Pajukoski II tuulivoimahanke

MELU- JA VARJOSTUSMALLINNUSRAPORTTI

OX2 Finland Oy & TM Voima

P23612

Sisällys

Pajukoski II tuulivoimahanke

1 TAUSTAA

Pajukoski II tuulivoimahankkeen hankeomistaja OX2 suunnittelee tuulivoimapuiston rakentamista Ylivieskaan. Vaihtoehdossa 1 (VE1) on 18 voimalaa, vaihtoehdossa 2 (VE2) voimaloita on 9 ja vaihtoehdossa 3 (VE3) voimaloita on 9 kappaletta.

Tuulivoimaloiden aiheuttamia meluvaikutuksia on arvioitu WindPRO-ohjelman DECIBEL-moduulilla. Tuulivoimaloiden aiheuttamat varjostusvaikutukset on mallinnettu WindPro-ohjelman SHADOW-moduulilla voimalapaikkojen sijoitusten mukaisesti. Melu- ja varjostusmallinnukset on laatinut Henna-Riikka Rintamäki ja laaduntarkastuksen on tehnyt Johanna Harju FCG Finnish Consulting Group Oy:stä.

2 LÄHTÖTIEDOT JA MENETELMÄT

2.1 Melu

2.1.1 Melumallinnus ISO 9613-2

Tuulivoimaloiden aiheuttamat äänenpainetasot on mallinnettu WindPRO-laskentaohjelman Decibel-moduulilla ISO 9613-2 standardin mukaisesti. Ympäristöhallinnon tuulivoimaloiden melun mallintamista koskevan ohjeen 2/2014 mukaisesti tuulen nopeutena käytettiin 10 m korkeudella mitattuna 8 m/s, ilman lämpötilana 15 °C, ilmanpaineena 101,325 kPa, ilman suhteellisena kosteutena 70 % ja maanpinnan kovuutena arvoa 0,4 maa-alueilla ja vesialueilla 0,0. Laskenta on tehty 4,0 m korkeudelle maanpinnan tasosta. Laskenta-asetukset esitetään taulukossa 5.

Tuulivoimaloiden ympäristöön tuottamat äänenpainetasot on mallinnettu käyttäen 6,1 MW:n voimalatyyppiä GE158-6.1MW (General Electric). Voimalatyypin roottorin halkaisija (RD) on 158 m, voimalan napakorkeus (HH) 221 m ja kokonaiskorkeus 300 metriä. Voimalatyypin melun lähtöarvona käytetty äänitehotaso L_{wA} on 107,0 dB. Mallinnuksessa äänitehotaso on 107,0 dB + 2,0 dB = 109,0 dB. Voimalavalmistajan asiakirjan tietoihin lisättiin 2,0 dB:n varmuusarvo, että saadaan äänitehotaso vastaamaan takuuarvoa.

Mallinnuksissa on huomioitu hankkeen läheisyydessä sijaitseva 9 voimalaitoksen hanke Pajukoski I. Pajukoski I:n voimaloiden V126-3.3MW tiedot esitetään tarkemmin taulukoissa 2 ja 6.

Melumallinnusten laskentatuloksia on havainnollistettu ns. keskiäänitasokarttojen avulla. Keskiäänitasokartoissa on esitetty melun keskiäänitaso- eli ekvivalenttiäänitasokäyrät (LAeq) 5 dB välein.

Taulukko 1. Pajukoski II tuulivoimahankkeen mallinnusohjelma ja tuulivoimaloiden äänitehotasot sekä melun erityispiirteet.

MALLINNUSOHJELMAN TIEDOT					
Mallinnusohjelma ja versio: WindPRO, (versio ks. WindPRO-raportti)				Mallinnusmenetelmä: ISO 9613-2	
TUULIVOIMALAN (TUULIVOIMALOIDEN TIEDOT)					
Tuulivoimalan valmistaja: General Electric				Tyyppi: GE158-6.1MW	Sarjanumero/t:-
Nimellisteho: 6,1 MW		Napakorkeus: 221 m		Roottorin halkaisija: 158 m	Tornin tyyppi: teräs/hybridi
Mahdollisuudet vaikuttaa tuulivoimalan melupäästöön käytön aikana ja sen vaikutus meluun					
Lapakulman säätö		Pyörimisnopeus		Muu, mikä	
Kyllä	- dB	Kyllä	- dB	Noise mode säätö:	Kyllä
~~Ei~~		~~Ei~~		Noise mode, äänitehotaso	

AKUSTISET TIEDOT/LASKENNAN LÄHTÖTIEDOT
Valmistajan tiedot asiakirjasta Noise_Emission-NRO_4,x_5,x_6,x-158-50Hz_EN_r0. Asiakirjan päivämäärä: 2021-08-10. Taulukossa esitetään melupäästö varmuusarvoineen (+ 2 dB). Lähtömelutaso varmuusarvoineen on yhteensä 109 dB.

Oktaaveittain [Hz], L_{WA} [dB]		1/3-oktaaveittain [Hz], L_{WA} [dB]					
		20	70,8	200	95,0	1600	97,5
63	92,2	25	75,2	250	96,3	2000	95,5
125	96,9	31,5	79,1	315	96,9	2500	92,9
250	100,9	40	82,4	400	97,7	3150	88,9
500	103,1	50	85,2	500	98,3	4000	84,8
1000	104,4	63	87,4	630	99,0	5000	78,3
2000	100,5	80	89,0	800	99,6	6300	68,7
4000	90,6	100	90,5	1000	100,2	8000	56,1
8000	69,2	125	91,9	1250	98,9	10000	57,1
$L_{WA,tot}$ = 107,0 + 2,0 dB		160	93,5				

Melun erityispiirteiden mittaus ja havainnot:							
Kapeakaistaisuus / Tonaalisuus		Impulssimaisuus		Merkityksellinen sykintä (amplitudimodulaatio)		Muu, Mikä:	
~~kyllä~~	ei	~~kyllä~~	ei	~~kyllä~~	ei	~~kyllä~~	ei

Taulukko 2. Läheisen Pajukoski I hankkeen voimaloiden äänitehotasot sekä melun erityispiirteet.

MALLINNUSOHJELMAN TIEDOT					
Mallinnusohjelma ja versio: WindPRO, (versio ks. WindPRO-raportti)				Mallinnusmenetelmä: ISO 9613-2	
TUULIVOIMALAN (TUULIVOIMALOIDEN TIEDOT)					
Tuulivoimalan valmistaja: Vestas				Tyyppi: V126	Sarjanumero/t:-
Nimellisteho: 3,3 MW		Napakorkeus: 137 m		Roottorin halkaisija: 126 m	Tornin tyyppi: teräs/hybridi
Mahdollisuudet vaikuttaa tuulivoimalan melupäästöön käytön aikana ja sen vaikutus meluun					
Lapakulman säätö		Pyörimisnopeus		Muu, mikä	
Kyllä	- dB	Kyllä	- dB	Noise mode säätö:	Kyllä
~~Ei~~		~~Ei~~		Noise mode, äänitehotaso	

AKUSTISET TIEDOT/LASKENNAN LÄHTÖTIEDOT							
Valmistajan tiedot asiakirjasta no. 0042-9192_V00 - V126-3 3MW Turbine Octaves HH 137m, According to General Specification 0034-7616.V08 V126-3.3 MW 50/60 Hz. asiakirjan päivämäärä: 2014-02-11							
Oktaaveittain [Hz], L_{WA} [dB]		1/3-oktaaveittain [Hz], L_{WA} [dB]					
		20	63,4	200	89,6	1600	94,4
63	87,9	25	70,6	250	90,9	2000	93,7
125	94,1	31,5	70,6	315	92,0	2500	91,4
250	95,7	40	74,6	400	92,4	3150	88,3
500	99,2	50	79,7	500	93,7	4000	87,2
1000	101,8	63	83,1	630	96,3	5000	80,3
2000	98,1	80	85,0	800	96,8	6300	76,2
4000	91,2	100	87,4	1000	97,3	8000	73,9
8000	90,3	125	91,0	1250	96,9	10000	-
$L_{WA,tot}$ = 105,9		160	88,8				
Melun erityispiirteiden mittaus ja havainnot:							

Kapeakaistaisuus / Tonaalisuus		Impulssimaisuus		Merkityksellinen sykintä (amplitudimodulaatio)		Muu, Mikä:	
~~kyllä~~	ei	~~kyllä~~	ei	~~kyllä~~	ei	~~kyllä~~	ei

Taulukko 3. Käytetyt laskenta-asetukset ISO 9613-2 -mallinnuksissa.

AKUSTISET TIEDOT/LASKENNAN LÄHTÖTIEDOT			
Laskentakorkeus		Laskentaruudun koko [m·m]	
ISO 9613-2: 4,0 m		50x50 m	
Suhteellinen kosteus		Lämpötila	
70 %	Muu, mikä ja miksi:	ISO 9613-2: 15 C°	
Maastomallin lähde ja tarkkuus			
Maastomallin lähde: MML maastotietokanta		Vaakaresoluutio: 1,0	Pystyresoluutio: 0,5
Maan- ja vedenpinnan absorption ja heijastuksen huomioiminen, käytetyt kertoimet			
ISO 9613-2	maanpinta 0,4	vesialueet 0,0	HUOM
Ilmakehän stabiilius laskennassa/meteorologinen korjaus			
Neutraali, (0): Neutraali		Muu, mikä ja miksi:	
Sääolosuhteiden huomiointi; laskennassa käytetty tuulen suunnat ja nopeus			
Tuulen suunta: 0-360°		Tuulen nopeus: 10 metrin korkeudella mitattuna 8 m/s	
Voimalan äänen suuntaavuus ja vaimentuminen			
Vapaa avaruus: kyllä		Muu, mikä, miksi:	

2.1.2 Matalataajuinen melu

Matala- eli pienitaajuinen melu laskettiin Ympäristöministeriön ohjeen 2/2014 mukaisin menetelmin käyttäen kullekin voimalatyypille voimalavalmistajan asiakirjan äänitehotasoja.

Ohje 2/2014 antaa menetelmän matalataajuisen melun laskentaan rakennusten ulkopuolelle. Sosiaali- ja terveysministeriön Asumisterveysasetus 2015 antaa matalataajuiselle melulle toimenpiderajat asuinhuoneissa. Rakennusten sisälle kantautuva äänitaso arvioitiin Turun AMK:n (Keränen, Hongisto ja Hakala, 2019) julkistamien Anojanssi-projektin tuottamien tulosten mukaisin ääneneristävyysarvoin ja tuloksia verrattiin toimenpiderajoihin.

Taulukko 4. Suomalaisen pientalon julkisivun äänitasoeron alalikiarvo Anojanssi-projektin tulosten mukaisesti.

f [Hz]	20	25	31.5	40	50	63	80	100	125	160	200
>DLσ [dB]	7.6	8.3	9.2	10.3	11.5	13.0	14.8	16.8	18.8	21.1	22.8

Matalataajuinen melu laskettiin ohjeen YM 2/2014 mukaisesti. Laskennan lähtökohta on standardi ISO 9613-2, jossa huomioidaan äänen geometrinen etäisyysvaimennus sekä maanpinnan ja ilmakehän absorption aiheuttamat vakioidut vahvistukset ja vaimennukset.

Tulokset esitetään taajuuskohtaisena taulukkona hankealueen lähistöltä valituille asuin- ja lomarakennuksille.

2.2 Varjostusmallinnus

Tuulivoimaloiden varjostusvaikutuksia mallinnettiin WindPRO-ohjelman Shadow-moduulilla. Varjostusmallinnuksissa käytetyt voimalatiedot esitetään taulukoissa 7 ja 8.

Taulukko 5. Pajukoski II hankkeen mallinnusohjelma ja tuulivoimaloiden koko varjostusmallinnuksissa.

MALLINNUSOHJELMAN TIEDOT			
Mallinnusohjelma ja versio: WindPRO, (versio ks. WindPRO-raportti)			
TUULIVOIMALAN (TUULIVOIMALOIDEN TIEDOT)			
Tuulivoimalan valmistaja: Generic		Tyyppi: RD200	Sarjanumero/t:-
Nimellisteho: 6,1 MW	Napakorkeus: 200 m	Roottorin halkaisija: 200 m	Tornin tyyppi: teräs/hybridi

Taulukko 6. Pajukoski I -hankkeen mallinnusohjelma ja tuulivoimaloiden koko varjostusmallinnuksissa.

MALLINNUSOHJELMAN TIEDOT			
Mallinnusohjelma ja versio: WindPRO, (versio ks. WindPRO-raportti)			
TUULIVOIMALAN (TUULIVOIMALOIDEN TIEDOT)			
Tuulivoimalan valmistaja: Vestas		Tyyppi: V126-3,3MW	Sarjanumero/t:-
Nimellisteho: 3,3 MW	Napakorkeus: 137 m	Roottorin halkaisija: 126 m	Tornin tyyppi: teräs/hybridi

Pajukoski II tuulivoimaloiden varjostusvaikutukset on mallinnettu käyttäen roottorinhalkaisijaltaan 200 metristä voimalaitosta 200 metriä korkealla tornilla. Kokonaiskorkeudeltaan voimala on mallinnuksissa 300 metriä. Yhteisvaikutuksia mallinnettiin tuotannossa olevan Pajukoski I tuulivoimapuiston voimalalla Vestas V126-3.3MW napakorkeudella 137 metriä. Pajukoski I voimaloiden kokonaiskorkeus on 200 metriä.

Laskennassa varjot huomioidaan, kun aurinko on vähintään 3 astetta horisontin yläpuolella. Varjoksi lasketaan tilanne, jossa siipi peittää vähintään 20 % auringosta. Varjostusmallinnukset tehdään kerättyihin tietoihin perustuvana ”real case” mallinnuksena.

Varjostusmallinnuksessa huomioidaan siiven lavan maksimileveys sekä siiven kärjen leveys 90 % etäisyydellä turbiinista. Mallinnuksessa siiven oletetaan kapenevan lineaarisesti kohti kärjen leveysarvoa. Varjostusmallinnuksessa on käytetty siiven lavan maksimileveytenä 4,71 metriä ja siiven kärjen leveytenä 1,44 metriä.

Varjostusmallin laskennassa on huomioitu hankealueen korkeustiedot, tuulivoimaloiden sijainnit, tuulivoimalan napakorkeudet ja roottorin halkaisija sekä hankealueen aikavyöhyke. Mallinnuksessa otettiin huomioon auringon asema horisontissa eri kellon- ja vuodenaikoina, pilvisyys kuukausittain eli kuinka paljon aurinko paistaa ollessaan horisontin yläpuolella sekä tuulivoimalaitosten arvioitu vuotuinen käyntiaika.

Varjostuksen tarkastelukorkeutena lähialueen asuin- tai lomarakennusten pihapiirissä käytettiin 1,0 metriä ja laskentaikkunan koko oli 5,0 x 5,0 metriä. Laskentaikkunoiden suunnat asennettiin voimaloita kohti ns. ”greenhouse mode”.

Auringon keskimääräiset paistetunnit perustuvat Jokioisen sääaseman mitattuihin säätietoihin 1969-1993. Laskentojen tuulen suunta ja nopeusjakaumana käytettiin NASA:n MERRA-dataa (Modern Era Retrospective-analysis for Research and Applications) hankealueen läheisyydeltä.

Varjostusvaikutukset on mallinnettu kahdessa eri tilanteessa - huomioimalla puuston suojaava vaikutus ja ilman puuston vaikutusta. Mallinnuksessa käytetty puusto on Luonnonvarakeskuksen (Luke) vuoden 2019 aineistosta.

Varjostusmallinnuksen tuloksia on havainnollistettu kartan avulla. Kartalla esitetään varjostusvaikutuksen (1, 8 ja 20 tuntia vuodessa) laajuus. Sen lisäksi mallinnuksessa on erikseen laskettu vaikutus tuulivoimahankealueen ympäristössä oleviin herkkiin kohteisiin.

2.3 Mallinnusten laskentapisteet

Melumallinnuksen ja matalataajuisen melun mallinnuksen laskentapisteet perustuvat Maanmittauslaitoksen Maastotietokannan rakennuskantaa koskeviin tietoihin, joista selviää rakennusten käyttötarkoitus kuten asuin- ja lomarakennukset. Laskentapisteen E osalta tiedot perustuvat asiakkaan Ylivieskan kunnalta saamiin tietoihin, joiden mukaan se on muussa käytössä kuin Ympäristöhallinnon ohjeen 2/2014 mukaan huomioitavana asuin- tai lomarakennuksena.

2.4 Raja- ja ohjearvot

2.4.1 Melu

Valtioneuvoston asetuksessa (1107/2015) tuulivoimaloille on määritelty suunnitteluarvot päivä- ja yöajan keskiäänitasojen maksimiarvolle. Jos tuulivoimalan melu sisältää tonaalisia, kapeakaistaisia tai impulssimaisia komponentteja, tai se on selvästi amplitudimoduloitunutta, mallinnustuloksiin tulee ohjeen mukaan lisätä viisi desibeliä ennen ohjearvoon vertaamista. Koska ohjearvo sisältää jo tyypillisen tuulivoimamelun piirteet, edellä mainitut äänenpiirteiden tulee olla tuulivoimalalle epätyypillisen voimakkaita, jotta mallinnustuloksissa täytyy huomioida viiden desibelin lisä äänitasoon.

