 14:45	08:46 16:18	07:14 17:46	06:26 20:17		04:42 21:49	03:12 23:21	03:09 23:33	04:37 22:08	06:10 20:21	07:35 18:36	08:08 15:53	09:39 14:36
6	09:59 14:48	08:43 16:21	07:10 17:49	06:22 20:20		04:39 21:52	03:10 23:24	03:11 23:31	04:40 22:04	06:12 20:18	07:37 18:33	08:11 15:50	09:41 14:35
7	09:57 14:50	08:40 16:25	07:07 17:52	06:19 20:23		04:36 21:55	03:08 23:26	03:13 23:29	04:43 22:01	06:15 20:14	07:40 18:29	08:15 15:47	09:44 14:33
8	09:56 14:52	08:37 16:28	07:04 17:55	06:15 20:26		04:32 21:58	03:06 23:27	03:16 23:27	04:46 21:58	06:18 20:11	07:43 18:26	08:18 15:44	09:46 14:32
9	09:54 14:55	08:34 16:31	07:00 17:58	06:12 20:29		04:29 22:01	03:04 23:30	03:18 23:25	04:49 21:54	06:21 20:07	07:46 18:22	08:21 15:41	09:48 14:31
10	09:52 14:58	08:30 16:34	06:57 18:01	06:08 20:32		04:26 22:04	03:03 23:32	03:20 23:23	04:53 21:51	06:24 20:04	18.30 (12_VE1) 18.19	07:49 15:38	09:50 14:29
11	09:51 15:00	08:27 16:38	06:53 18:04	06:05 20:35		04:23 22:08	03:01 23:34	03:23 23:21	04:56 21:48	06:27 20:00	18.25 (12_VE1) 18.16	07:52 15:35	09:52 14:28
12	09:49 15:03	08:24 16:41	06:50 18:07	06:01 20:38		04:19 22:11	03:00 23:36	03:26 23:18	04:59 21:44	06:30 19:57	18.23 (12_VE1) 18.12	07:55 15:32	09:54 14:27
13	09:47 15:06	08:21 16:44	06:46 18:10	05:58 20:41		04:16 22:14	02:57 23:37	03:28 23:16	05:02 21:41	06:32 19:53	18.21 (12_VE1) 18:09	07:58 15:29	09:56 14:27
14	09:45 15:09	08:18 16:47	06:43 18:13	05:54 20:44		04:13 22:17	02:56 23:39	03:31 23:13	05:05 21:38	06:35 19:50	18.20 (12_VE1) 18:05	08:01 15:26	09:57 14:26
15	09:43 15:12	08:14 16:50	06:39 18:16	05:51 20:47		04:10 22:20	02:56 23:40	03:34 23:11	05:08 21:34	06:38 19:46	18.18 (12_VE1) 18:02	08:04 15:23	09:59 14:25
16	09:40 15:14	08:11 16:54	06:36 18:19	05:47 20:50	17.39 (12_VE1) 17.43 (12_VE1)	04:07 22:23	02:55 23:41	03:36 23:08	05:11 21:31	06:41 19:43	18.17 (12_VE1) 18:14 (12_VE1)	08:07 17:59	10:00 15:20
17	09:38 15:17	08:08 16:57	06:32 18:22	05:44 20:53	17.36 (12_VE1) 17.47 (12_VE1)	04:04 22:27	02:54 23:42	03:39 23:06	05:14 21:27	06:44 19:39	18.16 (12_VE1) 18:44 (12_VE1)	08:10 17:55	10:02 15:17
18	09:36 15:20	08:04 17:00	06:29 18:25	05:40 20:56	17.34 (12_VE1) 17.49 (12_VE1)	04:01 22:30	02:54 23:43	03:42 23:03	05:17 21:24	06:46 19:36	18.16 (12_VE1) 18:44 (12_VE1)	08:13 17:52	10:03 15:15
19	09:33 15:23	08:01 17:03	06:25 18:27	05:37 20:59	17.33 (12_VE1) 17.53 (12_VE1)	03:57 22:33	02:54 23:44	03:45 23:00	05:20 21:21	06:49 19:32	18.15 (12_VE1) 18:43 (12_VE1)	08:16 17:48	10:04 15:12
20	09:31 15:27	07:58 17:06	06:22 18:30	05:33 21:02	17.31 (12_VE1) 17.55 (12_VE1)	03:54 22:36	02:54 23:44	03:48 22:57	05:23 21:17	06:52 19:29	18.15 (12_VE1) 18:43 (12_VE1)	08:19 17:45	10:05 15:09
21	09:28 15:30	07:55 17:09	06:18 18:33	05:30 21:05	17.30 (12_VE1) 17.56 (12_VE1)	03:51 22:39	02:54 23:45	03:51 22:54	05:26 21:14	06:55 19:25	18.15 (12_VE1) 18:42 (12_VE1)	08:22 17:42	10:05 15:07
22	09:26 15:33	07:51 17:12	06:15 18:36	05:26 21:08	17.29 (12_VE1) 17.56 (12_VE1)	03:48 22:42	02:54 23:45	03:54 22:51	05:29 21:10	06:58 19:22	18.15 (12_VE1) 18:42 (12_VE1)	08:25 17:38	10:06 15:04
23	09:23 15:36	07:48 17:15	06:11 18:39	05:23 21:11	17.29 (12_VE1) 17.57 (12_VE1)	03:46 22:45	02:54 23:45	03:57 22:49	05:32 21:07	07:01 19:18	18.15 (12_VE1) 18:41 (12_VE1)	08:28 17:35	10:07 15:02
24	09:21 15:39	07:44 17:19	06:08 18:42	05:20 21:14	17.28 (12_VE1) 17.56 (12_VE1)	03:43 22:48	02:55 23:45	04:00 22:46	05:35 21:03	07:03 19:15	18.15 (12_VE1) 18:37 (12_VE1)	08:31 17:32	10:07 14:59
25	09:18 15:42	07:41 17:22	06:04 18:45	05:16 21:17	17.28 (12_VE1) 17.56 (12_VE1)	03:40 22:51	02:56 23:44	04:03 22:43	05:38 21:00	07:06 19:11	18.16 (12_VE1) 18:33 (12_VE1)	07:34 16:28	10:07 14:57
26	09:15 15:46	07:38 17:25	06:01 18:48	05:13 21:20	17.28 (12_VE1) 17.55 (12_VE1)	03:37 22:54	02:57 23:44	04:06 22:40	05:41 20:56	07:09 19:08	18.18 (12_VE1) 18:30 (12_VE1)	07:37 16:25	10:07 14:54
27	09:12 15:49	07:34 17:28	05:57 18:51	05:09 21:23	17.28 (12_VE1) 17.55 (12_VE1)	03:34 22:57	02:58 23:43	04:09 22:36	05:44 20:53	07:12 19:04	18.20 (12_VE1) 18.27 (12_VE1)	07:40 16:22	10:07 14:52
28	09:10 15:52	07:31 17:31	05:54 18:54	05:06 21:27	17.28 (12_VE1) 17.54 (12_VE1)	03:32 23:00	02:59 23:43	04:12 22:33	05:47 20:49	07:15 19:01	18.27 (12_VE1) 18.19	07:43 16:19	10:07 14:50
29	09:07 15:55		06:50 18:59	05:03 21:30	18.29 (12_VE1) 18.53 (12_VE1)	03:29 23:03	03:00 23:42	04:15 22:30	05:49 20:46	07:17 18:57	18.15 (12_VE1) 18.15	07:46 16:15	10:07 14:48
30	09:04 15:59		06:47 19:00	04:59 21:33	18.29 (12_VE1) 18.51 (12_VE1)	03:26 23:06	03:00 23:41	04:18 22:27	05:52 20:42	07:20 18:54	18.15 (12_VE1) 18.12	07:49 16:12	10:06 14:46
31	09:01 16:02		06:43 19:02		18.31 (12_VE1) 18.50 (12_VE1)	03:24 23:08		04:22 22:24	05:55 20:39		18.15 (12_VE1) 18.12	07:52 16:09	10:05 14:35
Potential sun hours	175	239	363	450		566	617	603	506	393	306	201	142
Total, worst case			356	22						384			
Sun reduction			0,37	0,40						0,31			
Oper. time red.			0,93	0,93						0,93			
Wind dir. red.			0,62	0,62						0,62			
Total reduction			0,21	0,23						0,18			
Total, real			76	5						69			

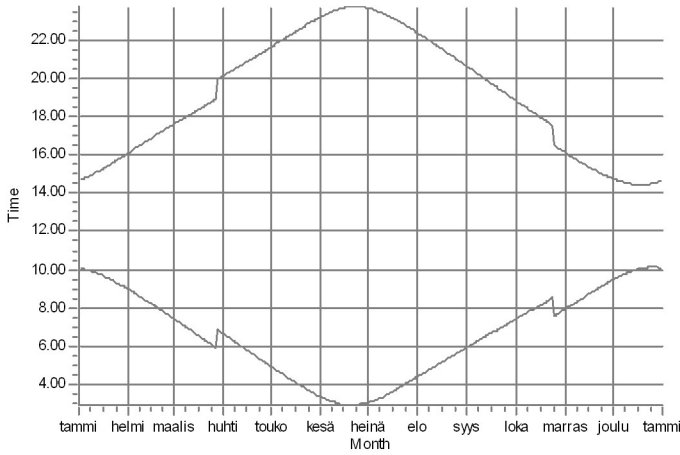
Table layout: For each day in each month the following matrix apply

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

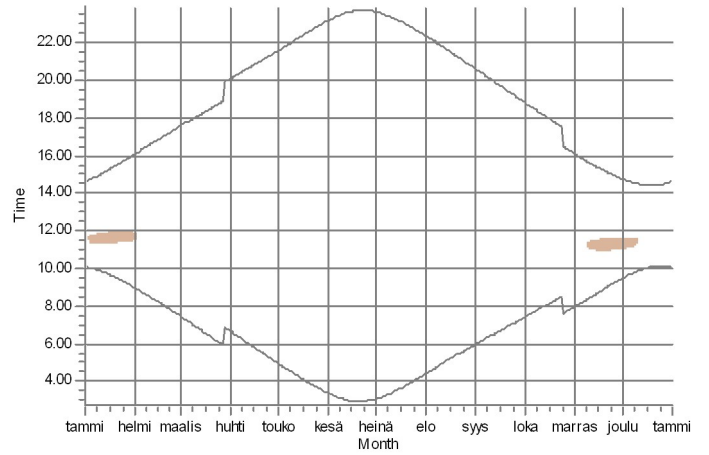
## SHADOW - Calendar, graphical

Calculation: Kokkopetaikkö\_VE1\_Välkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset

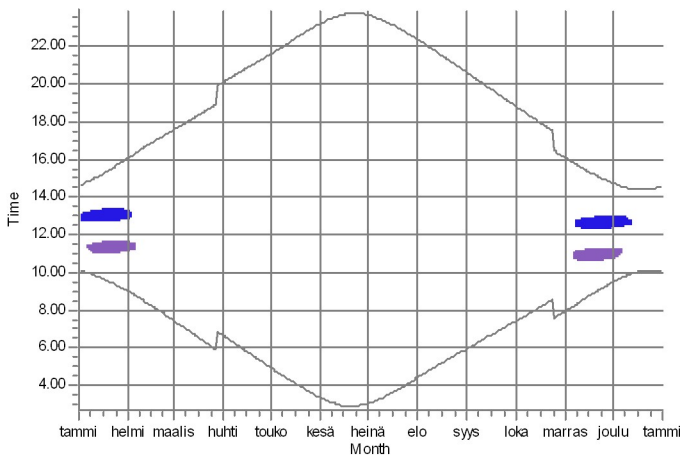
A: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (13)



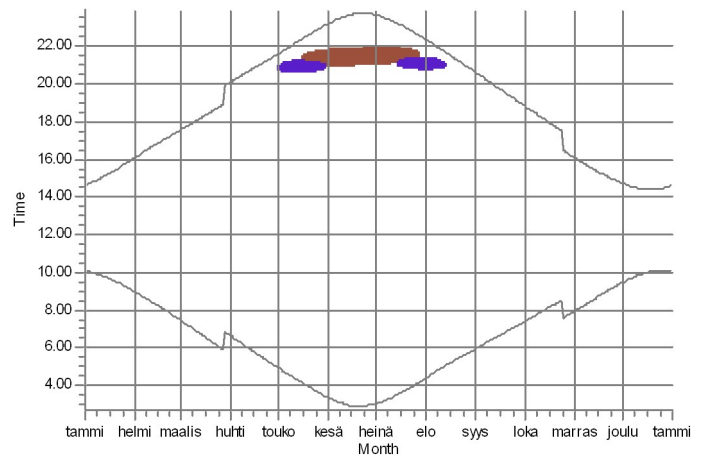
B: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (12)



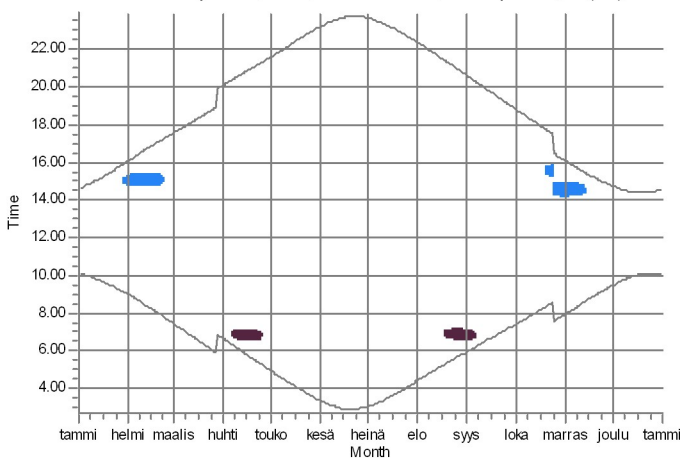
C: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (17)



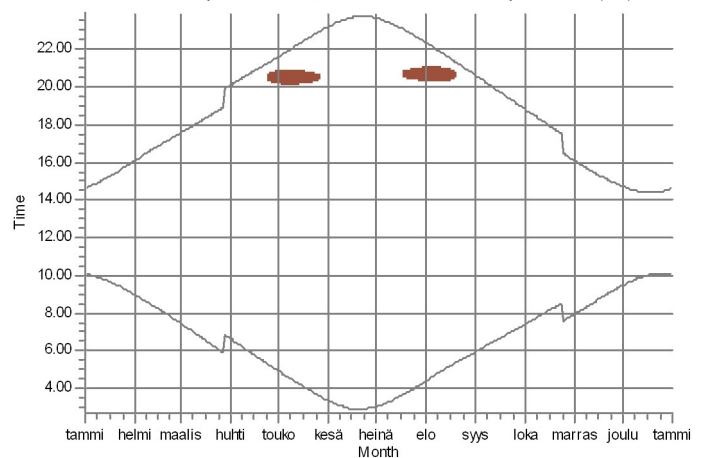
D: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (18)



E: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (19)



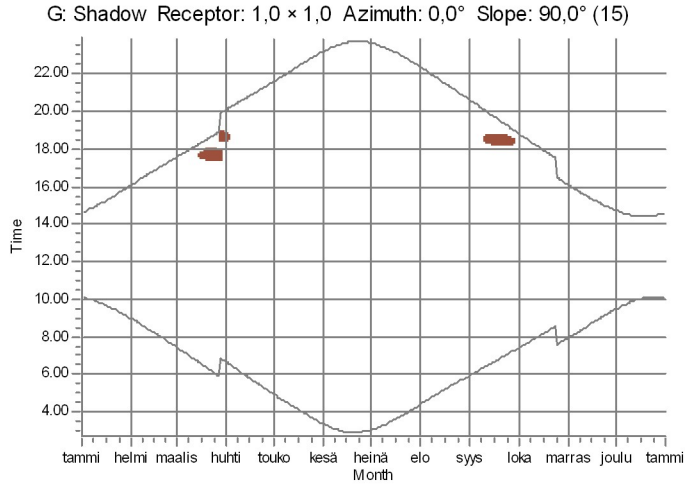
F: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (14)



WTG: M\_2: Siemens Gamesa SG 6.0-110 6200 250.0 ICF Hub: 180.0 m (TOT: 260.0 m) (40) 4\_VE1: VESTAS V162-7.2 7200 240.0 ICF Hub: 200.0 m (TOT: 320.0 m) (80) 11\_VE1: VESTAS V162-7.2 7200 240.0 ICF Hub: 200.0 m (TOT: 320.0 m) (80) H\_NL\_A1: VESTAS V162-7.2 7200 250.0 ICF Hub: 200.0 m (TOT: 300.0 m) (130) 2\_VE1: VESTAS V162-7.2 7200 240.0 ICF Hub: 200.0 m (TOT: 320.0 m) (80) 12\_VE1: VESTAS V162-7.2 7200 240.0 ICF Hub: 200.0 m (TOT: 320.0 m) (84) 3\_VE1: VESTAS V162-7.2 7200 240.0 ICF Hub: 200.0 m (TOT: 320.0 m) (80)

## SHADOW - Calendar, graphical

Calculation: Kokkopetaikkö\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset



## SHADOW - Main Result

Calculation: Kokkopetaikkö\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2023

### 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  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

Operational time  
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

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: Elevation Grid Data Object: kokkopetaikko\_EMDGrid\_4.  
Receptor grid resolution: 1,0 m

All coordinates are in  
Finish TM ETRS-TM35FIN-ETRS89

### WTGs

	East	North	Z	Row data/Description	WTG type			Shadow data				
					Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM [RPM]
1_VE2	434 208	7 073 709	157,4	VESTAS V162-7.2 7200 240.0 !... Yes	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
2_VE2	435 004	7 073 483	155,6	VESTAS V162-7.2 7200 240.0 !... Yes	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
3_VE2	435 846	7 073 518	154,5	VESTAS V162-7.2 7200 240.0 !... Yes	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
4_VE2	436 739	7 073 563	154,7	VESTAS V162-7.2 7200 240.0 !... Yes	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
5_VE2	435 175	7 072 670	156,0	VESTAS V162-7.2 7200 240.0 !... Yes	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
6_VE1	433 756	7 072 547	160,5	VESTAS V162-7.2 7200 240.0 !... Yes	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
7_VE2	434 325	7 071 775	156,6	VESTAS V162-7.2 7200 240.0 !... Yes	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
8_VE2	434 645	7 070 857	161,2	VESTAS V162-7.2 7200 240.0 !... Yes	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5

### Shadow receptor-Input

No.	East	North	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
	[m]	[m]	[m]	[m]	[m]	[m]	[°]		[m]
A	433 196	7 069 450	142,9	1,0	1,0	1,0	90,0	"Green house mode"	2,0
B	434 902	7 068 448	149,9	1,0	1,0	1,0	90,0	"Green house mode"	2,0
C	435 343	7 075 466	151,2	1,0	1,0	1,0	90,0	"Green house mode"	2,0
D	437 755	7 071 880	157,4	1,0	1,0	1,0	90,0	"Green house mode"	2,0
E	437 777	7 074 862	158,4	1,0	1,0	1,0	90,0	"Green house mode"	2,0
F	438 345	7 071 927	153,2	1,0	1,0	1,0	90,0	"Green house mode"	2,0
G	438 766	7 072 916	153,8	1,0	1,0	1,0	90,0	"Green house mode"	2,0

### Calculation Results

#### Shadow receptor

No.	Shadow, worst case			Shadow, expected values	
	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]	
A	22:53	57	0:30	5:27	
B	0:00	0	0:00	0:00	
C	47:11	70	0:59	3:29	
D	0:00	0	0:00	0:00	
E	22:11	50	0:34	2:39	
F	0:00	0	0:00	0:00	
G	0:00	0	0:00	0:00	



## SHADOW - Main Result

Calculation: Kokkopetaikko\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2023

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

No.	Name	Worst case [h/year]	Expected [h/year]
1_VE2	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (145)	0:00	0:00
2_VE2	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (147)	25:06	1:49
3_VE2	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (152)	22:05	1:40
4_VE2	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (150)	22:11	2:39
5_VE2	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (148)	0:00	0:00
6_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (146)	0:00	0:00
7_VE2	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (149)	0:00	0:00
8_VE2	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (151)	22:53	5:27

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

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



### SHADOW - Calendar

Calculation: Kokkopetaikko\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2023 Shadow receptor: A - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (13) Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

#### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.04 14.38	08.58 16.06	07.28 17.34	06.40 20.06	04.56 21.36	03.22 23.11	04.23 (8_VE2) 23.39	03.03 29	04.26 (8_VE2) 22.21	05.59 20.36	07.24 18.51	07.56 16.06
2	14.04 14.40	08.55 16.09	07.25 17.37	06.37 20.09	04.53 21.39	03.20 23.14	04.22 (8_VE2) 23.38	03.05 29	04.26 (8_VE2) 22.18	06.02 20.32	07.26 18.47	16.06 14.43
3	10.03 14.42	08.52 16.12	07.21 17.40	06.33 20.12	04.50 21.42	03.18 23.16	04.22 (8_VE2) 23.36	03.06 27	04.27 (8_VE2) 22.14	06.04 20.29	07.29 18.44	08.02 16.00
4	10.01 14.44	08.49 16.15	07.18 17.44	06.30 20.15	04.46 21.46	03.15 23.19	04.21 (8_VE2) 23.35	03.08 27	04.27 (8_VE2) 22.11	06.07 20.25	07.32 18.40	08.05 15.57
5	10.00 14.46	08.46 16.19	07.14 17.47	06.26 20.17	04.43 21.49	03.13 23.21	04.22 (8_VE2) 23.33	03.10 28	04.27 (8_VE2) 22.08	06.10 20.22	07.35 18.37	08.08 15.54
6	09.59 14.49	08.43 16.22	07.11 17.50	06.23 20.20	04.40 21.52	03.11 23.24	04.22 (8_VE2) 23.31	03.12 27	04.27 (8_VE2) 22.05	06.13 20.18	07.38 18.33	08.12 15.51
7	09.57 14.51	08.40 16.25	07.07 17.53	06.19 20.23	04.36 21.55	03.09 23.26	04.21 (8_VE2) 23.29	03.14 27	04.28 (8_VE2) 22.01	06.16 20.15	07.41 18.30	08.15 15.47
8	09.56 14.53	08.37 16.28	07.04 17.55	06.16 20.26	04.33 21.58	03.07 23.28	04.21 (8_VE2) 23.27	03.17 26	04.28 (8_VE2) 21.58	06.19 20.11	07.44 18.26	08.18 15.44
9	09.54 14.56	08.34 16.32	07.01 17.58	06.12 20.29	04.30 22.01	03.06 23.30	04.21 (8_VE2) 23.25	03.19 25	04.29 (8_VE2) 21.55	06.22 20.08	07.47 18.23	08.21 15.41
10	09.52 14.58	08.31 16.35	06.57 18.01	06.09 20.32	04.27 22.05	03.04 23.32	04.21 (8_VE2) 23.23	03.21 24	04.30 (8_VE2) 21.51	06.24 20.04	07.49 18.20	08.24 15.38
11	09.51 15.01	08.27 16.38	06.54 18.04	06.05 20.35	04.23 22.08	03.02 23.34	04.22 (8_VE2) 23.21	03.24 24	04.30 (8_VE2) 21.48	06.27 20.01	07.52 18.16	08.27 15.35
12	09.49 15.04	08.24 16.41	06.50 18.07	06.02 20.38	04.20 22.11	03.01 23.36	04.22 (8_VE2) 23.18	03.26 23	04.31 (8_VE2) 21.45	06.30 19.57	07.55 18.13	08.31 15.32
13	09.47 15.07	08.21 16.45	06.47 18.10	05.58 20.41	04.17 22.14	03.00 23.37	04.22 (8_VE2) 23.16	03.29 22	04.32 (8_VE2) 21.41	06.33 19.54	07.58 18.09	08.34 15.30
14	09.45 15.09	08.18 16.48	06.43 18.13	05.55 20.44	04.14 22.17	02.58 23.39	04.22 (8_VE2) 23.13	03.32 21	04.32 (8_VE2) 21.38	06.36 19.50	08.01 18.06	08.37 15.27
15	09.43 15.12	08.15 16.51	06.40 18.16	05.51 20.47	04.11 22.20	02.57 23.40	04.22 (8_VE2) 23.11	03.35 18	04.34 (8_VE2) 21.34	06.38 19.47	08.04 18.02	08.40 15.24
16	09.40 15.15	08.11 16.54	06.36 18.19	05.48 20.50	04.07 22.23	02.56 23.41	04.22 (8_VE2) 23.08	03.37 16	04.36 (8_VE2) 21.31	06.41 19.43	08.07 17.59	08.43 15.21
17	09.38 15.18	08.08 16.57	06.33 18.22	05.44 20.53	04.04 22.27	02.55 23.42	04.23 (8_VE2) 23.06	03.40 12	04.38 (8_VE2) 21.28	06.44 19.40	08.10 17.56	08.47 15.18
18	09.36 15.21	08.05 17.00	06.29 18.25	05.41 20.56	04.01 22.30	02.55 23.43	04.23 (8_VE2) 23.03	03.43 9	04.40 (8_VE2) 21.24	06.47 19.36	08.13 17.52	08.50 15.15
19	09.33 15.24	08.01 17.04	06.26 18.28	05.37 20.59	03.58 22.33	02.55 23.44	04.23 (8_VE2) 23.00	03.46 5	04.42 (8_VE2) 21.21	06.50 19.33	08.16 17.49	08.53 15.13
20	09.31 15.27	07.58 17.07	06.22 18.31	05.34 21.02	03.55 22.36	02.55 23.44	04.24 (8_VE2) 22.57	03.49 29	04.47 (8_VE2) 21.17	06.53 19.29	08.19 17.46	08.56 15.10
21	09.28 15.30	07.55 17.10	06.19 18.34	05.31 21.05	03.52 22.39	02.55 23.44	04.24 (8_VE2) 22.54	03.52 29	04.53 (8_VE2) 21.14	06.55 19.26	08.22 17.42	08.59 15.07
22	09.26 15.34	07.52 17.13	06.15 18.37	05.27 21.08	03.49 22.42	02.55 23.45	04.24 (8_VE2) 22.52	03.55 29	04.53 (8_VE2) 21.10	06.58 19.22	08.25 17.39	09.02 15.05
23	09.23 15.37	07.48 17.16	06.12 18.40	05.24 21.11	03.46 22.45	02.56 23.45	04.23 (8_VE2) 22.49	03.58 30	04.53 (8_VE2) 21.07	07.01 19.19	08.28 17.36	09.05 15.02
24	09.21 15.40	07.45 17.19	06.08 18.42	05.20 21.14	03.44 22.48	02.56 23.44	04.24 (8_VE2) 22.46	04.01 29	04.54 (8_VE2) 21.04	07.04 19.15	08.31 17.32	09.08 15.00
25	09.18 15.43	07.41 17.22	06.05 18.45	05.17 21.17	03.41 22.51	02.57 23.44	04.32 (8_VE2) 22.43	04.04 29	04.54 (8_VE2) 21.00	07.07 19.12	08.34 17.29	09.11 14.58
26	09.15 15.46	07.38 17.25	06.01 18.48	05.13 21.21	03.38 22.54	02.58 23.44	04.29 (8_VE2) 22.40	04.07 29	04.55 (8_VE2) 20.57	07.09 19.08	08.37 17.26	09.14 14.55
27	09.13 15.50	07.35 17.28	05.58 18.51	05.10 21.24	03.35 22.57	02.59 23.43	04.28 (8_VE2) 22.37	04.10 29	04.56 (8_VE2) 20.53	07.12 19.05	08.40 17.22	09.17 14.53
28	09.10 15.53	07.31 17.31	05.54 18.54	05.07 21.27	03.32 23.00	02.56 23.42	04.26 (8_VE2) 22.33	04.13 28	04.57 (8_VE2) 20.50	07.15 19.01	08.43 17.19	09.20 14.51
29	09.07 15.56	07.28 17.34	05.51 18.51	05.03 21.30	03.30 23.03	02.57 23.41	04.25 (8_VE2) 22.30	04.16 29	04.58 (8_VE2) 20.46	07.18 18.58	08.46 17.16	09.23 14.49
30	09.04 15.59	07.27 17.35	05.50 18.50	05.00 21.33	03.27 23.06	02.58 23.40	04.23 (8_VE2) 22.27	04.19 29	04.59 (8_VE2) 20.43	07.21 18.54	08.50 17.13	09.26 14.46
31	09.01 16.02	07.24 17.38	05.47 18.47	04.59 21.36	03.24 23.09	02.59 23.41	04.22 (8_VE2) 22.24	04.19 29	04.60 (8_VE2) 20.42	07.24 18.54	08.53 17.13	09.29 14.46
Potential sun hours	175	240	363	450	565	616	603	506	393	306	201	142
Total, worst case					115	839	419					
Sun reduction					0,45	0,40	0,43					
Oper. time red.					0,93	0,93	0,93					
Wind dir. red.					0,62	0,62	0,62					
Total reduction					0,26	0,23	0,25					
Total, real					30	192	105					

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)

## SHADOW - Calendar

Calculation: Kokkopetaikko\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2023 Shadow receptor: B - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (12)  
Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

## Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.04	08.58	07.28	06.40	04.56	03.22	03.03	04.25	05.59	07.23	07.56	09.28
	14.38	16.06	17.34	20.06	21.36	23.11	23.39	22.21	20.36	18.51	16.06	14.44
2	10.03	08.55	07.24	06.37	04.53	03.20	03.05	04.28	06.01	07.26	07.59	09.31
	14.40	16.09	17.37	20.09	21.39	23.13	23.37	22.17	20.32	18.47	16.03	14.42
3	10.02	08.52	07.21	06.33	04.50	03.18	03.06	04.32	06.04	07.29	08.02	09.33
	14.42	16.12	17.40	20.11	21.42	23.16	23.36	22.14	20.29	18.44	16.00	14.41
4	10.01	08.49	07.18	06.30	04.46	03.15	03.08	04.35	06.07	07.32	08.05	09.36
	14.44	16.15	17.43	20.14	21.45	23.18	23.34	22.11	20.25	18.40	15.57	14.39
5	10.00	08.46	07.14	06.26	04.43	03.13	03.10	04.38	06.10	07.35	08.08	09.39
	14.46	16.19	17.46	20.17	21.48	23.21	23.33	22.08	20.22	18.37	15.54	14.37
6	09.59	08.43	07.11	06.23	04.40	03.11	03.12	04.41	06.13	07.38	08.11	09.41
	14.49	16.22	17.49	20.20	21.52	23.23	23.31	22.04	20.18	18.33	15.50	14.36
7	09.57	08.40	07.07	06.19	04.36	03.09	03.14	04.44	06.16	07.41	08.15	09.43
	14.51	16.25	17.52	20.23	21.55	23.26	23.29	22.01	20.15	18.30	15.47	14.34
8	09.56	08.37	07.04	06.16	04.33	03.07	03.17	04.47	06.19	07.43	08.18	09.46
	14.53	16.28	17.55	20.26	21.58	23.28	23.27	21.58	20.11	18.26	15.44	14.33
9	09.54	08.34	07.00	06.12	04.30	03.06	03.19	04.50	06.21	07.46	08.21	09.48
	14.56	16.32	17.58	20.29	22.01	23.30	23.25	21.54	20.08	18.23	15.41	14.32
10	09.52	08.30	06.57	06.09	04.27	03.04	03.21	04.53	06.24	07.49	08.24	09.50
	14.58	16.35	18.01	20.32	22.04	23.32	23.23	21.51	20.04	18.19	15.38	14.30
11	09.50	08.27	06.53	06.05	04.23	03.02	03.24	04.56	06.27	07.52	08.27	09.52
	15.01	16.38	18.04	20.35	22.07	23.33	23.20	21.48	20.01	18.16	15.35	14.29
12	09.49	08.24	06.50	06.02	04.20	03.01	03.26	04.59	06.30	07.55	08.30	09.54
	15.04	16.41	18.07	20.38	22.11	23.35	23.18	21.44	19.57	18.13	15.32	14.28
13	09.47	08.21	06.47	05.58	04.17	03.00	03.29	05.02	06.33	07.58	08.34	09.55
	15.07	16.44	18.10	20.41	22.14	23.37	23.16	21.41	19.54	18.09	15.29	14.28
14	09.44	08.18	06.43	05.55	04.14	02.58	03.32	05.05	06.36	08.01	08.37	09.57
	15.09	16.48	18.13	20.44	22.17	23.38	23.13	21.38	19.50	18.06	15.27	14.27
15	09.42	08.14	06.40	05.51	04.11	02.57	03.35	05.08	06.38	08.04	08.40	09.59
	15.12	16.51	18.16	20.47	22.20	23.39	23.11	21.34	19.47	18.02	15.24	14.26
16	09.40	08.11	06.36	05.48	04.07	02.56	03.37	05.11	06.41	08.07	08.43	10.00
	15.15	16.54	18.19	20.50	22.23	23.41	23.08	21.31	19.43	17.59	15.21	14.26
17	09.38	08.08	06.33	05.44	04.04	02.55	03.40	05.14	06.44	08.10	08.46	10.01
	15.18	16.57	18.22	20.53	22.26	23.42	23.05	21.27	19.39	17.56	15.18	14.26
18	09.36	08.05	06.29	05.41	04.01	02.55	03.43	05.17	06.47	08.13	08.49	10.02
	15.21	17.00	18.25	20.56	22.29	23.42	23.03	21.24	19.36	17.52	15.15	14.25
19	09.33	08.01	06.26	05.37	03.58	02.55	03.46	05.20	06.50	08.16	08.53	10.03
	15.24	17.03	18.28	20.59	22.33	23.43	23.00	21.21	19.32	17.49	15.13	14.25
20	09.31	07.58	06.22	05.34	03.55	02.55	03.49	05.23	06.52	08.19	08.56	10.04
	15.27	17.07	18.31	21.02	22.36	23.44	22.57	21.17	19.29	17.45	15.10	14.26
21	09.28	07.55	06.19	05.30	03.52	02.55	03.52	05.26	06.55	08.22	08.59	10.05
	15.30	17.10	18.34	21.05	22.39	23.44	22.54	21.14	19.25	17.42	15.07	14.26
22	09.26	07.51	06.15	05.27	03.49	02.55	03.55	05.29	06.58	08.25	09.02	10.06
	15.34	17.13	18.36	21.08	22.42	23.44	22.51	21.10	19.22	17.39	15.05	14.26
23	09.23	07.48	06.12	05.24	03.46	02.56	03.58	05.32	07.01	08.28	09.05	10.06
	15.37	17.16	18.39	21.11	22.45	23.44	22.48	21.07	19.18	17.35	15.02	14.27
24	09.20	07.45	06.08	05.20	03.43	02.56	04.01	05.35	07.04	08.31	09.08	10.07
	15.40	17.19	18.42	21.14	22.48	23.44	22.45	21.03	19.15	17.32	15.00	14.27
25	09.18	07.41	06.05	05.17	03.41	02.57	04.04	05.38	07.06	07.34	09.11	10.07
	15.43	17.22	18.45	21.17	22.51	23.44	22.42	21.00	19.11	16.29	14.58	14.28
26	09.15	07.38	06.01	05.13	03.38	02.58	04.07	05.41	07.09	07.37	09.14	10.07
	15.46	17.25	18.48	21.20	22.54	23.43	22.39	20.56	19.08	16.26	14.55	14.29
27	09.12	07.35	05.58	05.10	03.35	02.59	04.10	05.44	07.12	07.40	09.17	10.07
	15.49	17.28	18.51	21.23	22.57	23.43	22.36	20.53	19.04	16.22	14.53	14.30
28	09.10	07.31	05.54	05.06	03.32	03.00	04.13	05.47	07.15	07.43	09.20	10.07
	15.53	17.31	18.54	21.27	23.00	23.42	22.33	20.50	19.01	16.19	14.51	14.32
29	09.07		06.51	05.03	03.30	03.00	04.16	05.50	07.18	07.46	09.23	10.06
	15.56		19.57	21.30	23.03	23.41	22.30	20.46	18.58	16.16	14.49	14.33
30	09.04		06.47	05.00	03.27	03.01	04.19	05.53	07.21	07.49	09.25	10.06
	15.59		20.00	21.33	23.05	23.40	22.27	20.43	18.54	16.13	14.46	14.34
31	09.01		06.44		03.25		04.22	05.56		07.53		10.05
	16.02		20.03		23.08		22.24	20.39		16.09		14.36
Potential sun hours	175	240	363	450	565	616	603	506	393	306	201	143
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: Kokkopetaikko\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2023 Shadow receptor: C - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (17)  
Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June				
1	10.05	12.48 (2_VE2)	08.58	11.13 (3_VE2)	07.28	06.40	04.56	03.21		
	14.37	1	12.49 (2_VE2)	16.05	33	13.12 (2_VE2)	17.34	20.06	21.36	23.12
2	10.04	12.48 (2_VE2)	08.55	11.15 (3_VE2)	07.24	06.36	04.52	03.19		
	14.39	8	12.56 (2_VE2)	16.08	23	13.09 (2_VE2)	17.37	20.09	21.39	23.14
3	10.03	12.47 (2_VE2)	08.52	11.17 (3_VE2)	07.21	06.33	04.49	03.16		
	14.41	14	13.01 (2_VE2)	16.12	14	11.31 (3_VE2)	17.40	20.12	21.43	23.17
4	10.02	12.48 (2_VE2)	08.49	11.20 (3_VE2)	07.18	06.29	04.46	03.14		
	14.43	19	13.07 (2_VE2)	16.15	8	11.28 (3_VE2)	17.43	20.14	21.46	23.20
5	10.01	12.47 (2_VE2)	08.46	11.21 (3_VE2)	07.14	06.26	04.42	03.12		
	14.45	21	13.08 (2_VE2)	16.18	17.46	20.17	21.49	23.22		
6	09.59	12.48 (2_VE2)	08.43	11.23 (3_VE2)	07.11	06.22	04.39	03.10		
	14.48	21	13.09 (2_VE2)	16.21	17.49	20.20	21.52	23.24		
7	09.58	11.21 (3_VE2)	08.40	11.26 (3_VE2)	07.07	06.19	04.36	03.08		
	14.50	25	13.09 (2_VE2)	16.25	17.52	20.23	21.55	23.27		
8	09.56	11.17 (3_VE2)	08.37	11.29 (3_VE2)	07.04	06.15	04.32	03.06		
	14.52	31	13.10 (2_VE2)	16.28	17.55	20.26	21.58	23.29		
9	09.55	11.13 (3_VE2)	08.34	11.32 (3_VE2)	07.00	06.12	04.29	03.04		
	14.55	37	13.11 (2_VE2)	16.31	17.58	20.29	22.02	23.31		
10	09.53	11.09 (3_VE2)	08.31	11.35 (3_VE2)	06.57	06.08	04.26	03.03		
	14.58	43	13.12 (2_VE2)	16.34	18.01	20.32	22.05	23.33		
11	09.51	11.07 (3_VE2)	08.28	11.38 (3_VE2)	06.53	06.05	04.23	03.01		
	15.00	47	13.13 (2_VE2)	16.38	18.04	20.35	22.08	23.35		
12	09.49	11.07 (3_VE2)	08.24	11.41 (3_VE2)	06.50	06.01	04.19	03.00		
	15.03	49	13.14 (2_VE2)	16.41	18.07	20.38	22.11	23.36		
13	09.47	11.07 (3_VE2)	08.21	11.44 (3_VE2)	06.47	05.58	04.16	02.57		
	15.06	51	13.15 (2_VE2)	16.44	18.10	20.41	22.14	23.38		
14	09.45	11.07 (3_VE2)	08.18	11.47 (3_VE2)	06.43	05.54	04.13	02.56		
	15.09	52	13.15 (2_VE2)	16.47	18.13	20.44	22.18	23.40		
15	09.43	11.07 (3_VE2)	08.15	11.50 (3_VE2)	06.40	05.51	04.10	02.55		
	15.12	53	13.16 (2_VE2)	16.51	18.16	20.47	22.21	23.41		
16	09.41	11.07 (3_VE2)	08.11	11.53 (3_VE2)	06.36	05.47	04.07	02.55		
	15.14	54	13.16 (2_VE2)	16.54	18.19	20.50	22.24	23.42		
17	09.39	11.06 (3_VE2)	08.08	11.56 (3_VE2)	06.33	05.44	04.04	02.54		
	15.17	57	13.17 (2_VE2)	16.57	18.22	20.53	22.27	23.43		
18	09.36	11.06 (3_VE2)	08.05	11.59 (3_VE2)	06.29	05.41	04.01	02.54		
	15.20	57	13.17 (2_VE2)	17.00	18.25	20.56	22.30	23.44		
19	09.34	11.06 (3_VE2)	08.02	11.62 (3_VE2)	06.26	05.37	03.57	02.53		
	15.24	57	13.17 (2_VE2)	17.03	18.28	20.59	22.33	23.45		
20	09.31	11.06 (3_VE2)	07.58	11.65 (3_VE2)	06.22	05.34	03.54	02.53		
	15.27	59	13.18 (2_VE2)	17.06	18.31	21.02	22.36	23.45		
21	09.29	11.07 (3_VE2)	07.55	11.68 (3_VE2)	06.19	05.30	03.51	02.53		
	15.30	58	13.19 (2_VE2)	17.09	18.34	21.05	22.40	23.45		
22	09.26	11.07 (3_VE2)	07.52	11.71 (3_VE2)	06.15	05.27	03.48	02.54		
	15.33	58	13.19 (2_VE2)	17.13	18.36	21.08	22.43	23.46		
23	09.24	11.07 (3_VE2)	07.48	11.74 (3_VE2)	06.12	05.23	03.46	02.54		
	15.36	57	13.18 (2_VE2)	17.16	18.39	21.11	22.46	23.46		
24	09.21	11.07 (3_VE2)	07.45	11.77 (3_VE2)	06.08	05.20	03.43	02.55		
	15.39	57	13.18 (2_VE2)	17.19	18.42	21.15	22.49	23.46		
25	09.18	11.08 (3_VE2)	07.41	11.80 (3_VE2)	06.05	05.16	03.40	02.55		
	15.42	55	13.18 (2_VE2)	17.22	18.45	21.18	22.52	23.45		
26	09.16	11.09 (3_VE2)	07.38	11.83 (3_VE2)	06.01	05.13	03.37	02.56		
	15.46	55	13.19 (2_VE2)	17.25	18.48	21.21	22.55	23.45		
27	09.13	11.09 (3_VE2)	07.35	11.86 (3_VE2)	05.58	05.09	03.34	02.57		
	15.49	53	13.18 (2_VE2)	17.28	18.51	21.24	22.58	23.44		
28	09.10	11.10 (3_VE2)	07.31	11.89 (3_VE2)	05.54	05.06	03.31	02.59		
	15.52	50	13.17 (2_VE2)	17.31	18.54	21.27	23.01	23.43		
29	09.07	11.10 (3_VE2)	07.28	11.92 (3_VE2)	06.51	05.03	03.29	03.00		
	15.55	48	13.16 (2_VE2)	17.34	19.57	21.30	23.03	23.42		
30	09.04	11.12 (3_VE2)	07.25	11.95 (3_VE2)	06.47	04.59	03.26	03.00		
	15.59	44	13.16 (2_VE2)	17.37	20.00	21.33	23.06	23.41		
31	09.01	11.12 (3_VE2)	07.22	11.98 (3_VE2)	06.44	04.56	03.24	03.00		
	16.02	40	13.15 (2_VE2)	17.40	20.03	21.36	23.09	23.41		
Potential sun hours	175	239	363	450	566	617				
Total, worst case	1331	78								
Sun reduction	0,14	0,26								
Oper. time red.	0,93	0,93								
Wind dir. red.	0,65	0,65								
Total reduction	0,09	0,16								
Total, real	116	12								

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

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

## SHADOW - Calendar

Calculation: Kokkopetaikko\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2023 Shadow receptor: C - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (17)  
Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	July	August	September	October	November	December
1	03.02	04.25	05.58	07.23	07.56	09.29
	23.40	22.21	20.36	18.50	16.06	14.44
2	03.03	04.28	06.01	07.26	07.59	09.32
	23.39	22.18	20.32	18.47	16.03	14.42
3	03.05	04.31	06.04	07.29	08.02	09.34
	23.37	22.15	20.29	18.44	15.59	14.40
4	03.07	04.34	06.07	07.32	08.05	09.37
	23.36	22.11	20.25	18.40	15.56	14.38
5	03.09	04.37	06.10	07.35	08.09	09.39
	23.34	22.08	20.22	18.37	15.53	14.36
6	03.11	04.40	06.13	07.38	08.12	09.42
	23.32	22.05	20.18	18.33	15.50	14.35
7	03.13	04.43	06.16	07.41	08.15	10.50 (3_VE2)
	23.30	22.02	20.15	18.30	15.47	14.33
8	03.15	04.46	06.18	07.44	08.18	10.59 (3_VE2)
	23.28	21.58	20.11	18.26	15.44	14.32
9	03.18	04.50	06.21	07.46	08.21	10.45 (3_VE2)
	23.26	21.55	20.08	18.23	15.41	14.31
10	03.20	04.53	06.24	07.49	08.25	12.40 (2_VE2)
	23.24	21.52	20.04	18.19	15.38	14.29
11	03.23	04.56	06.27	07.52	08.28	10.44 (3_VE2)
	23.21	21.48	20.01	18.16	15.35	14.28
12	03.25	04.59	06.30	07.55	08.31	10.42 (3_VE2)
	23.19	21.45	19.57	18.12	15.32	14.27
13	03.28	05.02	06.33	07.58	08.34	10.42 (3_VE2)
	23.17	21.41	19.54	18.09	15.29	14.27
14	03.31	05.05	06.35	08.01	08.37	10.41 (3_VE2)
	23.14	21.38	19.50	18.06	15.26	14.26
15	03.34	05.08	06.38	08.04	08.40	10.42 (3_VE2)
	23.12	21.35	19.47	18.02	15.23	14.25
16	03.36	05.11	06.41	08.07	08.44	12.51 (2_VE2)
	23.09	21.31	19.43	17.59	15.20	14.25
17	03.39	05.14	06.44	08.10	08.47	10.42 (3_VE2)
	23.06	21.28	19.40	17.55	15.18	14.25
18	03.42	05.17	06.47	08.13	08.50	10.41 (3_VE2)
	23.03	21.24	19.36	17.52	15.15	14.24
19	03.45	05.20	06.50	08.16	08.53	10.41 (3_VE2)
	23.01	21.21	19.33	17.49	15.12	14.24
20	03.48	05.23	06.52	08.19	08.56	12.52 (2_VE2)
	22.58	21.18	19.29	17.45	15.09	14.25
21	03.51	05.26	06.55	08.22	08.59	10.42 (3_VE2)
	22.55	21.14	19.25	17.42	15.07	14.25
22	03.54	05.29	06.58	08.25	09.02	10.42 (3_VE2)
	22.52	21.11	19.22	17.39	15.04	14.25
23	03.57	05.32	07.01	08.28	09.06	12.54 (2_VE2)
	22.49	21.07	19.18	17.35	15.02	14.26
24	04.00	05.35	07.04	08.31	09.09	10.43 (3_VE2)
	22.46	21.04	19.15	17.32	14.59	14.26
25	04.03	05.38	07.06	07.34	09.12	10.44 (3_VE2)
	22.43	21.00	19.11	16.29	14.57	14.27
26	04.06	05.41	07.09	07.37	09.15	10.45 (3_VE2)
	22.40	20.57	19.08	16.25	14.54	14.28
27	04.09	05.44	07.12	07.40	09.18	10.46 (3_VE2)
	22.37	20.53	19.04	16.22	14.52	14.29
28	04.12	05.47	07.15	07.43	09.20	10.46 (3_VE2)
	22.34	20.50	19.01	16.19	14.50	14.31
29	04.15	05.50	07.18	07.47	09.23	12.55 (2_VE2)
	22.31	20.46	18.57	16.15	14.48	14.32
30	04.18	05.53	07.21	07.50	09.26	10.47 (3_VE2)
	22.28	20.43	18.54	16.12	14.46	14.33
31	04.22	05.55		07.53		10.06
	22.24	20.39		16.09		14.35
Potential sun hours	604	506	393	306	201	142
Total, worst case					1149	273
Sun reduction					0,10	0,07
Oper. time red.					0,93	0,93
Wind dir. red.					0,65	0,65
Total reduction					0,06	0,04
Total, real					70	12

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

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

## SHADOW - Calendar

Calculation: Kokkopetaikko\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2023 Shadow receptor: D - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (18)  
Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

## Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.04	08.58	07.28	06.40	04.56	03.22	03.02	04.25	05.58	07.23	07.56	09.28
	14.38	16.05	17.34	20.05	21.36	23.11	23.39	22.21	20.35	18.50	16.06	14.44
2	10.04	08.55	07.24	06.36	04.53	03.19	03.04	04.28	06.01	07.26	07.59	09.31
	14.39	16.08	17.37	20.08	21.39	23.14	23.38	22.17	20.32	18.47	16.03	14.42
3	10.03	08.52	07.21	06.33	04.49	03.17	03.05	04.31	06.04	07.29	08.02	09.34
	14.41	16.12	17.40	20.11	21.42	23.16	23.36	22.14	20.28	18.43	15.59	14.40
4	10.01	08.49	07.17	06.29	04.46	03.15	03.07	04.34	06.07	07.32	08.05	09.36
	14.43	16.15	17.43	20.14	21.45	23.19	23.35	22.11	20.25	18.40	15.56	14.38
5	10.00	08.46	07.14	06.26	04.42	03.12	03.09	04.37	06.10	07.35	08.08	09.39
	14.46	16.18	17.46	20.17	21.49	23.21	23.33	22.08	20.21	18.36	15.53	14.37
6	09.59	08.43	07.11	06.22	04.39	03.10	03.11	04.40	06.13	07.38	08.11	09.41
	14.48	16.21	17.49	20.20	21.52	23.24	23.31	22.04	20.18	18.33	15.50	14.35
7	09.57	08.40	07.07	06.19	04.36	03.08	03.14	04.43	06.15	07.40	08.15	09.44
	14.50	16.25	17.52	20.23	21.55	23.26	23.29	22.01	20.14	18.29	15.47	14.33
8	09.56	08.37	07.04	06.15	04.33	03.06	03.16	04.47	06.18	07.43	08.18	09.46
	14.53	16.28	17.55	20.26	21.58	23.28	23.27	21.58	20.11	18.26	15.44	14.32
9	09.54	08.34	07.00	06.12	04.29	03.05	03.18	04.50	06.21	07.46	08.21	09.48
	14.55	16.31	17.58	20.29	22.01	23.30	23.25	21.54	20.07	18.23	15.41	14.31
10	09.52	08.30	06.57	06.08	04.26	03.03	03.21	04.53	06.24	07.49	08.24	09.50
	14.58	16.34	18.01	20.32	22.04	23.32	23.23	21.51	20.04	18.19	15.38	14.30
11	09.51	08.27	06.53	06.05	04.23	03.02	03.23	04.56	06.27	07.52	08.27	09.52
	15.00	16.38	18.04	20.35	22.08	23.34	23.21	21.48	20.00	18.16	15.35	14.29
12	09.49	08.24	06.50	06.01	04.20	03.00	03.26	04.59	06.30	07.55	08.30	09.54
	15.03	16.41	18.07	20.38	22.11	23.36	23.18	21.44	19.57	18.12	15.32	14.28
13	09.47	08.21	06.46	05.58	04.16	02.58	03.28	05.02	06.32	07.58	08.34	09.56
	15.06	16.44	18.10	20.41	22.14	23.37	23.16	21.41	19.53	18.09	15.29	14.27
14	09.45	08.18	06.43	05.54	04.13	02.57	03.31	05.05	06.35	08.01	08.37	09.57
	15.09	16.47	18.13	20.44	22.17	23.39	23.13	21.38	19.50	18.05	15.26	14.26
15	09.43	08.14	06.39	05.51	04.10	02.56	03.34	05.08	06.38	08.04	08.40	09.59
	15.12	16.50	18.16	20.47	22.20	23.40	23.11	21.34	19.46	18.02	15.23	14.26
16	09.40	08.11	06.36	05.47	04.07	02.55	03.37	05.11	06.41	08.07	08.43	10.00
	15.15	16.54	18.19	20.50	22.23	23.41	23.08	21.31	19.43	17.59	15.20	14.25
17	09.38	08.08	06.32	05.44	04.04	02.55	03.39	05.14	06.44	08.10	08.46	10.02
	15.18	16.57	18.22	20.53	22.26	23.42	23.06	21.27	19.39	17.55	15.18	14.25
18	09.36	08.05	06.29	05.40	04.01	02.54	03.42	05.17	06.47	08.13	08.49	10.03
	15.21	17.00	18.25	20.56	22.30	23.43	23.03	21.24	19.36	17.52	15.15	14.25
19	09.33	08.01	06.25	05.37	03.58	02.54	03.45	05.20	06.49	08.16	08.53	10.04
	15.24	17.03	18.28	20.59	22.33	23.44	23.00	21.21	19.32	17.48	15.12	14.25
20	09.31	07.58	06.22	05.34	03.55	02.54	03.48	05.23	06.52	08.19	08.56	10.05
	15.27	17.06	18.30	21.02	22.36	23.44	22.57	21.17	19.29	17.45	15.10	14.25
21	09.28	07.55	06.18	05.30	03.52	02.54	03.51	05.26	06.55	08.22	08.59	10.05
	15.30	17.09	18.33	21.05	22.39	23.45	22.54	21.14	19.25	17.42	15.07	14.25
22	09.26	07.51	06.15	05.27	03.49	02.54	03.54	05.29	06.58	08.25	09.02	10.06
	15.33	17.12	18.36	21.08	22.42	23.45	22.51	21.10	19.22	17.38	15.04	14.25
23	09.23	07.48	06.11	05.23	03.46	02.55	03.57	05.32	07.01	08.28	09.05	10.06
	15.36	17.16	18.39	21.11	22.45	23.45	22.49	21.07	19.18	17.35	15.02	14.26
24	09.21	07.45	06.08	05.20	03.43	02.55	04.00	05.35	07.03	08.31	09.08	10.07
	15.39	17.19	18.42	21.14	22.48	23.45	22.46	21.03	19.15	17.32	14.59	14.27
25	09.18	07.41	06.04	05.16	03.40	02.56	04.03	05.38	07.06	07.34	09.11	10.07
	15.43	17.22	18.45	21.17	22.51	23.44	22.43	21.00	19.11	16.28	14.57	14.28
26	09.15	07.38	06.01	05.13	03.37	02.57	04.06	05.41	07.09	07.37	09.14	10.07
	15.46	17.25	18.48	21.20	22.54	23.44	22.39	20.56	19.08	16.25	14.55	14.29
27	09.12	07.34	05.57	05.09	03.34	02.58	04.09	05.44	07.12	07.40	09.17	10.07
	15.49	17.28	18.51	21.23	22.57	23.43	22.36	20.53	19.04	16.22	14.52	14.30
28	09.10	07.31	05.54	05.06	03.32	02.59	04.12	05.47	07.15	07.43	09.20	10.07
	15.52	17.31	18.54	21.27	23.00	23.42	22.33	20.49	19.01	16.19	14.50	14.31
29	09.07		06.50	05.03	03.29	03.01	04.16	05.50	07.18	07.46	09.23	10.06
	15.55		19.57	21.30	23.03	23.41	22.30	20.46	18.57	16.15	14.48	14.32
30	09.04		06.47	04.59	03.27	03.01	04.19	05.52	07.20	07.49	09.26	10.06
	15.59		20.00	21.33	23.06	23.40	22.27	20.42	18.54	16.12	14.46	14.34
31	09.01		06.43		03.24		04.22	05.55		07.52		10.05
	16.02		20.02		23.08		22.24	20.39		16.09		14.35
Potential sun hours	175	239	363	450	566	617	603	506	393	306	201	142
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: Kokkopetaikko\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2023 Shadow receptor: F - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (14) Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.04	08.58	07.28	06.40	04.56	03.21	03.02	04.25	05.58	07.23	07.56	09.28
	14.37	16.05	17.34	20.05	21.36	23.11	23.39	22.21	20.35	18.50	16.06	14.44
2	10.04	08.55	07.24	06.36	04.52	03.19	03.04	04.28	06.01	07.26	07.59	09.31
	14.39	16.08	17.37	20.08	21.39	23.14	23.38	22.17	20.32	18.47	16.03	14.42
3	10.02	08.52	07.21	06.33	04.49	03.17	03.05	04.31	06.04	07.29	08.02	09.34
	14.41	16.12	17.40	20.11	21.42	23.16	23.36	22.14	20.28	18.43	15.59	14.40
4	10.01	08.49	07.17	06.29	04.46	03.15	03.07	04.34	06.07	07.32	08.05	09.36
	14.43	16.15	17.43	20.14	21.45	23.19	23.35	22.11	20.25	18.40	15.56	14.38
5	10.00	08.46	07.14	06.26	04.42	03.12	03.09	04.37	06.10	07.35	08.08	09.39
	14.46	16.18	17.46	20.17	21.48	23.21	23.33	22.08	20.21	18.36	15.53	14.37
6	09.59	08.43	07.10	06.22	04.39	03.10	03.11	04.40	06.13	07.37	08.11	09.41
	14.48	16.21	17.49	20.20	21.52	23.24	23.31	22.04	20.18	18.33	15.50	14.35
7	09.57	08.40	07.07	06.19	04.36	03.08	03.14	04.43	06.15	07.40	08.15	09.43
	14.50	16.25	17.52	20.23	21.55	23.26	23.29	22.01	20.14	18.29	15.47	14.33
8	09.56	08.37	07.04	06.15	04.33	03.06	03.16	04.46	06.18	07.43	08.18	09.46
	14.53	16.28	17.55	20.26	21.58	23.28	23.27	21.58	20.11	18.26	15.44	14.32
9	09.54	08.33	07.00	06.12	04.29	03.05	03.18	04.50	06.21	07.46	08.21	09.48
	14.55	16.31	17.58	20.29	22.01	23.30	23.25	21.54	20.07	18.23	15.41	14.31
10	09.52	08.30	06.57	06.08	04.26	03.03	03.21	04.53	06.24	07.49	08.24	09.50
	14.58	16.34	18.01	20.32	22.04	23.32	23.23	21.51	20.04	18.19	15.38	14.30
11	09.51	08.27	06.53	06.05	04.23	03.01	03.23	04.56	06.27	07.52	08.27	09.52
	15.00	16.38	18.04	20.35	22.07	23.34	23.21	21.48	20.00	18.16	15.35	14.29
12	09.49	08.24	06.50	06.01	04.20	03.00	03.26	04.59	06.30	07.55	08.30	09.54
	15.03	16.41	18.07	20.38	22.11	23.36	23.18	21.44	19.57	18.12	15.32	14.28
13	09.47	08.21	06.46	05.58	04.16	02.58	03.28	05.02	06.32	07.58	08.34	09.56
	15.06	16.44	18.10	20.41	22.14	23.37	23.16	21.41	19.53	18.09	15.29	14.27
14	09.45	08.18	06.43	05.54	04.13	02.57	03.31	05.05	06.35	08.01	08.37	09.57
	15.09	16.47	18.13	20.44	22.17	23.39	23.13	21.38	19.50	18.05	15.26	14.26
15	09.42	08.14	06.39	05.51	04.10	02.56	03.34	05.08	06.38	08.04	08.40	09.59
	15.12	16.50	18.16	20.47	22.20	23.40	23.11	21.34	19.46	18.02	15.23	14.26
16	09.40	08.11	06.36	05.47	04.07	02.55	03.37	05.11	06.41	08.07	08.43	10.00
	15.15	16.54	18.19	20.50	22.23	23.41	23.08	21.31	19.43	17.59	15.20	14.25
17	09.38	08.08	06.32	05.44	04.04	02.54	03.39	05.14	06.44	08.10	08.46	10.02
	15.18	16.57	18.22	20.53	22.26	23.42	23.06	21.27	19.39	17.55	15.18	14.25
18	09.36	08.04	06.29	05.40	04.01	02.54	03.42	05.17	06.46	08.13	08.49	10.03
	15.21	17.00	18.25	20.56	22.30	23.43	23.03	21.24	19.36	17.52	15.15	14.25
19	09.33	08.01	06.25	05.37	03.58	02.54	03.45	05.20	06.49	08.16	08.53	10.04
	15.24	17.03	18.27	20.59	22.33	23.44	23.00	21.21	19.32	17.48	15.12	14.25
20	09.31	07.58	06.22	05.33	03.55	02.54	03.48	05.23	06.52	08.19	08.56	10.05
	15.27	17.06	18.30	21.02	22.36	23.44	22.57	21.17	19.29	17.45	15.09	14.25
21	09.28	07.55	06.18	05.30	03.52	02.54	03.51	05.26	06.55	08.22	08.59	10.05
	15.30	17.09	18.33	21.05	22.39	23.44	22.54	21.14	19.25	17.42	15.07	14.25
22	09.26	07.51	06.15	05.27	03.49	02.54	03.54	05.29	06.58	08.25	09.02	10.06
	15.33	17.12	18.36	21.08	22.42	23.45	22.51	21.10	19.22	17.38	15.04	14.25
23	09.23	07.48	06.11	05.23	03.46	02.55	03.57	05.32	07.01	08.28	09.05	10.06
	15.36	17.16	18.39	21.11	22.45	23.45	22.48	21.07	19.18	17.35	15.02	14.26
24	09.21	07.44	06.08	05.20	03.43	02.55	04.00	05.35	07.03	08.31	09.08	10.07
	15.39	17.19	18.42	21.14	22.48	23.45	22.45	21.03	19.15	17.32	14.59	14.27
25	09.18	07.41	06.04	05.16	03.40	02.56	04.03	05.38	07.06	07.34	09.11	10.07
	15.42	17.22	18.45	21.17	22.51	23.44	22.42	21.00	19.11	16.28	14.57	14.27
26	09.15	07.38	06.01	05.13	03.37	02.57	04.06	05.41	07.09	07.37	09.14	10.07
	15.46	17.25	18.48	21.20	22.54	23.44	22.39	20.56	19.08	16.25	14.55	14.28
27	09.12	07.34	05.57	05.09	03.34	02.58	04.09	05.44	07.12	07.40	09.17	10.07
	15.49	17.28	18.51	21.23	22.57	23.43	22.36	20.53	19.04	16.22	14.52	14.30
28	09.10	07.31	05.54	05.06	03.32	02.59	04.12	05.47	07.15	07.43	09.20	10.07
	15.52	17.31	18.54	21.27	23.00	23.42	22.33	20.49	19.01	16.19	14.50	14.31
29	09.07		06.50	05.03	03.29	03.00	04.15	05.49	07.18	07.46	09.23	10.06
	15.55		19.57	21.30	23.03	23.41	22.30	20.46	18.57	16.15	14.48	14.32
30	09.04		06.47	04.59	03.26	03.00	04.19	05.52	07.20	07.49	09.26	10.06
	15.59		20.00	21.33	23.06	23.40	22.27	20.42	18.54	16.12	14.46	14.34
31	09.01		06.43		03.24		04.22	05.55		07.52		10.05
	16.02		20.02		23.08		22.24	20.39		16.09		14.35
Potential sun hours	175	239	363	450	566	617	603	506	393	306	201	142
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