Taulukko 7. Valtioneuvoston asetuksen mukaiset tuulivoimaloiden melutason ohjearvot (Valtioneuvoston asetus 27.8.2015).

Vaikutuskohde	Päivä (7-22)	Yö (22-7)
Pysyvä asutus	45 dB	40 dB
Loma-asutus	45 dB	40 dB
Hoitolaitokset	45 dB	40 dB
Oppilaitokset	45 dB	—
Virkistysalueet	45 dB	—
Leirintäalueet	45 dB	40 dB
Kansallispuistot	40 dB	40 dB

Sosiaali- ja terveysministeriön asetuksessa (545/2015) on annettu matalataajuiselle melulle toimenpiderajoja. Toimenpiderajat koskevat asuinhuoneita ja ne on annettu taajuuspainottamattomina yhden tunnin keskiäänitasoina tersseittäin. Toimenpiderajat koskevat yöaikaa ja päivällä sallitaan 5 dB suuremmat arvot.

Taulukko 8. Matalataajuisen sisämelun tunnin keskiäänitason toimenpiderajat nukkumiseen tarkoitetuissa tiloissa.

Terssikaista Hz	20	25	31,5	40	50	63	80	100	125	160	200
Keskiäänitaso LZeq,1h, dB	74	64	56	49	44	42	40	38	36	34	32
Edellisestä laskettu keskiäänitaso A-painotettuna LAeq,1h, dB	24	19	17	14	14	16	18	19	20	21	21

Lisäksi yöaikainen mahdollisesti unihäiriötä aiheuttava melu, joka erottuu selvästi taustamelusta, ei saa ylittää 25 dB yhden tunnin keskiäänitasona $L_{Aeq,1h}$ mitattuna niissä tiloissa, jotka on tarkoitettu nukkumiseen.

2.4.2 Varjostus

Suomessa ei ole viranomaisten antamia yleisiä määräyksiä tuulivoimaloiden muodostaman varjostuksen enimmäiskestoista eikä varjonmuodostuksen arviointiperusteista. Ympäristöministeriön tuulivoimarakentamisen suunnitteluohjeistuksessa esitetään käytettäväksi muiden maiden suosituksia välkkeen rajoittamisesta (Ympäristöministeriö 2012 (1)).

Useissa maissa on annettu raja-arvoja tai suosituksia hyväksyttävän välkevaikutuksen määrästä. Esimerkiksi Ruotsissa suositus on kahdeksan tuntia vuodessa ja 30 minuuttia päivässä.

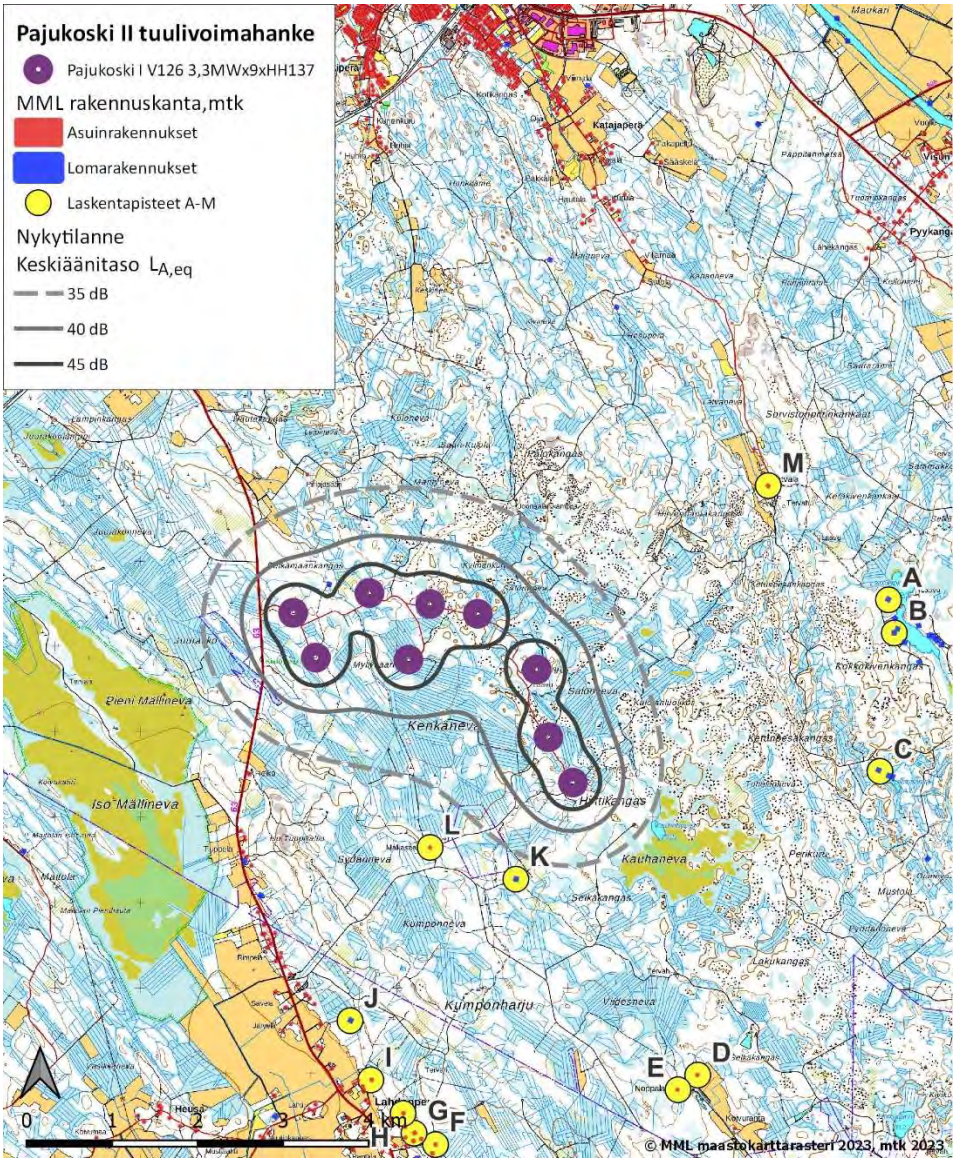
Arvioinnissa on tarkasteltu vaikutuksia alueella, jossa varjoja tai välkettä mallinnuksen mukaisessa todellisessa tilanteessa (”real case”) esiintyy vähintään kahdeksan tuntia vuodessa.

3 MELUMALLINNUSTEN TULOKSET

3.1 Melu

3.1.1 Nykytilanne

Suunnitellun Pajukoski II tuulivoimahankkeen länsipuolella sijaitsee tuotannossa oleva Pajukoski I tuulivoimapuisto. Pajukoski I tuulivoimapuiston aiheuttama melu on esitetty alla olevassa kuvassa (kuva 1) ja mallinnuspisteiden A-M nykytilanteen melutasot taulukossa 9. Mallinnettaessa Pajukoski II tuulivoimahankkeen lähialueen melutasoja Pajukoski I voimalaitostyypillä V126-3,3 MW HH137 melutasot eivät ylitä 40 dB ohjearvoa laskentapisteissä.



Kuva 1. Laskennalliset Pajukoski I tuulivoimatuotannosta aiheutuvat melutasot Pajukoski II tuulivoimahankkeen läheisyydessä nykytilanteessa standardin ISO 9613-2 mukaisesti.

Taulukko 9. Laskennalliset melutasot nykytilanteessa Pajukoski II tuulivoimahankkeen laskentapisteissä voimalaitoksella V126-3,3MW.

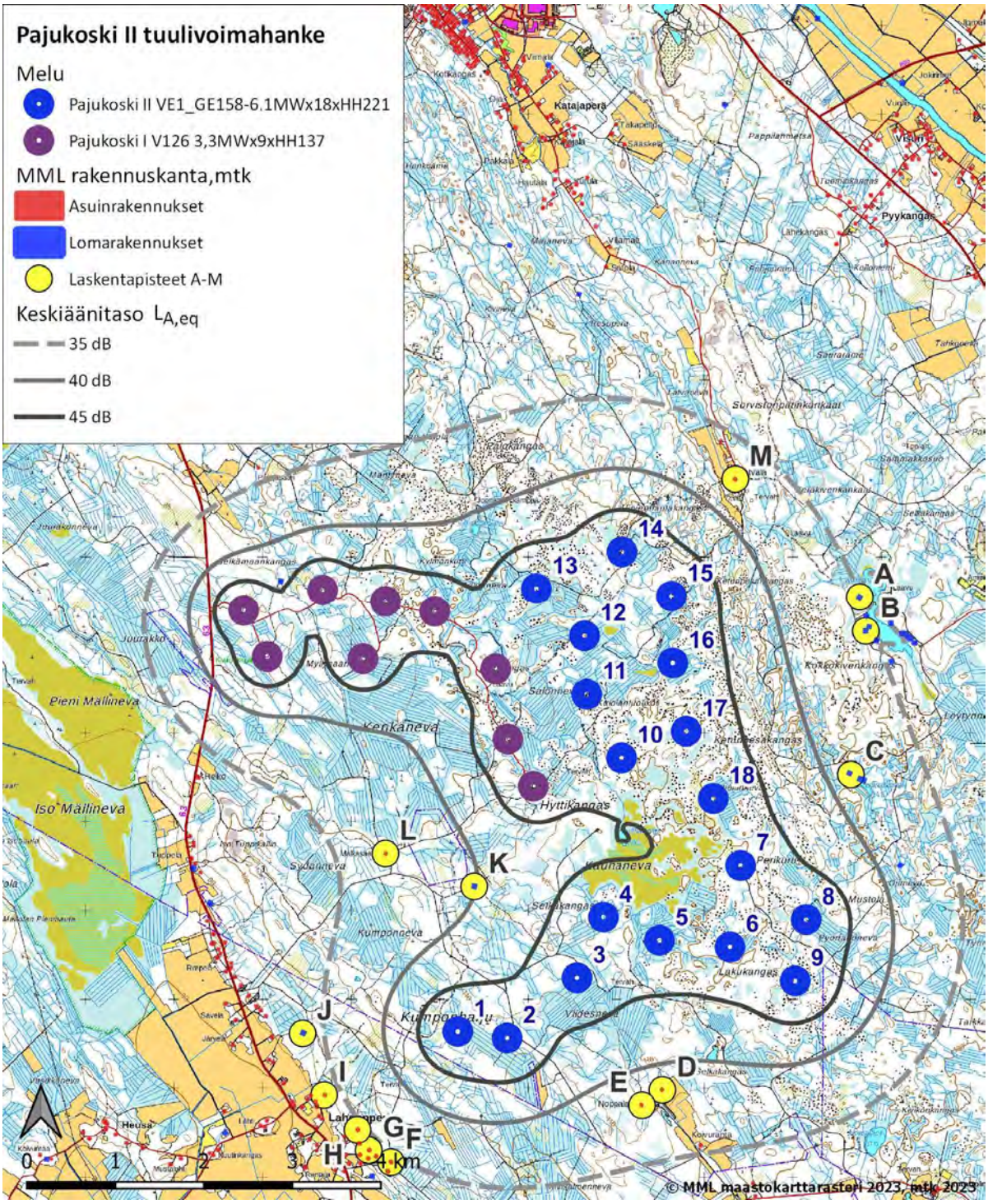
Laskentapiste	Z (korkeus metriä mpy)	Äänitaso ulkona, L_{Aeq} (dB)
A Lomarakennus A (Lampinjärvi)	90,0	23,7
B Lomarakennus B (Lampinkallio)	93,7	23,7
C Lomarakennus C (Latvalampi)	96,0	24,3
D Asuinrakennus D (Noppala)	105,2	23,2
E Muu rakennus E (Noppala)	109,7	23,0
F Asuinrakennus F (Maijannevantie)	96,2	22,4
G Asuinrakennus G (Maijannevantie)	92,9	22,6
H Asuinrakennus H (Hietasaari)	92,5	23,0
I Asuinrakennus I (Lahdenperä)	88,0	23,7
J Lomarakennus J (Junno)	89,4	25,2
K Lomarakennus K (Isomännikkö)	106,1	34,3
L Asuinrakennus L (Malkasaari)	100,9	33,4
M Asuinrakennus M (Latvala)	82,6	25,8

3.1.2 Melun laskentatulokset ISO 9613-2 voimalaitoksella GE158 - 6,1 MW. (107,0 dB + 2,0 dB)

VE1

Vaihtoehdossa 1 mallinnus tehtiin General Electricin voimalaitoksella GE158 - 6,1 MW. Napakorkeutena käytettiin 221 metriä, jolloin kokonaiskorkeus eli lavan pyyhkäisykorkeus oli 300 metriä.

Kuvassa 2 esitetään melumallinnuksen tulokset vaihtoehdossa 1 (VE1). Keskimmäinen harmaa käyrä on 40 dB melualueen raja, joka on myös asumista ja loma-asumista koskeva ohjearvo (1107/2015). Laskentapisteiksi on valittu voimala-alueen lähellä olevia asuin- ja lomarakennuksia. Laskentapisteiden pihapiiriin lasketut äänitasot esitetään taulukossa 10. Tuloksista nähdään, että 40 dB ohjearvo ei ylity laskentapisteissä.



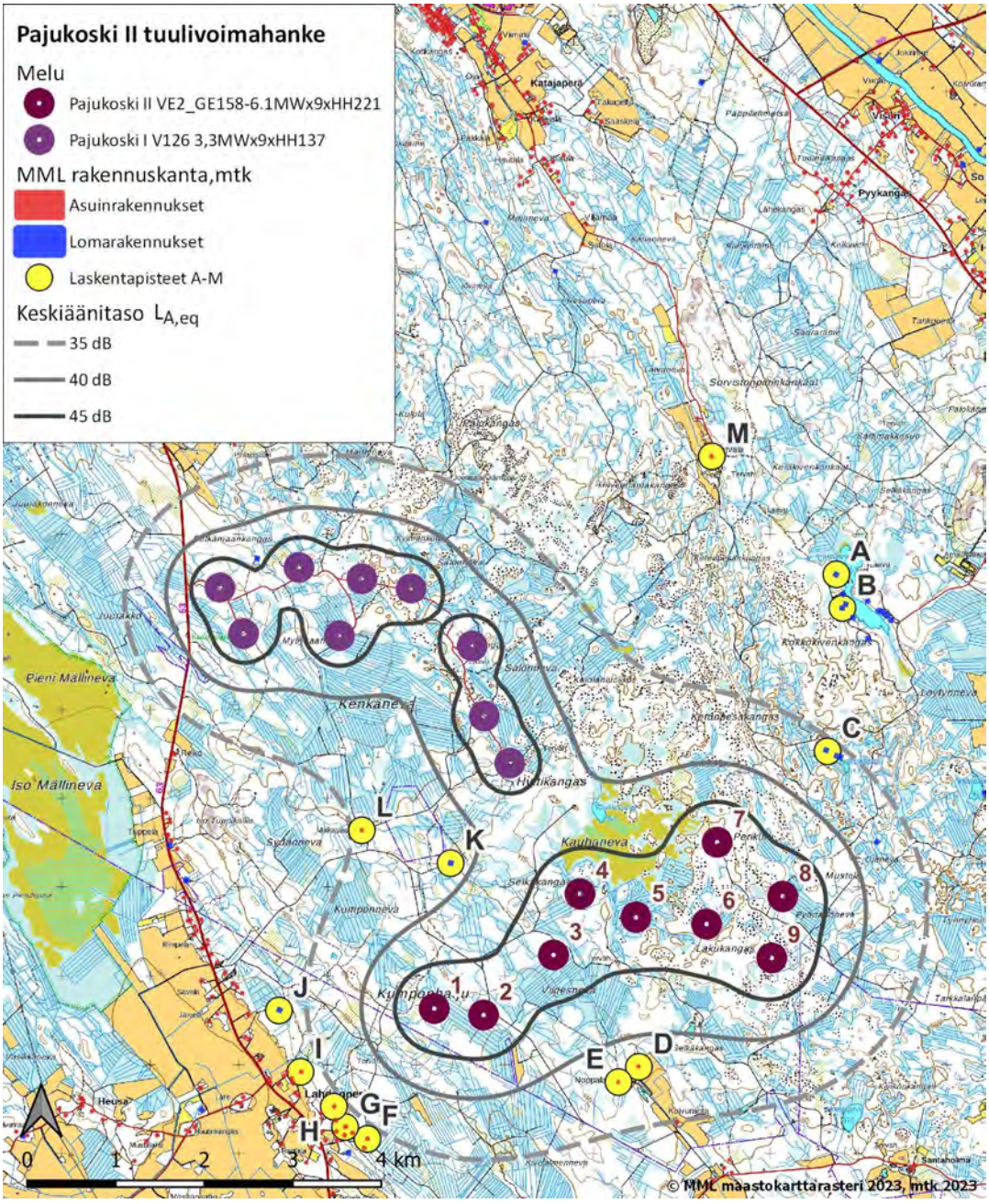
Kuva 2. VE1 melumallinnuksen tulos.

Taulukko 10. VE1 mallinnetut melutasot yhteisvaikutuksin Pajukoski I kanssa.

Laskentapiste	Z (korkeus metriä mpy)	Äänitaso ulkona, L_{Aeq} (dB)
A Lomarakennus A (Lampinjärvi)	90,0	35,0
B Lomarakennus B (Lampinkallio)	93,7	35,4
C Lomarakennus C (Latvalampi)	96,0	38,6
D Asuinrakennus D (Noppala)	105,2	38,5
E Muu rakennus E (Noppala)	109,7	37,9
F Asuinrakennus F (Maijannevantie)	96,2	34,4
G Asuinrakennus G (Maijannevantie)	92,9	34,1
H Asuinrakennus H (Hietasaari)	92,5	34,5
I Asuinrakennus I (Lahdenperä)	88,0	33,9
J Lomarakennus J (Junno)	89,4	33,7
K Lomarakennus K (Isomännikkö)	106,1	39,9
L Asuinrakennus L (Malkasaari)	100,9	36,6
M Asuinrakennus M (Latvala)	82,6	37,2

VE2

Kuvassa 3 esitetään melumallinnuksen tulokset vaihtoehdossa 2. Keskimmäinen harmaa käyrä on 40 dB melualueen raja, joka on myös asumista ja loma-asumista koskeva ohjearvo (1107/2015). Laskentapisteiksi on valittu voimala-alueen lähellä olevia asuin- ja lomarakennuksia. Laskentapisteiden pihapiiriin lasketut äänitasot esitetään taulukossa 11. Kuvasta nähdään, että laskentapisteet sijaitsevat 40 dB käyrän ulkopuolella, joten vaihtoehdossa 2 ei ole ohjearvon ylityksiä.



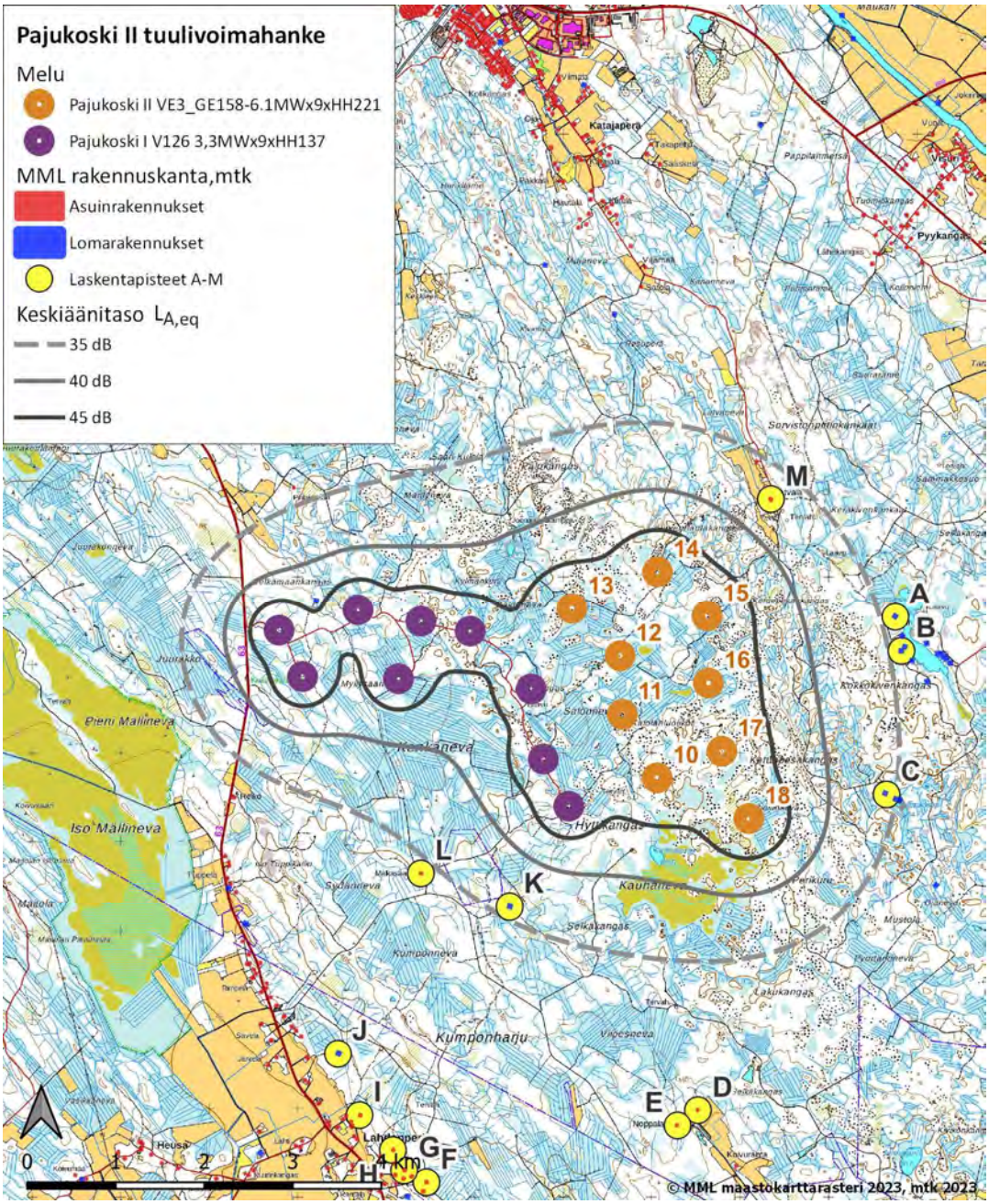
Kuva 3. VE2 melumallinnuksen tulos.

Taulukko 11. VE2 mallinnetut melutasot yhteisvaikutuksin Pajukoski I kanssa.

Laskentapiste	Z (korkeus metriä mpy)	Äänitaso ulkona, L_{Aeq} (dB)
A Lomarakennus A (Lampinjärvi)	90,0	28,6
B Lomarakennus B (Lampinkallio)	93,7	29,5
C Lomarakennus C (Latvalampi)	96,0	35,8
D Asuinrakennus D (Noppala)	105,2	38,2
E Muu rakennus E (Noppala)	109,7	37,6
F Asuinrakennus F (Maijannevantie)	96,2	34,1
G Asuinrakennus G (Maijannevantie)	92,9	33,8
H Asuinrakennus H (Hietasaari)	92,5	34,2
I Asuinrakennus I (Lahdenperä)	88,0	33,5
J Lomarakennus J (Junno)	89,4	33,2
K Lomarakennus K (Isomännikkö)	106,1	39,0
L Asuinrakennus L (Malkasaari)	100,9	35,4
M Asuinrakennus M (Latvala)	82,6	27,4

VE3

Kuvassa 4 esitetään melumallinnuksen tulokset vaihtoehdossa 3. Keskimmäinen harmaa käyrä on 40 dB melualueen raja, joka on myös asumista ja loma-asumista koskeva ohjearvo (1107/2015). Laskentapisteiksi on valittu voimala-alueen lähellä olevia asuin- ja lomarakennuksia. Laskentapisteiden pihapiiriin lasketut äänitasot esitetään taulukossa 12. Kuvasta nähdään, että laskentapisteet sijaitsevat 40 dB käyrän ulkopuolella, joten vaihtoehdossa 3 ei ole ohjearvon ylityksiä.



Kuva 4. VE3 melumallinnuksen tulos.

Taulukko 12. VE3 mallinnetut melutasot yhteisvaikutuksin Pajukoski I kanssa.

Laskentapiste	Z (korkeus metriä mpy)	Äänitaso ulkona, L_{Aeq} (dB)
A Lomarakennus A (Lampinjärvi)	90,0	34,2
B Lomarakennus B (Lampinkallio)	93,7	34,3
C Lomarakennus C (Latvalampi)	96,0	35,6
D Asuinrakennus D (Noppala)	105,2	28,3
E Muu rakennus E (Noppala)	109,7	27,8
F Asuinrakennus F (Maijannevantie)	96,2	25,0
G Asuinrakennus G (Maijannevantie)	92,9	25,0
H Asuinrakennus H (Hietasaari)	92,5	25,4
I Asuinrakennus I (Lahdenperä)	88,0	25,8
J Lomarakennus J (Junno)	89,4	26,9
K Lomarakennus K (Isomännikkö)	106,1	35,7
L Asuinrakennus L (Malkasaari)	100,9	34,3
M Asuinrakennus M (Latvala)	82,6	36,9

3.1.3 Matalataajuiset melutasot nykytilanteessa

Sisätilojen laskennallisia tuloksia on verrattu Sosiaali- ja terveysministeriön (STM) Asumisterveysasetuksessa (545/2015) annettuihin toimenpiderajoihin. Nämä ovat enimmäisarvoja, jotka on laadittu yöaikaiselle melulle nukkumiseen tarkoitettuihin tiloihin.

Sisätilojen laskennalliset tulokset on saatu huomioimalla tutkitut suomalaisen pientalon ulkovaipan ääneneristyksen alalikiarvot (84 % persentiili, Anojanssi 2018). Arvioinnin epävarmuustekijäksi voidaan kuitenkin sanoa se, että yleisellä tasolla rakennusten ääneneristävyydessä on suuria yksilöllisiä eroja matalilla eli pienillä taajuuksilla ja sisällä vallitsevaan äänitasoon vaikuttaa merkittävästi myös huoneen mitat sekä sisustus.

Mallinnettaessa Pajukoski II tuulivoimahankkeen lähialueen matalataajuisia melutasoja Pajukoski I voimalaitostyypillä V126-3,3 MW HH137, on melu rakennusten sisätiloissa lähimpänä toimenpiderajaa 10,0 dB alle toimenpiderajan taajuudella 50 Hz (Lomarakennus K). Tulokset, jotka ovat lähimpänä toimenpiderajaa ovat korostettuna taulukossa 13 taajuuskaistoittain.

Taulukko 13. Matalataajuisen melun laskentatulokset nykytilanteessa Pajukoski II hankkeen laskentapisteissä A-M, mallinnettaessa Pajukoski I voimalaitostyypillä V126-3,3 MW HH137.

Äänitaso kohteessa (dB)											
Terssikaistan taajuus (Hz)	**20**	**25**	**31,5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**
A	36,3	36,7	30,2	28	27,1	24,4	20	15,8	12,6	2,6	-2,0
B	36,3	36,7	30,2	28	27,1	24,4	20	15,8	12,6	2,7	-1,9
C	36,6	37	30,5	28,3	27,4	24,7	20,3	16,2	13,0	3,1	-1,5
D	35,8	36,2	29,7	27,5	26,6	23,9	19,5	15,3	12,0	2,1	-2,6
E	35,7	36,1	29,6	27,4	26,5	23,8	19,4	15,2	11,9	1,9	-2,8
F	35,4	35,7	29,3	27,1	26,2	23,4	19,0	14,8	11,4	1,4	-3,4
G	35,5	35,9	29,5	27,2	26,3	23,6	19,1	14,9	11,6	1,6	-3,2
H	35,8	36,2	29,8	27,6	26,7	24,0	19,5	15,3	12,0	2,0	-2,7
I	36,4	36,8	30,3	28,1	27,2	24,5	20,1	15,9	12,6	2,7	-2,0
J	37,4	37,8	31,4	29,2	28,3	25,6	21,2	17,1	13,9	4,1	-0,4
K	*43,0*	*43,4*	*37,0*	*34,8*	**34,0**	*31,4*	*27,1*	*23,2*	*20,3*	*10,9*	*7,0*
L	42,8	43,3	36,8	34,7	33,8	31,3	26,9	23,0	20,1	10,7	6,7
M	37,8	38,2	31,7	29,6	28,7	26,0	21,6	17,5	14,4	4,6	0,1
Toimenpideraja $L_{Zeq,1h}$ (dB)	74	64	56	49	44	42	40	38	36	34	32

Taulukko 14. Matalataajuisen melu rakennusten ulkopuolella nykytilanteessa Pajukoski II hankkeen laskentapisteissä A-M.

Äänitaso kohteessa (dB)											
Terssikaistan taajuus (Hz)	**20**	**25**	**31,5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**
A	43,9	45	39,4	38,3	38,6	37,4	34,8	32,6	31,4	23,7	20,8
B	43,9	45	39,4	38,3	38,6	37,4	34,8	32,6	31,4	23,8	20,9
C	44,2	45,3	39,7	38,6	38,9	37,7	35,1	33	31,8	24,2	21,3
D	43,4	44,5	38,9	37,8	38,1	36,9	34,3	32,1	30,8	23,2	20,2
E	43,3	44,4	38,8	37,7	38	36,8	34,2	32	30,7	23	20
F	43	44	38,5	37,4	37,7	36,4	33,8	31,6	30,2	22,5	19,4
G	43,1	44,2	38,7	37,5	37,8	36,6	33,9	31,7	30,4	22,7	19,6
H	43,4	44,5	39	37,9	38,2	37	34,3	32,1	30,8	23,1	20,1
I	44	45,1	39,5	38,4	38,7	37,5	34,9	32,7	31,4	23,8	20,8
J	45	46,1	40,6	39,5	39,8	38,6	36	33,9	32,7	25,2	22,4
K	50,6	51,7	46,2	45,1	45,5	44,4	41,9	40	39,1	32	29,8
L	50,4	51,6	46	45	45,3	44,3	41,7	39,8	38,9	31,8	29,5
M	45,4	46,5	40,9	39,9	40,2	39	36,4	34,3	33,2	25,7	22,9

3.1.4 Matalataajuiset melutasot

VE1

Taulukossa 15 esitetään vaihtoehdossa 1 sisätiloihin aiheutuva matalataajuinen melu, joka on saatu vähentämällä rakennuksen ulkopuolelle mallinnetuista äänitasoista edellä mainitut ääneneristyksen alalikiarvot taajuuskaistoittain. Toimenpiderajojen ylityksiä ei ole. Sisätilojen laskennalliset äänitasot ovat lähimpänä toimenpiderajaa kohteessa Lomarakennus K taajuudella 50 Hz. Taulukossa 16 esitetään vertailun vuoksi rakennusten ulkopuolelle mallinnettu matalataajuinen melu. Raportin liitteenä esitetään sisätiloihin laskettu matalataajuinen melu graafeina kunkin laskentapisteen osalta erikseen. Tulokset, jotka ovat lähimpänä toimenpiderajaa ovat korostettuna taulukossa 15 taajuuskaistoittain.

Taulukko 15. Matalataajuinen melu sisätiloissa vaihtoehdossa 1 (VE1).

Äänitaso kohteessa (dB)											
Terssikaistan taajuus (Hz)	**20**	**25**	**31,5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**
A	50,6	48,4	45,7	42,9	39,8	36,0	31,4	26,6	21,6	15,4	11,9
B	50,9	48,6	46,0	43,1	40,0	36,3	31,6	26,8	21,8	15,7	12,2
C	52,9	50,7	48,0	45,2	42,1	38,4	33,8	29,0	24,0	18,1	14,8
D	52,8	50,5	47,9	45,0	41,9	38,2	33,6	28,8	23,8	18,0	14,7
E	52,4	50,1	47,5	44,6	41,5	37,8	33,2	28,4	23,4	17,5	14,2
F	49,5	47,3	44,6	41,8	38,7	34,9	30,3	25,4	20,4	14,3	10,8
G	49,4	47,1	44,4	41,6	38,5	34,7	30,1	25,3	20,3	14,1	10,6
H	49,6	47,4	44,6	41,8	38,7	35,0	30,3	25,5	20,5	14,4	10,9
I	49,3	47,1	44,3	41,5	38,4	34,7	30,1	25,2	20,3	14,0	10,5
J	49,3	47,1	44,3	41,5	38,5	34,7	30,1	25,3	20,4	14,0	10,4
K	*53,6*	*51,6*	*48,6*	*45,8*	**42,9**	*39,3*	*34,8*	*30,1*	*25,6*	*19,1*	*15,8*
L	51,3	49,4	46,2	43,5	40,7	37,2	32,6	28,0	23,7	16,6	13,0
M	51,6	49,4	46,7	43,9	40,8	37,1	32,5	27,7	22,8	16,8	13,4
Toimenpideraja $L_{Zeq,1h}$ (dB)	74	64	56	49	44	42	40	38	36	34	32

Taulukko 16. Matalataajuinen melu rakennuksen ulkopuolella vaihtoehdossa1 (VE1).

Äänitaso kohteessa (dB)											
Terssikaistan taajuus (Hz)	**20**	**25**	**31,5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**
A	58,2	56,7	54,9	53,2	51,3	49,0	46,2	43,4	40,4	36,5	34,7
B	58,5	56,9	55,2	53,4	51,5	49,3	46,4	43,6	40,6	36,8	35,0
C	60,5	59,0	57,2	55,5	53,6	51,4	48,6	45,8	42,8	39,2	37,6
D	60,4	58,8	57,1	55,3	53,4	51,2	48,4	45,6	42,6	39,1	37,5
E	60,0	58,4	56,7	54,9	53,0	50,8	48,0	45,2	42,2	38,6	37,0
F	57,1	55,6	53,8	52,1	50,2	47,9	45,1	42,2	39,2	35,4	33,6
G	57,0	55,4	53,6	51,9	50,0	47,7	44,9	42,1	39,1	35,2	33,4
H	57,2	55,7	53,8	52,1	50,2	48,0	45,1	42,3	39,3	35,5	33,7
I	56,9	55,4	53,5	51,8	49,9	47,7	44,9	42,0	39,1	35,1	33,3
J	56,9	55,4	53,5	51,8	50,0	47,7	44,9	42,1	39,2	35,1	33,2
K	61,2	59,9	57,8	56,1	54,4	52,3	49,6	46,9	44,4	40,2	38,6
L	58,9	57,7	55,4	53,8	52,2	50,2	47,4	44,8	42,5	37,7	35,8
M	59,2	57,7	55,9	54,2	52,3	50,1	47,3	44,5	41,6	37,9	36,2

VE2

Taulukossa 17 esitetään vaihtoehdossa 2 sisätiloihin aiheutuva matalataajuinen melu, joka on saatu vähentämällä rakennuksen ulkopuolelle mallinnetuista äänitasoista edellä mainitut ääneneristyksen alalikiarvot taajuuskaistoittain. Toimenpiderajojen ylityksiä ei ole. Sisätilojen laskennalliset äänitasot ovat lähimpänä toimenpiderajaa kohteessa Lomarakennus K taajuudella 50 Hz. Taulukossa 18 esitetään vertailun vuoksi rakennusten ulkopuolelle mallinnettu matalataajuinen melu. Raportin liitteenä esitetään sisätiloihin laskettu matalataajuinen melu graafeina kunkin laskentapisteen osalta erikseen. Tulokset, jotka ovat lähimpänä toimenpiderajaa ovat korostettuna taulukossa 17 taajuuskaistoittain.