## SHADOW - Calendar

Calculation: Kokkopetaikko\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2023 Shadow receptor: G - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (15°)  
Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

## Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.05	08.58	07.28	06.40	04.56	03.21	03.02	04.25	05.58	07.23	07.56	09.28
	14.37	16.05	17.34	20.05	21.36	23.11	23.39	22.21	20.35	18.50	16.06	14.44
2	10.04	08.55	07.24	06.36	04.52	03.19	03.03	04.28	06.01	07.26	07.59	09.31
	14.39	16.08	17.37	20.08	21.39	23.14	23.38	22.17	20.32	18.47	16.02	14.42
3	10.03	08.52	07.21	06.33	04.49	03.17	03.05	04.31	06.04	07.29	08.02	09.34
	14.41	16.12	17.40	20.11	21.42	23.16	23.36	22.14	20.28	18.43	15.59	14.40
4	10.01	08.49	07.17	06.29	04.46	03.14	03.07	04.34	06.07	07.32	08.05	09.36
	14.43	16.15	17.43	20.14	21.45	23.19	23.35	22.11	20.25	18.40	15.56	14.38
5	10.00	08.46	07.14	06.26	04.42	03.12	03.09	04.37	06.10	07.35	08.08	09.39
	14.45	16.18	17.46	20.17	21.49	23.21	23.33	22.08	20.21	18.36	15.53	14.36
6	09.59	08.43	07.10	06.22	04.39	03.10	03.11	04.40	06.12	07.37	08.11	09.41
	14.48	16.21	17.49	20.20	21.52	23.24	23.31	22.04	20.18	18.33	15.50	14.35
7	09.57	08.40	07.07	06.19	04.36	03.08	03.13	04.43	06.15	07.40	08.15	09.44
	14.50	16.25	17.52	20.23	21.55	23.26	23.29	22.01	20.14	18.29	15.47	14.33
8	09.56	08.37	07.04	06.15	04.32	03.06	03.16	04.46	06.18	07.43	08.18	09.46
	14.52	16.28	17.55	20.26	21.58	23.28	23.27	21.58	20.11	18.26	15.44	14.32
9	09.54	08.34	07.00	06.12	04.29	03.04	03.18	04.49	06.21	07.46	08.21	09.48
	14.55	16.31	17.58	20.29	22.01	23.30	23.25	21.54	20.07	18.22	15.41	14.31
10	09.52	08.30	06.57	06.08	04.26	03.03	03.20	04.53	06.24	07.49	08.24	09.50
	14.58	16.34	18.01	20.32	22.04	23.32	23.23	21.51	20.04	18.19	15.38	14.29
11	09.51	08.27	06.53	06.05	04.23	03.01	03.23	04.56	06.27	07.52	08.27	09.52
	15.00	16.38	18.04	20.35	22.08	23.34	23.21	21.48	20.00	18.16	15.35	14.28
12	09.49	08.24	06.50	06.01	04.19	03.00	03.26	04.59	06.30	07.55	08.30	09.54
	15.03	16.41	18.07	20.38	22.11	23.36	23.18	21.44	19.57	18.12	15.32	14.27
13	09.47	08.21	06.46	05.58	04.16	02.57	03.28	05.02	06.32	07.58	08.34	09.56
	15.06	16.44	18.10	20.41	22.14	23.37	23.16	21.41	19.53	18.09	15.29	14.27
14	09.45	08.18	06.43	05.54	04.13	02.56	03.31	05.05	06.35	08.01	08.37	09.57
	15.09	16.47	18.13	20.44	22.17	23.39	23.13	21.38	19.50	18.05	15.26	14.26
15	09.43	08.14	06.39	05.51	04.10	02.56	03.34	05.08	06.38	08.04	08.40	09.59
	15.12	16.50	18.16	20.47	22.20	23.40	23.11	21.34	19.46	18.02	15.23	14.25
16	09.40	08.11	06.36	05.47	04.07	02.55	03.36	05.11	06.41	08.07	08.43	10.00
	15.14	16.54	18.19	20.50	22.23	23.41	23.08	21.31	19.43	17.59	15.20	14.25
17	09.38	08.08	06.32	05.44	04.04	02.54	03.39	05.14	06.44	08.10	08.46	10.02
	15.17	16.57	18.22	20.53	22.27	23.42	23.06	21.27	19.39	17.55	15.17	14.25
18	09.36	08.04	06.29	05.40	04.01	02.54	03.42	05.17	06.46	08.13	08.50	10.03
	15.20	17.00	18.25	20.56	22.30	23.43	23.03	21.24	19.36	17.52	15.15	14.24
19	09.33	08.01	06.25	05.37	03.57	02.54	03.45	05.20	06.49	08.16	08.53	10.04
	15.23	17.03	18.27	20.59	22.33	23.44	23.00	21.21	19.32	17.48	15.12	14.24
20	09.31	07.58	06.22	05.33	03.54	02.54	03.48	05.23	06.52	08.19	08.56	10.05
	15.27	17.06	18.30	21.02	22.36	23.44	22.57	21.17	19.29	17.45	15.09	14.25
21	09.28	07.55	06.18	05.30	03.51	02.54	03.51	05.26	06.55	08.22	08.59	10.05
	15.30	17.09	18.33	21.05	22.39	23.45	22.54	21.14	19.25	17.42	15.07	14.25
22	09.26	07.51	06.15	05.26	03.48	02.54	03.54	05.29	06.58	08.25	09.02	10.06
	15.33	17.12	18.36	21.08	22.42	23.45	22.51	21.10	19.22	17.38	15.04	14.25
23	09.23	07.48	06.11	05.23	03.46	02.54	03.57	05.32	07.01	08.28	09.05	10.07
	15.36	17.15	18.39	21.11	22.45	23.45	22.49	21.07	19.18	17.35	15.02	14.26
24	09.21	07.44	06.08	05.20	03.43	02.55	04.00	05.35	07.03	08.31	09.08	10.07
	15.39	17.19	18.42	21.14	22.48	23.45	22.46	21.03	19.15	17.32	14.59	14.26
25	09.18	07.41	06.04	05.16	03.40	02.56	04.03	05.38	07.06	07.34	09.11	10.07
	15.42	17.22	18.45	21.17	22.51	23.44	22.43	21.00	19.11	16.28	14.57	14.27
26	09.15	07.38	06.01	05.13	03.37	02.57	04.06	05.41	07.09	07.37	09.14	10.07
	15.46	17.25	18.48	21.20	22.54	23.44	22.40	20.56	19.08	16.25	14.54	14.28
27	09.12	07.34	05.57	05.09	03.34	02.58	04.09	05.44	07.12	07.40	09.17	10.07
	15.49	17.28	18.51	21.23	22.57	23.43	22.36	20.53	19.04	16.22	14.52	14.29
28	09.10	07.31	05.54	05.06	03.32	02.59	04.12	05.47	07.15	07.43	09.20	10.07
	15.52	17.31	18.54	21.27	23.00	23.43	22.33	20.49	19.01	16.19	14.50	14.31
29	09.07		06.50	05.03	03.29	03.00	04.15	05.49	07.17	07.46	09.23	10.07
	15.55		19.57	21.30	23.03	23.42	22.30	20.46	18.57	16.15	14.48	14.32
30	09.04		06.47	04.59	03.26	03.00	04.18	05.52	07.20	07.49	09.26	10.06
	15.59		20.00	21.33	23.06	23.41	22.27	20.42	18.54	16.12	14.46	14.33
31	09.01		06.43		03.24		04.22	05.55		07.52		10.05
	16.02		20.02		23.08		22.24	20.39		16.09		14.35
Potential sun hours	175	239	363	450	566	617	603	506	393	306	201	142
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

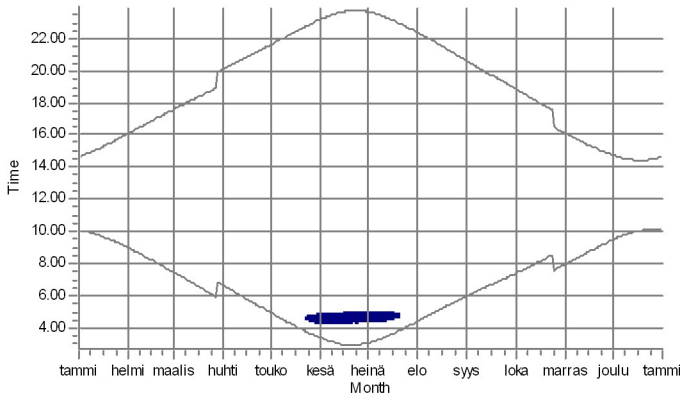
Table layout: For each day in each month the following matrix apply

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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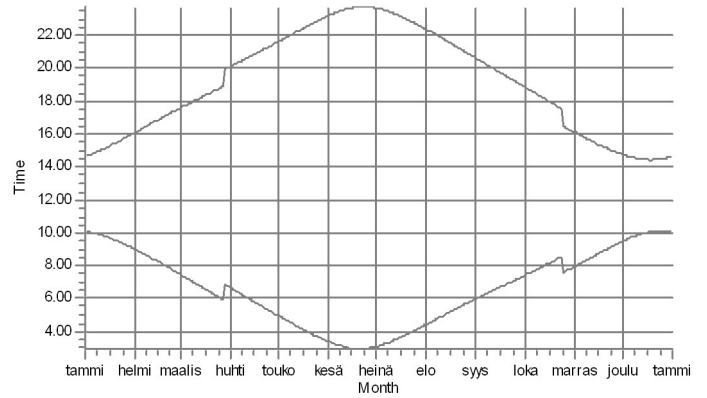
## SHADOW - Calendar, graphical

Calculation: Kokkopetaikkö\_VE2\_Välkemallinnus\_ilman puustoa\_11.01.2023

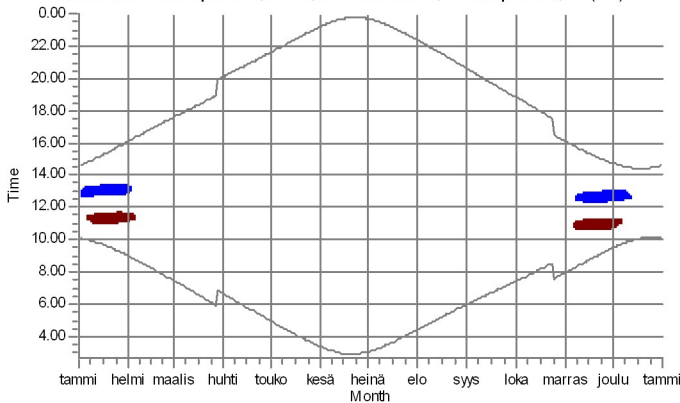
A: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (13)



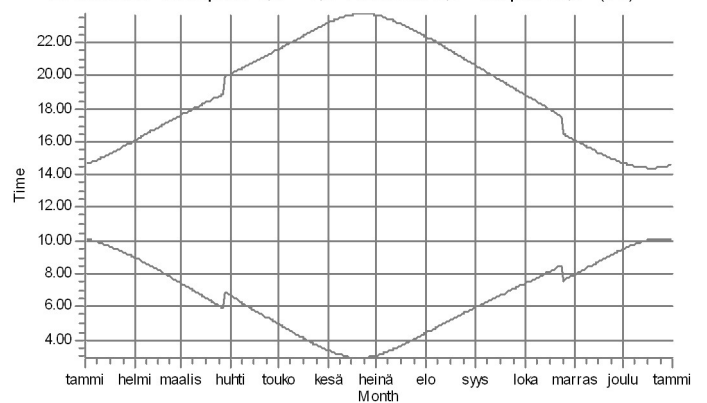
B: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (12)



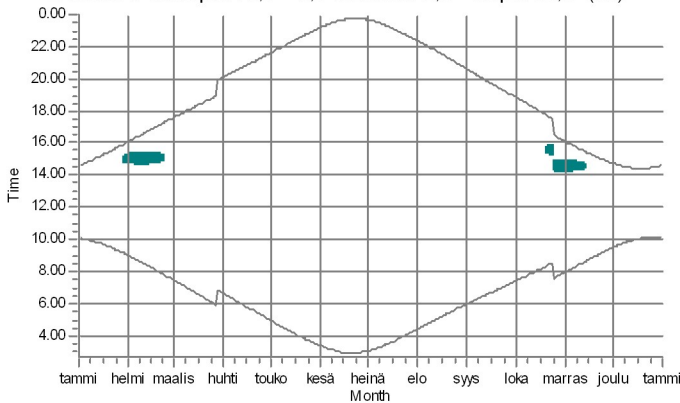
C: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (17)



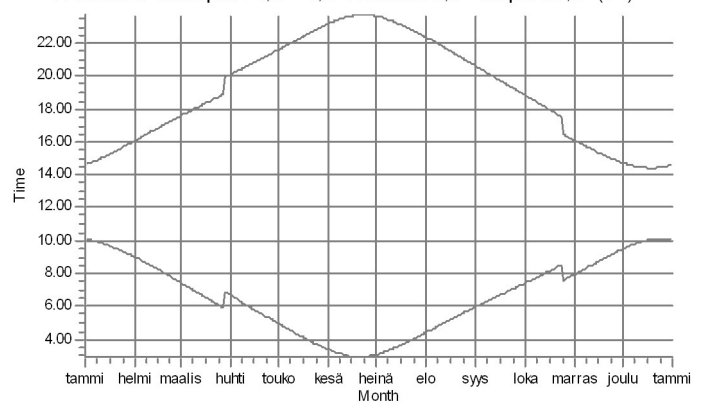
D: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (18)



E: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (19)



F: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (14)

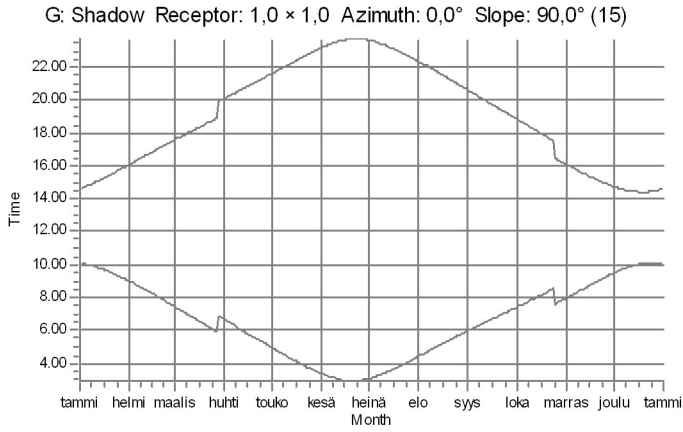


### WTGs

	2_VE2: VESTAS V162-7.2 7200 240.0 IO! hub: 200,0 m (TOT: 320,0 m) (147)
	4_VE2: VESTAS V162-7.2 7200 240.0 IO! hub: 200,0 m (TOT: 320,0 m) (150)
	8_VE2: VESTAS V162-7.2 7200 240.0 IO! hub: 200,0 m (TOT: 320,0 m) (151)
	3_VE2: VESTAS V162-7.2 7200 240.0 IO! hub: 200,0 m (TOT: 320,0 m) (152)

## SHADOW - Calendar, graphical

Calculation: Kokkopetaikkö\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2023



WTGs

## LIITE 2. Hankevaihtoehtojen VE1 ja VE2 yhteisvaikutusvälkemallinnusten windPRO-tulosteita

## SHADOW - Main Result

Calculation: Kokkopetaikkö\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset

### 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  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

Operational time  
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

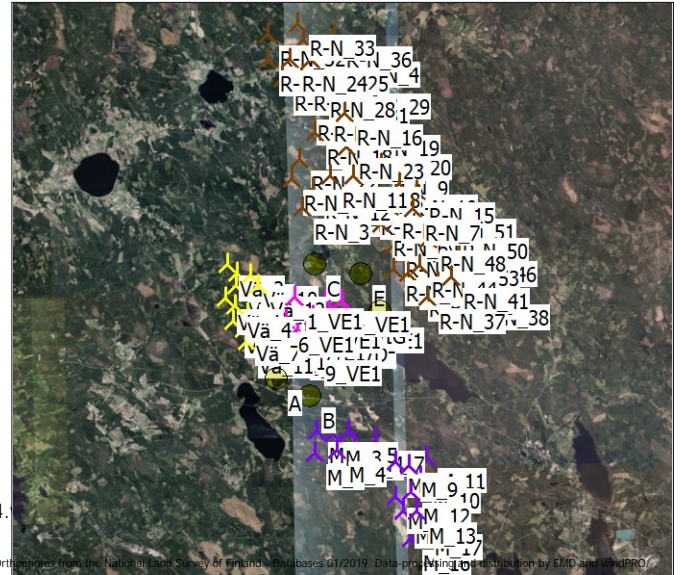
A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:  
Height contours used: Elevation Grid Data Object: kokkopetaikko\_EMDGrid\_4.  
Receptor grid resolution: 1,0 m

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]	Shadow data Calculation distance [m]	RPM [RPM]
10_VE1	435 319	7 071 856	153,5	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
11_VE1	436 069	7 072 925	155,6	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
12_VE1	436 836	7 072 662	157,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
1_VE1	434 208	7 073 709	157,4	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
2_VE1	435 004	7 073 483	155,6	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
3_VE1	435 846	7 073 518	154,5	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
4_VE1	436 739	7 073 563	154,7	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
5_VE1	435 175	7 072 670	156,0	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
6_VE1	433 756	7 072 547	160,5	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
7_VE1	434 322	7 072 074	156,1	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
8_VE1	434 401	7 071 282	159,7	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
9_VE1	435 123	7 070 935	155,5	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
M_1	435 107	7 065 481	165,7	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_10	440 720	7 064 070	161,1	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_11	441 028	7 065 116	160,5	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_12	440 205	7 063 260	161,3	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_13	440 483	7 062 260	160,3	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_14	439 728	7 062 270	160,3	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_15	439 359	7 062 997	160,9	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_16	440 169	7 060 783	158,6	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_17	440 793	7 061 617	158,8	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_2	435 221	7 066 620	156,8	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_3	436 114	7 066 456	166,5	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_4	436 313	7 065 545	165,1	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_5	436 904	7 066 552	161,3	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_6	437 238	7 065 888	168,8	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_7	438 315	7 066 083	157,7	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_8	439 374	7 064 901	159,5	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_9	440 168	7 064 685	160,3	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
R-N_1	435 818	7 078 836	160,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_10	439 868	7 079 636	141,8	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_11	436 268	7 080 086	150,6	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_12	435 268	7 079 486	152,0	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_13	438 970	7 079 541	144,6	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_14	437 018	7 078 836	144,4	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_15	440 800	7 079 223	135,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_16	437 072	7 083 415	141,0	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_17	435 872	7 083 615	155,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5

To be continued on next page...





## SHADOW - Main Result

Calculation: Kokkopetaikkö\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset

...continued from previous page

	East	North	Z	Row data/Description	WTG type		Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
					Valid	Manufact.					Calculation distance [m]	RPM [RPM]
			[m]									
R-N_18	435 472	7 082 415	149,8	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_19	437 975	7 082 812	145,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_2	433 068	7 086 336	142,9	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_20	438 568	7 081 836	137,2	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_21	436 372	7 082 215	153,2	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_22	434 672	7 081 015	148,0	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_23	437 172	7 081 615	164,4	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_24	434 197	7 086 257	143,9	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_25	435 397	7 086 257	130,8	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_26	434 818	7 085 236	145,6	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_27	433 797	7 085 257	144,4	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_28	435 668	7 084 936	147,1	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_29	437 518	7 084 986	125,9	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_3	434 718	7 078 486	152,1	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_30	434 972	7 083 715	150,8	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_31	436 418	7 084 536	141,5	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_32	433 068	7 087 686	134,7	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_33	434 671	7 088 174	120,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_34	434 997	7 087 257	130,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_35	438 220	7 078 641	149,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_36	436 618	7 087 486	117,9	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_37	441 263	7 073 627	156,5	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_38	443 609	7 073 744	147,9	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_39	440 730	7 074 304	152,9	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_4	437 555	7 086 671	125,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_40	441 798	7 074 339	149,0	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_41	442 541	7 074 629	144,9	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_42	440 247	7 074 886	150,7	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_43	439 518	7 075 136	150,7	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_44	440 895	7 075 261	148,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_45	440 108	7 075 881	144,7	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_46	442 968	7 076 036	141,4	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_47	439 569	7 076 392	147,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_48	441 379	7 076 620	151,2	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_49	440 620	7 077 241	152,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_5	439 390	7 078 442	152,9	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_50	442 561	7 077 288	135,7	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_51	441 919	7 078 341	134,5	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_52	434 218	7 080 036	151,0	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_53	442 067	7 075 898	149,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_6	438 934	7 077 503	148,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_7	440 597	7 078 257	150,4	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_8	437 468	7 080 086	149,4	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_9	438 968	7 080 686	137,9	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
Vä_1	430 560	7 073 744	178,1	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_10	431 901	7 074 942	169,1	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_11	431 620	7 071 434	148,4	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_12	432 285	7 074 367	169,2	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_13	432 183	7 071 797	156,2	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_14	432 300	7 072 493	167,5	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_16	432 850	7 071 628	161,8	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_17	432 963	7 072 303	165,3	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_2	430 695	7 075 566	167,3	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_3	430 918	7 072 517	156,5	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_4	431 056	7 073 315	174,7	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_5	431 136	7 074 420	175,5	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_6	431 191	7 075 105	169,1	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_7	431 467	7 072 090	156,5	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_8	431 681	7 072 925	168,6	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_9	431 734	7 073 984	173,3	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4

## SHADOW - Main Result

Calculation: Kokkopetaikkö\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset

### Shadow receptor-Input

No.	East	North	Z	Width	Height	Elevation	Slope of	Direction mode	Eye height
			[m]	[m]	[m]	a.g.l.	window		(ZVI) a.g.l.
						[m]	[°]		[m]
A	433 196	7 069 450	142,9	1,0	1,0	1,0	90,0	"Green house mode"	2,0
B	434 902	7 068 448	149,9	1,0	1,0	1,0	90,0	"Green house mode"	2,0
C	435 343	7 075 466	151,2	1,0	1,0	1,0	90,0	"Green house mode"	2,0
D	437 755	7 071 880	157,4	1,0	1,0	1,0	90,0	"Green house mode"	2,0
E	437 777	7 074 862	158,4	1,0	1,0	1,0	90,0	"Green house mode"	2,0
F	438 345	7 071 927	153,2	1,0	1,0	1,0	90,0	"Green house mode"	2,0
G	438 766	7 072 916	153,8	1,0	1,0	1,0	90,0	"Green house mode"	2,0

### Calculation Results

#### Shadow receptor

No.	Shadow, worst case			Shadow, expected values	
	Shadow hours	Shadow days	Max shadow	Shadow hours	
	per year	per year	hours per day	per year	
	[h/year]	[days/year]	[h/day]	[h/year]	
A	0:00	0	0:00	0:00	
B	20:33	60	0:26	1:29	
C	47:11	70	0:59	3:29	
D	67:49	104	0:53	16:47	
E	35:01	88	0:34	5:35	
F	27:27	62	0:35	6:52	
G	12:42	36	0:28	2:30	

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

No.	Name	Worst case	Expected
		[h/year]	[h/year]
10_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (87)	0:00	0:00
11_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (86)	20:51	5:20
12_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (84)	87:07	20:49
1_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (78)	0:00	0:00
2_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (80)	25:06	1:49
3_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (89)	22:05	1:40
4_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (83)	22:11	2:39
5_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (81)	0:00	0:00
6_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (79)	0:00	0:00
7_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (82)	0:00	0:00
8_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (85)	0:00	0:00
9_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (88)	0:00	0:00
M_1	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (43)	0:00	0:00
M_10	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (50)	0:00	0:00
M_11	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (49)	0:00	0:00
M_12	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (51)	0:00	0:00
M_13	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (52)	0:00	0:00
M_14	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (53)	0:00	0:00
M_15	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (54)	0:00	0:00
M_16	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (55)	0:00	0:00
M_17	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (56)	0:00	0:00
M_2	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (40)	20:33	1:29
M_3	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (41)	0:00	0:00
M_4	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (44)	0:00	0:00
M_5	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (42)	0:00	0:00
M_6	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (45)	0:00	0:00
M_7	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (46)	0:00	0:00
M_8	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (47)	0:00	0:00
M_9	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (48)	0:00	0:00
R-N_1	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (90)	0:00	0:00
R-N_10	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (99)	0:00	0:00
R-N_11	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (100)	0:00	0:00
R-N_12	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (101)	0:00	0:00
R-N_13	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (102)	0:00	0:00
R-N_14	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (103)	0:00	0:00
R-N_15	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (104)	0:00	0:00
R-N_16	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (105)	0:00	0:00

To be continued on next page...