Taulukko 17. Matalataajuinen melu sisätiloissa, VE2.

Äänitaso kohteessa (dB)											
Terssikaistan taajuus (Hz)	**20**	**25**	**31,5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**
A	45,4	43,5	40,3	37,5	34,7	31,0	26,4	21,6	16,9	9,8	5,9
B	46,0	44,0	41,0	38,2	35,3	31,6	26,9	22,2	17,4	10,5	6,7
C	50,0	47,8	45,1	42,3	39,3	35,5	30,9	26,2	21,3	15,3	12,0
D	52,0	49,8	*47,1*	44,3	41,2	37,5	32,9	28,1	23,2	17,4	14,2
E	51,6	49,4	46,7	43,9	40,8	37,1	32,5	27,7	22,8	17,0	13,7
F	48,7	46,5	43,7	40,9	37,9	34,2	29,5	24,8	19,9	13,8	10,4
G	48,5	46,3	43,5	40,7	37,7	34,0	29,3	24,6	19,7	13,5	10,1
H	48,7	46,5	43,8	40,9	37,9	34,2	29,6	24,8	19,9	13,8	10,4
I	48,3	46,2	43,3	40,5	37,5	33,8	29,2	24,5	19,6	13,3	9,9
J	48,1	46,1	43,1	40,3	37,4	33,7	29,1	24,4	19,7	13,2	9,7
K	*52,1*	*50,2*	*47,1*	*44,3*	**41,5**	*38,0*	*33,4*	*28,9*	*24,5*	*17,9*	*14,6*
L	49,3	47,7	44,2	41,5	38,9	35,5	31,0	26,5	22,5	15,0	11,4
M	44,2	42,6	39,0	36,3	33,7	30,2	25,6	20,9	16,6	8,7	4,5
Toimenpideraja $L_{Zeq,1h}$ (dB)	74	64	56	49	44	42	40	38	36	34	32

Taulukko 18. Matalataajuinen melu rakennuksen ulkopuolella, VE2.

Äänitaso kohteessa (dB)											
Terssikaistan taajuus (Hz)	**20**	**25**	**31,5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**
A	53,0	51,8	49,5	47,8	46,2	44,0	41,2	38,4	35,7	30,9	28,7
B	53,6	52,3	50,2	48,5	46,8	44,6	41,7	39,0	36,2	31,6	29,5
C	57,6	56,1	54,3	52,6	50,8	48,5	45,7	43,0	40,1	36,4	34,8
D	59,6	58,1	56,3	54,6	52,7	50,5	47,7	44,9	42,0	38,5	37,0
E	59,2	57,7	55,9	54,2	52,3	50,1	47,3	44,5	41,6	38,1	36,5
F	56,3	54,8	52,9	51,2	49,4	47,2	44,3	41,6	38,7	34,9	33,2
G	56,1	54,6	52,7	51,0	49,2	47,0	44,1	41,4	38,5	34,6	32,9
H	56,3	54,8	53,0	51,2	49,4	47,2	44,4	41,6	38,7	34,9	33,2
I	55,9	54,5	52,5	50,8	49,0	46,8	44,0	41,3	38,4	34,4	32,7
J	55,7	54,4	52,3	50,6	48,9	46,7	43,9	41,2	38,5	34,3	32,5
K	59,7	58,5	56,3	54,6	53,0	51,0	48,2	45,7	43,3	39,0	37,4
L	56,9	56,0	53,4	51,8	50,4	48,5	45,8	43,3	41,3	36,1	34,2
M	51,8	50,9	48,2	46,6	45,2	43,2	40,4	37,7	35,4	29,8	27,3

VE3

Taulukossa 19 esitetään vaihtoehdossa 3 sisätiloihin aiheutuva matalataajuinen melu, joka on saatu vähentämällä rakennuksen ulkopuolelle mallinnetuista äänitasoista edellä mainitut ääneneristyksen alalikiarvot taajuuskaistoittain. Toimenpiderajojen ylityksiä ei ole. Sisätilojen laskennalliset äänitasot ovat lähimpänä toimenpiderajaa kohteessa Lomarakennus K taajuudella 50 Hz. Taulukossa 20 esitetään vertailun vuoksi rakennusten ulkopuolelle mallinnettu matalataajuinen melu. Raportin liitteenä esitetään sisätiloihin laskettu matalataajuinen melu graafeina kunkin laskentapisteen osalta erikseen. Tulokset, jotka ovat lähimpänä toimenpiderajaa ovat korostettuna taulukossa 19 taajuuskaistoittain.

Taulukko 19. Matalataajuinen melu sisätiloissa, VE3.

Äänitaso kohteessa (dB)											
Terssikaistan taajuus (Hz)	**20**	**25**	**31,5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**
A	49,3	47,1	44,4	41,5	38,5	34,8	30,2	25,4	20,5	14,4	10,9
B	49,4	47,2	44,5	41,6	38,6	34,9	30,3	25,5	20,6	14,5	11,0
C	50,0	47,9	45,1	42,3	39,3	35,6	31,0	26,2	21,3	15,3	11,9
D	45,2	43,3	40,2	37,4	34,5	30,8	26,1	21,3	16,6	9,6	5,6
E	44,9	43,0	39,9	37,0	34,2	30,5	25,8	21,0	16,3	9,2	5,2
F	42,9	41,1	37,8	34,9	32,2	28,6	23,9	19,1	14,5	6,6	2,3
G	42,9	41,2	37,8	35,0	32,2	28,6	23,9	19,1	14,5	6,7	2,3
H	43,1	41,4	38,0	35,2	32,5	28,9	24,2	19,4	14,9	7,0	2,7
I	43,4	41,7	38,2	35,4	32,7	29,2	24,5	19,7	15,3	7,4	3,0
J	44,0	42,4	38,8	36,1	33,5	30,0	25,3	20,6	16,3	8,4	4,1
K	49,4	47,8	44,3	41,6	39,0	35,6	31,1	26,7	22,7	15,2	11,6
L	48,3	47,0	43,2	40,5	38,1	34,7	30,2	25,8	21,9	14,1	10,3
M	*51,0*	*48,8*	*46,1*	*43,2*	**40,2**	*36,5*	*31,9*	*27,2*	22,4	*16,3*	*13,0*
Toimenpideraja $L_{Zeq,1h}$ (dB)	74	64	56	49	44	42	40	38	36	34	32

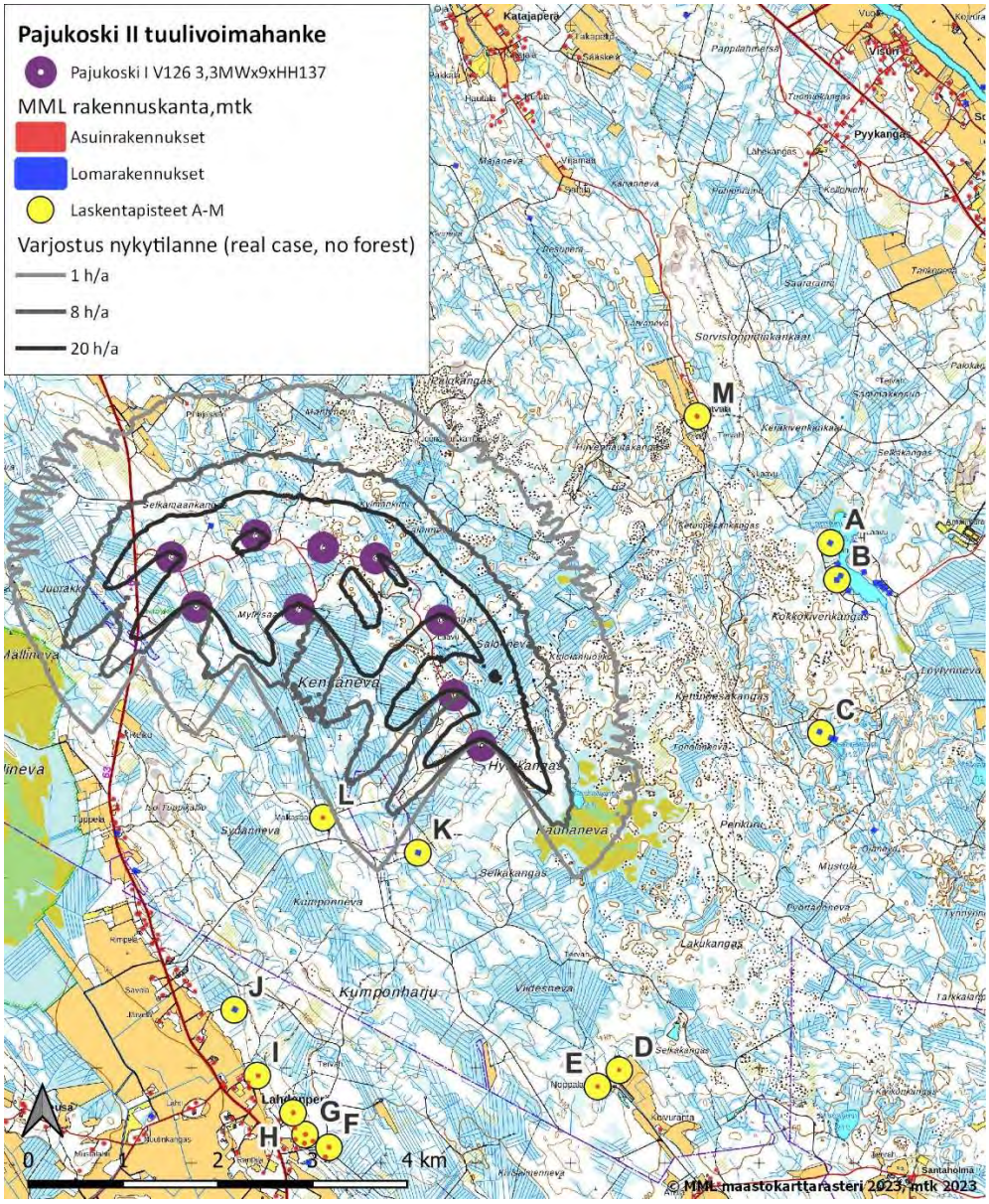
Taulukko 20. Matalataajuinen melu rakennuksen ulkopuolella, VE3.

Äänitaso kohteessa (dB)											
Terssikaistan taajuus (Hz)	**20**	**25**	**31,5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**
A	56,9	55,4	53,6	51,8	50,0	47,8	45,0	42,2	39,3	35,5	33,7
B	57,0	55,5	53,7	51,9	50,1	47,9	45,1	42,3	39,4	35,6	33,8
C	57,6	56,2	54,3	52,6	50,8	48,6	45,8	43,0	40,1	36,4	34,7
D	52,8	51,6	49,4	47,7	46,0	43,8	40,9	38,1	35,4	30,7	28,4
E	52,5	51,3	49,1	47,3	45,7	43,5	40,6	37,8	35,1	30,3	28,0
F	50,5	49,4	47,0	45,2	43,7	41,6	38,7	35,9	33,3	27,7	25,1
G	50,5	49,5	47,0	45,3	43,7	41,6	38,7	35,9	33,3	27,8	25,1
H	50,7	49,7	47,2	45,5	44,0	41,9	39,0	36,2	33,7	28,1	25,5
I	51,0	50,0	47,4	45,7	44,2	42,2	39,3	36,5	34,1	28,5	25,8
J	51,6	50,7	48,0	46,4	45,0	43,0	40,1	37,4	35,1	29,5	26,9
K	57,0	56,1	53,5	51,9	50,5	48,6	45,9	43,5	41,5	36,3	34,4
L	55,9	55,3	52,4	50,8	49,6	47,7	45,0	42,6	40,7	35,2	33,1
M	58,6	57,1	55,3	53,5	51,7	49,5	46,7	44,0	41,2	37,4	35,8

3.2 Varjostus

3.2.1 Nykytilanne

Suunnitellun Pajukoski II tuulivoimahankkeen länsipuolella sijaitsee tuotannossa oleva Pajukoski I tuulivoimapuisto. Pajukoski I tuulivoimapuiston aiheuttama varjostus on esitetty alla olevassa kuvassa (kuva 5) ja Pajukoski II mallinnuspisteiden A-M nykytilanteen varjostusmallinnuksen tulokset taulukossa 21. Mallinnuksessa ei ole huomioitu puuston suojaavaa vaikutusta. Mallinnuksen mukaan varjostusvaikutuksia ei tule Pajukoski II tuulivoimahankkeen laskentapisteisiin.



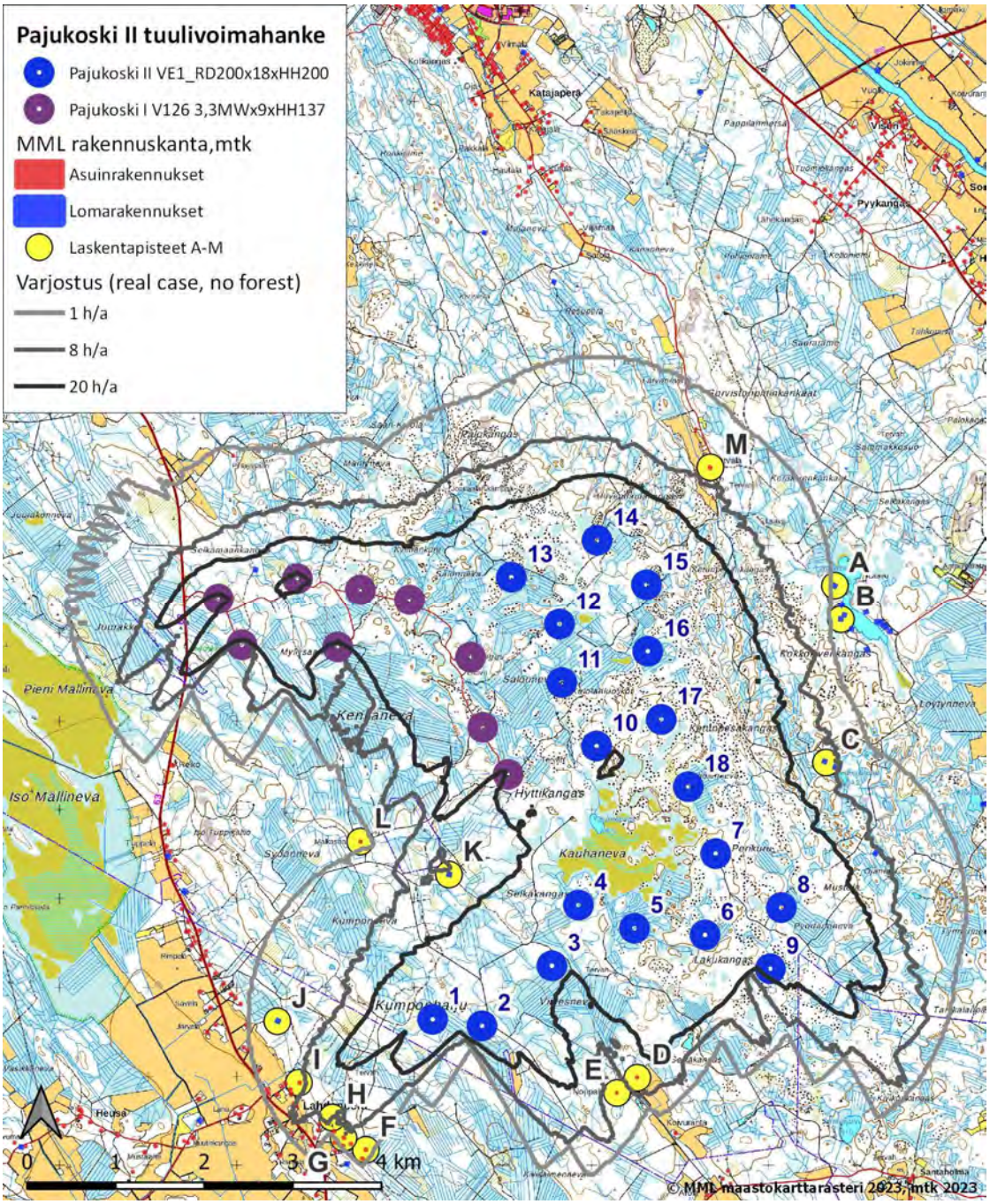
Kuva 5. Laskennalliset varjostusmallinnuksen tulokset nykytilanteessa. Mallinnus on tehty todellisen tilanteen mukaan ilman puuston suojavaikutusta.

Taulukko 21. Nykytilanteen laskennalliset varjostustunnit vuodessa lähialueen laskentapisteissä, kun puuston suojaavaa vaikutusta ei huomioida.

	ETRS89-TM35 Itä	ETRS89-TM35 Pohjoinen	Z (m)	Laskentaikkuna (m)	Varjostus (h/a)
A Lomarakennus A (Lampinjärvi)	384 750	7 099 539	90,0	5,0 x 5,0	0:00
B Lomarakennus B (Lampinkallio)	384 818	7 099 152	93,7	5,0 x 5,0	0:00
C Lomarakennus C (Latvalampi)	384 650	7 097 533	96,0	5,0 x 5,0	0:00
D Asuinrakennus D (Noppala)	382 520	7 093 979	105,2	5,0 x 5,0	0:00
E Muu rakennus E (Noppala)	382 290	7 093 807	109,7	5,0 x 5,0	0:00
F Asuinrakennus F (Maijannevantie)	379 455	7 093 166	96,2	5,0 x 5,0	0:00
G Asuinrakennus G (Maijannevantie)	379 203	7 093 300	92,9	5,0 x 5,0	0:00
H Asuinrakennus H (Hietasaari)	379 076	7 093 530	92,5	5,0 x 5,0	0:00
I Asuinrakennus I (Lahdenperä)	378 699	7 093 923	88,0	5,0 x 5,0	0:00
J Lomarakennus J (Junno)	378 456	7 094 615	89,4	5,0 x 5,0	0:00
K Lomarakennus K (Isomännikkö)	380 394	7 096 271	106,1	5,0 x 5,0	0:00
L Asuinrakennus L (Malkasaari)	379 392	7 096 642	100,9	5,0 x 5,0	0:00
M Asuinrakennus M (Latvala)	383 344	7 100 875	82,6	5,0 x 5,0	0:00

3.2.2 Varjostus ilman puuston suojaavaa vaikutusta

Vaihtoehdossa 1 (VE1) tuulivoimahanketta lähimpien asuin- ja lomarakennusten pihapiirissä varjostusvaikutus on yli 8 tuntia vuodessa neljässä laskentapisteessä (C, D, H ja K), kun puuston suojaavaa vaikutusta ei ole huomioitu. Tulokset esitetään taulukossa 22 ja kuvassa 6.

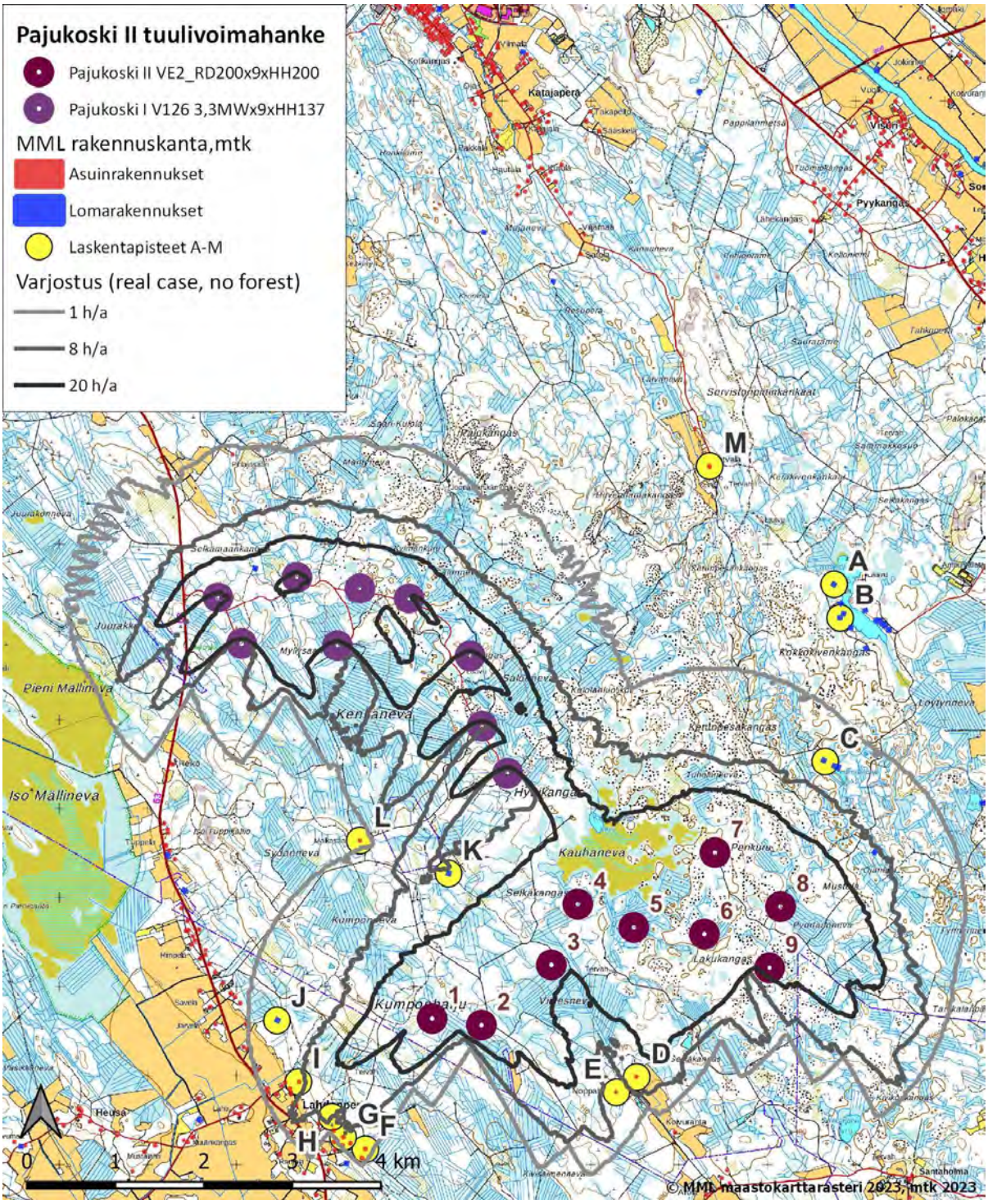


Kuva 6. VE1 varjostusmallinnuksen tulos ilman puuston suojaavaa vaikutusta.

Taulukko 22. VE1 varjostusmallinnuksen tulos, kun puuston suojaavaa vaikutusta ei ole huomioitu "real case, no forest".

	ETRS89-TM35 Itä	ETRS89-TM35 Pohjoinen	Z (m)	Laskentaikkuna (m)	Varjostus (h/a)
A Lomarakennus A (Lampinjärvi)	384 750	7 099 539	90,0	5,0 x 5,0	0:00
B Lomarakennus B (Lampinkallio)	384 818	7 099 152	93,7	5,0 x 5,0	0:00
C Lomarakennus C (Latvalampi)	384 650	7 097 533	96,0	5,0 x 5,0	10:33
D Asuinrakennus D (Noppala)	382 520	7 093 979	105,2	5,0 x 5,0	12:14
E Muu rakennus E (Noppala)	382 290	7 093 807	109,7	5,0 x 5,0	5:01
F Asuinrakennus F (Maijannevantie)	379 455	7 093 166	96,2	5,0 x 5,0	3:19
G Asuinrakennus G (Maijannevantie)	379 203	7 093 300	92,9	5,0 x 5,0	7:30
H Asuinrakennus H (Hietasaari)	379 076	7 093 530	92,5	5,0 x 5,0	9:21
I Asuinrakennus I (Lahdenperä)	378 699	7 093 923	88,0	5,0 x 5,0	6:22
J Lomarakennus J (Junno)	378 456	7 094 615	89,4	5,0 x 5,0	2:55
K Lomarakennus K (Isomännikkö)	380 394	7 096 271	106,1	5,0 x 5,0	10:40
L Asuinrakennus L (Malkasaari)	379 392	7 096 642	100,9	5,0 x 5,0	0:00
M Asuinrakennus M (Latvala)	383 344	7 100 875	82,6	5,0 x 5,0	6:05

Vaihtoehdossa 2 (VE2) tuulivoimahanketta lähimpien asuin- ja lomarakennusten pihapiirissä varjostusvaikutus on yli 8 tuntia vuodessa kolmessa laskentapisteessä (D, H ja K), kun puuston suojaavaa vaikutusta ei ole huomioitu. Tulokset esitetään taulukossa 23 ja kuvassa 7.

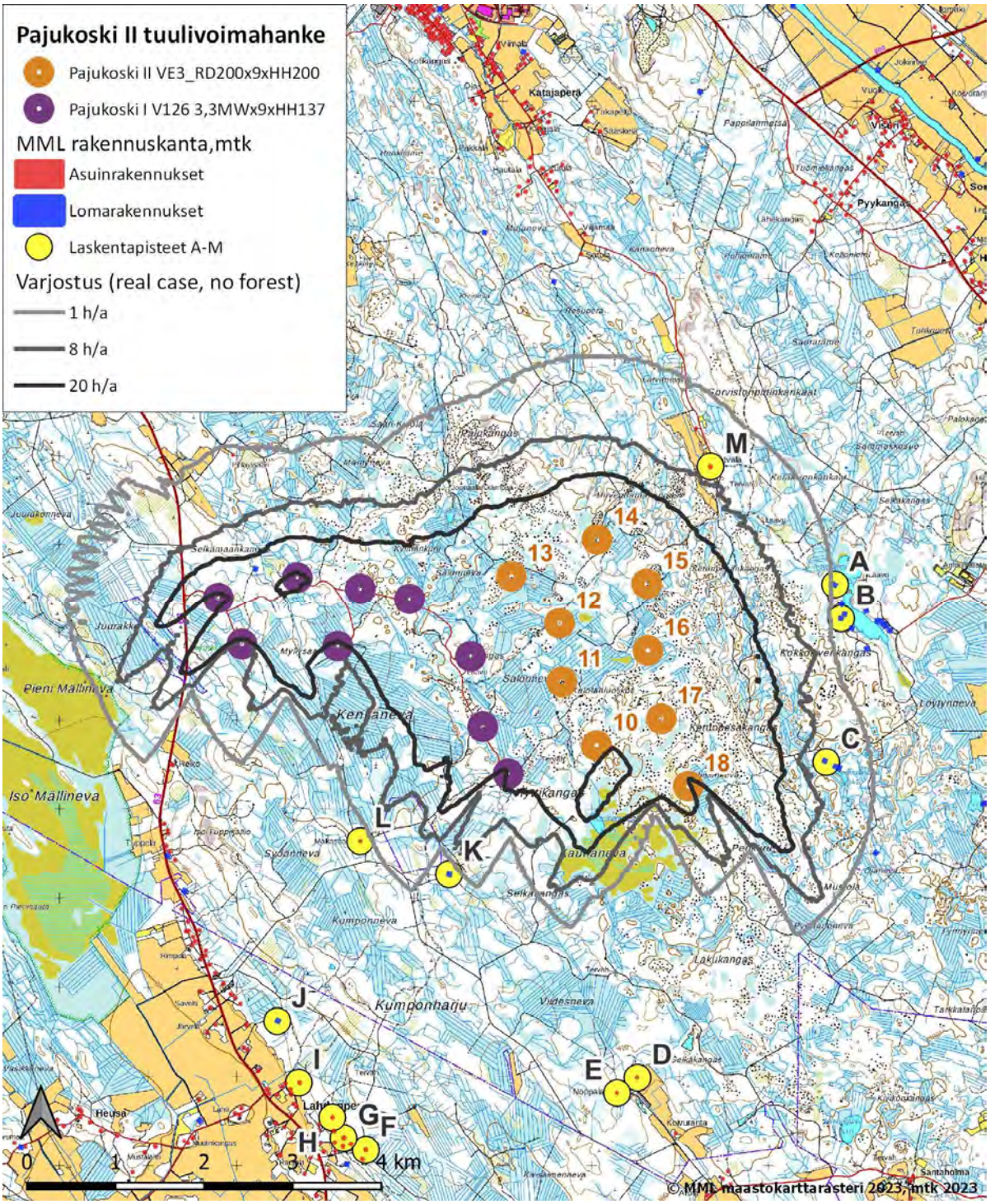


Kuva 7. VE2 varjostusmallinnuksen tulos ilman puuston suojaavaa vaikutusta.

Taulukko 23. VE2 varjostusmallinnuksen tulos, kun puuston suojaavaa vaikutusta ei ole huomioitu "real case, no forest".

	ETRS89-TM35 Itä	ETRS89-TM35 Pohjoinen	Z (m)	Laskentaikkuna (m)	Varjostus (h/a)
A Lomarakennus A (Lampinjärvi)	384 750	7 099 539	90,0	5,0 x 5,0	0:00
B Lomarakennus B (Lampinkallio)	384 818	7 099 152	93,7	5,0 x 5,0	0:00
C Lomarakennus C (Latvalampi)	384 650	7 097 533	96,0	5,0 x 5,0	4:47
D Asuinrakennus D (Noppala)	382 520	7 093 979	105,2	5,0 x 5,0	12:14
E Muu rakennus E (Noppala)	382 290	7 093 807	109,7	5,0 x 5,0	5:01
F Asuinrakennus F (Maijannevantie)	379 455	7 093 166	96,2	5,0 x 5,0	3:19
G Asuinrakennus G (Maijannevantie)	379 203	7 093 300	92,9	5,0 x 5,0	7:30
H Asuinrakennus H (Hietasaari)	379 076	7 093 530	92,5	5,0 x 5,0	9:21
I Asuinrakennus I (Lahdenperä)	378 699	7 093 923	88,0	5,0 x 5,0	6:22
J Lomarakennus J (Junno)	378 456	7 094 615	89,4	5,0 x 5,0	2:55
K Lomarakennus K (Isomännikkö)	380 394	7 096 271	106,1	5,0 x 5,0	10:40
L Asuinrakennus L (Malkasaari)	379 392	7 096 642	100,9	5,0 x 5,0	0:00
M Asuinrakennus M (Latvala)	383 344	7 100 875	82,6	5,0 x 5,0	0:00

Vaihtoehdossa 3 (VE3) tuulivoimahanketta lähimpien asuin- ja lomarakennusten pihapiirissä varjostusvaikutus ei ylitä 8 tuntia vuodessa, kun puuston suojaavaa vaikutusta ei ole huomioitu. Tulokset esitetään taulukossa 24 ja kuvassa 8.



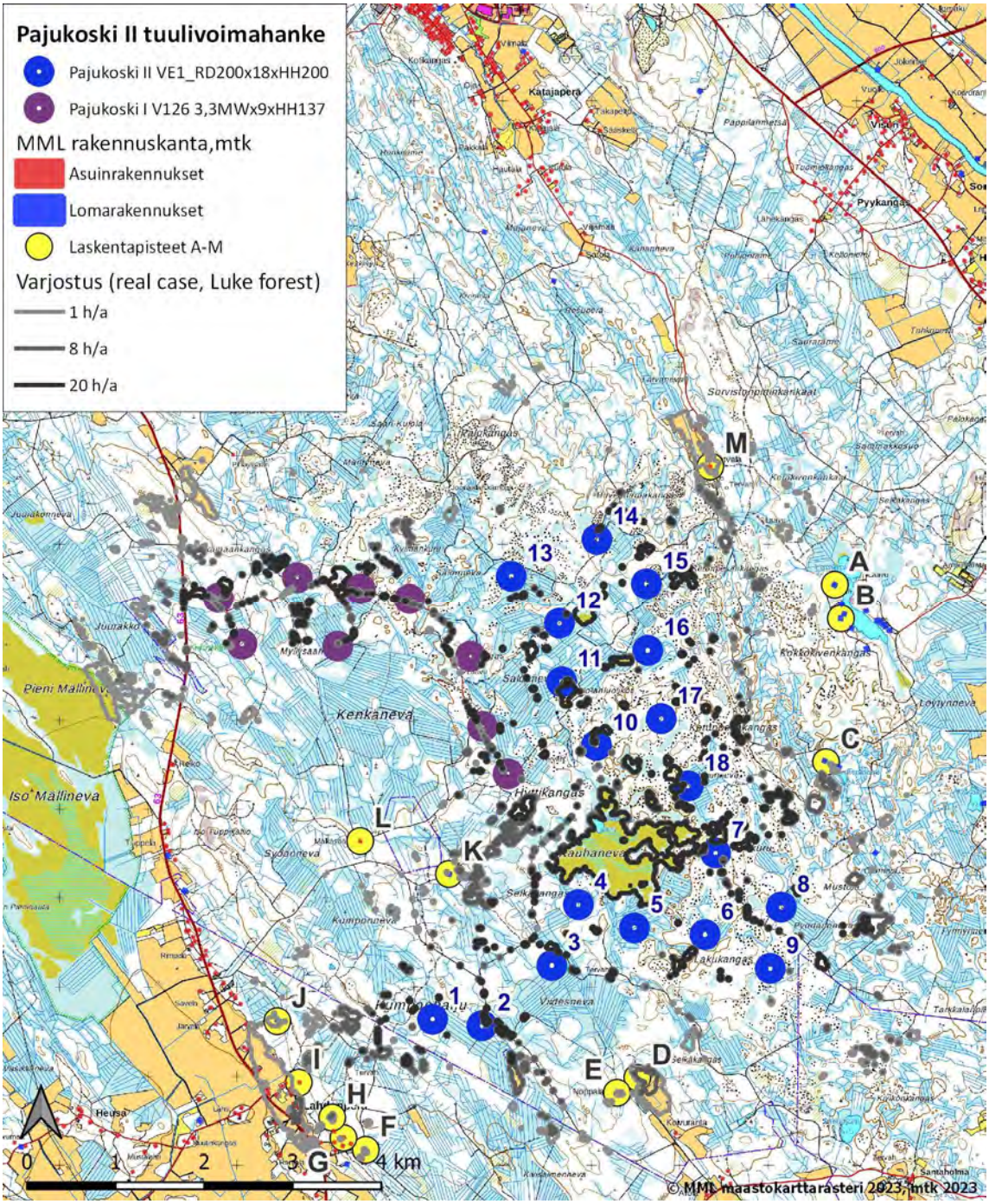
Kuva 8. VE3 varjostusmallinnuksen tulos ilman puuston suojaavaa vaikutusta.