## SHADOW - Main Result

Calculation: Kokkopetaikkö\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
R-N_17	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (106)	0:00	0:00
R-N_18	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (107)	0:00	0:00
R-N_19	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (108)	0:00	0:00
R-N_2	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (91)	0:00	0:00
R-N_20	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (109)	0:00	0:00
R-N_21	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (110)	0:00	0:00
R-N_22	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (111)	0:00	0:00
R-N_23	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (112)	0:00	0:00
R-N_24	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (113)	0:00	0:00
R-N_25	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (114)	0:00	0:00
R-N_26	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (115)	0:00	0:00
R-N_27	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (116)	0:00	0:00
R-N_28	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (117)	0:00	0:00
R-N_29	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (118)	0:00	0:00
R-N_3	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (92)	0:00	0:00
R-N_30	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (119)	0:00	0:00
R-N_31	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (120)	0:00	0:00
R-N_32	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (121)	0:00	0:00
R-N_33	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (122)	0:00	0:00
R-N_34	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (123)	0:00	0:00
R-N_35	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (124)	0:00	0:00
R-N_36	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (125)	0:00	0:00
R-N_37	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (126)	0:00	0:00
R-N_38	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (127)	0:00	0:00
R-N_39	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (128)	0:00	0:00
R-N_4	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (93)	0:00	0:00
R-N_40	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (129)	0:00	0:00
R-N_41	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (130)	0:00	0:00
R-N_42	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (131)	0:00	0:00
R-N_43	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (132)	12:50	2:53
R-N_44	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (133)	0:00	0:00
R-N_45	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (134)	0:00	0:00
R-N_46	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (135)	0:00	0:00
R-N_47	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (136)	0:00	0:00
R-N_48	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (137)	0:00	0:00
R-N_49	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (138)	0:00	0:00
R-N_5	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (94)	0:00	0:00
R-N_50	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (139)	0:00	0:00
R-N_51	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (140)	0:00	0:00
R-N_52	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (141)	0:00	0:00
R-N_53	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (142)	0:00	0:00
R-N_6	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (95)	0:00	0:00
R-N_7	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (96)	0:00	0:00
R-N_8	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (97)	0:00	0:00
R-N_9	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (98)	0:00	0:00
Vä_1	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (26)	0:00	0:00
Vä_10	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (33)	0:00	0:00
Vä_11	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (30)	0:00	0:00
Vä_12	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (34)	0:00	0:00
Vä_13	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (31)	0:00	0:00
Vä_14	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (29)	0:00	0:00
Vä_16	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (32)	0:00	0:00
Vä_17	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (38)	0:00	0:00
Vä_2	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (39)	0:00	0:00
Vä_3	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (35)	0:00	0:00
Vä_4	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (27)	0:00	0:00
Vä_5	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (25)	0:00	0:00
Vä_6	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (24)	0:00	0:00
Vä_7	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (37)	0:00	0:00
Vä_8	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (28)	0:00	0:00
Vä_9	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (36)	0:00	0:00

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

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

## SHADOW - Calendar

Calculation: Kokkopetaikkö\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset Shadow receptor: A - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (13)  
Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.04	08.58	07.28	06.40	04.56	03.22	03.03	04.25	05.59	07.24	07.56	09.28
	14.38	16.06	17.34	20.06	21.36	23.11	23.39	22.21	20.36	18.51	16.06	14.44
2	10.04	08.55	07.25	06.37	04.53	03.20	03.05	04.29	06.02	07.26	07.59	09.31
	14.40	16.09	17.37	20.09	21.39	23.14	23.38	22.18	20.32	18.47	16.03	14.43
3	10.03	08.52	07.21	06.33	04.50	03.18	03.06	04.32	06.04	07.29	08.02	09.34
	14.42	16.12	17.40	20.12	21.42	23.16	23.36	22.14	20.29	18.44	16.00	14.41
4	10.01	08.49	07.18	06.30	04.46	03.15	03.08	04.35	06.07	07.32	08.05	09.36
	14.44	16.15	17.44	20.15	21.46	23.19	23.35	22.11	20.25	18.40	15.57	14.39
5	10.00	08.46	07.14	06.26	04.43	03.13	03.10	04.38	06.10	07.35	08.08	09.39
	14.46	16.19	17.47	20.17	21.49	23.21	23.33	22.08	20.22	18.37	15.54	14.37
6	09.59	08.43	07.11	06.23	04.40	03.11	03.12	04.41	06.13	07.38	08.12	09.41
	14.49	16.22	17.50	20.20	21.52	23.24	23.31	22.05	20.18	18.33	15.51	14.36
7	09.57	08.40	07.07	06.19	04.36	03.09	03.14	04.44	06.16	07.41	08.15	09.44
	14.51	16.25	17.53	20.23	21.55	23.26	23.29	22.01	20.15	18.30	15.47	14.34
8	09.56	08.37	07.04	06.16	04.33	03.07	03.17	04.47	06.19	07.44	08.18	09.46
	14.53	16.28	17.55	20.26	21.58	23.28	23.27	21.58	20.11	18.26	15.44	14.33
9	09.54	08.34	07.01	06.12	04.30	03.06	03.19	04.50	06.22	07.47	08.21	09.48
	14.56	16.32	17.58	20.29	22.01	23.30	23.25	21.55	20.08	18.23	15.41	14.32
10	09.52	08.31	06.57	06.09	04.27	03.04	03.21	04.53	06.24	07.49	08.24	09.50
	14.58	16.35	18.01	20.32	22.05	23.32	23.23	21.51	20.04	18.20	15.38	14.30
11	09.51	08.27	06.54	06.05	04.23	03.02	03.24	04.56	06.27	07.52	08.27	09.52
	15.01	16.38	18.04	20.35	22.08	23.34	23.21	21.48	20.01	18.16	15.35	14.29
12	09.49	08.24	06.50	06.02	04.20	03.01	03.26	04.59	06.30	07.55	08.31	09.54
	15.04	16.41	18.07	20.38	22.11	23.36	23.18	21.45	19.57	18.13	15.32	14.28
13	09.47	08.21	06.47	05.58	04.17	03.00	03.29	05.02	06.33	07.58	08.34	09.56
	15.07	16.45	18.10	20.41	22.14	23.37	23.16	21.41	19.54	18.09	15.30	14.28
14	09.45	08.18	06.43	05.55	04.14	02.58	03.32	05.05	06.36	08.01	08.37	09.57
	15.09	16.48	18.13	20.44	22.17	23.39	23.13	21.38	19.50	18.06	15.27	14.27
15	09.43	08.15	06.40	05.51	04.11	02.57	03.35	05.08	06.38	08.04	08.40	09.59
	15.12	16.51	18.16	20.47	22.20	23.40	23.11	21.34	19.47	18.02	15.24	14.26
16	09.40	08.11	06.36	05.48	04.07	02.56	03.37	05.11	06.41	08.07	08.43	10.00
	15.15	16.54	18.19	20.50	22.23	23.41	23.08	21.31	19.43	17.59	15.21	14.26
17	09.38	08.08	06.33	05.44	04.04	02.55	03.40	05.15	06.44	08.10	08.47	10.02
	15.18	16.57	18.22	20.53	22.27	23.42	23.06	21.28	19.40	17.56	15.18	14.26
18	09.36	08.05	06.29	05.41	04.01	02.55	03.43	05.18	06.47	08.13	08.50	10.03
	15.21	17.00	18.25	20.56	22.30	23.43	23.03	21.24	19.36	17.52	15.15	14.25
19	09.33	08.01	06.26	05.37	03.58	02.55	03.46	05.21	06.50	08.16	08.53	10.04
	15.24	17.04	18.28	20.59	22.33	23.44	23.00	21.21	19.33	17.49	15.13	14.25
20	09.31	07.58	06.22	05.34	03.55	02.55	03.49	05.23	06.53	08.19	08.56	10.05
	15.27	17.07	18.31	21.02	22.36	23.44	22.57	21.17	19.29	17.46	15.10	14.26
21	09.28	07.55	06.19	05.31	03.52	02.55	03.52	05.26	06.55	08.22	08.59	10.05
	15.30	17.10	18.34	21.05	22.39	23.44	22.54	21.14	19.26	17.42	15.07	14.26
22	09.26	07.52	06.15	05.27	03.49	02.55	03.55	05.29	06.58	08.25	09.02	10.06
	15.34	17.13	18.37	21.08	22.42	23.45	22.52	21.10	19.22	17.39	15.05	14.26
23	09.23	07.48	06.12	05.24	03.46	02.56	03.58	05.32	07.01	08.28	09.05	10.06
	15.37	17.16	18.40	21.11	22.45	23.45	22.49	21.07	19.19	17.36	15.02	14.27
24	09.21	07.45	06.08	05.20	03.44	02.56	04.01	05.35	07.04	08.31	09.08	10.07
	15.40	17.19	18.42	21.14	22.48	23.44	22.46	21.04	19.15	17.32	15.00	14.27
25	09.18	07.41	06.05	05.17	03.41	02.57	04.04	05.38	07.07	07.34	09.11	10.07
	15.43	17.22	18.45	21.17	22.51	23.44	22.43	21.00	19.12	16.29	14.58	14.28
26	09.15	07.38	06.01	05.13	03.38	02.58	04.07	05.41	07.09	07.37	09.14	10.07
	15.46	17.25	18.48	21.21	22.54	23.44	22.40	20.57	19.08	16.26	14.55	14.29
27	09.13	07.35	05.58	05.10	03.35	02.59	04.10	05.44	07.12	07.40	09.17	10.07
	15.50	17.28	18.51	21.24	22.57	23.43	22.37	20.53	19.05	16.22	14.53	14.30
28	09.10	07.31	05.54	05.07	03.32	03.00	04.13	05.47	07.15	07.43	09.20	10.07
	15.53	17.31	18.54	21.27	23.00	23.42	22.33	20.50	19.01	16.19	14.51	14.32
29	09.07		06.51	05.03	03.30	03.00	04.16	05.50	07.18	07.46	09.23	10.06
	15.56		19.57	21.30	23.03	23.41	22.30	20.46	18.58	16.16	14.49	14.33
30	09.04		06.47	05.00	03.27	03.01	04.19	05.53	07.21	07.50	09.26	10.06
	15.59		20.00	21.33	23.06	23.40	22.27	20.43	18.54	16.13	14.46	14.34
31	09.01		06.44		03.25		04.22	05.56		07.53		10.05
	16.02		20.03		23.08		22.24	20.39		16.09		14.36
Potential sun hours	175	240	363	450	565	616	603	506	393	306	201	142
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

SHADOW - Calendar

Calculation: Kokkopetaikko\_VE1\_Valkemallinnus ilman puustoa\_11.01.2022\_yhteisvaikutukset Shadow receptor: B - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (12)
Sunshine probability S (Average daily sunshine hours) []

Assumptions for shadow calculations
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

Table with columns for months (January to December) and rows for each day (1 to 31). Includes summary rows for sun hours and reduction percentages.

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

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



## SHADOW - Calendar

Calculation: Kokkopetaikkö\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset Shadow receptor: C - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (17) Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June				
1	10.05	12.48 (2_VE1)	08.58	11.13 (3_VE1)	07.28	06.40	04.56	03.21		
	14.37	1	12.49 (2_VE1)	16.05	33	13.12 (2_VE1)	17.34	20.06	21.36	23.12
2	10.04	12.48 (2_VE1)	08.55	11.15 (3_VE1)	07.24	06.36	04.52	03.19		
	14.39	8	12.56 (2_VE1)	16.08	23	13.09 (2_VE1)	17.37	20.09	21.39	23.14
3	10.03	12.47 (2_VE1)	08.52	11.17 (3_VE1)	07.21	06.33	04.49	03.16		
	14.41	14	13.01 (2_VE1)	16.12	14	11.31 (3_VE1)	17.40	20.12	21.43	23.17
4	10.02	12.48 (2_VE1)	08.49	11.20 (3_VE1)	07.18	06.29	04.46	03.14		
	14.43	19	13.07 (2_VE1)	16.15	8	11.28 (3_VE1)	17.43	20.14	21.46	23.20
5	10.01	12.47 (2_VE1)	08.46	11.28 (3_VE1)	07.14	06.26	04.42	03.12		
	14.45	21	13.08 (2_VE1)	16.18	17.46	20.17	21.49	23.22		
6	09.59	12.48 (2_VE1)	08.43	11.28 (3_VE1)	07.11	06.22	04.39	03.10		
	14.48	21	13.09 (2_VE1)	16.21	17.49	20.20	21.52	23.24		
7	09.58	11.21 (3_VE1)	08.40	11.28 (3_VE1)	07.07	06.19	04.36	03.08		
	14.50	25	13.09 (2_VE1)	16.25	17.52	20.23	21.55	23.27		
8	09.56	11.17 (3_VE1)	08.37	11.28 (3_VE1)	07.04	06.15	04.32	03.06		
	14.52	31	13.10 (2_VE1)	16.28	17.55	20.26	21.58	23.29		
9	09.55	11.13 (3_VE1)	08.34	11.28 (3_VE1)	07.00	06.12	04.29	03.04		
	14.55	37	13.11 (2_VE1)	16.31	17.58	20.29	22.02	23.31		
10	09.53	11.09 (3_VE1)	08.31	11.28 (3_VE1)	06.57	06.08	04.26	03.03		
	14.58	43	13.12 (2_VE1)	16.34	18.01	20.32	22.05	23.33		
11	09.51	11.07 (3_VE1)	08.28	11.28 (3_VE1)	06.53	06.05	04.23	03.01		
	15.00	47	13.13 (2_VE1)	16.38	18.04	20.35	22.08	23.35		
12	09.49	11.07 (3_VE1)	08.24	11.28 (3_VE1)	06.50	06.01	04.19	03.00		
	15.03	49	13.14 (2_VE1)	16.41	18.07	20.38	22.11	23.36		
13	09.47	11.07 (3_VE1)	08.21	11.28 (3_VE1)	06.47	05.58	04.16	02.57		
	15.06	51	13.15 (2_VE1)	16.44	18.10	20.41	22.14	23.38		
14	09.45	11.07 (3_VE1)	08.18	11.28 (3_VE1)	06.43	05.54	04.13	02.56		
	15.09	52	13.15 (2_VE1)	16.47	18.13	20.44	22.18	23.40		
15	09.43	11.07 (3_VE1)	08.15	11.28 (3_VE1)	06.40	05.51	04.10	02.55		
	15.12	53	13.16 (2_VE1)	16.51	18.16	20.47	22.21	23.41		
16	09.41	11.07 (3_VE1)	08.11	11.28 (3_VE1)	06.36	05.47	04.07	02.55		
	15.14	54	13.16 (2_VE1)	16.54	18.19	20.50	22.24	23.42		
17	09.39	11.06 (3_VE1)	08.08	11.28 (3_VE1)	06.33	05.44	04.04	02.54		
	15.17	57	13.17 (2_VE1)	16.57	18.22	20.53	22.27	23.43		
18	09.36	11.06 (3_VE1)	08.05	11.28 (3_VE1)	06.29	05.41	04.01	02.54		
	15.20	57	13.17 (2_VE1)	17.00	18.25	20.56	22.30	23.44		
19	09.34	11.06 (3_VE1)	08.02	11.28 (3_VE1)	06.26	05.37	03.57	02.53		
	15.24	57	13.17 (2_VE1)	17.03	18.28	20.59	22.33	23.45		
20	09.31	11.06 (3_VE1)	07.58	11.28 (3_VE1)	06.22	05.34	03.54	02.53		
	15.27	59	13.18 (2_VE1)	17.06	18.31	21.02	22.36	23.45		
21	09.29	11.07 (3_VE1)	07.55	11.28 (3_VE1)	06.19	05.30	03.51	02.53		
	15.30	58	13.19 (2_VE1)	17.09	18.34	21.05	22.40	23.45		
22	09.26	11.07 (3_VE1)	07.52	11.28 (3_VE1)	06.15	05.27	03.48	02.54		
	15.33	58	13.19 (2_VE1)	17.13	18.36	21.08	22.43	23.46		
23	09.24	11.07 (3_VE1)	07.48	11.28 (3_VE1)	06.12	05.23	03.46	02.54		
	15.36	57	13.18 (2_VE1)	17.16	18.39	21.11	22.46	23.46		
24	09.21	11.07 (3_VE1)	07.45	11.28 (3_VE1)	06.08	05.20	03.43	02.55		
	15.39	57	13.18 (2_VE1)	17.19	18.42	21.15	22.49	23.46		
25	09.18	11.08 (3_VE1)	07.41	11.28 (3_VE1)	06.05	05.16	03.40	02.55		
	15.42	55	13.18 (2_VE1)	17.22	18.45	21.18	22.52	23.45		
26	09.16	11.09 (3_VE1)	07.38	11.28 (3_VE1)	06.01	05.13	03.37	02.56		
	15.46	55	13.19 (2_VE1)	17.25	18.48	21.21	22.55	23.45		
27	09.13	11.09 (3_VE1)	07.35	11.28 (3_VE1)	05.58	05.09	03.34	02.57		
	15.49	53	13.18 (2_VE1)	17.28	18.51	21.24	22.58	23.44		
28	09.10	11.10 (3_VE1)	07.31	11.28 (3_VE1)	05.54	05.06	03.31	02.59		
	15.52	50	13.17 (2_VE1)	17.31	18.54	21.27	23.01	23.43		
29	09.07	11.10 (3_VE1)	07.28	11.28 (3_VE1)	06.51	05.03	03.29	03.00		
	15.55	48	13.16 (2_VE1)	17.34	19.57	21.30	23.03	23.42		
30	09.04	11.12 (3_VE1)	07.25	11.28 (3_VE1)	06.47	04.59	03.26	03.00		
	15.59	44	13.16 (2_VE1)	17.37	20.00	21.33	23.06	23.41		
31	09.01	11.12 (3_VE1)	07.22	11.28 (3_VE1)	06.44	04.56	03.24	03.00		
	16.02	40	13.15 (2_VE1)	17.40	20.03	21.36	23.09	23.41		
Potential sun hours	175	239	363	450	566	617				
Total, worst case	1331	78								
Sun reduction	0,14	0,26								
Oper. time red.	0,93	0,93								
Wind dir. red.	0,65	0,65								
Total reduction	0,09	0,16								
Total, real	116	12								

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

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

## SHADOW - Calendar

Calculation: Kokkopetaikkö\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset Shadow receptor: C - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (17)  
Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	July	August	September	October	November	December
1	03.02	04.25	05.58	07.23	07.56	09.29
	23.40	22.21	20.36	18.50	16.06	14.44
2	03.03	04.28	06.01	07.26	07.59	09.32
	23.39	22.18	20.32	18.47	16.03	14.42
3	03.05	04.31	06.04	07.29	08.02	09.34
	23.37	22.15	20.29	18.44	15.59	14.40
4	03.07	04.34	06.07	07.32	08.05	09.37
	23.36	22.11	20.25	18.40	15.56	14.38
5	03.09	04.37	06.10	07.35	08.09	09.39
	23.34	22.08	20.22	18.37	15.53	14.36
6	03.11	04.40	06.13	07.38	08.12	09.42
	23.32	22.05	20.18	18.33	15.50	14.35
7	03.13	04.43	06.16	07.41	08.15	10.50 (3_VE1)
	23.30	22.02	20.15	18.30	15.47	14.33
8	03.15	04.46	06.18	07.44	08.18	10.59 (3_VE1)
	23.28	21.58	20.11	18.26	15.44	14.32
9	03.18	04.50	06.21	07.46	08.21	10.45 (3_VE1)
	23.26	21.55	20.08	18.23	15.41	14.31
10	03.20	04.53	06.24	07.49	08.25	10.44 (3_VE1)
	23.24	21.52	20.04	18.19	15.38	14.29
11	03.23	04.56	06.27	07.52	08.28	10.43 (3_VE1)
	23.21	21.48	20.01	18.16	15.35	14.28
12	03.25	04.59	06.30	07.55	08.31	10.42 (3_VE1)
	23.19	21.45	19.57	18.12	15.32	14.27
13	03.28	05.02	06.33	07.58	08.34	10.42 (3_VE1)
	23.17	21.41	19.54	18.09	15.29	14.27
14	03.31	05.05	06.35	08.01	08.37	10.41 (3_VE1)
	23.14	21.38	19.50	18.06	15.26	14.26
15	03.34	05.08	06.38	08.04	08.40	10.42 (3_VE1)
	23.12	21.35	19.47	18.02	15.23	14.25
16	03.36	05.11	06.41	08.07	08.44	10.42 (3_VE1)
	23.09	21.31	19.43	17.59	15.20	14.25
17	03.39	05.14	06.44	08.10	08.47	10.42 (3_VE1)
	23.06	21.28	19.40	17.55	15.18	14.25
18	03.42	05.17	06.47	08.13	08.50	10.41 (3_VE1)
	23.03	21.24	19.36	17.52	15.15	14.24
19	03.45	05.20	06.50	08.16	08.53	10.41 (3_VE1)
	23.01	21.21	19.33	17.49	15.12	14.24
20	03.48	05.23	06.52	08.19	08.56	10.42 (3_VE1)
	22.58	21.18	19.29	17.45	15.09	14.25
21	03.51	05.26	06.55	08.22	08.59	10.42 (3_VE1)
	22.55	21.14	19.25	17.42	15.07	14.25
22	03.54	05.29	06.58	08.25	09.02	10.42 (3_VE1)
	22.52	21.11	19.22	17.39	15.04	14.25
23	03.57	05.32	07.01	08.28	09.06	10.43 (3_VE1)
	22.49	21.07	19.18	17.35	15.02	14.26
24	04.00	05.35	07.04	08.31	09.09	10.44 (3_VE1)
	22.46	21.04	19.15	17.32	14.59	14.26
25	04.03	05.38	07.06	07.34	09.12	10.45 (3_VE1)
	22.43	21.00	19.11	16.29	14.57	14.27
26	04.06	05.41	07.09	07.37	09.15	10.45 (3_VE1)
	22.40	20.57	19.08	16.25	14.54	14.28
27	04.09	05.44	07.12	07.40	09.18	10.46 (3_VE1)
	22.37	20.53	19.04	16.22	14.52	14.29
28	04.12	05.47	07.15	07.43	09.20	10.46 (3_VE1)
	22.34	20.50	19.01	16.19	14.50	14.31
29	04.15	05.50	07.18	07.47	09.23	10.47 (3_VE1)
	22.31	20.46	18.57	16.15	14.48	14.32
30	04.18	05.53	07.21	07.50	09.26	10.48 (3_VE1)
	22.28	20.43	18.54	16.12	14.46	14.33
31	04.22	05.55		07.53		10.06
	22.24	20.39		16.09		14.35
Potential sun hours	604	506	393	306	201	142
Total, worst case					1149	273
Sun reduction					0,10	0,07
Oper. time red.					0,93	0,93
Wind dir. red.					0,65	0,65
Total reduction					0,06	0,04
Total, real					70	12

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: Kokkopetaikkö\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset Shadow receptor: D - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (18) Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June	
1	10.04	08.58	07.28	06.40	04.56	20.50 (11_VE1)	03.22
	14.38	16.05	17.34	20.05	21.36	3 20.53 (11_VE1)	23.11
2	10.04	08.55	07.24	06.36	04.53	20.48 (11_VE1)	03.19
	14.39	16.08	17.37	20.08	21.39	8 20.56 (11_VE1)	23.14
3	10.03	08.52	07.21	06.33	04.49	20.46 (11_VE1)	03.17
	14.41	16.12	17.40	20.11	21.42	12 20.58 (11_VE1)	23.16
4	10.01	08.49	07.17	06.29	04.46	20.45 (11_VE1)	03.15
	14.43	16.15	17.43	20.14	21.45	16 21.01 (11_VE1)	23.19
5	10.00	08.46	07.14	06.26	04.42	20.43 (11_VE1)	03.12
	14.46	16.18	17.46	20.17	21.49	21 21.04 (11_VE1)	23.21
6	09.59	08.43	07.11	06.22	04.39	20.43 (11_VE1)	03.10
	14.48	16.21	17.49	20.20	21.52	24 21.07 (11_VE1)	23.24
7	09.57	08.40	07.07	06.19	04.36	20.43 (11_VE1)	03.08
	14.50	16.25	17.52	20.23	21.55	26 21.09 (11_VE1)	23.26
8	09.56	08.37	07.04	06.15	04.33	20.42 (11_VE1)	03.06
	14.53	16.28	17.55	20.26	21.58	27 21.09 (11_VE1)	23.28
9	09.54	08.34	07.00	06.12	04.29	20.41 (11_VE1)	03.05
	14.55	16.31	17.58	20.29	22.01	28 21.09 (11_VE1)	23.30
10	09.52	08.30	06.57	06.08	04.26	20.41 (11_VE1)	03.03
	14.58	16.34	18.01	20.32	22.04	28 21.09 (11_VE1)	23.32
11	09.51	08.27	06.53	06.05	04.23	20.41 (11_VE1)	03.02
	15.00	16.38	18.04	20.35	22.08	29 21.10 (11_VE1)	23.34
12	09.49	08.24	06.50	06.01	04.20	20.41 (11_VE1)	03.00
	15.03	16.41	18.07	20.38	22.11	29 21.10 (11_VE1)	23.36
13	09.47	08.21	06.46	05.58	04.16	20.40 (11_VE1)	02.58
	15.06	16.44	18.10	20.41	22.14	30 21.10 (11_VE1)	23.37
14	09.45	08.18	06.43	05.54	04.13	20.41 (11_VE1)	02.57
	15.09	16.47	18.13	20.44	22.17	29 21.10 (11_VE1)	23.39
15	09.43	08.14	06.39	05.51	04.10	20.41 (11_VE1)	02.56
	15.12	16.50	18.16	20.47	22.20	29 21.10 (11_VE1)	23.40
16	09.40	08.11	06.36	05.47	04.07	20.42 (11_VE1)	02.55
	15.15	16.54	18.19	20.50	22.23	28 21.10 (11_VE1)	23.41
17	09.38	08.08	06.32	05.44	04.04	20.41 (11_VE1)	02.55
	15.18	16.57	18.22	20.53	22.26	32 21.25 (12_VE1)	23.42
18	09.36	08.05	06.29	05.40	04.01	20.42 (11_VE1)	02.54
	15.21	17.00	18.25	20.56	22.30	42 21.31 (12_VE1)	23.43
19	09.33	08.01	06.25	05.37	03.58	20.42 (11_VE1)	02.54
	15.24	17.03	18.28	20.59	22.33	46 21.33 (12_VE1)	23.44
20	09.31	07.58	06.22	05.34	03.55	20.43 (11_VE1)	02.54
	15.27	17.06	18.30	21.02	22.36	48 21.35 (12_VE1)	23.44
21	09.28	07.55	06.18	05.30	03.52	20.44 (11_VE1)	02.54
	15.30	17.09	18.33	21.05	22.39	50 21.37 (12_VE1)	23.45
22	09.26	07.51	06.15	05.27	03.49	20.44 (11_VE1)	02.54
	15.33	17.12	18.36	21.08	22.42	51 21.37 (12_VE1)	23.45
23	09.23	07.48	06.11	05.23	03.46	20.45 (11_VE1)	02.55
	15.36	17.16	18.39	21.11	22.45	52 21.39 (12_VE1)	23.45
24	09.21	07.45	06.08	05.20	03.43	20.46 (11_VE1)	02.55
	15.39	17.19	18.42	21.14	22.48	53 21.40 (12_VE1)	23.45
25	09.18	07.41	06.04	05.16	03.40	20.47 (11_VE1)	02.56
	15.43	17.22	18.45	21.17	22.51	53 21.41 (12_VE1)	23.44
26	09.15	07.38	06.01	05.13	03.37	20.48 (11_VE1)	02.57
	15.46	17.25	18.48	21.20	22.54	52 21.42 (12_VE1)	23.44
27	09.12	07.34	05.57	05.09	03.34	20.50 (11_VE1)	02.58
	15.49	17.28	18.51	21.23	22.57	51 21.43 (12_VE1)	23.43
28	09.10	07.31	05.54	05.06	03.32	20.51 (11_VE1)	02.59
	15.52	17.31	18.54	21.27	23.00	48 21.43 (12_VE1)	23.42
29	09.07		06.50	05.03	03.29	20.54 (11_VE1)	03.01
	15.55		19.57	21.30	23.03	45 21.44 (12_VE1)	23.41
30	09.04		06.47	04.59	03.27	21.03 (12_VE1)	03.01
	15.59		20.00	21.33	23.06	41 21.44 (12_VE1)	23.40
31	09.01		06.43		03.24	21.04 (12_VE1)	
	16.02		20.02		23.08	41 21.45 (12_VE1)	
Potential sun hours	175	239	363	450	566		617
Total, worst case					1072		1398
Sun reduction					0,45		0,40
Oper. time red.					0,93		0,93
Wind dir. red.					0,63		0,63
Total reduction					0,26		0,23
Total, real					281		324