Taulukko 24. VE3 varjostusmallinnuksen tulos, kun puuston suojaavaa vaikutusta ei ole huomioitu "real case, no forest".

	ETRS89-TM35 Itä	ETRS89-TM35 Pohjoinen	Z (m)	Laskentaikkuna (m)	Varjostus (h/a)
A Lomarakennus A (Lampinjärvi)	384 750	7 099 539	90,0	5,0 x 5,0	0:00
B Lomarakennus B (Lampinkallio)	384 818	7 099 152	93,7	5,0 x 5,0	0:00
C Lomarakennus C (Latvalampi)	384 650	7 097 533	96,0	5,0 x 5,0	5:42
D Asuinrakennus D (Noppala)	382 520	7 093 979	105,2	5,0 x 5,0	0:00
E Muu rakennus E (Noppala)	382 290	7 093 807	109,7	5,0 x 5,0	0:00
F Asuinrakennus F (Maijannevantie)	379 455	7 093 166	96,2	5,0 x 5,0	0:00
G Asuinrakennus G (Maijannevantie)	379 203	7 093 300	92,9	5,0 x 5,0	0:00
H Asuinrakennus H (Hietasaari)	379 076	7 093 530	92,5	5,0 x 5,0	0:00
I Asuinrakennus I (Lahdenperä)	378 699	7 093 923	88,0	5,0 x 5,0	0:00
J Lomarakennus J (Junno)	378 456	7 094 615	89,4	5,0 x 5,0	0:00
K Lomarakennus K (Isomännikkö)	380 394	7 096 271	106,1	5,0 x 5,0	0:00
L Asuinrakennus L (Malkasaari)	379 392	7 096 642	100,9	5,0 x 5,0	0:00
M Asuinrakennus M (Latvala)	383 344	7 100 875	82,6	5,0 x 5,0	6:05

3.2.3 Varjostus puuston suojaava vaikutus huomioituna

Taulukossa 25 ja kuvassa 9 esitetään varjostusmallinnuksen tulos, kun puuston suojaava vaikutus on huomioitu vaihtoehdossa 1 (VE1). Pajukoski II tuulivoimahanketta lähimpien asuin- ja lomarakennusten pihapiirissä varjostusvaikutus ylittää 8 tuntia vuodessa laskentapisteessä H.

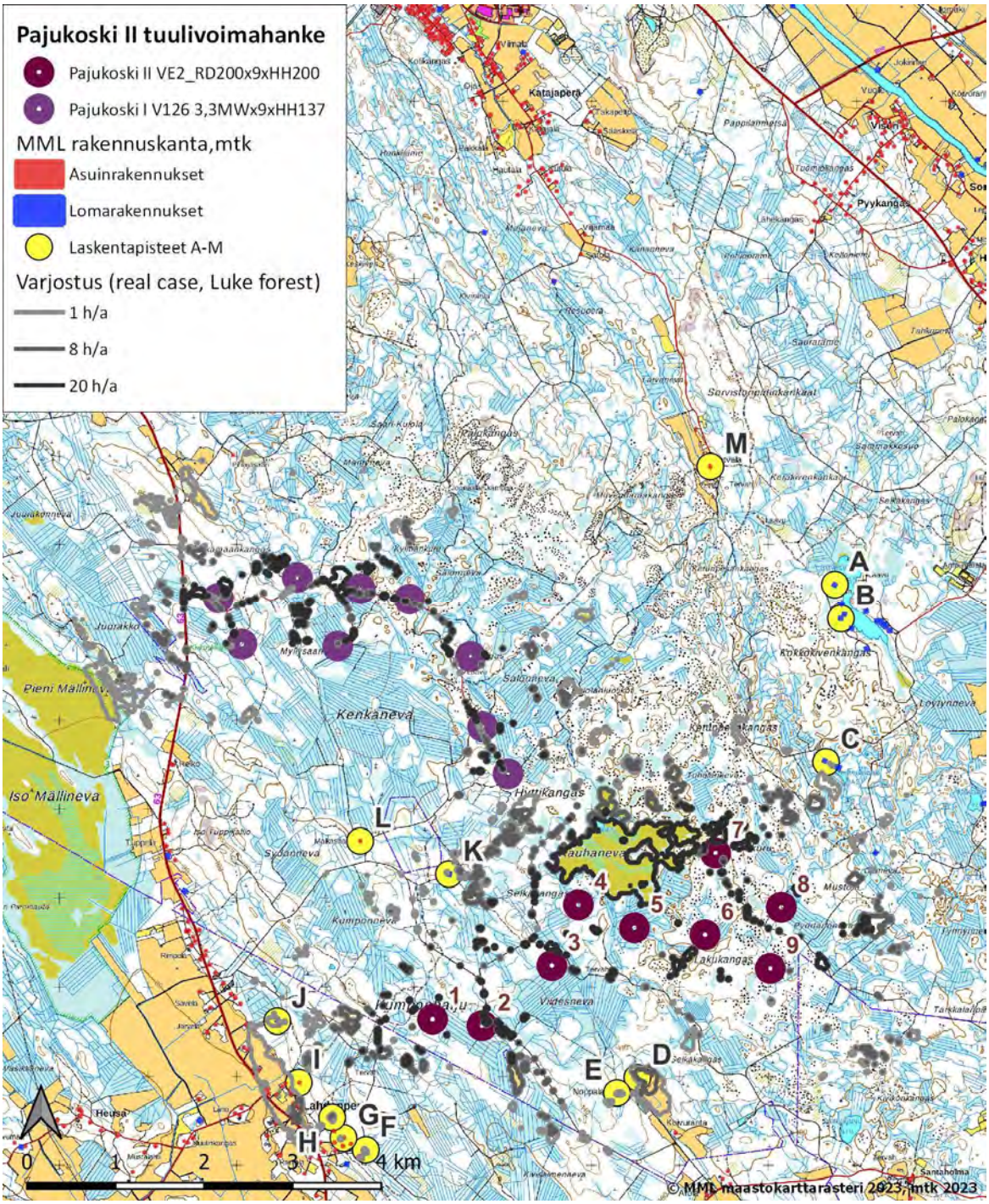


Kuva 9. VE1 varjostusmallinnuksen tulos, kun puuston suojaava vaikutus on huomioitu.

Taulukko 25. VE1 varjostusmallinnuksen tulos, kun puuston suojaava vaikutus on huomioitu "real case, Luke forest".

	ETRS89-TM35 Itä	ETRS89-TM35 Pohjoinen	Z (m)	Laskentaikkuna (m)	Varjostus (h/a)
A Lomarakennus A (Lampinjärvi)	384 750	7 099 539	90,0	5,0 x 5,0	0:00
B Lomarakennus B (Lampinkallio)	384 818	7 099 152	93,7	5,0 x 5,0	0:00
C Lomarakennus C (Latvalampi)	384 650	7 097 533	96,0	5,0 x 5,0	0:00
D Asuinrakennus D (Noppala)	382 520	7 093 979	105,2	5,0 x 5,0	7:47
E Muu rakennus E (Noppala)	382 290	7 093 807	109,7	5,0 x 5,0	5:01
F Asuinrakennus F (Maijannevantie)	379 455	7 093 166	96,2	5,0 x 5,0	3:19
G Asuinrakennus G (Maijannevantie)	379 203	7 093 300	92,9	5,0 x 5,0	0:00
H Asuinrakennus H (Hietasaari)	379 076	7 093 530	92,5	5,0 x 5,0	9:21
I Asuinrakennus I (Lahdenperä)	378 699	7 093 923	88,0	5,0 x 5,0	0:00
J Lomarakennus J (Junno)	378 456	7 094 615	89,4	5,0 x 5,0	2:55
K Lomarakennus K (Isomännikkö)	380 394	7 096 271	106,1	5,0 x 5,0	2:55
L Asuinrakennus L (Malkasaari)	379 392	7 096 642	100,9	5,0 x 5,0	0:00
M Asuinrakennus M (Latvala)	383 344	7 100 875	82,6	5,0 x 5,0	6:05

Taulukossa 26 ja kuvassa 10 esitetään varjostusmallinnuksen tulos, kun puuston suojaava vaikutus on huomioitu vaihtoehdossa 2 (VE2). Pajukoski II tuulivoimahanketta lähimpien asuin- ja lomarakennusten pihapiirissä varjostusvaikutus ylittää 8 tuntia vuodessa laskentapisteessä H.



Kuva 10. VE2 varjostusmallinnuksen tulos, kun puuston suojaava vaikutus on huomioitu.

Taulukko 26. VE2 varjostusmallinnuksen tulos, kun puuston suojaava vaikutus on huomioitu "real case, Luke forest".

	ETRS89-TM35 Itä	ETRS89-TM35 Pohjoinen	Z (m)	Laskentaikkuna (m)	Varjostus (h/a)
A Lomarakennus A (Lampinjärvi)	384 750	7 099 539	90,0	5,0 x 5,0	0:00
B Lomarakennus B (Lampinkallio)	384 818	7 099 152	93,7	5,0 x 5,0	0:00
C Lomarakennus C (Latvalampi)	384 650	7 097 533	96,0	5,0 x 5,0	0:00
D Asuinrakennus D (Noppala)	382 520	7 093 979	105,2	5,0 x 5,0	7:47
E Muu rakennus E (Noppala)	382 290	7 093 807	109,7	5,0 x 5,0	5:01
F Asuinrakennus F (Maijannevantie)	379 455	7 093 166	96,2	5,0 x 5,0	3:19
G Asuinrakennus G (Maijannevantie)	379 203	7 093 300	92,9	5,0 x 5,0	0:00
H Asuinrakennus H (Hietasaari)	379 076	7 093 530	92,5	5,0 x 5,0	9:21
I Asuinrakennus I (Lahdenperä)	378 699	7 093 923	88,0	5,0 x 5,0	0:00
J Lomarakennus J (Junno)	378 456	7 094 615	89,4	5,0 x 5,0	2:55
K Lomarakennus K (Isomännikkö)	380 394	7 096 271	106,1	5,0 x 5,0	2:55
L Asuinrakennus L (Malkasaari)	379 392	7 096 642	100,9	5,0 x 5,0	0:00
M Asuinrakennus M (Latvala)	383 344	7 100 875	82,6	5,0 x 5,0	0:00

Vaihtoehdossa 3 tulokset alittavat 8h vuodessa ilman puuston suojaavaa vaikutusta, joten mallinnusta metsäaineiston kanssa ei esitetä (Real case, Luke forest).

FCG Finnish Consulting Group Oy

Henna-Riikka Rintamäki, ins. AMK
Laatija

Johanna Harju, ins. AMK
Tarkastaja

Liitteet

Liite 1: Pajukoski II tuulivoimahanke – melun leviämismallinnuksen (ISO 9613-2, YM 2/2014) tulokset nykytilanteessa.

Project:
Pajukoski tv-hanke

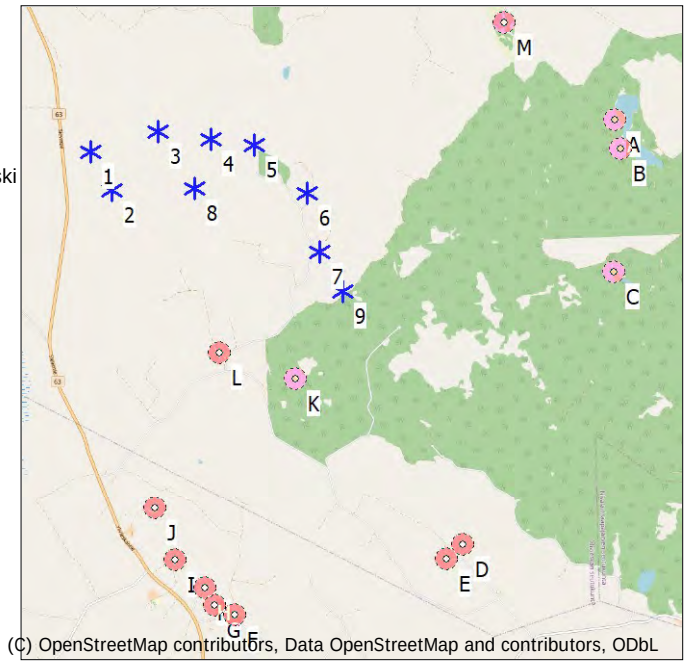
Licensed user:
FCG Finnish Consulting Group Oy
Osmontie 34, PO Box 950
FI-00601 Helsinki
+358104095666
Henna-Riikka Rintamäki / henna-riikka.rintamaki@fcg.fi
Calculated:
30.1.2024 13.24/3.6.377

DECIBEL - Main Result

Calculation: Pajukoski II nykytilanne Pajukoski I V126 3,3MWx9xHH137

Noise calculation model:
ISO 9613-2 General
Wind speed (in 10 m height):
8,0 m/s
Ground attenuation:
General, terrain specific
Ground factor for porous ground: 0,4
Area object with hard ground: Area object (Roughness): REGIONS_Pajukoski
Area type with hard ground: Vesistöt
Ground factor for hard ground: 0,0
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure tones penalty is added to total noise impact at receptors
Noise sensitive area
Height above ground level, when no value in NSA object:
4,0 m; Don't allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



Scale 1:100 000
Existing WTG
Noise sensitive area

WTGs

	East	North	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]
1	377 791	7 099 387	87,5	VESTAS V126-3.3 HH137...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
2	378 057	7 098 862	90,0	VESTAS V126-3.3 HH137...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
3	378 683	7 099 618	85,9	VESTAS V126-3.3 HH137...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
4	379 394	7 099 490	94,6	VESTAS V126-3.3 HH137...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
5	379 949	7 099 376	100,0	VESTAS V126-3.3 HH137...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
6	380 638	7 098 723	105,0	VESTAS V126-3.3 HH137...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
7	380 775	7 097 932	105,0	VESTAS V126-3.3 HH137...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
8	379 139	7 098 839	92,5	VESTAS V126-3.3 HH137...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
9	381 062	7 097 401	107,5	VESTAS V126-3.3 HH137...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9

Calculation Results

Sound level

Noise sensitive area No.	Name	East	North	Z [m]	Demands Immission height [m]	Noise [dB(A)]	Sound level From WTGs [dB(A)]	Distance to noise demand [m]
A	Lomarakennus A (Lampinjärvi)	384 750	7 099 539	90,0	4,0	40,0	21,9	3 552
B	Lomarakennus B (Lampinkallio)	384 818	7 099 152	93,7	4,0	40,0	21,9	3 493
C	Lomarakennus C (Latvalampi)	384 650	7 097 533	96,0	4,0	40,0	22,5	3 000
D	Asuinrakennus D (Noppala)	382 520	7 093 979	105,2	4,0	40,0	21,4	3 158
E	Muu rakennus E (Noppala)	382 290	7 093 807	109,7	4,0	40,0	21,2	3 236
F	Asuinrakennus F (Maijannevantie)	379 455	7 093 166	96,2	4,0	40,0	20,6	3 954
G	Asuinrakennus G (Maijannevantie)	379 203	7 093 300	92,9	4,0	40,0	20,8	3 923
H	Asuinrakennus H (Hietasaari)	379 076	7 093 530	92,5	4,0	40,0	21,2	3 769
I	Asuinrakennus I (Lahdenperä)	378 699	7 093 923	88,0	4,0	40,0	21,9	3 616
J	Lomarakennus J (Junno)	378 456	7 094 615	89,4	4,0	40,0	23,4	3 212
K	Lomarakennus K (Isomännikkö)	380 394	7 096 271	106,1	4,0	40,0	32,7	730
L	Asuinrakennus L (Malkasaari)	379 392	7 096 642	100,9	4,0	40,0	31,8	1 165
M	Asuinrakennus M (Latvala)	383 344	7 100 875	82,6	4,0	40,0	24,0	2 837

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Calculated:
30.1.2024 13.24/3.6.377

DECIBEL - Main Result

Calculation: Pajukoski II nykytilanne Pajukoski I V126 3,3MWx9xHH137

Distances (m)

	WTG								
NSA	1	2	3	4	5	6	7	8	9
A	6961	6728	6068	5357	4804	4193	4288	5655	4263
B	7031	6768	6153	5435	4875	4202	4224	5688	4145
C	7105	6726	6321	5609	5050	4185	3896	5664	3591
D	7184	6615	6821	6336	5978	5103	4321	5920	3719
E	7168	6593	6839	6378	6041	5186	4394	5937	3798
F	6439	5865	6498	6324	6229	5681	4945	5681	4529
G	6248	5679	6339	6193	6121	5609	4891	5539	4502
H	5996	5428	6100	5968	5910	5422	4718	5309	4350
I	5539	4980	5695	5610	5594	5176	4514	4935	4204
J	4818	4265	5008	4964	4989	4651	4047	4278	3814
K	4060	3489	3759	3371	3136	2464	1704	2858	1312
L	3178	2590	3059	2848	2790	2425	1891	2211	1834
M	5749	5658	4828	4186	3712	3458	3907	4672	4157

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Calculated:
30.1.2024 13.24/3.6.377

DECIBEL - Assumptions for noise calculation

Calculation: Pajukoski II nykytilanne Pajukoski I V126 3,3MWx9xHH137

Noise calculation model:
ISO 9613-2 General
Wind speed (in 10 m height):
8,0 m/s
Ground attenuation:
General, terrain specific
Ground factor for porous ground: 0,4
Area object with hard ground: Area object (Roughness): REGIONS_Pajukoski II_melu ja varjostus_1.w2r (8)
Area type with hard ground: Vesistöt
Ground factor for hard ground: 0,0
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure tones penalty is added to total noise impact at receptors
Noise sensitive area
Height above ground level, when no value in NSA object:
4,0 m; Don't allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)
Octave data required
Frequency dependent air absorption

63	125	250	500	1 000	2 000	4 000	8 000
[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]
0,10	0,38	1,12	2,36	4,08	8,78	26,60	95,00

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89

WTG: VESTAS V126-3.3 HH137 3300 126.0 !O!
Noise: Mode 0 - 11-2014 No STE

Source	Source/Date	Creator	Edited
Manufacturer	1.4.2014	USER	22.1.2024 13.06

Based on Document no.: 0034-7616 V09.

					Octave data							
Status	Hub height [m]	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones	63 [dB]	125 [dB]	250 [dB]	500 [dB]	1000 [dB]	2000 [dB]	4000 [dB]	8000 [dB]
From Windcat	137,0	8,0	105,9	Yes	87,9	94,1	95,7	99,2	101,8	98,1	91,2	90,3

Noise sensitive area: A Lomarakennus A (Lampinjärvi)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: B Lomarakennus B (Lampinkallio)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

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DECIBEL - Assumptions for noise calculation

Calculation: Pajukoski II nykytilanne Pajukoski I V126 3,3MWx9xHH137

Noise sensitive area: C Lomarakennus C (Latvalampi)
Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: D Asuinrakennus D (Noppala)
Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: E Muu rakennus E (Noppala)
Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: F Asuinrakennus F (Maijannevantie)
Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: G Asuinrakennus G (Maijannevantie)
Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: H Asuinrakennus H (Hietasaari)
Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: I Asuinrakennus I (Lahdenperä)
Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: J Lomarakennus J (Junno)
Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

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DECIBEL - Assumptions for noise calculation

Calculation: Pajukoski II nykytilanne Pajukoski I V126 3,3MWx9xHH137

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: K Lomarakennus K (Isomännikkö)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: L Asuinrakennus L (Malkasaari)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: M Asuinrakennus M (Latvala)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

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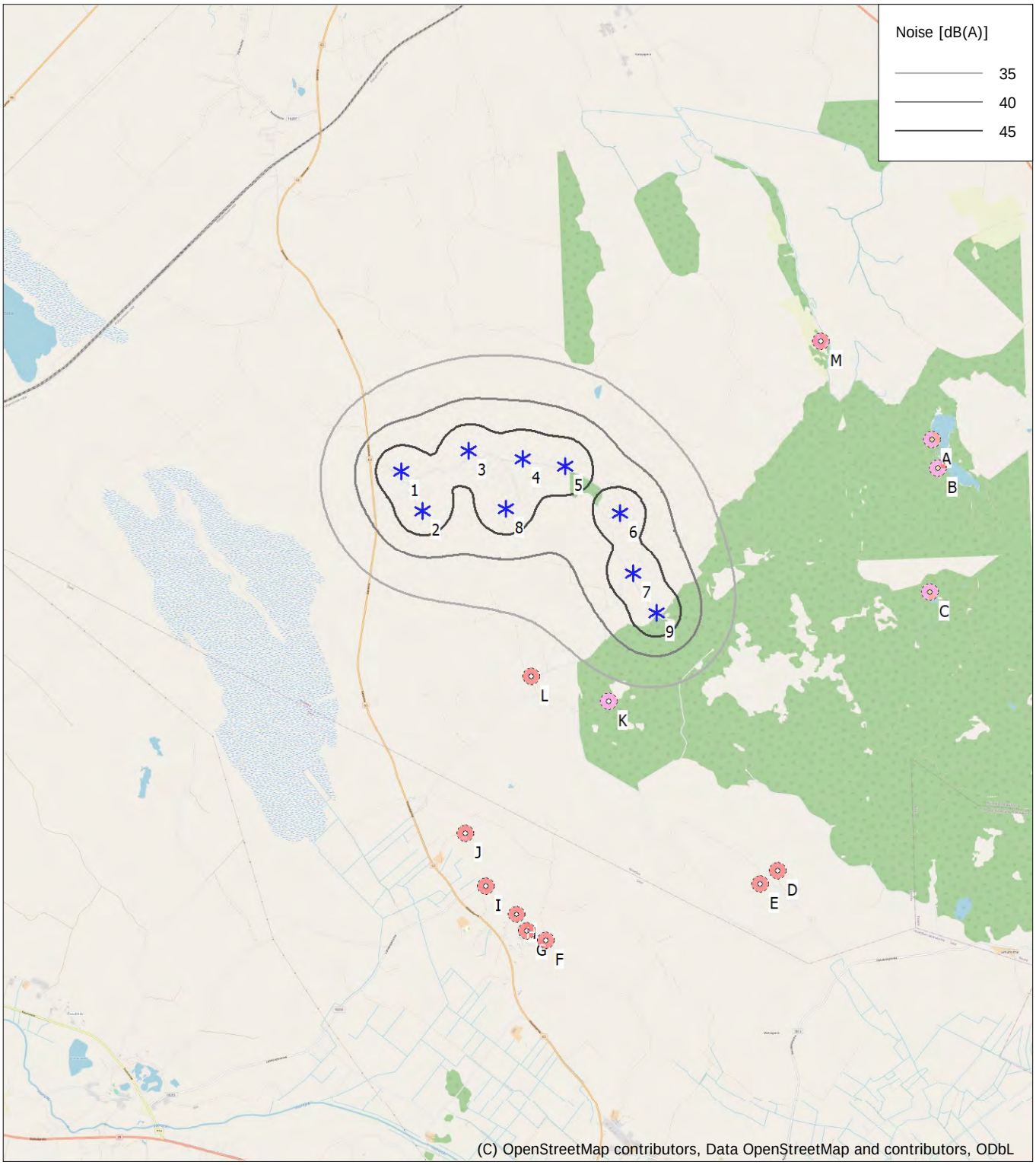
Calculated:
30.1.2024 13.24/3.6.377

DECIBEL - Map 8,0 m/s

Calculation: Pajukoski II nykytilanne Pajukoski I V126 3,3MWx9xHH137



0 1 2 3 4 km

Map: EMD OpenStreetMap , Print scale 1:75 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 379 554 North: 7 098 142

Existing WTG Noise sensitive area

Noise calculation model: ISO 9613-2 General. Wind speed: 8,0 m/s
Height above sea level from active line object

Liite 2: Pajukoski II tuulivoimahanke – melun leviämismallinnuksen (ISO 9613-2, YM 2/2014) tulokset WindPro-raporttina vaihtoehdossa VE1.

Project:
Pajukoski tv-hanke

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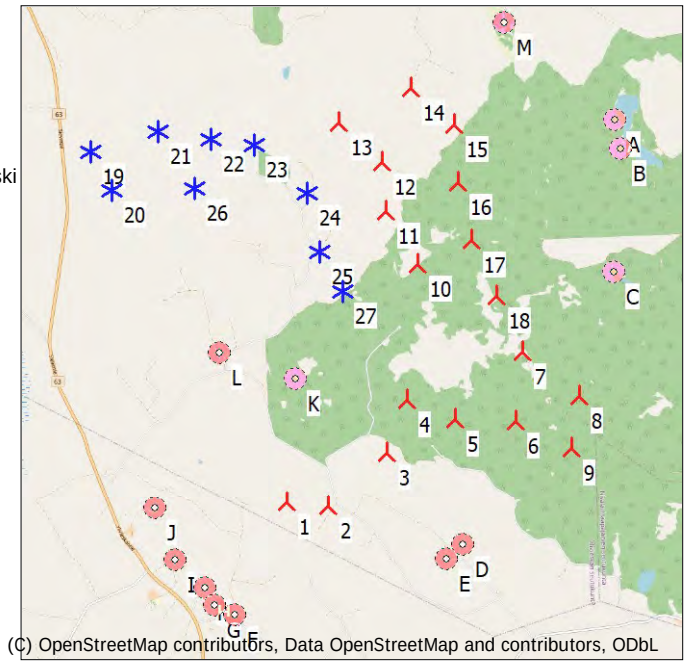
Calculated:
22.1.2024 13.15/3.6.377

DECIBEL - Main Result

Calculation: Pajukoski II VE1_GE158-6.1MWx18xHH221_20230215 +YV Pajukoski I V126 3,3MWx9xHH137(105,9dB)

Noise calculation model:
ISO 9613-2 General
Wind speed (in 10 m height):
8,0 m/s
Ground attenuation:
General, terrain specific
Ground factor for porous ground: 0,4
Area object with hard ground: Area object (Roughness): REGIONS_Pajukoski
Area type with hard ground: Vesistöt
Ground factor for hard ground: 0,0
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure tones penalty is added to total noise impact at receptors
Noise sensitive area
Height above ground level, when no value in NSA object:
4,0 m; Don't allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



Scale 1:100 000

New WTG
Existing WTG
Noise sensitive area

WTGs

	East	North	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]
1	380 209	7 094 637	107,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
2	380 766	7 094 564	106,8	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
3	381 556	7 095 242	112,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
4	381 855	7 095 926	117,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
5	382 487	7 095 665	119,8	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
6	383 284	7 095 590	122,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
7	383 404	7 096 507	124,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
8	384 145	7 095 898	110,0	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
9	384 021	7 095 208	112,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
10	382 059	7 097 720	120,0	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
11	381 666	7 098 437	107,7	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
12	381 641	7 099 097	110,0	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
13	381 097	7 099 635	104,3	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
14	382 064	7 100 051	105,0	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
15	382 623	7 099 549	108,6	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
16	382 638	7 098 790	111,8	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
17	382 790	7 098 020	125,0	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
18	383 095	7 097 262	120,7	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
19	377 791	7 099 387	87,5	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
20	378 057	7 098 862	90,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
21	378 683	7 099 618	85,9	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
22	379 394	7 099 490	94,6	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
23	379 949	7 099 376	100,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
24	380 638	7 098 723	105,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
25	380 775	7 097 932	105,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
26	379 139	7 098 839	92,5	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
27	381 062	7 097 401	107,5	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9

Calculation Results

Sound level

Noise sensitive area

No.	Name	East	North	Z [m]	Immission height [m]	Demands Noise [dB(A)]	Sound level From WTGs [dB(A)]	Distance to noise demand [m]
A	Lomarakennus A (Lampinjärvi)	384 750	7 099 539	90,0	4,0	40,0	35,0	969
B	Lomarakennus B (Lampinkallio)	384 818	7 099 152	93,7	4,0	40,0	35,4	940
C	Lomarakennus C (Latvalampi)	384 650	7 097 533	96,0	4,0	40,0	38,6	270
D	Asuinrakennus D (Noppala)	382 520	7 093 979	105,2	4,0	40,0	38,5	292
E	Muu rakennus E (Noppala)	382 290	7 093 807	109,7	4,0	40,0	37,9	395

To be continued on next page...

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DECIBEL - Main Result

Calculation: Pajukoski II VE1_GE158-6.1MWx18xHH221_20230215 +YV Pajukoski I V126 3,3MWx9xHH137(105,9dB)

...continued from previous page

Noise sensitive area

No.	Name	East	North	Z [m]	Immission height [m]	Demands Noise [dB(A)]	Sound level From WTGs [dB(A)]	Distance to noise demand [m]
F	Asuinrakennus F (Maijannevantie)	379 455	7 093 166	96,2	4,0	40,0	34,4	767
G	Asuinrakennus G (Maijannevantie)	379 203	7 093 300	92,9	4,0	40,0	34,1	808
H	Asuinrakennus H (Hietasaari)	379 076	7 093 530	92,5	4,0	40,0	34,5	732
I	Asuinrakennus I (Lahdenperä)	378 699	7 093 923	88,0	4,0	40,0	33,9	831
J	Lomarakennus J (Junno)	378 456	7 094 615	89,4	4,0	40,0	33,7	914
K	Lomarakennus K (Isomännikkö)	380 394	7 096 271	106,1	4,0	40,0	39,9	23
L	Asuinrakennus L (Malkasaari)	379 392	7 096 642	100,9	4,0	40,0	36,6	858
M	Asuinrakennus M (Latvala)	383 344	7 100 875	82,6	4,0	40,0	37,2	416

Distances (m)

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M
1	6682	6452	5302	2403	2240	1653	1673	1584	1670	1753	1644	2165	6981
2	6374	6121	4889	1849	1702	1917	2010	1981	2164	2311	1747	2491	6817
3	5354	5092	3850	1589	1612	2954	3051	3014	3147	3163	1552	2577	5910
4	4630	4380	3224	2057	2163	3658	3732	3669	3738	3643	1501	2565	5168
5	4487	4194	2858	1686	1868	3929	4047	4024	4169	4166	2179	3246	5280
6	4212	3878	2375	1783	2041	4532	4680	4685	4879	4925	2969	4032	5285
7	3317	2999	1614	2678	2921	5173	5285	5253	5368	5297	3019	4014	4368
8	3691	3323	1711	2515	2795	5428	5583	5595	5793	5832	3770	4811	5041
9	4392	4024	2409	1940	2227	5002	5182	5222	5475	5597	3780	4846	5707
10	3248	3108	2598	3769	3920	5246	5262	5143	5070	4756	2207	2877	3407
11	3275	3232	3118	4539	4672	5716	5697	5549	5402	4991	2512	2897	2960
12	3140	3177	3391	5193	5330	6321	6289	6129	5952	5498	3089	3329	2462
13	3654	3752	4128	5832	5949	6674	6612	6431	6195	5672	3437	3445	2566
14	2734	2897	3609	6089	6248	7363	7332	7173	6991	6524	4132	4331	1522
15	2127	2231	2859	5571	5752	7126	7124	6986	6859	6458	3964	4346	1509
16	2241	2210	2372	4812	4995	6462	6476	6353	6261	5909	3374	3892	2201
17	2480	2323	1923	4050	4243	5889	5928	5827	5790	5512	2966	3667	2908
18	2815	2558	1578	3333	3548	5480	5554	5485	5520	5341	2877	3755	3622
19	6961	7031	7105	7184	7168	6439	6248	5996	5539	4818	4060	3178	5749
20	6728	6768	6726	6615	6593	5865	5679	5428	4980	4265	3489	2590	5658
21	6068	6153	6321	6821	6839	6498	6339	6100	5695	5008	3759	3059	4828
22	5357	5435	5609	6336	6378	6324	6193	5968	5610	4964	3371	2848	4186
23	4804	4875	5050	5978	6041	6229	6121	5910	5594	4989	3136	2790	3712
24	4193	4202	4185	5103	5186	5681	5609	5422	5176	4651	2464	2425	3458
25	4288	4224	3896	4321	4394	4945	4891	4718	4514	4047	1704	1891	3907
26	5655	5688	5664	5920	5937	5681	5539	5309	4935	4278	2858	2211	4672
27	4263	4145	3591	3719	3798	4529	4502	4350	4204	3814	1312	1834	4157

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Calculated:
22.1.2024 13.15/3.6.377

DECIBEL - Assumptions for noise calculation

Calculation: Pajukoski II VE1_GE158-6.1MWx18xHH221_20230215 +YV Pajukoski I V126 3,3MWx9xHH137(105,9dB)

Noise calculation model:
ISO 9613-2 General
Wind speed (in 10 m height):
8,0 m/s
Ground attenuation:
General, terrain specific
Ground factor for porous ground: 0,4
Area object with hard ground: Area object (Roughness): REGIONS_Pajukoski II_melu ja varjostus_1.w2r (8)
Area type with hard ground: Vesistöt
Ground factor for hard ground: 0,0
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure tones penalty is added to total noise impact at receptors
Noise sensitive area
Height above ground level, when no value in NSA object:
4,0 m; Don't allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)
Octave data required
Frequency dependent air absorption

63	125	250	500	1 000	2 000	4 000	8 000
[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]
0,10	0,38	1,12	2,36	4,08	8,78	26,60	95,00

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89

WTG: GE WIND ENERGY 6.1-158 HH221 6100 158.0 !O!
Noise: 6.1-158 NRO 107dB + 2 dB

Source	Source/Date	Creator	Edited
Noise_Emission-NRO_4.x_5.x_6.x-158-50Hz_EN_r01	10.8.2021	USER	27.12.2023 13.30

					Octave data							
Status	Hub height [m]	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones	63 [dB]	125 [dB]	250 [dB]	500 [dB]	1000 [dB]	2000 [dB]	4000 [dB]	8000 [dB]
From Windcat	221,0	8,0	109,0	No	92,2	96,9	100,9	103,1	104,4	100,5	90,6	69,2

WTG: VESTAS V126-3.3 HH137 3300 126.0 !O!
Noise: Mode 0 - 11-2014 No STE

Source	Source/Date	Creator	Edited
Manufacturer	1.4.2014	USER	22.1.2024 13.06

Based on Document no.: 0034-7616 V09.