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: Kokkopetaikko\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset Shadow receptor: D - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (18) Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	July	August	September	October	November	December				
1	03.02	21.07 (12_VE1)	04.25	20.51 (11_VE1)	05.58	07.23	07.56	09.28		
	23.39	47	21.54 (12_VE1)	22.21	29	21.20 (11_VE1)	20.35	18.50	16.06	14.44
2	03.04	21.07 (12_VE1)	04.28	20.51 (11_VE1)	06.01	07.26	07.59	09.31		
	23.38	47	21.54 (12_VE1)	22.17	29	21.20 (11_VE1)	20.32	18.47	16.03	14.42
3	03.05	21.07 (12_VE1)	04.31	20.52 (11_VE1)	06.04	07.29	08.02	09.34		
	23.36	47	21.54 (12_VE1)	22.14	28	21.20 (11_VE1)	20.28	18.43	15.59	14.40
4	03.07	21.08 (12_VE1)	04.34	20.51 (11_VE1)	06.07	07.32	08.05	09.36		
	23.35	46	21.54 (12_VE1)	22.11	28	21.19 (11_VE1)	20.25	18.40	15.56	14.38
5	03.09	21.08 (12_VE1)	04.37	20.52 (11_VE1)	06.10	07.35	08.08	09.39		
	23.33	46	21.54 (12_VE1)	22.08	27	21.19 (11_VE1)	20.21	18.36	15.53	14.37
6	03.11	21.09 (12_VE1)	04.40	20.52 (11_VE1)	06.13	07.38	08.11	09.41		
	23.31	46	21.55 (12_VE1)	22.04	26	21.18 (11_VE1)	20.18	18.33	15.50	14.35
7	03.14	21.09 (12_VE1)	04.43	20.53 (11_VE1)	06.15	07.40	08.15	09.44		
	23.29	45	21.54 (12_VE1)	22.01	22	21.15 (11_VE1)	20.14	18.29	15.47	14.33
8	03.16	21.10 (12_VE1)	04.47	20.54 (11_VE1)	06.18	07.43	08.18	09.46		
	23.27	44	21.54 (12_VE1)	21.58	19	21.13 (11_VE1)	20.11	18.26	15.44	14.32
9	03.18	21.09 (12_VE1)	04.50	20.54 (11_VE1)	06.21	07.46	08.21	09.48		
	23.25	44	21.53 (12_VE1)	21.54	15	21.09 (11_VE1)	20.07	18.23	15.41	14.31
10	03.21	21.10 (12_VE1)	04.53	20.55 (11_VE1)	06.24	07.49	08.24	09.50		
	23.23	44	21.54 (12_VE1)	21.51	12	21.07 (11_VE1)	20.04	18.19	15.38	14.30
11	03.23	21.11 (12_VE1)	04.56	20.57 (11_VE1)	06.27	07.52	08.27	09.52		
	23.21	43	21.54 (12_VE1)	21.48	7	21.04 (11_VE1)	20.00	18.16	15.35	14.29
12	03.26	21.11 (12_VE1)	04.59	20.59 (11_VE1)	06.30	07.55	08.30	09.54		
	23.18	42	21.53 (12_VE1)	21.44	1	21.00 (11_VE1)	19.57	18.12	15.32	14.28
13	03.28	21.12 (12_VE1)	05.02	20.62	06.32	07.58	08.34	09.56		
	23.16	41	21.53 (12_VE1)	21.41		19.53	18.09	15.29	14.27	
14	03.31	21.13 (12_VE1)	05.05	20.63	06.35	08.01	08.37	09.57		
	23.13	40	21.53 (12_VE1)	21.38		19.50	18.05	15.26	14.26	
15	03.34	21.01 (11_VE1)	05.08	20.63	06.38	08.04	08.40	09.59		
	23.11	47	21.52 (12_VE1)	21.34		19.46	18.02	15.23	14.26	
16	03.37	20.59 (11_VE1)	05.11	20.61	06.41	08.07	08.43	10.00		
	23.08	50	21.52 (12_VE1)	21.31		19.43	17.59	15.20	14.25	
17	03.39	20.58 (11_VE1)	05.14	20.64	06.44	08.10	08.46	10.02		
	23.06	51	21.51 (12_VE1)	21.27		19.39	17.55	15.18	14.25	
18	03.42	20.57 (11_VE1)	05.17	20.67	06.47	08.13	08.49	10.03		
	23.03	52	21.50 (12_VE1)	21.24		19.36	17.52	15.15	14.25	
19	03.45	20.56 (11_VE1)	05.20	20.69	06.49	08.16	08.53	10.04		
	23.00	53	21.51 (12_VE1)	21.21		19.32	17.48	15.12	14.25	
20	03.48	20.55 (11_VE1)	05.23	20.65	06.52	08.19	08.56	10.05		
	22.57	53	21.49 (12_VE1)	21.17		19.29	17.45	15.10	14.25	
21	03.51	20.54 (11_VE1)	05.26	20.65	06.55	08.22	08.59	10.05		
	22.54	53	21.48 (12_VE1)	21.14		19.25	17.42	15.07	14.25	
22	03.54	20.54 (11_VE1)	05.29	20.68	06.58	08.25	09.02	10.06		
	22.51	52	21.48 (12_VE1)	21.10		19.22	17.38	15.04	14.25	
23	03.57	20.54 (11_VE1)	05.32	20.71	07.01	08.28	09.05	10.06		
	22.49	49	21.46 (12_VE1)	21.07		19.18	17.35	15.02	14.26	
24	04.00	20.53 (11_VE1)	05.35	20.73	07.03	08.31	09.08	10.07		
	22.46	47	21.44 (12_VE1)	21.03		19.15	17.32	14.59	14.27	
25	04.03	20.53 (11_VE1)	05.38	20.76	07.06	07.34	09.11	10.07		
	22.43	44	21.43 (12_VE1)	21.00		19.11	16.28	14.57	14.28	
26	04.06	20.52 (11_VE1)	05.41	20.79	07.09	07.37	09.14	10.07		
	22.39	38	21.39 (12_VE1)	20.56		19.08	16.25	14.55	14.29	
27	04.09	20.52 (11_VE1)	05.44	20.77	07.12	07.40	09.17	10.07		
	22.36	28	21.20 (11_VE1)	20.53		19.04	16.22	14.52	14.30	
28	04.12	20.51 (11_VE1)	05.47	20.75	07.15	07.43	09.20	10.07		
	22.33	29	21.20 (11_VE1)	20.49		19.01	16.19	14.50	14.31	
29	04.16	20.52 (11_VE1)	05.50	20.78	07.18	07.46	09.23	10.06		
	22.30	29	21.21 (11_VE1)	20.46		18.57	16.15	14.48	14.32	
30	04.19	20.51 (11_VE1)	05.52	20.77	07.20	07.49	09.26	10.06		
	22.27	29	21.20 (11_VE1)	20.42		18.54	16.12	14.46	14.34	
31	04.22	20.51 (11_VE1)	05.55			07.52		10.05		
	22.24	30	21.21 (11_VE1)	20.39		16.09		14.35		
Potential sun hours	603		506	393		306	201	142		
Total, worst case	1356		243							
Sun reduction	0,43		0,41							
Oper. time red.	0,93		0,93							
Wind dir. red.	0,63		0,63							
Total reduction	0,25		0,24							
Total, real	344		59							

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: Kokkopetaikko\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset Shadow receptor: E - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (19) Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June
1	10.05 14.37	08.58 16.05	14.52 (4_VE1) 15.15 (4_VE1)	07.28 17.34	06.40 20.05	04.56 21.36
2	10.04 14.39	08.55 16.08	14.51 (4_VE1) 15.17 (4_VE1)	07.24 17.37	06.36 20.08	04.52 21.39
3	10.03 14.41	08.52 16.12	14.50 (4_VE1) 15.18 (4_VE1)	07.21 17.40	06.33 20.11	04.49 21.42
4	10.02 14.43	08.49 16.15	14.50 (4_VE1) 15.19 (4_VE1)	07.17 17.43	06.29 20.14	04.46 21.46
5	10.01 14.45	08.46 16.18	14.49 (4_VE1) 15.20 (4_VE1)	07.14 17.46	06.26 20.17	04.42 21.49
6	09.59 14.48	08.43 16.21	14.48 (4_VE1) 15.20 (4_VE1)	07.11 17.49	06.22 20.20	04.39 21.52
7	09.58 14.50	08.40 16.25	14.49 (4_VE1) 15.21 (4_VE1)	07.07 17.52	06.19 20.23	04.36 21.55
8	09.56 14.52	08.37 16.28	14.48 (4_VE1) 15.22 (4_VE1)	07.04 17.55	06.15 20.26	04.32 21.58
9	09.55 14.55	08.34 16.31	14.48 (4_VE1) 15.21 (4_VE1)	07.00 17.58	06.12 20.29	04.29 22.01
10	09.53 14.57	08.31 16.34	14.48 (4_VE1) 15.22 (4_VE1)	06.57 18.01	06.08 20.32	04.26 22.05
11	09.51 15.00	08.27 16.38	14.48 (4_VE1) 15.22 (4_VE1)	06.53 18.04	06.05 20.35	04.23 22.08
12	09.49 15.03	08.24 16.41	14.48 (4_VE1) 15.22 (4_VE1)	06.50 18.07	06.01 20.38	04.19 22.11
13	09.47 15.06	08.21 16.44	14.49 (4_VE1) 15.22 (4_VE1)	06.46 18.10	05.58 20.41	04.16 22.14
14	09.45 15.08	08.18 16.47	14.49 (4_VE1) 15.22 (4_VE1)	06.43 18.13	05.54 20.44	04.13 22.17
15	09.43 15.11	08.14 16.50	14.49 (4_VE1) 15.21 (4_VE1)	06.39 18.16	05.51 20.47	04.10 22.20
16	09.41 15.14	08.11 16.54	14.50 (4_VE1) 15.21 (4_VE1)	06.36 18.19	05.47 20.50	04.07 22.24
17	09.38 15.17	08.08 16.57	14.51 (4_VE1) 15.20 (4_VE1)	06.32 18.22	05.44 20.53	04.03 22.27
18	09.36 15.20	08.05 17.00	14.51 (4_VE1) 15.18 (4_VE1)	06.29 18.25	05.40 20.56	04.00 22.30
19	09.34 15.23	08.01 17.03	14.53 (4_VE1) 15.18 (4_VE1)	06.25 18.28	05.37 20.59	03.57 22.33
20	09.31 15.26	07.58 17.06	14.54 (4_VE1) 15.16 (4_VE1)	06.22 18.30	05.33 21.02	03.54 22.36
21	09.29 15.30	07.55 17.09	14.56 (4_VE1) 15.13 (4_VE1)	06.18 18.33	05.30 21.05	03.51 22.39
22	09.26 15.33	07.51 17.12	15.00 (4_VE1) 15.10 (4_VE1)	06.15 18.36	05.26 21.08	03.48 22.42
23	09.23 15.36	07.48 17.15	06.11 18.39	05.23 21.11	06.41 (R-N_43) 06.58 (R-N_43)	03.45 22.45
24	09.21 15.39	07.45 17.19	06.08 18.42	05.20 21.14	06.43 (R-N_43) 06.56 (R-N_43)	03.42 22.48
25	09.18 15.42	07.41 17.22	06.04 18.45	05.16 21.17	06.48 (R-N_43) 06.51 (R-N_43)	03.40 22.51
26	09.15 15.45	07.38 17.25	06.01 18.48	05.13 21.21	06.48 (R-N_43) 06.51 (R-N_43)	03.37 22.54
27	09.13 15.49	07.34 17.28	05.57 18.51	05.09 21.24	06.48 (R-N_43) 06.51 (R-N_43)	03.34 22.57
28	09.10 15.52	07.31 17.31	05.54 18.54	05.06 21.27	06.48 (R-N_43) 06.51 (R-N_43)	03.31 23.00
29	09.07 15.55	14.57 (4_VE1) 15.03 (4_VE1)	06.50 19.57	05.02 21.30	06.48 (R-N_43) 06.51 (R-N_43)	03.29 23.03
30	09.04 15.58	14.55 (4_VE1) 15.07 (4_VE1)	06.47 20.00	04.59 21.33	06.48 (R-N_43) 06.51 (R-N_43)	03.26 23.06
31	09.01 16.02	14.54 (4_VE1) 15.11 (4_VE1)	06.43 20.03	06.43 20.03	06.48 (R-N_43) 06.51 (R-N_43)	03.24 23.09
Potential sun hours	175	239	363	450	566	617
Total, worst case	35	629				
Sun reduction	0,14	0,26				
Oper. time red.	0,93	0,93				
Wind dir. red.	0,64	0,64				
Total reduction	0,09	0,16				
Total, real	3	99				

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

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

Calculation: Kokkopetaikkö\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset Shadow receptor: E - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (19)

## Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,81	2,25	4,39	5,97	8,13	8,13	8,42	6,71	4,10	1,90	0,67	0,32

## Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
562	429	310	341	481	794	926	1 041	1 071	878	734	582	8 149

	July	August	September	October	November	December		
1	03.01 23.40	04.25 22.21	05.58 20.36	06.40 (R-N_43) 07.03 (R-N_43)	07.23 18.50	07.56 16.06	14.18 (4_VE1) 14.52 (4_VE1)	09.29 14.43
2	03.03 23.38	04.28 22.18	06.01 20.32	06.41 (R-N_43) 07.02 (R-N_43)	07.26 18.47	07.59 16.02	14.17 (4_VE1) 14.51 (4_VE1)	09.31 14.42
3	03.05 23.37	04.31 22.14	06.04 20.29	06.43 (R-N_43) 07.00 (R-N_43)	07.29 18.43	08.02 15.59	14.18 (4_VE1) 14.51 (4_VE1)	09.34 14.40
4	03.07 23.35	04.34 22.11	06.07 20.25	06.44 (R-N_43) 06.57 (R-N_43)	07.32 18.40	08.05 15.56	14.18 (4_VE1) 14.51 (4_VE1)	09.37 14.38
5	03.09 23.34	04.37 22.08	06.10 20.22	06.47 (R-N_43) 06.53 (R-N_43)	07.35 18.36	08.08 15.53	14.19 (4_VE1) 14.51 (4_VE1)	09.39 14.36
6	03.11 23.32	04.40 22.05	06.13 20.18	07.38 18.33	07.38 18.33	08.12 15.50	14.20 (4_VE1) 14.50 (4_VE1)	09.42 14.35
7	03.13 23.30	04.43 22.01	06.15 20.15	07.40 18.29	07.40 18.29	08.15 15.47	14.20 (4_VE1) 14.49 (4_VE1)	09.44 14.33
8	03.15 23.28	04.46 21.58	06.18 20.11	07.43 18.26	07.43 18.26	08.18 15.44	14.21 (4_VE1) 14.48 (4_VE1)	09.46 14.32
9	03.18 23.26	04.49 21.55	06.21 20.07	07.46 18.23	07.46 18.23	08.21 15.41	14.22 (4_VE1) 14.47 (4_VE1)	09.48 14.30
10	03.20 23.23	04.52 21.51	06.24 20.04	07.49 18.19	07.49 18.19	08.24 15.38	14.23 (4_VE1) 14.46 (4_VE1)	09.50 14.29
11	03.23 23.21	04.56 21.48	06.27 20.00	07.52 18.16	07.52 18.16	08.28 15.35	14.25 (4_VE1) 14.42 (4_VE1)	09.52 14.28
12	03.25 23.19	04.59 21.45	06.30 19.57	07.55 18.12	07.55 18.12	08.31 15.32	14.26 (4_VE1) 14.38 (4_VE1)	09.54 14.27
13	03.28 23.16	05.02 21.41	06.32 19.53	07.58 18.09	07.58 18.09	08.34 15.29	14.29 (4_VE1) 14.34 (4_VE1)	09.56 14.26
14	03.31 23.14	05.05 21.38	06.35 19.50	08.01 18.05	08.01 18.05	08.37 15.26	14.34 (4_VE1)	09.58 14.26
15	03.33 23.11	05.08 21.34	06.38 19.46	08.04 18.02	08.04 18.02	08.40 15.23	14.34 (4_VE1)	09.59 14.25
16	03.36 23.09	05.11 21.31	06.41 19.43	08.07 17.59	08.07 17.59	08.43 15.20	14.34 (4_VE1)	10.01 14.25
17	03.39 23.06	05.14 21.28	06.44 19.39	08.10 17.55	08.10 17.55	08.47 15.17	14.34 (4_VE1)	10.02 14.24
18	03.42 23.03	05.17 21.24	06.47 (R-N_43) 19.36	08.13 17.52	08.13 17.52	08.50 15.15	14.34 (4_VE1)	10.03 14.24
19	03.45 23.00	05.20 21.21	06.48 (R-N_43) 19.32	08.16 17.48	08.16 17.48	08.53 15.12	14.34 (4_VE1)	10.04 14.24
20	03.48 22.58	05.23 21.17	06.47 (R-N_43) 19.29	08.19 17.45	08.19 17.45	15.30 (4_VE1) 15.42 (4_VE1)	08.56 15.09	10.05 14.24
21	03.51 22.55	05.26 21.14	06.45 (R-N_43) 19.25	08.22 17.42	08.22 17.42	15.26 (4_VE1) 15.45 (4_VE1)	08.59 15.07	10.06 14.25
22	03.54 22.52	05.29 21.10	06.43 (R-N_43) 19.22	08.25 17.38	08.25 17.38	15.24 (4_VE1) 15.46 (4_VE1)	09.02 15.04	10.06 14.25
23	03.57 22.49	05.32 21.07	06.43 (R-N_43) 19.18	08.28 17.35	08.28 17.35	15.23 (4_VE1) 15.48 (4_VE1)	09.05 15.02	10.07 14.26
24	04.00 22.46	05.35 21.03	06.42 (R-N_43) 19.15	08.31 17.32	08.31 17.32	15.21 (4_VE1) 15.49 (4_VE1)	09.08 14.59	10.07 14.26
25	04.03 22.43	05.38 21.00	06.41 (R-N_43) 19.11	07.34 16.28	07.34 16.28	14.20 (4_VE1) 14.50 (4_VE1)	09.11 14.57	10.07 14.27
26	04.06 22.40	05.41 20.57	06.40 (R-N_43) 19.08	07.37 16.25	07.37 16.25	14.19 (4_VE1) 14.50 (4_VE1)	09.14 14.54	10.08 14.28
27	04.09 22.37	05.44 20.53	06.40 (R-N_43) 19.04	07.12 16.22	07.12 16.22	14.19 (4_VE1) 14.51 (4_VE1)	09.17 14.52	10.07 14.29
28	04.12 22.34	05.47 20.50	06.40 (R-N_43) 19.01	07.15 16.19	07.15 16.19	14.18 (4_VE1) 14.51 (4_VE1)	09.20 14.50	10.07 14.30
29	04.15 22.30	05.49 20.46	06.39 (R-N_43) 18.57	07.18 16.15	07.18 16.15	14.18 (4_VE1) 14.51 (4_VE1)	09.23 14.48	10.07 14.32
30	04.18 22.27	05.52 20.43	06.40 (R-N_43) 18.54	07.20 16.12	07.20 16.12	14.17 (4_VE1) 14.51 (4_VE1)	09.26 14.45	10.06 14.33
31	04.21 22.24	05.55 20.39	06.40 (R-N_43) 18.54	07.53 16.09	07.53 16.09	14.17 (4_VE1) 14.51 (4_VE1)	10.06 14.35	10.06 14.35
Potential sun hours	604	506	393	306	201	142		
Total, worst case		307	80	333	334			
Sun reduction		0,41	0,31	0,19	0,10			
Oper. time red.		0,93	0,93	0,93	0,93			
Wind dir. red.		0,61	0,61	0,64	0,64			
Total reduction		0,24	0,18	0,12	0,06			
Total, real		73	14	39	20			

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: Kokkopetaikkö\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset Shadow receptor: F - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (14)

### Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June
1	10.04	08.58	07.28	06.40	04.56	20.17 (12_VE1) 03.21
	14.37	16.05	17.34	20.05	21.36	30 20.47 (12_VE1) 23.11
2	10.04	08.55	07.24	06.36	04.52	20.16 (12_VE1) 03.19
	14.39	16.08	17.37	20.08	21.39	31 20.47 (12_VE1) 23.14
3	10.02	08.52	07.21	06.33	04.49	20.15 (12_VE1) 03.17
	14.41	16.12	17.40	20.11	21.42	33 20.48 (12_VE1) 23.16
4	10.01	08.49	07.17	06.29	04.46	20.15 (12_VE1) 03.15
	14.43	16.15	17.43	20.14	21.45	33 20.48 (12_VE1) 23.19
5	10.00	08.46	07.14	06.26	04.42	20.14 (12_VE1) 03.12
	14.46	16.18	17.46	20.17	21.48	34 20.48 (12_VE1) 23.21
6	09.59	08.43	07.10	06.22	04.39	20.15 (12_VE1) 03.10
	14.48	16.21	17.49	20.20	21.52	34 20.49 (12_VE1) 23.24
7	09.57	08.40	07.07	06.19	04.36	20.15 (12_VE1) 03.08
	14.50	16.25	17.52	20.23	21.55	34 20.49 (12_VE1) 23.26
8	09.56	08.37	07.04	06.15	04.33	20.14 (12_VE1) 03.06
	14.53	16.28	17.55	20.26	21.58	35 20.49 (12_VE1) 23.28
9	09.54	08.33	07.00	06.12	04.29	20.14 (12_VE1) 03.05
	14.55	16.31	17.58	20.29	22.01	34 20.48 (12_VE1) 23.30
10	09.52	08.30	06.57	06.08	04.26	20.14 (12_VE1) 03.03
	14.58	16.34	18.01	20.32	22.04	34 20.48 (12_VE1) 23.32
11	09.51	08.27	06.53	06.05	04.23	20.15 (12_VE1) 03.01
	15.00	16.38	18.04	20.35	22.07	33 20.48 (12_VE1) 23.34
12	09.49	08.24	06.50	06.01	04.20	20.15 (12_VE1) 03.00
	15.03	16.41	18.07	20.38	22.11	33 20.48 (12_VE1) 23.36
13	09.47	08.21	06.46	05.58	04.16	20.15 (12_VE1) 02.58
	15.06	16.44	18.10	20.41	22.14	32 20.47 (12_VE1) 23.37
14	09.45	08.18	06.43	05.54	04.13	20.16 (12_VE1) 02.57
	15.09	16.47	18.13	20.44	22.17	31 20.47 (12_VE1) 23.39
15	09.42	08.14	06.39	05.51	04.10	20.16 (12_VE1) 02.56
	15.12	16.50	18.16	20.47	22.20	30 20.46 (12_VE1) 23.40
16	09.40	08.11	06.36	05.47	04.07	20.17 (12_VE1) 02.55
	15.15	16.54	18.19	20.50	22.23	29 20.46 (12_VE1) 23.41
17	09.38	08.08	06.32	05.44	04.04	20.17 (12_VE1) 02.54
	15.18	16.57	18.22	20.53	22.26	28 20.45 (12_VE1) 23.42
18	09.36	08.04	06.29	05.40	04.01	20.18 (12_VE1) 02.54
	15.21	17.00	18.25	20.56	22.30	27 20.45 (12_VE1) 23.43
19	09.33	08.01	06.25	05.37	03.58	20.19 (12_VE1) 02.54
	15.24	17.03	18.27	20.59	22.33	25 20.44 (12_VE1) 23.44
20	09.31	07.58	06.22	05.33	03.55	20.20 (12_VE1) 02.54
	15.27	17.06	18.30	21.02	22.36	23 20.43 (12_VE1) 23.44
21	09.28	07.55	06.18	05.30	03.52	20.21 (12_VE1) 02.54
	15.30	17.09	18.33	21.05	22.39	21 20.42 (12_VE1) 23.44
22	09.26	07.51	06.15	05.27	03.49	20.22 (12_VE1) 02.54
	15.33	17.12	18.36	21.08	22.42	19 20.41 (12_VE1) 23.45
23	09.23	07.48	06.11	05.23	03.46	20.24 (12_VE1) 02.55
	15.36	17.16	18.39	21.11	22.45	15 20.39 (12_VE1) 23.45
24	09.21	07.44	06.08	05.20	03.43	20.26 (12_VE1) 02.55
	15.39	17.19	18.42	21.14	22.48	12 20.38 (12_VE1) 23.45
25	09.18	07.41	06.04	05.16	03.40	20.29 (12_VE1) 02.56
	15.42	17.22	18.45	21.17	10 20.37 (12_VE1) 22.51	6 20.35 (12_VE1) 23.44
26	09.15	07.38	06.01	05.13	03.37	20.24 (12_VE1) 03.37
	15.46	17.25	18.48	21.20	16 20.40 (12_VE1) 22.54	23.44
27	09.12	07.34	05.57	05.09	03.34	20.21 (12_VE1) 03.34
	15.49	17.28	18.51	21.23	21 20.42 (12_VE1) 22.57	23.43
28	09.10	07.31	05.54	05.06	03.32	20.20 (12_VE1) 03.32
	15.52	17.31	18.54	21.27	24 20.44 (12_VE1) 23.00	23.42
29	09.07		06.50	05.03	03.29	20.19 (12_VE1) 03.29
	15.55		19.57	21.30	26 20.45 (12_VE1) 23.03	23.41
30	09.04		06.47	04.59	03.26	20.18 (12_VE1) 03.26
	15.59		20.00	21.33	28 20.46 (12_VE1) 23.06	03.00
31	09.01		06.43		03.24	23.40
	16.02		20.02		23.08	
Potential sun hours	175	239	363	450	566	617
Total, worst case				125		696
Sun reduction				0,40		0,45
Oper. time red.				0,93		0,93
Wind dir. red.				0,63		0,63
Total reduction				0,23		0,26
Total, real				29		181

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

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

## SHADOW - Calendar

Calculation: Kokkopetaikkö\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset Shadow receptor: F - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (14) Sunshine probability S (Average daily sunshine hours) []

### Assumptions for shadow calculations

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	July	August	September	October	November	December
1	03.02	04.25	20.25 (12_VE1)	05.58	07.23	07.56
	23.39	22.21	20.58 (12_VE1)	20.35	18.50	16.06
2	03.04	04.28	20.25 (12_VE1)	06.01	07.26	07.59
	23.38	22.17	20.58 (12_VE1)	20.32	18.47	16.03
3	03.05	04.31	20.25 (12_VE1)	06.04	07.29	08.02
	23.36	22.14	20.59 (12_VE1)	20.28	18.43	15.59
4	03.07	04.34	20.24 (12_VE1)	06.07	07.32	08.05
	23.35	22.11	20.58 (12_VE1)	20.25	18.40	15.56
5	03.09	04.37	20.24 (12_VE1)	06.10	07.35	08.08
	23.33	22.08	20.59 (12_VE1)	20.21	18.36	15.53
6	03.11	04.40	20.24 (12_VE1)	06.13	07.37	08.11
	23.31	22.04	20.58 (12_VE1)	20.18	18.33	15.50
7	03.14	04.43	20.24 (12_VE1)	06.15	07.40	08.15
	23.29	22.01	20.58 (12_VE1)	20.14	18.29	15.47
8	03.16	04.46	20.25 (12_VE1)	06.18	07.43	08.18
	23.27	21.58	20.58 (12_VE1)	20.11	18.26	15.44
9	03.18	04.50	20.24 (12_VE1)	06.21	07.46	08.21
	23.25	21.54	20.57 (12_VE1)	20.07	18.23	15.41
10	03.21	04.53	20.25 (12_VE1)	06.24	07.49	08.24
	23.23	21.51	20.57 (12_VE1)	20.04	18.19	15.38
11	03.23	04.56	20.25 (12_VE1)	06.27	07.52	08.27
	23.21	21.48	20.56 (12_VE1)	20.00	18.16	15.35
12	03.26	04.59	20.25 (12_VE1)	06.30	07.55	08.30
	23.18	21.44	20.55 (12_VE1)	19.57	18.12	15.32
13	03.28	05.02	20.26 (12_VE1)	06.32	07.58	08.34
	23.16	21.41	20.54 (12_VE1)	19.53	18.09	15.29
14	03.31	05.05	20.27 (12_VE1)	06.35	08.01	08.37
	23.13	21.38	20.53 (12_VE1)	19.50	18.05	15.26
15	03.34	05.08	20.28 (12_VE1)	06.38	08.04	08.40
	23.11	21.34	20.51 (12_VE1)	19.46	18.02	15.23
16	03.37	05.11	20.29 (12_VE1)	06.41	08.07	08.43
	23.08	21.31	20.49 (12_VE1)	19.43	17.59	15.20
17	03.39	05.14	20.31 (12_VE1)	06.44	08.10	08.46
	23.06	21.27	20.46 (12_VE1)	19.39	17.55	15.18
18	03.42	05.17	20.34 (12_VE1)	06.46	08.13	08.49
	23.03	21.24	20.43 (12_VE1)	19.36	17.52	15.15
19	03.45	20.37 (12_VE1)	05.20	06.49	08.16	08.53
	23.00	20.47 (12_VE1)	21.21	19.32	17.48	15.12
20	03.48	20.35 (12_VE1)	05.23	06.52	08.19	08.56
	22.57	20.49 (12_VE1)	21.17	19.29	17.45	15.09
21	03.51	20.33 (12_VE1)	05.26	06.55	08.22	08.59
	22.54	20.50 (12_VE1)	21.14	19.25	17.42	15.07
22	03.54	20.31 (12_VE1)	05.29	06.58	08.25	09.02
	22.51	20.51 (12_VE1)	21.10	19.22	17.38	15.04
23	03.57	20.31 (12_VE1)	05.32	07.01	08.28	09.05
	22.48	20.53 (12_VE1)	21.07	19.18	17.35	15.02
24	04.00	20.30 (12_VE1)	05.35	07.03	08.31	09.08
	22.45	20.53 (12_VE1)	21.03	19.15	17.32	14.59
25	04.03	20.29 (12_VE1)	05.38	07.06	07.34	09.11
	22.42	20.55 (12_VE1)	21.00	19.11	16.28	14.57
26	04.06	20.28 (12_VE1)	05.41	07.09	07.37	09.14
	22.39	20.55 (12_VE1)	20.56	19.08	16.25	14.55
27	04.09	20.28 (12_VE1)	05.44	07.12	07.40	09.17
	22.36	20.56 (12_VE1)	20.53	19.04	16.22	14.52
28	04.12	20.27 (12_VE1)	05.47	07.15	07.43	09.20
	22.33	20.56 (12_VE1)	20.49	19.01	16.19	14.50
29	04.15	20.27 (12_VE1)	05.49	07.18	07.46	09.23
	22.30	20.57 (12_VE1)	20.46	18.57	16.15	14.48
30	04.19	20.26 (12_VE1)	05.52	07.20	07.49	09.26
	22.27	20.57 (12_VE1)	20.42	18.54	16.12	14.46
31	04.22	20.26 (12_VE1)	05.55		07.52	
	22.24	20.58 (12_VE1)	20.39		16.09	
Potential sun hours	603	506		393	306	201
Total, worst case	309	517				
Sun reduction	0,43	0,41				
Oper. time red.	0,93	0,93				
Wind dir. red.	0,63	0,63				
Total reduction	0,25	0,24				
Total, real	78	124				

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

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

Calculation: Kokkopetaikko\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset Shadow receptor: G - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (15)  
Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June	July	August	September	October	November	December	
1	10:05 14:37	08:58 16:05	07:28 17:34	06:40 20:05	18.32 (12_VE1) 18.47 (12_VE1)	04:56 21:36	03:21 23:11	03:02 22:21	04:25 20:35	05:58 20:35	07:23 18:50	07:56 16:06	09:28 14:44
2	10:04 14:39	08:55 16:08	07:24 17:37	06:36 20:08	18.36 (12_VE1) 18.43 (12_VE1)	04:52 21:39	03:19 23:14	03:03 23:38	04:28 22:17	06:01 20:32	07:26 18:47	07:59 16:02	09:31 14:42
3	10:03 14:41	08:52 16:12	07:21 17:40	06:33 20:11		04:49 23:16	03:17 23:36	03:05 22:14	04:31 20:28	06:04 20:28	07:29 18:43	08:02 15:59	09:34 14:40
4	10:01 14:43	08:49 16:15	07:17 17:43	06:29 20:14		04:46 21:45	03:14 23:19	03:07 23:35	04:34 22:11	06:07 20:25	07:32 18:40	08:05 15:56	09:36 14:38
5	10:00 14:45	08:46 16:18	07:14 17:46	06:26 20:17		04:42 21:49	03:12 23:21	03:09 23:33	04:37 22:08	06:10 20:21	07:35 18:36	08:08 15:53	09:39 14:36
6	09:59 14:48	08:43 16:21	07:10 17:49	06:22 20:20		04:39 21:52	03:10 23:24	03:11 23:31	04:40 22:04	06:12 20:18	07:37 18:33	08:11 15:50	09:41 14:35
7	09:57 14:50	08:40 16:25	07:07 17:52	06:19 20:23		04:36 21:55	03:08 23:26	03:13 23:29	04:43 22:01	06:15 20:14	07:40 18:29	08:15 15:47	09:44 14:33
8	09:56 14:52	08:37 16:28	07:04 17:55	06:15 20:26		04:32 21:58	03:06 23:27	03:16 23:58	04:46 21:58	06:18 20:11	07:43 18:26	08:18 15:44	09:46 14:32
9	09:54 14:55	08:34 16:31	07:00 17:58	06:12 20:29		04:29 22:01	03:04 23:30	03:18 23:25	04:49 21:54	06:21 20:07	07:46 18:22	08:21 15:41	09:48 14:31
10	09:52 14:58	08:30 16:34	06:57 18:01	06:08 20:32		04:26 22:04	03:03 23:32	03:20 23:23	04:53 21:51	06:24 20:04	18.30 (12_VE1) 18.19	18.24 15:38	09:50 14:29
11	09:51 15:00	08:27 16:38	06:53 18:04	06:05 20:35		04:23 22:08	03:01 23:34	03:23 23:21	04:56 21:48	06:27 20:00	6 18.25 (12_VE1) 18.16	07:52 15:35	09:52 14:28
12	09:49 15:03	08:24 16:41	06:50 18:07	06:01 20:38		04:19 22:11	03:00 23:36	03:26 23:18	04:59 21:44	06:30 19:57	14 18.23 (12_VE1) 18.12	07:55 15:32	09:54 14:27
13	09:47 15:06	08:21 16:44	06:46 18:10	05:58 20:41		04:16 22:14	02:57 23:37	03:28 23:16	05:02 21:41	06:32 19:53	18 18.21 (12_VE1) 18:09	07:58 15:29	09:56 14:27
14	09:45 15:09	08:18 16:47	06:43 18:13	05:54 20:44		04:13 22:17	02:56 23:39	03:31 23:13	05:05 21:38	06:35 19:50	23 18.20 (12_VE1) 18:05	08:01 15:26	09:57 14:26
15	09:43 15:12	08:14 16:50	06:39 18:16	05:51 20:47		04:10 22:20	02:56 23:40	03:34 23:11	05:08 21:34	06:38 19:46	25 18.18 (12_VE1) 18:02	08:04 15:23	09:59 14:25
16	09:40 15:14	08:11 16:54	06:36 18:19	05:47 20:50	17.39 (12_VE1) 17.43 (12_VE1)	04:07 22:23	02:55 23:41	03:36 23:08	05:11 21:31	06:41 19:43	27 18.17 (12_VE1) 18:07	08:07 15:20	10:00 14:25
17	09:38 15:17	08:08 16:57	06:32 18:22	05:44 20:53	17.36 (12_VE1) 17.47 (12_VE1)	04:04 22:27	02:54 23:42	03:39 23:06	05:14 21:27	06:44 19:39	28 18.16 (12_VE1) 18:00	08:10 15:17	10:02 14:25
18	09:36 15:20	08:04 17:00	06:29 18:25	05:40 20:56	17.34 (12_VE1) 17.49 (12_VE1)	04:01 22:30	02:54 23:43	03:42 23:03	05:17 21:24	06:46 19:36	28 18.16 (12_VE1) 18:00	08:13 15:15	10:03 14:24
19	09:33 15:23	08:01 17:03	06:25 18:27	05:37 20:59	17.33 (12_VE1) 17.53 (12_VE1)	03:57 22:33	02:54 23:44	03:45 23:00	05:20 21:21	06:49 19:32	28 18.15 (12_VE1) 18:00	08:16 15:12	10:04 14:24
20	09:31 15:27	07:58 17:06	06:22 18:30	05:33 21:02	17.31 (12_VE1) 17.55 (12_VE1)	03:54 22:36	02:54 23:44	03:48 22:57	05:23 21:17	06:52 19:29	28 18.15 (12_VE1) 18:00	08:19 15:09	10:05 14:25
21	09:28 15:30	07:55 17:09	06:18 18:33	05:30 21:05	17.30 (12_VE1) 17.56 (12_VE1)	03:51 22:39	02:54 23:45	03:51 22:54	05:26 21:14	06:55 19:25	27 18.15 (12_VE1) 18:00	08:22 15:07	10:05 14:25
22	09:26 15:33	07:51 17:12	06:15 18:36	05:26 21:08	17.29 (12_VE1) 17.56 (12_VE1)	03:48 22:42	02:54 23:45	03:54 22:51	05:29 21:10	06:58 19:22	27 18.15 (12_VE1) 18:00	08:25 15:04	10:06 14:25
23	09:23 15:36	07:48 17:15	06:11 18:39	05:23 21:11	17.29 (12_VE1) 17.57 (12_VE1)	03:45 22:45	02:54 23:45	03:57 22:49	05:32 21:07	07:01 19:18	26 18.15 (12_VE1) 18:00	08:28 15:02	10:07 14:26
24	09:21 15:39	07:44 17:19	06:08 18:42	05:20 21:14	17.28 (12_VE1) 17.56 (12_VE1)	03:43 22:48	02:55 23:45	04:00 22:46	05:35 21:03	07:03 19:15	22 18.15 (12_VE1) 18:00	08:31 15:00	10:07 14:26
25	09:18 15:42	07:41 17:22	06:04 18:45	05:16 21:17	17.28 (12_VE1) 17.56 (12_VE1)	03:40 22:51	02:56 23:44	04:03 22:43	05:38 21:00	07:06 19:11	17 18.16 (12_VE1) 18:00	07:34 15:00	10:07 14:27
26	09:15 15:46	07:38 17:25	06:01 18:48	05:13 21:20	17.28 (12_VE1) 17.55 (12_VE1)	03:37 22:54	02:57 23:44	04:06 22:40	05:41 20:56	07:09 19:08	12 18.18 (12_VE1) 18:00	07:37 15:00	10:07 14:28
27	09:12 15:49	07:34 17:28	05:57 18:51	05:09 21:23	17.28 (12_VE1) 17.55 (12_VE1)	03:34 22:57	02:58 23:43	04:09 22:36	05:44 20:53	07:12 19:04	7 18.20 (12_VE1) 18:00	07:40 15:00	10:07 14:29
28	09:10 15:52	07:31 17:31	05:54 18:54	05:06 21:27	17.28 (12_VE1) 17.54 (12_VE1)	03:32 23:00	02:59 23:43	04:12 22:33	05:47 20:49	07:15 19:01	07:43 16:19	09:20 15:00	10:07 14:31
29	09:07 15:55	07:28 17:35	05:50 18:59	05:03 21:30	18.29 (12_VE1) 18.53 (12_VE1)	03:29 23:03	03:00 23:42	04:15 22:30	05:49 20:46	07:17 18:57	07:46 16:15	09:23 14:48	10:07 14:32
30	09:04 15:59	07:25 17:42	05:47 19:02	04:59 21:33	18.29 (12_VE1) 18.51 (12_VE1)	03:26 23:06	03:00 23:41	04:18 22:27	05:52 20:42	07:20 18:54	07:49 16:12	09:26 14:46	10:06 14:33
31	09:01 16:02	07:22 17:49	05:43 19:09	04:58 21:36	18.31 (12_VE1) 18.50 (12_VE1)	03:24 23:08	03:00 23:41	04:22 22:24	05:55 20:39	07:22 18:54	07:52 16:09	09:26 14:46	10:05 14:35
Potential sun hours	175	239	363	450		566	617	603	506	393	306	201	142
Total, worst case			356	22						384			
Sun reduction			0,37	0,40						0,31			
Oper. time red.			0,93	0,93						0,93			
Wind dir. red.			0,62	0,62						0,62			
Total reduction			0,21	0,23						0,18			
Total, real			76	5						69			

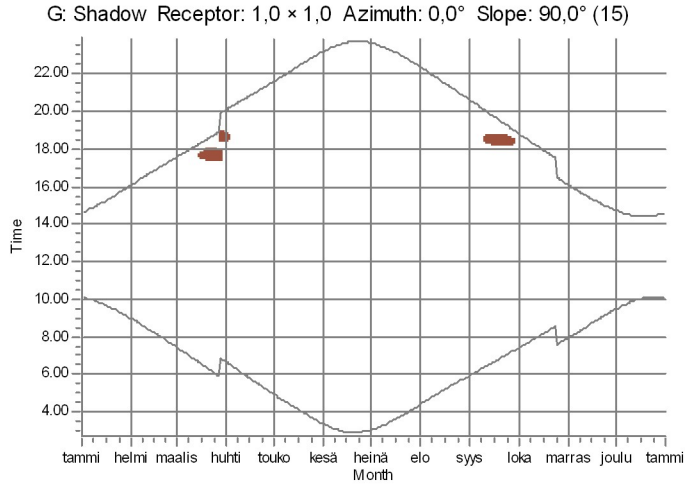
Table layout: For each day in each month the following matrix apply

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



## SHADOW - Calendar, graphical

Calculation: Kokkopetaikkö\_VE1\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset



## SHADOW - Main Result

Calculation: Kokkopetaikkö\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset

### 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  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

Operational time  
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

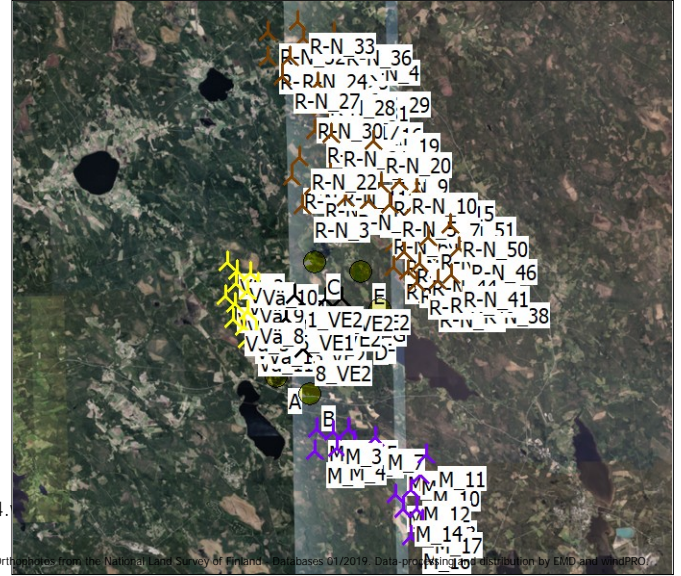
A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:  
Height contours used: Elevation Grid Data Object: kokkopetaikko\_EMDGrid\_4.  
Receptor grid resolution: 1,0 m

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]	Shadow data Calculation distance [m]	RPM [RPM]
1_VE2	434 208	7 073 709	157,4	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
2_VE2	435 004	7 073 483	155,6	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
3_VE2	435 846	7 073 518	154,5	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
4_VE2	436 739	7 073 563	154,7	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
5_VE2	435 175	7 072 670	156,0	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
6_VE1	433 756	7 072 547	160,5	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
7_VE2	434 325	7 071 775	156,6	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
8_VE2	434 645	7 070 857	161,2	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	240,0	200,0	2 034	9,5
M_1	435 107	7 065 481	165,7	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_10	440 720	7 064 070	161,1	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_11	441 028	7 065 116	160,5	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_12	440 205	7 063 260	161,3	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_13	440 483	7 062 260	160,3	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_14	439 728	7 062 270	160,3	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_15	439 359	7 062 997	160,9	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_16	440 169	7 060 783	158,6	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_17	440 793	7 061 617	158,8	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_2	435 221	7 066 620	156,8	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_3	436 114	7 066 456	166,5	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_4	436 313	7 065 545	165,1	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_5	436 904	7 066 552	161,3	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_6	437 238	7 065 888	168,8	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_7	438 315	7 066 083	157,7	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_8	439 374	7 064 901	159,5	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
M_9	440 168	7 064 685	160,3	Siemens Gamesa SG ...	Yes	Siemens Gamesa	SG 6.0-170-6 200	6 200	200,0	180,0	2 036	8,8
R-N_10	435 818	7 078 836	160,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_11	439 868	7 079 636	141,8	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_12	436 268	7 080 086	150,6	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_13	435 268	7 079 486	152,0	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_14	438 970	7 079 541	144,6	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_15	437 018	7 078 836	144,4	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_16	440 800	7 079 223	135,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_17	437 072	7 083 415	141,0	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_18	435 872	7 083 615	155,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_19	435 472	7 082 415	149,8	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_2	437 975	7 082 812	145,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_20	433 068	7 086 336	142,9	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5

To be continued on next page...





## SHADOW - Main Result

Calculation: Kokkopetaikkö\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset

...continued from previous page

	East	North	Z	Row data/Description	WTG type		Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
					Valid	Manufact.					Calculation distance [m]	RPM [RPM]
			[m]									
R-N_21	436 372	7 082 215	153,2	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_22	434 672	7 081 015	148,0	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_23	437 172	7 081 615	164,4	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_24	434 197	7 086 257	143,9	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_25	435 397	7 086 257	130,8	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_26	434 818	7 085 236	145,6	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_27	433 797	7 085 257	142,4	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_28	435 668	7 084 936	147,1	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_29	437 518	7 084 986	125,9	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_3	434 718	7 078 486	152,1	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_30	434 972	7 083 715	150,8	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_31	436 418	7 084 536	141,5	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_32	433 068	7 087 686	134,7	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_33	434 671	7 088 174	120,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_34	434 997	7 087 257	130,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_35	438 220	7 078 641	149,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_36	436 618	7 087 486	117,9	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_37	441 263	7 073 627	156,5	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_38	443 609	7 073 744	147,9	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_39	440 730	7 074 304	152,9	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_4	437 555	7 086 671	125,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_40	441 798	7 074 339	149,0	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_41	442 541	7 074 629	144,9	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_42	440 247	7 074 886	150,7	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_43	439 518	7 075 136	150,7	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_44	440 895	7 075 261	148,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_45	440 108	7 075 881	144,7	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_46	442 968	7 076 036	141,4	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_47	439 569	7 076 392	147,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_48	441 379	7 076 620	151,2	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_49	440 620	7 077 241	152,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_5	439 390	7 078 442	152,9	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_50	442 561	7 077 288	135,7	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_51	441 919	7 078 341	134,5	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_52	434 218	7 080 036	151,0	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_53	442 067	7 075 898	149,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_6	438 934	7 077 503	148,3	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_7	440 597	7 078 257	150,4	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_8	437 468	7 080 086	149,4	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
R-N_9	438 968	7 080 686	137,9	VESTAS V162-7.2 72...	Yes	VESTAS	V162-7.2-7 200	7 200	200,0	200,0	2 034	9,5
Vä_1	430 560	7 073 744	178,1	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_10	431 901	7 074 942	169,1	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_11	431 620	7 071 434	148,4	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_12	432 285	7 074 367	169,2	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_13	432 183	7 071 797	156,2	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_14	432 300	7 072 493	167,5	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_16	432 850	7 071 628	161,8	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_17	432 963	7 072 303	165,3	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_2	430 695	7 075 566	167,3	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_3	430 918	7 072 517	156,5	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_4	431 056	7 073 315	174,7	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_5	431 136	7 074 420	175,5	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_6	431 191	7 075 105	169,1	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_7	431 467	7 072 090	156,5	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_8	431 681	7 072 925	168,6	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4
Vä_9	431 734	7 073 984	173,3	VESTAS V150-4.2 42...	Yes	VESTAS	V150-4.2-4 200	4 200	150,0	145,0	1 902	10,4

### Shadow receptor-Input

No.	East	North	Z	Width	Height	Elevation	Slope of	Direction mode	Eye height
						a.g.l.	window		(ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
A	433 196	7 069 450	142,9	1,0	1,0	1,0	90,0	"Green house mode"	2,0
B	434 902	7 068 448	149,9	1,0	1,0	1,0	90,0	"Green house mode"	2,0

To be continued on next page...

## SHADOW - Main Result

Calculation: Kokkopetaikkö\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset

...continued from previous page

No.	East	North	Z	Width	Height	Elevation	Slope of	Direction mode	Eye height
			[m]	[m]	[m]	a.g.l.	window		(ZVI) a.g.l.
						[m]	[°]		[m]
C	435 343	7 075 466	151,2	1,0	1,0	1,0	90,0	"Green house mode"	2,0
D	437 755	7 071 880	157,4	1,0	1,0	1,0	90,0	"Green house mode"	2,0
E	437 777	7 074 862	158,4	1,0	1,0	1,0	90,0	"Green house mode"	2,0
F	438 345	7 071 927	153,2	1,0	1,0	1,0	90,0	"Green house mode"	2,0
G	438 766	7 072 916	153,8	1,0	1,0	1,0	90,0	"Green house mode"	2,0

## Calculation Results

Shadow receptor

No.	Shadow, worst case			Shadow, expected values	
	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]	
A	22:53	57	0:30	5:27	
B	20:33	60	0:26	1:29	
C	47:11	70	0:59	3:29	
D	0:00	0	0:00	0:00	
E	35:01	88	0:34	5:35	
F	0:00	0	0:00	0:00	
G	0:00	0	0:00	0:00	

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

No.	Name	Worst case [h/year]	Expected [h/year]
1_VE2	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (145)	0:00	0:00
2_VE2	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (147)	25:06	1:49
3_VE2	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (152)	22:05	1:40
4_VE2	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (150)	22:11	2:39
5_VE2	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (148)	0:00	0:00
6_VE1	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (146)	0:00	0:00
7_VE2	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (149)	0:00	0:00
8_VE2	VESTAS V162-7.2 7200 240.0 !O! hub: 200,0 m (TOT: 320,0 m) (151)	22:53	5:27
M_1	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (43)	0:00	0:00
M_10	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (50)	0:00	0:00
M_11	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (49)	0:00	0:00
M_12	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (51)	0:00	0:00
M_13	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (52)	0:00	0:00
M_14	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (53)	0:00	0:00
M_15	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (54)	0:00	0:00
M_16	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (55)	0:00	0:00
M_17	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (56)	0:00	0:00
M_2	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (40)	20:33	1:29
M_3	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (41)	0:00	0:00
M_4	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (44)	0:00	0:00
M_5	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (42)	0:00	0:00
M_6	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (45)	0:00	0:00
M_7	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (46)	0:00	0:00
M_8	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (47)	0:00	0:00
M_9	Siemens Gamesa SG 6.0-170 6200 200.0 !O! hub: 180,0 m (TOT: 280,0 m) (48)	0:00	0:00
R-N_1	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (90)	0:00	0:00
R-N_10	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (99)	0:00	0:00
R-N_11	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (100)	0:00	0:00
R-N_12	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (101)	0:00	0:00
R-N_13	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (102)	0:00	0:00
R-N_14	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (103)	0:00	0:00
R-N_15	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (104)	0:00	0:00
R-N_16	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (105)	0:00	0:00
R-N_17	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (106)	0:00	0:00
R-N_18	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (107)	0:00	0:00
R-N_19	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (108)	0:00	0:00
R-N_2	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (91)	0:00	0:00
R-N_20	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (109)	0:00	0:00
R-N_21	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (110)	0:00	0:00

To be continued on next page...

## SHADOW - Main Result

Calculation: Kokkopetaikkö\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
R-N_22	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (111)	0:00	0:00
R-N_23	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (112)	0:00	0:00
R-N_24	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (113)	0:00	0:00
R-N_25	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (114)	0:00	0:00
R-N_26	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (115)	0:00	0:00
R-N_27	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (116)	0:00	0:00
R-N_28	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (117)	0:00	0:00
R-N_29	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (118)	0:00	0:00
R-N_3	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (92)	0:00	0:00
R-N_30	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (119)	0:00	0:00
R-N_31	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (120)	0:00	0:00
R-N_32	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (121)	0:00	0:00
R-N_33	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (122)	0:00	0:00
R-N_34	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (123)	0:00	0:00
R-N_35	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (124)	0:00	0:00
R-N_36	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (125)	0:00	0:00
R-N_37	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (126)	0:00	0:00
R-N_38	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (127)	0:00	0:00
R-N_39	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (128)	0:00	0:00
R-N_4	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (93)	0:00	0:00
R-N_40	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (129)	0:00	0:00
R-N_41	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (130)	0:00	0:00
R-N_42	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (131)	0:00	0:00
R-N_43	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (132)	12:50	2:53
R-N_44	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (133)	0:00	0:00
R-N_45	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (134)	0:00	0:00
R-N_46	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (135)	0:00	0:00
R-N_47	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (136)	0:00	0:00
R-N_48	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (137)	0:00	0:00
R-N_49	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (138)	0:00	0:00
R-N_5	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (94)	0:00	0:00
R-N_50	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (139)	0:00	0:00
R-N_51	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (140)	0:00	0:00
R-N_52	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (141)	0:00	0:00
R-N_53	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (142)	0:00	0:00
R-N_6	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (95)	0:00	0:00
R-N_7	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (96)	0:00	0:00
R-N_8	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (97)	0:00	0:00
R-N_9	VESTAS V162-7.2 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (98)	0:00	0:00
Vä_1	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (26)	0:00	0:00
Vä_10	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (33)	0:00	0:00
Vä_11	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (30)	0:00	0:00
Vä_12	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (34)	0:00	0:00
Vä_13	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (31)	0:00	0:00
Vä_14	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (29)	0:00	0:00
Vä_16	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (32)	0:00	0:00
Vä_17	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (38)	0:00	0:00
Vä_2	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (39)	0:00	0:00
Vä_3	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (35)	0:00	0:00
Vä_4	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (27)	0:00	0:00
Vä_5	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (25)	0:00	0:00
Vä_6	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (24)	0:00	0:00
Vä_7	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (37)	0:00	0:00
Vä_8	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (28)	0:00	0:00
Vä_9	VESTAS V150-4.2 4200 150.0 !O! hub: 145,0 m (TOT: 220,0 m) (36)	0:00	0:00

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

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

## SHADOW - Calendar

Calculation: Kokkopetaikko\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset Shadow receptor: A - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (13)

## Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

## Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.04 14.38	08.58 16.06	07.28 17.34	06.40 20.06	04.56 21.36	03.22 23.11	04.23 (8_VE2) 23.39	04.25 22.21	05.59 20.36	07.24 18.51	07.56 16.06	09.28 14.44
2	10.04 14.40	08.55 16.09	07.25 17.37	06.37 20.09	04.53 21.39	03.20 23.14	04.22 (8_VE2) 23.38	04.29 22.18	06.02 20.32	07.26 18.47	07.59 16.03	09.31 14.43
3	10.03 14.42	08.52 16.12	07.21 17.40	06.33 20.12	04.50 21.42	03.18 23.16	04.22 (8_VE2) 23.36	04.32 22.14	06.04 20.29	07.29 18.44	08.02 16.00	09.34 14.41
4	10.01 14.44	08.49 16.15	07.18 17.44	06.30 20.15	04.46 21.46	03.15 23.19	04.21 (8_VE2) 23.35	04.35 22.11	06.07 20.25	07.32 18.40	08.05 15.57	09.36 14.39
5	10.00 14.46	08.46 16.19	07.14 17.47	06.26 20.17	04.43 21.49	03.13 23.21	04.22 (8_VE2) 23.33	04.38 22.08	06.10 20.22	07.35 18.37	08.08 15.54	09.39 14.37
6	09.59 14.49	08.43 16.22	07.11 17.50	06.23 20.20	04.40 21.52	03.11 23.24	04.22 (8_VE2) 23.31	04.41 22.05	06.13 20.18	07.38 18.33	08.12 15.51	09.41 14.36
7	09.57 14.51	08.40 16.25	07.07 17.53	06.19 20.23	04.36 21.55	03.09 23.26	04.21 (8_VE2) 23.29	04.44 22.01	06.16 20.15	07.41 18.30	08.15 15.47	09.44 14.34
8	09.56 14.53	08.37 16.28	07.04 17.55	06.16 20.26	04.33 21.58	03.07 23.28	04.21 (8_VE2) 23.27	04.47 21.58	06.19 20.11	07.44 18.26	08.18 15.44	09.46 14.33
9	09.54 14.56	08.34 16.32	07.01 17.58	06.12 20.29	04.30 22.01	03.06 23.30	04.21 (8_VE2) 23.25	04.50 21.55	06.22 20.08	07.47 18.23	08.21 15.41	09.48 14.32
10	09.52 14.58	08.31 16.35	06.57 18.01	06.09 20.32	04.27 22.05	03.04 23.32	04.21 (8_VE2) 23.23	04.53 21.51	06.24 20.04	07.49 18.20	08.24 15.38	09.50 14.30
11	09.51 15.01	08.27 16.38	06.54 18.04	06.05 20.35	04.23 22.08	03.02 23.34	04.22 (8_VE2) 23.21	04.56 21.48	06.27 20.01	07.52 18.16	08.27 15.35	09.52 14.29
12	09.49 15.04	08.24 16.41	06.50 18.07	06.02 20.38	04.20 22.11	03.01 23.36	04.22 (8_VE2) 23.18	04.59 21.45	06.30 19.57	07.55 18.13	08.31 15.32	09.54 14.28
13	09.47 15.07	08.21 16.45	06.47 18.10	05.58 20.41	04.17 22.14	03.00 23.37	04.22 (8_VE2) 23.16	05.02 21.41	06.33 19.54	07.58 18.09	08.34 15.30	09.56 14.28
14	09.45 15.09	08.18 16.48	06.43 18.13	05.55 20.44	04.14 22.17	02.58 23.39	04.22 (8_VE2) 23.13	05.05 21.38	06.36 19.50	08.01 18.06	08.37 15.27	09.57 14.27
15	09.43 15.12	08.15 16.51	06.40 18.16	05.51 20.47	04.11 22.20	02.57 23.40	04.22 (8_VE2) 23.11	05.08 21.34	06.38 19.47	08.04 18.02	08.40 15.24	09.59 14.26
16	09.40 15.15	08.11 16.54	06.36 18.19	05.48 20.50	04.07 22.23	02.56 23.41	04.22 (8_VE2) 23.08	05.11 21.31	06.41 19.43	08.07 17.59	08.43 15.21	10.00 14.26
17	09.38 15.18	08.08 16.57	06.33 18.22	05.44 20.53	04.04 22.27	02.55 23.42	04.23 (8_VE2) 23.06	05.15 21.28	06.44 19.40	08.10 17.56	08.47 15.18	10.02 14.26
18	09.36 15.21	08.05 17.00	06.29 18.25	05.41 20.56	04.01 22.30	02.55 23.43	04.23 (8_VE2) 23.03	05.18 21.24	06.47 19.36	08.13 17.52	08.50 15.15	10.03 14.25
19	09.33 15.24	08.01 17.04	06.26 18.28	05.37 20.59	03.58 22.33	02.55 23.44	04.23 (8_VE2) 23.00	05.21 21.21	06.50 19.33	08.16 17.49	08.53 15.13	10.04 14.25
20	09.31 15.27	07.58 17.07	06.22 18.31	05.34 21.02	03.55 22.36	02.55 23.44	04.24 (8_VE2) 22.57	05.23 21.17	06.53 19.29	08.19 17.46	08.56 15.10	10.05 14.26
21	09.28 15.30	07.55 17.10	06.19 18.34	05.31 21.05	03.52 22.39	02.55 23.44	04.24 (8_VE2) 22.54	05.26 21.14	06.55 19.26	08.22 17.42	08.59 15.07	10.05 14.26
22	09.26 15.34	07.52 17.13	06.15 18.37	05.27 21.08	03.49 22.42	02.55 23.45	04.24 (8_VE2) 22.52	05.29 21.10	06.58 19.22	08.25 17.39	09.02 15.05	10.06 14.26
23	09.23 15.37	07.48 17.16	06.12 18.40	05.24 21.11	03.46 22.45	02.56 23.45	04.23 (8_VE2) 22.49	05.32 21.07	07.01 19.19	08.28 17.36	09.05 15.02	10.06 14.27
24	09.21 15.40	07.45 17.19	06.08 18.42	05.20 21.14	03.44 22.48	02.56 23.44	04.24 (8_VE2) 22.46	05.35 21.04	07.04 19.15	08.31 17.32	09.08 15.00	10.07 14.27
25	09.18 15.43	07.41 17.22	06.05 18.45	05.17 21.17	03.41 22.51	02.57 23.44	04.32 (8_VE2) 22.43	05.38 21.00	07.07 19.12	07.34 16.29	09.11 14.58	10.07 14.28
26	09.15 15.46	07.38 17.25	06.01 18.48	05.13 21.21	03.38 22.54	02.58 23.44	04.29 (8_VE2) 22.40	05.41 20.57	07.09 19.08	07.37 16.26	09.14 14.55	10.07 14.29
27	09.13 15.50	07.35 17.28	05.58 18.51	05.10 21.24	03.35 22.57	02.59 23.43	04.28 (8_VE2) 22.37	05.44 20.50	07.12 19.05	07.40 16.22	09.17 14.53	10.07 14.30
28	09.10 15.53	07.31 17.31	05.54 18.54	05.07 21.27	03.32 23.00	02.58 23.42	04.26 (8_VE2) 22.33	05.47 20.50	07.15 19.01	07.43 16.19	09.20 14.51	10.07 14.32
29	09.07 15.56	07.27 17.34	05.50 18.57	05.03 21.30	03.30 23.03	02.59 23.41	04.25 (8_VE2) 22.30	05.50 20.46	07.18 18.58	07.46 16.16	09.23 14.49	10.06 14.33
30	09.04 15.59	07.24 17.37	05.47 19.01	05.00 21.33	03.27 23.06	02.59 23.40	04.23 (8_VE2) 22.27	05.53 20.43	07.21 18.54	07.50 16.13	09.26 14.46	10.06 14.34
31	09.01 16.02	07.21 17.40	05.44 19.03	04.99 21.36	03.24 23.09	02.58 23.40	04.22 (8_VE2) 22.24	05.56 20.39	07.23 18.51	07.53 16.09	09.26 14.46	10.05 14.36
Potential sun hours	175	240	363	450	565	616	603	506	393	306	201	142
Total, worst case					115	839	419					
Sun reduction					0,45	0,40	0,43					
Oper. time red.					0,93	0,93	0,93					
Wind dir. red.					0,62	0,62	0,62					
Total reduction					0,26	0,23	0,25					
Total, real					30	192	105					

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

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



## SHADOW - Calendar

Calculation: Kokkopetaikkö\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset Shadow receptor: C - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (17)  
Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June				
1	10.05	12.48 (2_VE2)	08.58	11.13 (3_VE2)	07.28	06.40	04.56	03.21		
	14.37	1	12.49 (2_VE2)	16.05	33	13.12 (2_VE2)	17.34	20.06	21.36	23.12
2	10.04	12.48 (2_VE2)	08.55	11.15 (3_VE2)	07.24	06.36	04.52	03.19		
	14.39	8	12.56 (2_VE2)	16.08	23	13.09 (2_VE2)	17.37	20.09	21.39	23.14
3	10.03	12.47 (2_VE2)	08.52	11.17 (3_VE2)	07.21	06.33	04.49	03.16		
	14.41	14	13.01 (2_VE2)	16.12	14	11.31 (3_VE2)	17.40	20.12	21.43	23.17
4	10.02	12.48 (2_VE2)	08.49	11.20 (3_VE2)	07.18	06.29	04.46	03.14		
	14.43	19	13.07 (2_VE2)	16.15	8	11.28 (3_VE2)	17.43	20.14	21.46	23.20
5	10.01	12.47 (2_VE2)	08.46	11.21 (3_VE2)	07.14	06.26	04.42	03.12		
	14.45	21	13.08 (2_VE2)	16.18	17.46	20.17	21.49	23.22		
6	09.59	12.48 (2_VE2)	08.43	11.23 (3_VE2)	07.11	06.22	04.39	03.10		
	14.48	21	13.09 (2_VE2)	16.21	17.49	20.20	21.52	23.24		
7	09.58	11.21 (3_VE2)	08.40	11.26 (3_VE2)	07.07	06.19	04.36	03.08		
	14.50	25	13.09 (2_VE2)	16.25	17.52	20.23	21.55	23.27		
8	09.56	11.17 (3_VE2)	08.37	11.29 (3_VE2)	07.04	06.15	04.32	03.06		
	14.52	31	13.10 (2_VE2)	16.28	17.55	20.26	21.58	23.29		
9	09.55	11.13 (3_VE2)	08.34	11.32 (3_VE2)	07.00	06.12	04.29	03.04		
	14.55	37	13.11 (2_VE2)	16.31	17.58	20.29	22.02	23.31		
10	09.53	11.09 (3_VE2)	08.31	11.35 (3_VE2)	06.57	06.08	04.26	03.03		
	14.58	43	13.12 (2_VE2)	16.34	18.01	20.32	22.05	23.33		
11	09.51	11.07 (3_VE2)	08.28	11.38 (3_VE2)	06.53	06.05	04.23	03.01		
	15.00	47	13.13 (2_VE2)	16.38	18.04	20.35	22.08	23.35		
12	09.49	11.07 (3_VE2)	08.24	11.41 (3_VE2)	06.50	06.01	04.19	03.00		
	15.03	49	13.14 (2_VE2)	16.41	18.07	20.38	22.11	23.36		
13	09.47	11.07 (3_VE2)	08.21	11.44 (3_VE2)	06.47	05.58	04.16	02.57		
	15.06	51	13.15 (2_VE2)	16.44	18.10	20.41	22.14	23.38		
14	09.45	11.07 (3_VE2)	08.18	11.47 (3_VE2)	06.43	05.54	04.13	02.56		
	15.09	52	13.15 (2_VE2)	16.47	18.13	20.44	22.18	23.40		
15	09.43	11.07 (3_VE2)	08.15	11.50 (3_VE2)	06.40	05.51	04.10	02.55		
	15.12	53	13.16 (2_VE2)	16.51	18.16	20.47	22.21	23.41		
16	09.41	11.07 (3_VE2)	08.11	11.53 (3_VE2)	06.36	05.47	04.07	02.55		
	15.14	54	13.16 (2_VE2)	16.54	18.19	20.50	22.24	23.42		
17	09.39	11.06 (3_VE2)	08.08	11.56 (3_VE2)	06.33	05.44	04.04	02.54		
	15.17	57	13.17 (2_VE2)	16.57	18.22	20.53	22.27	23.43		
18	09.36	11.06 (3_VE2)	08.05	11.59 (3_VE2)	06.29	05.41	04.01	02.54		
	15.20	57	13.17 (2_VE2)	17.00	18.25	20.56	22.30	23.44		
19	09.34	11.06 (3_VE2)	08.02	12.02 (3_VE2)	06.26	05.37	03.57	02.53		
	15.24	57	13.17 (2_VE2)	17.03	18.28	20.59	22.33	23.45		
20	09.31	11.06 (3_VE2)	07.58	12.05 (3_VE2)	06.22	05.34	03.54	02.53		
	15.27	59	13.18 (2_VE2)	17.06	18.31	21.02	22.36	23.45		
21	09.29	11.07 (3_VE2)	07.55	12.08 (3_VE2)	06.19	05.30	03.51	02.53		
	15.30	58	13.19 (2_VE2)	17.09	18.34	21.05	22.40	23.45		
22	09.26	11.07 (3_VE2)	07.52	12.11 (3_VE2)	06.15	05.27	03.48	02.54		
	15.33	58	13.19 (2_VE2)	17.13	18.36	21.08	22.43	23.46		
23	09.24	11.07 (3_VE2)	07.48	12.14 (3_VE2)	06.12	05.23	03.46	02.54		
	15.36	57	13.18 (2_VE2)	17.16	18.39	21.11	22.46	23.46		
24	09.21	11.07 (3_VE2)	07.45	12.17 (3_VE2)	06.08	05.20	03.43	02.55		
	15.39	57	13.18 (2_VE2)	17.19	18.42	21.15	22.49	23.46		
25	09.18	11.08 (3_VE2)	07.41	12.20 (3_VE2)	06.05	05.16	03.40	02.55		
	15.42	55	13.18 (2_VE2)	17.22	18.45	21.18	22.52	23.45		
26	09.16	11.09 (3_VE2)	07.38	12.23 (3_VE2)	06.01	05.13	03.37	02.56		
	15.46	55	13.19 (2_VE2)	17.25	18.48	21.21	22.55	23.45		
27	09.13	11.09 (3_VE2)	07.35	12.24 (3_VE2)	05.58	05.09	03.34	02.57		
	15.49	53	13.18 (2_VE2)	17.28	18.51	21.24	22.58	23.44		
28	09.10	11.10 (3_VE2)	07.31	12.25 (3_VE2)	05.54	05.06	03.31	02.59		
	15.52	50	13.17 (2_VE2)	17.31	18.54	21.27	23.01	23.43		
29	09.07	11.10 (3_VE2)	07.28	12.26 (3_VE2)	06.51	05.03	03.29	03.00		
	15.55	48	13.16 (2_VE2)	17.34	19.57	21.30	23.03	23.42		
30	09.04	11.12 (3_VE2)	07.25	12.27 (3_VE2)	06.47	04.59	03.26	03.00		
	15.59	44	13.16 (2_VE2)	17.37	20.00	21.33	23.06	23.41		
31	09.01	11.12 (3_VE2)	07.22	12.28 (3_VE2)	06.44	04.56	03.24	03.00		
	16.02	40	13.15 (2_VE2)	17.40	20.03	21.36	23.09	23.41		
Potential sun hours	175	239	363	450	566	617				
Total, worst case	1331	78								
Sun reduction	0,14	0,26								
Oper. time red.	0,93	0,93								
Wind dir. red.	0,65	0,65								
Total reduction	0,09	0,16								
Total, real	116	12								

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

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



## SHADOW - Calendar

Calculation: Kokkopetaikkö\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset Shadow receptor: C - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (17)  
Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

### Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	July	August	September	October	November	December	
1	03.02	04.25	05.58	07.23	07.56	09.29	10.49 (3_VE2)
	23.40	22.21	20.36	18.50	16.06	14.44	47 12.55 (2_VE2)
2	03.03	04.28	06.01	07.26	07.59	09.32	10.51 (3_VE2)
	23.39	22.18	20.32	18.47	16.03	14.42	44 12.55 (2_VE2)
3	03.05	04.31	06.04	07.29	08.02	09.34	10.56 (3_VE2)
	23.37	22.15	20.29	18.44	15.59	14.40	38 12.55 (2_VE2)
4	03.07	04.34	06.07	07.32	08.05	09.37	11.01 (3_VE2)
	23.36	22.11	20.25	18.40	15.56	14.38	32 12.55 (2_VE2)
5	03.09	04.37	06.10	07.35	08.09	09.39	11.06 (3_VE2)
	23.34	22.08	20.22	18.37	15.53	14.36	26 12.55 (2_VE2)
6	03.11	04.40	06.13	07.38	08.12	09.42	12.33 (2_VE2)
	23.32	22.05	20.18	18.33	15.50	14.35	22 12.55 (2_VE2)
7	03.13	04.43	06.16	07.41	08.15	10.50 (3_VE2)	09.44 12.34 (2_VE2)
	23.30	22.02	20.15	18.30	15.47	9 10.59 (3_VE2)	14.33 20 12.54 (2_VE2)
8	03.15	04.46	06.18	07.44	08.18	10.47 (3_VE2)	09.46 12.35 (2_VE2)
	23.28	21.58	20.11	18.26	15.44	14 11.01 (3_VE2)	14.32 20 12.55 (2_VE2)
9	03.18	04.50	06.21	07.46	08.21	10.45 (3_VE2)	09.49 12.36 (2_VE2)
	23.26	21.55	20.08	18.23	15.41	25 12.40 (2_VE2)	14.31 14 12.50 (2_VE2)
10	03.20	04.53	06.24	07.49	08.25	10.44 (3_VE2)	09.51 12.37 (2_VE2)
	23.24	21.52	20.04	18.19	15.38	34 12.43 (2_VE2)	14.29 8 12.45 (2_VE2)
11	03.23	04.56	06.27	07.52	08.28	10.43 (3_VE2)	09.53 12.38 (2_VE2)
	23.21	21.48	20.01	18.16	15.35	40 12.45 (2_VE2)	14.28 2 12.40 (2_VE2)
12	03.25	04.59	06.30	07.55	08.31	10.42 (3_VE2)	09.55
	23.19	21.45	19.57	18.12	15.32	45 12.47 (2_VE2)	14.27
13	03.28	05.02	06.33	07.58	08.34	10.42 (3_VE2)	09.56
	23.17	21.41	19.54	18.09	15.29	48 12.48 (2_VE2)	14.27
14	03.31	05.05	06.35	08.01	08.37	10.41 (3_VE2)	09.58
	23.14	21.38	19.50	18.06	15.26	51 12.49 (2_VE2)	14.26
15	03.34	05.08	06.38	08.04	08.40	10.42 (3_VE2)	10.00
	23.12	21.35	19.47	18.02	15.23	53 12.51 (2_VE2)	14.25
16	03.36	05.11	06.41	08.07	08.44	10.42 (3_VE2)	10.01
	23.09	21.31	19.43	17.59	15.20	54 12.51 (2_VE2)	14.25
17	03.39	05.14	06.44	08.10	08.47	10.42 (3_VE2)	10.02
	23.06	21.28	19.40	17.55	15.18	55 12.52 (2_VE2)	14.25
18	03.42	05.17	06.47	08.13	08.50	10.41 (3_VE2)	10.03
	23.03	21.24	19.36	17.52	15.15	57 12.52 (2_VE2)	14.24
19	03.45	05.20	06.50	08.16	08.53	10.41 (3_VE2)	10.04
	23.01	21.21	19.33	17.49	15.12	57 12.52 (2_VE2)	14.24
20	03.48	05.23	06.52	08.19	08.56	10.42 (3_VE2)	10.05
	22.58	21.18	19.29	17.45	15.09	58 12.54 (2_VE2)	14.25
21	03.51	05.26	06.55	08.22	08.59	10.42 (3_VE2)	10.06
	22.55	21.14	19.25	17.42	15.07	58 12.54 (2_VE2)	14.25
22	03.54	05.29	06.58	08.25	09.02	10.42 (3_VE2)	10.07
	22.52	21.11	19.22	17.39	15.04	59 12.54 (2_VE2)	14.25
23	03.57	05.32	07.01	08.28	09.06	10.43 (3_VE2)	10.07
	22.49	21.07	19.18	17.35	15.02	58 12.54 (2_VE2)	14.26
24	04.00	05.35	07.04	08.31	09.09	10.44 (3_VE2)	10.08
	22.46	21.04	19.15	17.32	14.59	56 12.54 (2_VE2)	14.26
25	04.03	05.38	07.06	07.34	09.12	10.45 (3_VE2)	10.08
	22.43	21.00	19.11	16.29	14.57	56 12.55 (2_VE2)	14.27
26	04.06	05.41	07.09	07.37	09.15	10.45 (3_VE2)	10.08
	22.40	20.57	19.08	16.25	14.54	55 12.55 (2_VE2)	14.28
27	04.09	05.44	07.12	07.40	09.18	10.46 (3_VE2)	10.08
	22.37	20.53	19.04	16.22	14.52	54 12.55 (2_VE2)	14.29
28	04.12	05.47	07.15	07.43	09.20	10.46 (3_VE2)	10.07
	22.34	20.50	19.01	16.19	14.50	53 12.55 (2_VE2)	14.31
29	04.15	05.50	07.18	07.47	09.23	10.47 (3_VE2)	10.07
	22.31	20.46	18.57	16.15	14.48	51 12.55 (2_VE2)	14.32
30	04.18	05.53	07.21	07.50	09.26	10.48 (3_VE2)	10.07
	22.28	20.43	18.54	16.12	14.46	49 12.55 (2_VE2)	14.33
31	04.22	05.55		07.53			10.06
	22.24	20.39		16.09			14.35
Potential sun hours	604	506	393	306	201		142
Total, worst case					1149		273
Sun reduction					0,10		0,07
Oper. time red.					0,93		0,93
Wind dir. red.					0,65		0,65
Total reduction					0,06		0,04
Total, real					70		12

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: Kokkopetaikkö\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset Shadow receptor: D - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (18)

## Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

## Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.04	08.58	07.28	06.40	04.56	03.22	03.02	04.25	05.58	07.23	07.56	09.28
	14.38	16.05	17.34	20.05	21.36	23.11	23.39	22.21	20.35	18.50	16.06	14.44
2	10.04	08.55	07.24	06.36	04.53	03.19	03.04	04.28	06.01	07.26	07.59	09.31
	14.39	16.08	17.37	20.08	21.39	23.14	23.38	22.17	20.32	18.47	16.03	14.42
3	10.03	08.52	07.21	06.33	04.49	03.17	03.05	04.31	06.04	07.29	08.02	09.34
	14.41	16.12	17.40	20.11	21.42	23.16	23.36	22.14	20.28	18.43	15.59	14.40
4	10.01	08.49	07.17	06.29	04.46	03.15	03.07	04.34	06.07	07.32	08.05	09.36
	14.43	16.15	17.43	20.14	21.45	23.19	23.35	22.11	20.25	18.40	15.56	14.38
5	10.00	08.46	07.14	06.26	04.42	03.12	03.09	04.37	06.10	07.35	08.08	09.39
	14.46	16.18	17.46	20.17	21.49	23.21	23.33	22.08	20.21	18.36	15.53	14.37
6	09.59	08.43	07.11	06.22	04.39	03.10	03.11	04.40	06.13	07.38	08.11	09.41
	14.48	16.21	17.49	20.20	21.52	23.24	23.31	22.04	20.18	18.33	15.50	14.35
7	09.57	08.40	07.07	06.19	04.36	03.08	03.14	04.43	06.15	07.40	08.15	09.44
	14.50	16.25	17.52	20.23	21.55	23.26	23.29	22.01	20.14	18.29	15.47	14.33
8	09.56	08.37	07.04	06.15	04.33	03.06	03.16	04.47	06.18	07.43	08.18	09.46
	14.53	16.28	17.55	20.26	21.58	23.28	23.27	21.58	20.11	18.26	15.44	14.32
9	09.54	08.34	07.00	06.12	04.29	03.05	03.18	04.50	06.21	07.46	08.21	09.48
	14.55	16.31	17.58	20.29	22.01	23.30	23.25	21.54	20.07	18.23	15.41	14.31
10	09.52	08.30	06.57	06.08	04.26	03.03	03.21	04.53	06.24	07.49	08.24	09.50
	14.58	16.34	18.01	20.32	22.04	23.32	23.23	21.51	20.04	18.19	15.38	14.30
11	09.51	08.27	06.53	06.05	04.23	03.02	03.23	04.56	06.27	07.52	08.27	09.52
	15.00	16.38	18.04	20.35	22.08	23.34	23.21	21.48	20.00	18.16	15.35	14.29
12	09.49	08.24	06.50	06.01	04.20	03.00	03.26	04.59	06.30	07.55	08.30	09.54
	15.03	16.41	18.07	20.38	22.11	23.36	23.18	21.44	19.57	18.12	15.32	14.28
13	09.47	08.21	06.46	05.58	04.16	02.58	03.28	05.02	06.32	07.58	08.34	09.56
	15.06	16.44	18.10	20.41	22.14	23.37	23.16	21.41	19.53	18.09	15.29	14.27
14	09.45	08.18	06.43	05.54	04.13	02.57	03.31	05.05	06.35	08.01	08.37	09.57
	15.09	16.47	18.13	20.44	22.17	23.39	23.13	21.38	19.50	18.05	15.26	14.26
15	09.43	08.14	06.39	05.51	04.10	02.56	03.34	05.08	06.38	08.04	08.40	09.59
	15.12	16.50	18.16	20.47	22.20	23.40	23.11	21.34	19.46	18.02	15.23	14.26
16	09.40	08.11	06.36	05.47	04.07	02.55	03.37	05.11	06.41	08.07	08.43	10.00
	15.15	16.54	18.19	20.50	22.23	23.41	23.08	21.31	19.43	17.59	15.20	14.25
17	09.38	08.08	06.32	05.44	04.04	02.55	03.39	05.14	06.44	08.10	08.46	10.02
	15.18	16.57	18.22	20.53	22.26	23.42	23.06	21.27	19.39	17.55	15.18	14.25
18	09.36	08.05	06.29	05.40	04.01	02.54	03.42	05.17	06.47	08.13	08.49	10.03
	15.21	17.00	18.25	20.56	22.30	23.43	23.03	21.24	19.36	17.52	15.15	14.25
19	09.33	08.01	06.25	05.37	03.58	02.54	03.45	05.20	06.49	08.16	08.53	10.04
	15.24	17.03	18.28	20.59	22.33	23.44	23.00	21.21	19.32	17.48	15.12	14.25
20	09.31	07.58	06.22	05.34	03.55	02.54	03.48	05.23	06.52	08.19	08.56	10.05
	15.27	17.06	18.30	21.02	22.36	23.44	22.57	21.17	19.29	17.45	15.10	14.25
21	09.28	07.55	06.18	05.30	03.52	02.54	03.51	05.26	06.55	08.22	08.59	10.05
	15.30	17.09	18.33	21.05	22.39	23.45	22.54	21.14	19.25	17.42	15.07	14.25
22	09.26	07.51	06.15	05.27	03.49	02.54	03.54	05.29	06.58	08.25	09.02	10.06
	15.33	17.12	18.36	21.08	22.42	23.45	22.51	21.10	19.22	17.38	15.04	14.25
23	09.23	07.48	06.11	05.23	03.46	02.55	03.57	05.32	07.01	08.28	09.05	10.06
	15.36	17.16	18.39	21.11	22.45	23.45	22.49	21.07	19.18	17.35	15.02	14.26
24	09.21	07.45	06.08	05.20	03.43	02.55	04.00	05.35	07.03	08.31	09.08	10.07
	15.39	17.19	18.42	21.14	22.48	23.45	22.46	21.03	19.15	17.32	14.59	14.27
25	09.18	07.41	06.04	05.16	03.40	02.56	04.03	05.38	07.06	07.34	09.11	10.07
	15.43	17.22	18.45	21.17	22.51	23.44	22.43	21.00	19.11	16.28	14.57	14.28
26	09.15	07.38	06.01	05.13	03.37	02.57	04.06	05.41	07.09	07.37	09.14	10.07
	15.46	17.25	18.48	21.20	22.54	23.44	22.39	20.56	19.08	16.25	14.55	14.29
27	09.12	07.34	05.57	05.09	03.34	02.58	04.09	05.44	07.12	07.40	09.17	10.07
	15.49	17.28	18.51	21.23	22.57	23.43	22.36	20.53	19.04	16.22	14.52	14.30
28	09.10	07.31	05.54	05.06	03.32	02.59	04.12	05.47	07.15	07.43	09.20	10.07
	15.52	17.31	18.54	21.27	23.00	23.42	22.33	20.49	19.01	16.19	14.50	14.31
29	09.07		06.50	05.03	03.29	03.01	04.16	05.50	07.18	07.46	09.23	10.06
	15.55		19.57	21.30	23.03	23.41	22.30	20.46	18.57	16.15	14.48	14.32
30	09.04		06.47	04.59	03.27	03.01	04.19	05.52	07.20	07.49	09.26	10.06
	15.59		20.00	21.33	23.06	23.40	22.27	20.42	18.54	16.12	14.46	14.34
31	09.01		06.43		03.24		04.22	05.55		07.52		10.05
	16.02		20.02		23.08		22.24	20.39		16.09		14.35
Potential sun hours	175	239	363	450	566	617	603	506	393	306	201	142
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: Kokkopetaikko\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset Shadow receptor: E - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (19)

## Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,81	2,25	4,39	5,97	8,13	8,13	8,42	6,71	4,10	1,90	0,67	0,32

## Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
562	429	310	341	481	794	926	1 041	1 071	878	734	582	8 149

	January	February	March	April	May	June		
1	10.05	08.58	14.52 (4_VE2)	07.28	06.40	04.56	03.21	
	14.37	16.05	23 15.15 (4_VE2)	17.34	20.05	21.36	23.12	
2	10.04	08.55	14.51 (4_VE2)	07.24	06.36	04.52	03.19	
	14.39	16.08	26 15.17 (4_VE2)	17.37	20.08	21.39	23.14	
3	10.03	08.52	14.50 (4_VE2)	07.21	06.33	04.49	03.16	
	14.41	16.12	28 15.18 (4_VE2)	17.40	20.11	21.42	23.17	
4	10.02	08.49	14.50 (4_VE2)	07.17	06.29	04.46	03.14	
	14.43	16.15	29 15.19 (4_VE2)	17.43	20.14	21.46	23.19	
5	10.01	08.46	14.49 (4_VE2)	07.14	06.26	04.42	03.12	
	14.45	16.18	31 15.20 (4_VE2)	17.46	20.17	21.49	23.22	
6	09.59	08.43	14.48 (4_VE2)	07.11	06.22	04.39	03.10	
	14.48	16.21	32 15.20 (4_VE2)	17.49	20.20	21.52	23.24	
7	09.58	08.40	14.49 (4_VE2)	07.07	06.19	06.51 (R-N_43)	03.08	
	14.50	16.25	32 15.21 (4_VE2)	17.52	20.23	6 06.57 (R-N_43)	21.55	23.26
8	09.56	08.37	14.48 (4_VE2)	07.04	06.15	06.47 (R-N_43)	04.32	03.06
	14.52	16.28	34 15.22 (4_VE2)	17.55	20.26	13 07.00 (R-N_43)	21.58	23.29
9	09.55	08.34	14.48 (4_VE2)	07.00	06.12	06.44 (R-N_43)	04.29	03.04
	14.55	16.31	33 15.21 (4_VE2)	17.58	20.29	18 07.02 (R-N_43)	22.01	23.31
10	09.53	08.31	14.48 (4_VE2)	06.57	06.08	06.43 (R-N_43)	04.26	03.03
	14.57	16.34	34 15.22 (4_VE2)	18.01	20.32	21 07.04 (R-N_43)	22.05	23.33
11	09.51	08.27	14.48 (4_VE2)	06.53	06.05	06.41 (R-N_43)	04.23	03.01
	15.00	16.38	34 15.22 (4_VE2)	18.04	20.35	23 07.04 (R-N_43)	22.08	23.34
12	09.49	08.24	14.48 (4_VE2)	06.50	06.01	06.40 (R-N_43)	04.19	03.00
	15.03	16.41	34 15.22 (4_VE2)	18.07	20.38	25 07.05 (R-N_43)	22.11	23.36
13	09.47	08.21	14.49 (4_VE2)	06.46	05.58	06.39 (R-N_43)	04.16	02.57
	15.06	16.44	33 15.22 (4_VE2)	18.10	20.41	25 07.04 (R-N_43)	22.14	23.38
14	09.45	08.18	14.49 (4_VE2)	06.43	05.54	06.39 (R-N_43)	04.13	02.56
	15.08	16.47	33 15.22 (4_VE2)	18.13	20.44	26 07.05 (R-N_43)	22.17	23.39
15	09.43	08.14	14.49 (4_VE2)	06.39	05.51	06.38 (R-N_43)	04.10	02.55
	15.11	16.50	32 15.21 (4_VE2)	18.16	20.47	27 07.05 (R-N_43)	22.20	23.41
16	09.41	08.11	14.50 (4_VE2)	06.36	05.47	06.39 (R-N_43)	04.07	02.55
	15.14	16.54	31 15.21 (4_VE2)	18.19	20.50	26 07.05 (R-N_43)	22.24	23.42
17	09.38	08.08	14.51 (4_VE2)	06.32	05.44	06.38 (R-N_43)	04.03	02.54
	15.17	16.57	29 15.20 (4_VE2)	18.22	20.53	26 07.04 (R-N_43)	22.27	23.43
18	09.36	08.05	14.51 (4_VE2)	06.29	05.40	06.38 (R-N_43)	04.00	02.54
	15.20	17.00	27 15.18 (4_VE2)	18.25	20.56	26 07.04 (R-N_43)	22.30	23.44
19	09.34	08.01	14.53 (4_VE2)	06.25	05.37	06.38 (R-N_43)	03.57	02.53
	15.23	17.03	25 15.18 (4_VE2)	18.28	20.59	25 07.03 (R-N_43)	22.33	23.44
20	09.31	07.58	14.54 (4_VE2)	06.22	05.33	06.38 (R-N_43)	03.54	02.53
	15.26	17.06	22 15.16 (4_VE2)	18.30	21.02	23 07.01 (R-N_43)	22.36	23.45
21	09.29	07.55	14.56 (4_VE2)	06.18	05.30	06.39 (R-N_43)	03.51	02.53
	15.30	17.09	17 15.13 (4_VE2)	18.33	21.05	21 07.00 (R-N_43)	22.39	23.45
22	09.26	07.51	15.00 (4_VE2)	06.15	05.26	06.40 (R-N_43)	03.48	02.54
	15.33	17.12	10 15.10 (4_VE2)	18.36	21.08	19 06.59 (R-N_43)	22.42	23.45
23	09.23	07.48		06.11	05.23	06.41 (R-N_43)	03.45	02.54
	15.36	17.15		18.39	21.11	17 06.58 (R-N_43)	22.45	23.45
24	09.21	07.45		06.08	05.20	06.43 (R-N_43)	03.42	02.55
	15.39	17.19		18.42	21.14	13 06.56 (R-N_43)	22.48	23.45
25	09.18	07.41		06.04	05.16	06.48 (R-N_43)	03.40	02.55
	15.42	17.22		18.45	21.17	3 06.51 (R-N_43)	22.51	23.45
26	09.15	07.38		06.01	05.13		03.37	02.56
	15.45	17.25		18.48	21.21		22.54	23.44
27	09.13	07.34		05.57	05.09		03.34	02.57
	15.49	17.28		18.51	21.24		22.57	23.44
28	09.10	07.31		05.54	05.06		03.31	02.59
	15.52	17.31		18.54	21.27		23.00	23.43
29	09.07	14.57 (4_VE2)		06.50	05.02		03.29	03.00
	15.55	6 15.03 (4_VE2)		19.57	21.30		23.03	23.42
30	09.04	14.55 (4_VE2)		06.47	04.59		03.26	03.00
	15.58	12 15.07 (4_VE2)		20.00	21.33		23.06	23.41
31	09.01	14.54 (4_VE2)		06.43			03.24	
	16.02	17 15.11 (4_VE2)		20.03			23.09	
Potential sun hours	175	239	363	450	566	617		
Total, worst case	35	629						
Sun reduction	0,14	0,26						
Oper. time red.	0,93	0,93						
Wind dir. red.	0,64	0,64						
Total reduction	0,09	0,16						
Total, real	3	99						

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

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

Calculation: Kokkopetaikkö\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset Shadow receptor: E - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (19)

## Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,81	2,25	4,39	5,97	8,13	8,13	8,42	6,71	4,10	1,90	0,67	0,32

## Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
562	429	310	341	481	794	926	1 041	1 071	878	734	582	8 149

	July	August	September	October	November	December		
1	03.01 23.40	04.25 22.21	05.58 20.36	06.40 (R-N_43) 07.03 (R-N_43)	07.23 18.50	07.56 16.06	14.18 (4_VE2) 14.52 (4_VE2)	09.29 14.43
2	03.03 23.38	04.28 22.18	06.01 20.32	06.41 (R-N_43) 07.02 (R-N_43)	07.26 18.47	07.59 16.02	14.17 (4_VE2) 14.51 (4_VE2)	09.31 14.42
3	03.05 23.37	04.31 22.14	06.04 20.29	06.43 (R-N_43) 07.00 (R-N_43)	07.29 18.43	08.02 15.59	14.18 (4_VE2) 14.51 (4_VE2)	09.34 14.40
4	03.07 23.35	04.34 22.11	06.07 20.25	06.44 (R-N_43) 06.57 (R-N_43)	07.32 18.40	08.05 15.56	14.18 (4_VE2) 14.51 (4_VE2)	09.37 14.38
5	03.09 23.34	04.37 22.08	06.10 20.22	06.47 (R-N_43) 06.53 (R-N_43)	07.35 18.36	08.08 15.53	14.19 (4_VE2) 14.51 (4_VE2)	09.39 14.36
6	03.11 23.32	04.40 22.05	06.13 20.18	07.38 18.33	07.38 18.33	08.12 15.50	14.20 (4_VE2) 14.50 (4_VE2)	09.42 14.35
7	03.13 23.30	04.43 22.01	06.15 20.15	07.40 18.29	07.40 18.29	08.15 15.47	14.20 (4_VE2) 14.49 (4_VE2)	09.44 14.33
8	03.15 23.28	04.46 21.58	06.18 20.11	07.43 18.26	07.43 18.26	08.18 15.44	14.21 (4_VE2) 14.48 (4_VE2)	09.46 14.32
9	03.18 23.26	04.49 21.55	06.21 20.07	07.46 18.23	07.46 18.23	08.21 15.41	14.22 (4_VE2) 14.47 (4_VE2)	09.48 14.30
10	03.20 23.23	04.52 21.51	06.24 20.04	07.49 18.19	07.49 18.19	08.24 15.38	14.23 (4_VE2) 14.46 (4_VE2)	09.50 14.29
11	03.23 23.21	04.56 21.48	06.27 20.00	07.52 18.16	07.52 18.16	08.28 15.35	14.25 (4_VE2) 14.42 (4_VE2)	09.52 14.28
12	03.25 23.19	04.59 21.45	06.30 19.57	07.55 18.12	07.55 18.12	08.31 15.32	14.26 (4_VE2) 14.38 (4_VE2)	09.54 14.27
13	03.28 23.16	05.02 21.41	06.32 19.53	07.58 18.09	07.58 18.09	08.34 15.29	14.29 (4_VE2) 14.34 (4_VE2)	09.56 14.26
14	03.31 23.14	05.05 21.38	06.35 19.50	08.01 18.05	08.01 18.05	08.37 15.26	14.34 (4_VE2) 14.34 (4_VE2)	09.58 14.26
15	03.33 23.11	05.08 21.34	06.38 19.46	08.04 18.02	08.04 18.02	08.40 15.23	14.34 (4_VE2) 14.34 (4_VE2)	09.59 14.25
16	03.36 23.09	05.11 21.31	06.41 19.43	08.07 17.59	08.07 17.59	08.43 15.20	14.34 (4_VE2) 14.34 (4_VE2)	10.01 14.25
17	03.39 23.06	05.14 21.28	06.44 19.39	08.10 17.55	08.10 17.55	08.47 15.17	14.34 (4_VE2) 14.34 (4_VE2)	10.02 14.24
18	03.42 23.03	05.17 21.24	06.47 (R-N_43) 19.36	08.13 17.52	08.13 17.52	08.50 15.15	14.34 (4_VE2) 14.34 (4_VE2)	10.03 14.24
19	03.45 23.00	05.20 21.21	06.48 (R-N_43) 19.32	08.16 17.48	08.16 17.48	08.53 15.12	14.34 (4_VE2) 14.34 (4_VE2)	10.04 14.24
20	03.48 22.58	05.23 21.17	06.47 (R-N_43) 19.29	08.19 17.45	08.19 17.45	15.30 (4_VE2) 15.42 (4_VE2)	08.56 15.09	10.05 14.24
21	03.51 22.55	05.26 21.14	06.45 (R-N_43) 19.25	08.22 17.42	08.22 17.42	15.26 (4_VE2) 15.45 (4_VE2)	08.59 15.07	10.06 14.25
22	03.54 22.52	05.29 21.10	06.43 (R-N_43) 19.22	08.25 17.38	08.25 17.38	15.24 (4_VE2) 15.46 (4_VE2)	09.02 15.04	10.06 14.25
23	03.57 22.49	05.32 21.07	06.43 (R-N_43) 19.18	08.28 17.35	08.28 17.35	15.23 (4_VE2) 15.48 (4_VE2)	09.05 15.02	10.07 14.26
24	04.00 22.46	05.35 21.03	06.42 (R-N_43) 19.15	08.31 17.32	08.31 17.32	15.21 (4_VE2) 15.49 (4_VE2)	09.08 14.59	10.07 14.26
25	04.03 22.43	05.38 21.00	06.41 (R-N_43) 19.11	08.34 17.28	08.34 17.28	14.20 (4_VE2) 14.50 (4_VE2)	09.11 14.57	10.07 14.27
26	04.06 22.40	05.41 20.57	06.40 (R-N_43) 19.08	08.37 17.25	08.37 17.25	14.19 (4_VE2) 14.50 (4_VE2)	09.14 14.54	10.08 14.28
27	04.09 22.37	05.44 20.53	06.40 (R-N_43) 19.04	08.40 17.22	08.40 17.22	14.19 (4_VE2) 14.51 (4_VE2)	09.17 14.52	10.07 14.29
28	04.12 22.34	05.47 20.50	06.40 (R-N_43) 19.01	08.43 17.19	08.43 17.19	14.18 (4_VE2) 14.51 (4_VE2)	09.20 14.50	10.07 14.30
29	04.15 22.30	05.49 20.46	06.39 (R-N_43) 18.57	08.46 17.15	08.46 17.15	14.18 (4_VE2) 14.51 (4_VE2)	09.23 14.48	10.07 14.32
30	04.18 22.27	05.52 20.43	06.40 (R-N_43) 18.54	08.49 17.12	08.49 17.12	14.17 (4_VE2) 14.51 (4_VE2)	09.26 14.45	10.06 14.33
31	04.21 22.24	05.55 20.39	06.40 (R-N_43) 18.51	08.53 17.09	08.53 17.09	14.17 (4_VE2) 14.51 (4_VE2)	09.26 14.45	10.06 14.35
Potential sun hours	604	506	393	306	201	142		
Total, worst case		307	80	333	334			
Sun reduction		0,41	0,31	0,19	0,10			
Oper. time red.		0,93	0,93	0,93	0,93			
Wind dir. red.		0,61	0,61	0,64	0,64			
Total reduction		0,24	0,18	0,12	0,06			
Total, real		73	14	39	20			

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: Kokkopetaikkö\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset Shadow receptor: F - Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (14)

## Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,81	2,25	4,39	5,97	8,13	8,13	8,42	6,71	4,10	1,90	0,67	0,32

## Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
562	429	310	341	481	794	926	1 041	1 071	878	734	582	8 149

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.04	08.58	07.28	06.40	04.56	03.21	03.02	04.25	05.58	07.23	07.56	09.28
	14.37	16.05	17.34	20.05	21.36	23.11	23.39	22.21	20.35	18.50	16.06	14.44
2	10.04	08.55	07.24	06.36	04.52	03.19	03.04	04.28	06.01	07.26	07.59	09.31
	14.39	16.08	17.37	20.08	21.39	23.14	23.38	22.17	20.32	18.47	16.03	14.42
3	10.02	08.52	07.21	06.33	04.49	03.17	03.05	04.31	06.04	07.29	08.02	09.34
	14.41	16.12	17.40	20.11	21.42	23.16	23.36	22.14	20.28	18.43	15.59	14.40
4	10.01	08.49	07.17	06.29	04.46	03.15	03.07	04.34	06.07	07.32	08.05	09.36
	14.43	16.15	17.43	20.14	21.45	23.19	23.35	22.11	20.25	18.40	15.56	14.38
5	10.00	08.46	07.14	06.26	04.42	03.12	03.09	04.37	06.10	07.35	08.08	09.39
	14.46	16.18	17.46	20.17	21.48	23.21	23.33	22.08	20.21	18.36	15.53	14.37
6	09.59	08.43	07.10	06.22	04.39	03.10	03.11	04.40	06.13	07.37	08.11	09.41
	14.48	16.21	17.49	20.20	21.52	23.24	23.31	22.04	20.18	18.33	15.50	14.35
7	09.57	08.40	07.07	06.19	04.36	03.08	03.14	04.43	06.15	07.40	08.15	09.43
	14.50	16.25	17.52	20.23	21.55	23.26	23.29	22.01	20.14	18.29	15.47	14.33
8	09.56	08.37	07.04	06.15	04.33	03.06	03.16	04.46	06.18	07.43	08.18	09.46
	14.53	16.28	17.55	20.26	21.58	23.28	23.27	21.58	20.11	18.26	15.44	14.32
9	09.54	08.33	07.00	06.12	04.29	03.05	03.18	04.50	06.21	07.46	08.21	09.48
	14.55	16.31	17.58	20.29	22.01	23.30	23.25	21.54	20.07	18.23	15.41	14.31
10	09.52	08.30	06.57	06.08	04.26	03.03	03.21	04.53	06.24	07.49	08.24	09.50
	14.58	16.34	18.01	20.32	22.04	23.32	23.23	21.51	20.04	18.19	15.38	14.30
11	09.51	08.27	06.53	06.05	04.23	03.01	03.23	04.56	06.27	07.52	08.27	09.52
	15.00	16.38	18.04	20.35	22.07	23.34	23.21	21.48	20.00	18.16	15.35	14.29
12	09.49	08.24	06.50	06.01	04.20	03.00	03.26	04.59	06.30	07.55	08.30	09.54
	15.03	16.41	18.07	20.38	22.11	23.36	23.18	21.44	19.57	18.12	15.32	14.28
13	09.47	08.21	06.46	05.58	04.16	02.58	03.28	05.02	06.32	07.58	08.34	09.56
	15.06	16.44	18.10	20.41	22.14	23.37	23.16	21.41	19.53	18.09	15.29	14.27
14	09.45	08.18	06.43	05.54	04.13	02.57	03.31	05.05	06.35	08.01	08.37	09.57
	15.09	16.47	18.13	20.44	22.17	23.39	23.13	21.38	19.50	18.05	15.26	14.26
15	09.42	08.14	06.39	05.51	04.10	02.56	03.34	05.08	06.38	08.04	08.40	09.59
	15.12	16.50	18.16	20.47	22.20	23.40	23.11	21.34	19.46	18.02	15.23	14.26
16	09.40	08.11	06.36	05.47	04.07	02.55	03.37	05.11	06.41	08.07	08.43	10.00
	15.15	16.54	18.19	20.50	22.23	23.41	23.08	21.31	19.43	17.59	15.20	14.25
17	09.38	08.08	06.32	05.44	04.04	02.54	03.39	05.14	06.44	08.10	08.46	10.02
	15.18	16.57	18.22	20.53	22.26	23.42	23.06	21.27	19.39	17.55	15.18	14.25
18	09.36	08.04	06.29	05.40	04.01	02.54	03.42	05.17	06.46	08.13	08.49	10.03
	15.21	17.00	18.25	20.56	22.30	23.43	23.03	21.24	19.36	17.52	15.15	14.25
19	09.33	08.01	06.25	05.37	03.58	02.54	03.45	05.20	06.49	08.16	08.53	10.04
	15.24	17.03	18.27	20.59	22.33	23.44	23.00	21.21	19.32	17.48	15.12	14.25
20	09.31	07.58	06.22	05.33	03.55	02.54	03.48	05.23	06.52	08.19	08.56	10.05
	15.27	17.06	18.30	21.02	22.36	23.44	22.57	21.17	19.29	17.45	15.09	14.25
21	09.28	07.55	06.18	05.30	03.52	02.54	03.51	05.26	06.55	08.22	08.59	10.05
	15.30	17.09	18.33	21.05	22.39	23.44	22.54	21.14	19.25	17.42	15.07	14.25
22	09.26	07.51	06.15	05.27	03.49	02.54	03.54	05.29	06.58	08.25	09.02	10.06
	15.33	17.12	18.36	21.08	22.42	23.45	22.51	21.10	19.22	17.38	15.04	14.25
23	09.23	07.48	06.11	05.23	03.46	02.55	03.57	05.32	07.01	08.28	09.05	10.06
	15.36	17.16	18.39	21.11	22.45	23.45	22.48	21.07	19.18	17.35	15.02	14.26
24	09.21	07.44	06.08	05.20	03.43	02.55	04.00	05.35	07.03	08.31	09.08	10.07
	15.39	17.19	18.42	21.14	22.48	23.45	22.45	21.03	19.15	17.32	14.59	14.27
25	09.18	07.41	06.04	05.16	03.40	02.56	04.03	05.38	07.06	07.34	09.11	10.07
	15.42	17.22	18.45	21.17	22.51	23.44	22.42	21.00	19.11	16.28	14.57	14.27
26	09.15	07.38	06.01	05.13	03.37	02.57	04.06	05.41	07.09	07.37	09.14	10.07
	15.46	17.25	18.48	21.20	22.54	23.44	22.39	20.56	19.08	16.25	14.55	14.28
27	09.12	07.34	05.57	05.09	03.34	02.58	04.09	05.44	07.12	07.40	09.17	10.07
	15.49	17.28	18.51	21.23	22.57	23.43	22.36	20.53	19.04	16.22	14.52	14.30
28	09.10	07.31	05.54	05.06	03.32	02.59	04.12	05.47	07.15	07.43	09.20	10.07
	15.52	17.31	18.54	21.27	23.00	23.42	22.33	20.49	19.01	16.19	14.50	14.31
29	09.07		06.50	05.03	03.29	03.00	04.15	05.49	07.18	07.46	09.23	10.06
	15.55		19.57	21.30	23.03	23.41	22.30	20.46	18.57	16.15	14.48	14.32
30	09.04		06.47	04.59	03.26	03.00	04.19	05.52	07.20	07.49	09.26	10.06
	15.59		20.00	21.33	23.06	23.40	22.27	20.42	18.54	16.12	14.46	14.34
31	09.01		06.43		03.24		04.22	05.55		07.52		10.05
	16.02		20.02		23.08		22.24	20.39		16.09		14.35
Potential sun hours	175	239	363	450	566	617	603	506	393	306	201	142
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: Kokkopetaikkö\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset Shadow receptor: G - Shadow Receptor: 1,0 x 1,0 Azimuth: 0,0° Slope: 90,0° (15)

## Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
0,81 2,25 4,39 5,97 8,13 8,13 8,42 6,71 4,10 1,90 0,67 0,32

## Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
562 429 310 341 481 794 926 1 041 1 071 878 734 582 8 149

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.05	08.58	07.28	06.40	04.56	03.21	03.02	04.25	05.58	07.23	07.56	09.28
	14.37	16.05	17.34	20.05	21.36	23.11	23.39	22.21	20.35	18.50	16.06	14.44
2	10.04	08.55	07.24	06.36	04.52	03.19	03.03	04.28	06.01	07.26	07.59	09.31
	14.39	16.08	17.37	20.08	21.39	23.14	23.38	22.17	20.32	18.47	16.02	14.42
3	10.03	08.52	07.21	06.33	04.49	03.17	03.05	04.31	06.04	07.29	08.02	09.34
	14.41	16.12	17.40	20.11	21.42	23.16	23.36	22.14	20.28	18.43	15.59	14.40
4	10.01	08.49	07.17	06.29	04.46	03.14	03.07	04.34	06.07	07.32	08.05	09.36
	14.43	16.15	17.43	20.14	21.45	23.19	23.35	22.11	20.25	18.40	15.56	14.38
5	10.00	08.46	07.14	06.26	04.42	03.12	03.09	04.37	06.10	07.35	08.08	09.39
	14.45	16.18	17.46	20.17	21.49	23.21	23.33	22.08	20.21	18.36	15.53	14.36
6	09.59	08.43	07.10	06.22	04.39	03.10	03.11	04.40	06.12	07.37	08.11	09.41
	14.48	16.21	17.49	20.20	21.52	23.24	23.31	22.04	20.18	18.33	15.50	14.35
7	09.57	08.40	07.07	06.19	04.36	03.08	03.13	04.43	06.15	07.40	08.15	09.44
	14.50	16.25	17.52	20.23	21.55	23.26	23.29	22.01	20.14	18.29	15.47	14.33
8	09.56	08.37	07.04	06.15	04.32	03.06	03.16	04.46	06.18	07.43	08.18	09.46
	14.52	16.28	17.55	20.26	21.58	23.28	23.27	21.58	20.11	18.26	15.44	14.32
9	09.54	08.34	07.00	06.12	04.29	03.04	03.18	04.49	06.21	07.46	08.21	09.48
	14.55	16.31	17.58	20.29	22.01	23.30	23.25	21.54	20.07	18.22	15.41	14.31
10	09.52	08.30	06.57	06.08	04.26	03.03	03.20	04.53	06.24	07.49	08.24	09.50
	14.58	16.34	18.01	20.32	22.04	23.32	23.23	21.51	20.04	18.19	15.38	14.29
11	09.51	08.27	06.53	06.05	04.23	03.01	03.23	04.56	06.27	07.52	08.27	09.52
	15.00	16.38	18.04	20.35	22.08	23.34	23.21	21.48	20.00	18.16	15.35	14.28
12	09.49	08.24	06.50	06.01	04.19	03.00	03.26	04.59	06.30	07.55	08.30	09.54
	15.03	16.41	18.07	20.38	22.11	23.36	23.18	21.44	19.57	18.12	15.32	14.27
13	09.47	08.21	06.46	05.58	04.16	02.57	03.28	05.02	06.32	07.58	08.34	09.56
	15.06	16.44	18.10	20.41	22.14	23.37	23.16	21.41	19.53	18.09	15.29	14.27
14	09.45	08.18	06.43	05.54	04.13	02.56	03.31	05.05	06.35	08.01	08.37	09.57
	15.09	16.47	18.13	20.44	22.17	23.39	23.13	21.38	19.50	18.05	15.26	14.26
15	09.43	08.14	06.39	05.51	04.10	02.56	03.34	05.08	06.38	08.04	08.40	09.59
	15.12	16.50	18.16	20.47	22.20	23.40	23.11	21.34	19.46	18.02	15.23	14.25
16	09.40	08.11	06.36	05.47	04.07	02.55	03.36	05.11	06.41	08.07	08.43	10.00
	15.14	16.54	18.19	20.50	22.23	23.41	23.08	21.31	19.43	17.59	15.20	14.25
17	09.38	08.08	06.32	05.44	04.04	02.54	03.39	05.14	06.44	08.10	08.46	10.02
	15.17	16.57	18.22	20.53	22.27	23.42	23.06	21.27	19.39	17.55	15.17	14.25
18	09.36	08.04	06.29	05.40	04.01	02.54	03.42	05.17	06.46	08.13	08.50	10.03
	15.20	17.00	18.25	20.56	22.30	23.43	23.03	21.24	19.36	17.52	15.15	14.24
19	09.33	08.01	06.25	05.37	03.57	02.54	03.45	05.20	06.49	08.16	08.53	10.04
	15.23	17.03	18.27	20.59	22.33	23.44	23.00	21.21	19.32	17.48	15.12	14.24
20	09.31	07.58	06.22	05.33	03.54	02.54	03.48	05.23	06.52	08.19	08.56	10.05
	15.27	17.06	18.30	21.02	22.36	23.44	22.57	21.17	19.29	17.45	15.09	14.25
21	09.28	07.55	06.18	05.30	03.51	02.54	03.51	05.26	06.55	08.22	08.59	10.05
	15.30	17.09	18.33	21.05	22.39	23.45	22.54	21.14	19.25	17.42	15.07	14.25
22	09.26	07.51	06.15	05.26	03.48	02.54	03.54	05.29	06.58	08.25	09.02	10.06
	15.33	17.12	18.36	21.08	22.42	23.45	22.51	21.10	19.22	17.38	15.04	14.25
23	09.23	07.48	06.11	05.23	03.46	02.54	03.57	05.32	07.01	08.28	09.05	10.07
	15.36	17.15	18.39	21.11	22.45	23.45	22.49	21.07	19.18	17.35	15.02	14.26
24	09.21	07.44	06.08	05.20	03.43	02.55	04.00	05.35	07.03	08.31	09.08	10.07
	15.39	17.19	18.42	21.14	22.48	23.45	22.46	21.03	19.15	17.32	14.59	14.26
25	09.18	07.41	06.04	05.16	03.40	02.56	04.03	05.38	07.06	07.34	09.11	10.07
	15.42	17.22	18.45	21.17	22.51	23.44	22.43	21.00	19.11	16.28	14.57	14.27
26	09.15	07.38	06.01	05.13	03.37	02.57	04.06	05.41	07.09	07.37	09.14	10.07
	15.46	17.25	18.48	21.20	22.54	23.44	22.40	20.56	19.08	16.25	14.54	14.28
27	09.12	07.34	05.57	05.09	03.34	02.58	04.09	05.44	07.12	07.40	09.17	10.07
	15.49	17.28	18.51	21.23	22.57	23.43	22.36	20.53	19.04	16.22	14.52	14.29
28	09.10	07.31	05.54	05.06	03.32	02.59	04.12	05.47	07.15	07.43	09.20	10.07
	15.52	17.31	18.54	21.27	23.00	23.43	22.33	20.49	19.01	16.19	14.50	14.31
29	09.07		06.50	05.03	03.29	03.00	04.15	05.49	07.17	07.46	09.23	10.07
	15.55		19.57	21.30	23.03	23.42	22.30	20.46	18.57	16.15	14.48	14.32
30	09.04		06.47	04.59	03.26	03.00	04.18	05.52	07.20	07.49	09.26	10.06
	15.59		20.00	21.33	23.06	23.41	22.27	20.42	18.54	16.12	14.46	14.33
31	09.01		06.43		03.24		04.22	05.55		07.52		10.05
	16.02		20.02		23.08		22.24	20.39		16.09		14.35
Potential sun hours	175	239	363	450	566	617	603	506	393	306	201	142
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

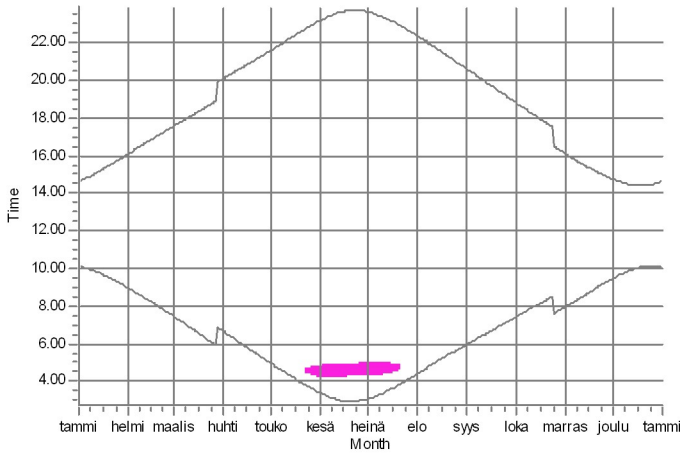
Day in month	Sun rise (hh:mm)	Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)
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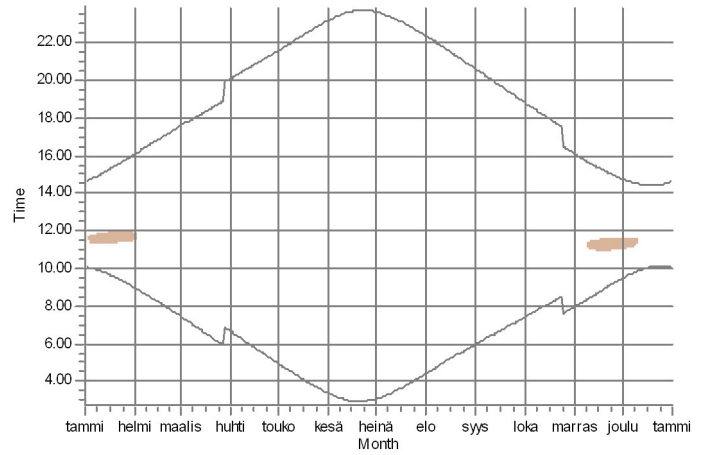
## SHADOW - Calendar, graphical

Calculation: Kokkopetaikkö\_VE2\_Välkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset

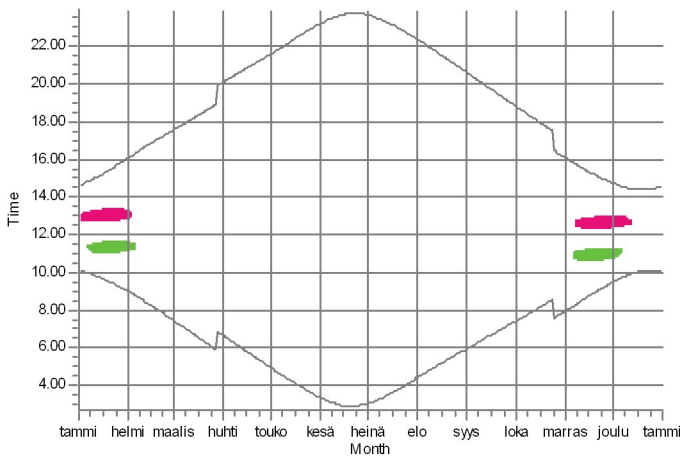
A: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (13)



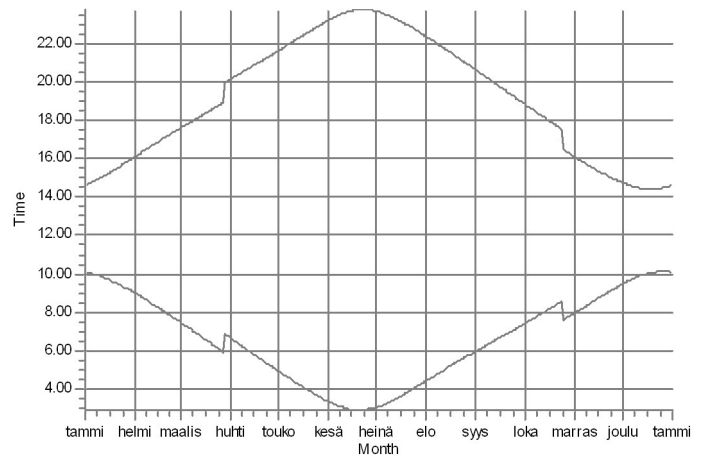
B: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (12)



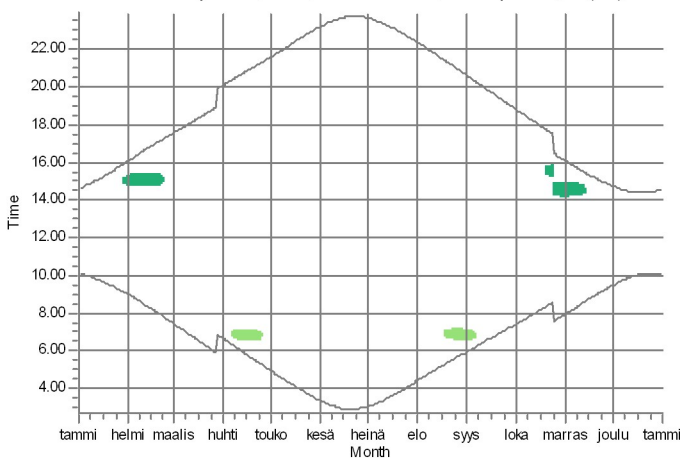
C: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (17)



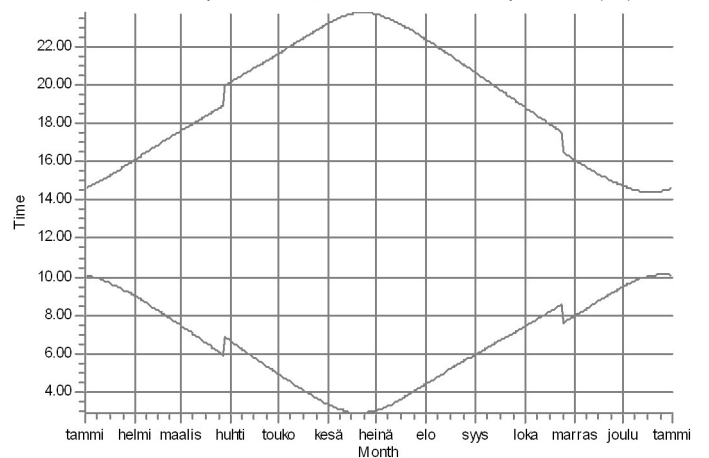
D: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (18)



E: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (19)



F: Shadow Receptor: 1,0 × 1,0 Azimuth: 0,0° Slope: 90,0° (14)



WGS

1\_M,2: Siemens Gamesa SG 6.0-170 6200 200.0 kV hub, 180.0 m (TOT: 280.0 m) (40)

2\_VE2: VESTAS V162-7.2 2200 240.0 kV hub, 200.0 m (TOT: 320.0 m) (141)

6\_VE2: VESTAS V162-7.2 2200 240.0 kV hub, 200.0 m (TOT: 320.0 m) (151)

6\_R,43: VESTAS V162-7.2 2200 200.0 kV hub, 200.0 m (TOT: 300.0 m) (132)

4\_VE2: VESTAS V162-7.2 2200 240.0 kV hub, 200.0 m (TOT: 320.0 m) (150)

3\_VE2: VESTAS V162-7.2 2200 240.0 kV hub, 200.0 m (TOT: 320.0 m) (152)

## SHADOW - Calendar, graphical

Calculation: Kokkopetaikkö\_VE2\_Valkemallinnus\_ilman puustoa\_11.01.2022\_yhteisvaikutukset