					Octave data							
Status	Hub height [m]	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones	63 [dB]	125 [dB]	250 [dB]	500 [dB]	1000 [dB]	2000 [dB]	4000 [dB]	8000 [dB]
From Windcat	137,0	8,0	105,9	Yes	87,9	94,1	95,7	99,2	101,8	98,1	91,2	90,3

Noise sensitive area: A Lomarakennus A (Lampinjärvi)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

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DECIBEL - Assumptions for noise calculation

Calculation: Pajukoski II VE1_GE158-6.1MWx18xHH221_20230215 +YV Pajukoski I V126 3,3MWx9xHH137(105,9dB)

Noise sensitive area: B Lomarakennus B (Lampinkallio)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: C Lomarakennus C (Latvalampi)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: D Asuinrakennus D (Noppala)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: E Muu rakennus E (Noppala)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: F Asuinrakennus F (Maijannevantie)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: G Asuinrakennus G (Maijannevantie)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: H Asuinrakennus H (Hietasaari)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: I Asuinrakennus I (Lahdenperä)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

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Calculated:
22.1.2024 13.15/3.6.377

DECIBEL - Assumptions for noise calculation

Calculation: Pajukoski II VE1_GE158-6.1MWx18xHH221_20230215 +YV Pajukoski I V126 3,3MWx9xHH137(105,9dB)

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: J Lomarakennus J (Junno)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: K Lomarakennus K (Isomännikkö)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: L Asuinrakennus L (Malkasaari)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: M Asuinrakennus M (Latvala)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

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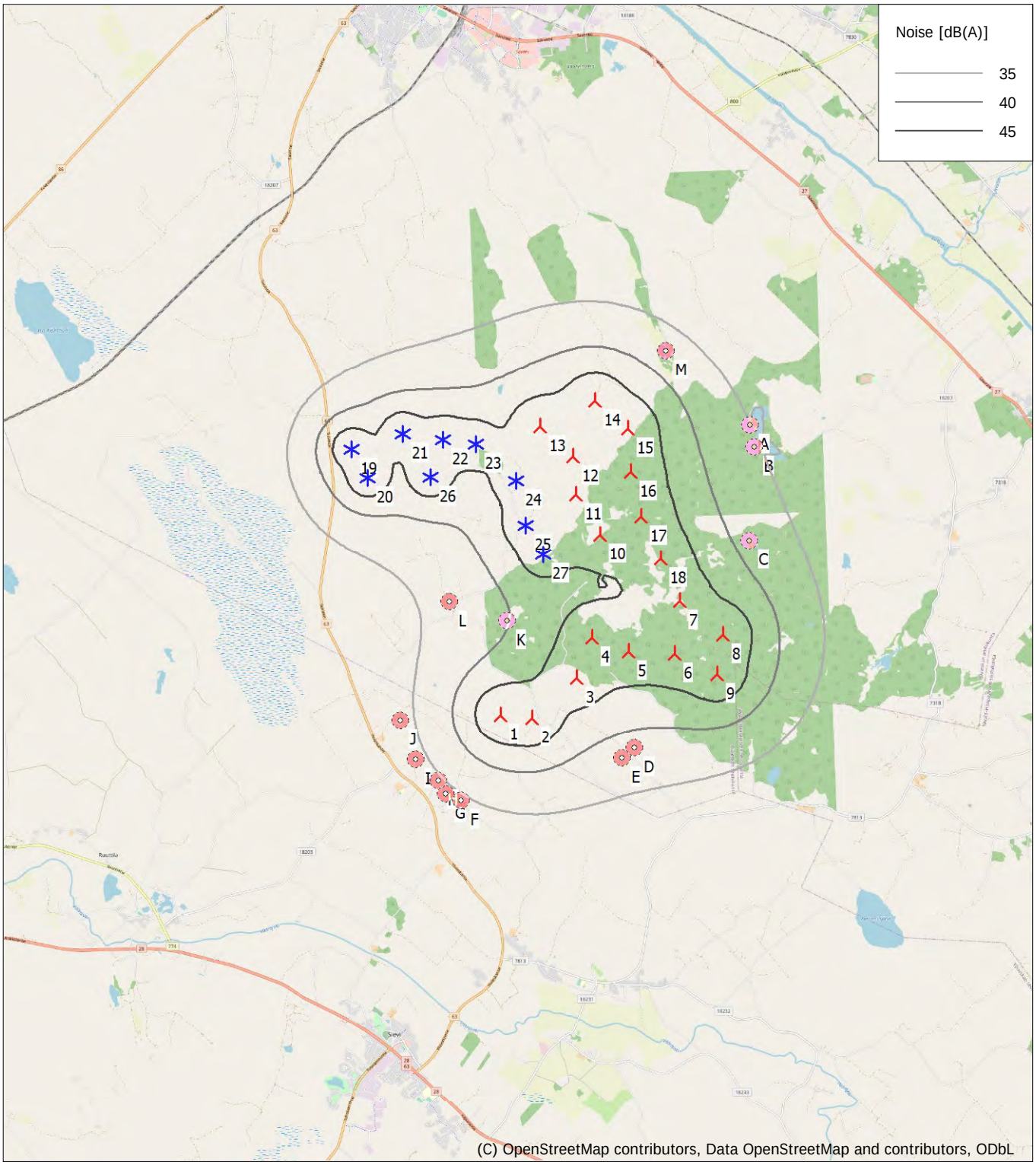
Calculated:
22.1.2024 13.15/3.6.377

DECIBEL - Map 8,0 m/s

Calculation: Pajukoski II VE1_GE158-6.1MWx18xHH221_20230215 +YV Pajukoski I V126 3,3MWx9xHH137(105,9dB)



0 1 2 3 4 km

Map: EMD OpenStreetMap , Print scale 1:100 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 380 968 North: 7 097 307

New WTG Existing WTG Noise sensitive area

Noise calculation model: ISO 9613-2 General. Wind speed: 8,0 m/s
Height above sea level from active line object

Liite 3: Pajukoski II tuulivoimahanke – melun leviämismallinnuksen (ISO 9613-2, YM 2/2014) tulokset WindPro-raporttina vaihtoehdossa VE2.

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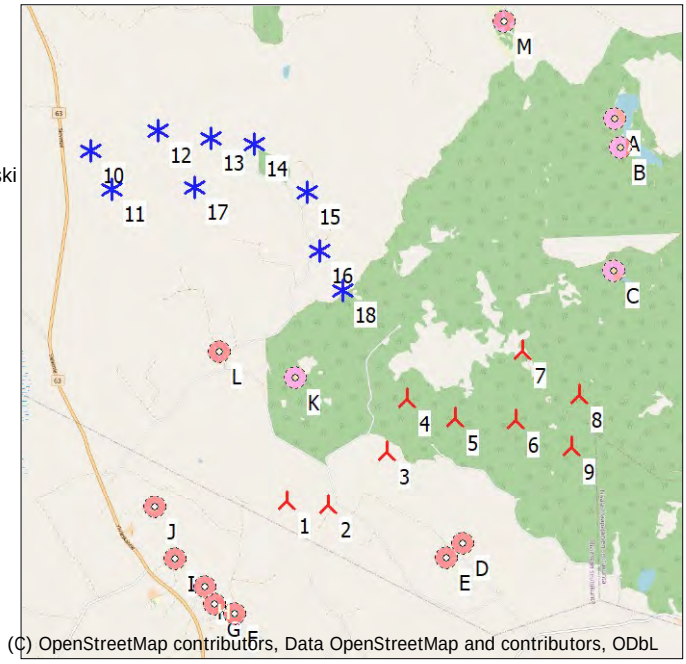
Calculated:
29.1.2024 14.11/3.6.377

DECIBEL - Main Result

Calculation: Pajukoski II VE2_GE158-6.1MWx9xHH221_20230215 +YV Pajukoski I V126 3,3MWx9xHH137(105,9dB)

Noise calculation model:
ISO 9613-2 General
Wind speed (in 10 m height):
8,0 m/s
Ground attenuation:
General, terrain specific
Ground factor for porous ground: 0,4
Area object with hard ground: Area object (Roughness): REGIONS_Pajukoski
Area type with hard ground: Vesistöt
Ground factor for hard ground: 0,0
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure tones penalty is added to total noise impact at receptors
Noise sensitive area
Height above ground level, when no value in NSA object:
4,0 m; Don't allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



(C) OpenStreetMap contributors, Data OpenStreetMap and contributors, ODbL

Scale 1:100 000
New WTG
Existing WTG
Noise sensitive area

WTGs

	East	North	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]
1	380 209	7 094 637	107,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
2	380 766	7 094 564	106,8	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
3	381 556	7 095 242	112,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
4	381 855	7 095 926	117,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
5	382 487	7 095 665	119,8	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
6	383 284	7 095 590	122,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
7	383 404	7 096 507	124,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
8	384 145	7 095 898	110,0	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
9	384 021	7 095 208	112,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
10	377 791	7 099 387	87,5	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
11	378 057	7 098 862	90,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
12	378 683	7 099 618	85,9	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
13	379 394	7 099 490	94,6	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
14	379 949	7 099 376	100,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
15	380 638	7 098 723	105,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
16	380 775	7 097 932	105,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
17	379 139	7 098 839	92,5	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
18	381 062	7 097 401	107,5	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9

Calculation Results

Sound level

Noise sensitive area

No.	Name	East	North	Z [m]	Demands Immission height [m]	Sound level Noise [dB(A)]	From WTGs [dB(A)]	Distance to noise demand [m]
A	Lomarakennus A (Lampinjärvi)	384 750	7 099 539	90,0	4,0	40,0	28,6	2 413
B	Lomarakennus B (Lampinkallio)	384 818	7 099 152	93,7	4,0	40,0	29,5	2 089
C	Lomarakennus C (Latvalampi)	384 650	7 097 533	96,0	4,0	40,0	35,8	622
D	Asuinrakennus D (Noppala)	382 520	7 093 979	105,2	4,0	40,0	38,2	346
E	Muu rakennus E (Noppala)	382 290	7 093 807	109,7	4,0	40,0	37,6	443
F	Asuinrakennus F (Maijannevantie)	379 455	7 093 166	96,2	4,0	40,0	34,1	780
G	Asuinrakennus G (Maijannevantie)	379 203	7 093 300	92,9	4,0	40,0	33,8	821
H	Asuinrakennus H (Hietasaari)	379 076	7 093 530	92,5	4,0	40,0	34,2	744
I	Asuinrakennus I (Lahdenperä)	378 699	7 093 923	88,0	4,0	40,0	33,5	847
J	Lomarakennus J (Junno)	378 456	7 094 615	89,4	4,0	40,0	33,2	931
K	Lomarakennus K (Isomännikkö)	380 394	7 096 271	106,1	4,0	40,0	39,0	232
L	Asuinrakennus L (Malkasaari)	379 392	7 096 642	100,9	4,0	40,0	35,4	1 057
M	Asuinrakennus M (Latvala)	383 344	7 100 875	82,6	4,0	40,0	27,4	2 809

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Calculated:
29.1.2024 14.11/3.6.377

DECIBEL - Main Result

Calculation: Pajukoski II VE2_GE158-6.1MWx9xHH221_20230215 +YV Pajukoski I V126 3,3MWx9xHH137(105,9dB)

Distances (m)

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M
1	6682	6452	5302	2403	2240	1653	1673	1584	1670	1753	1644	2165	6981
2	6374	6121	4889	1849	1702	1917	2010	1981	2164	2311	1747	2491	6817
3	5354	5092	3850	1589	1612	2954	3051	3014	3147	3163	1552	2577	5910
4	4630	4380	3224	2057	2163	3658	3732	3669	3738	3643	1501	2565	5168
5	4487	4194	2858	1686	1868	3929	4047	4024	4169	4166	2179	3246	5280
6	4212	3878	2375	1783	2041	4532	4680	4685	4879	4925	2969	4032	5285
7	3317	2999	1614	2678	2921	5173	5285	5253	5368	5297	3019	4014	4368
8	3691	3323	1711	2515	2795	5428	5583	5595	5793	5832	3770	4811	5041
9	4392	4024	2409	1940	2227	5002	5182	5222	5475	5597	3780	4846	5707
10	6961	7031	7105	7184	7168	6439	6248	5996	5539	4818	4060	3178	5749
11	6728	6768	6726	6615	6593	5865	5679	5428	4980	4265	3489	2590	5658
12	6068	6153	6321	6821	6839	6498	6339	6100	5695	5008	3759	3059	4828
13	5357	5435	5609	6336	6378	6324	6193	5968	5610	4964	3371	2848	4186
14	4804	4875	5050	5978	6041	6229	6121	5910	5594	4989	3136	2790	3712
15	4193	4202	4185	5103	5186	5681	5609	5422	5176	4651	2464	2425	3458
16	4288	4224	3896	4321	4394	4945	4891	4718	4514	4047	1704	1891	3907
17	5655	5688	5664	5920	5937	5681	5539	5309	4935	4278	2858	2211	4672
18	4263	4145	3591	3719	3798	4529	4502	4350	4204	3814	1312	1834	4157

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Calculated:
29.1.2024 14.11/3.6.377

DECIBEL - Assumptions for noise calculation

Calculation: Pajukoski II VE2_GE158-6.1MWx9xHH221_20230215 +YV Pajukoski I V126 3,3MWx9xHH137(105,9dB)

Noise calculation model:
ISO 9613-2 General
Wind speed (in 10 m height):
8,0 m/s
Ground attenuation:
General, terrain specific
Ground factor for porous ground: 0,4
Area object with hard ground: Area object (Roughness): REGIONS_Pajukoski II_melu ja varjostus_1.w2r (8)
Area type with hard ground: Vesistöt
Ground factor for hard ground: 0,0
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure tones penalty is added to total noise impact at receptors
Noise sensitive area
Height above ground level, when no value in NSA object:
4,0 m; Don't allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)
Octave data required
Frequency dependent air absorption

63	125	250	500	1 000	2 000	4 000	8 000
[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]
0,10	0,38	1,12	2,36	4,08	8,78	26,60	95,00

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89

WTG: GE WIND ENERGY 6.1-158 HH221 6100 158.0 !O!
Noise: 6.1-158 NRO 107dB + 2 dB

Source	Source/Date	Creator	Edited
Noise_Emission-NRO_4.x_5.x_6.x-158-50Hz_EN_r01	10.8.2021	USER	27.12.2023 13.30

					Octave data							
Status	Hub height [m]	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones	63 [dB]	125 [dB]	250 [dB]	500 [dB]	1000 [dB]	2000 [dB]	4000 [dB]	8000 [dB]
From Windcat	221,0	8,0	109,0	No	92,2	96,9	100,9	103,1	104,4	100,5	90,6	69,2

WTG: VESTAS V126-3.3 HH137 3300 126.0 !O!
Noise: Mode 0 - 11-2014 No STE

Source	Source/Date	Creator	Edited
Manufacturer	1.4.2014	USER	22.1.2024 13.06

Based on Document no.: 0034-7616 V09.

					Octave data							
Status	Hub height [m]	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones	63 [dB]	125 [dB]	250 [dB]	500 [dB]	1000 [dB]	2000 [dB]	4000 [dB]	8000 [dB]
From Windcat	137,0	8,0	105,9	Yes	87,9	94,1	95,7	99,2	101,8	98,1	91,2	90,3

Noise sensitive area: A Lomarakennus A (Lampinjärvi)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

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DECIBEL - Assumptions for noise calculation

Calculation: Pajukoski II VE2_GE158-6.1MWx9xHH221_20230215 +YV Pajukoski I V126 3,3MWx9xHH137(105,9dB)

Noise sensitive area: B Lomarakennus B (Lampinkallio)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: C Lomarakennus C (Latvalampi)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: D Asuinrakennus D (Noppala)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: E Muu rakennus E (Noppala)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: F Asuinrakennus F (Maijannevantie)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: G Asuinrakennus G (Maijannevantie)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: H Asuinrakennus H (Hietasaari)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: I Asuinrakennus I (Lahdenperä)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

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Calculated:
29.1.2024 14.11/3.6.377

DECIBEL - Assumptions for noise calculation

Calculation: Pajukoski II VE2_GE158-6.1MWx9xHH221_20230215 +YV Pajukoski I V126 3,3MWx9xHH137(105,9dB)

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: J Lomarakennus J (Junno)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: K Lomarakennus K (Isomännikkö)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: L Asuinrakennus L (Malkasaari)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: M Asuinrakennus M (Latvala)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

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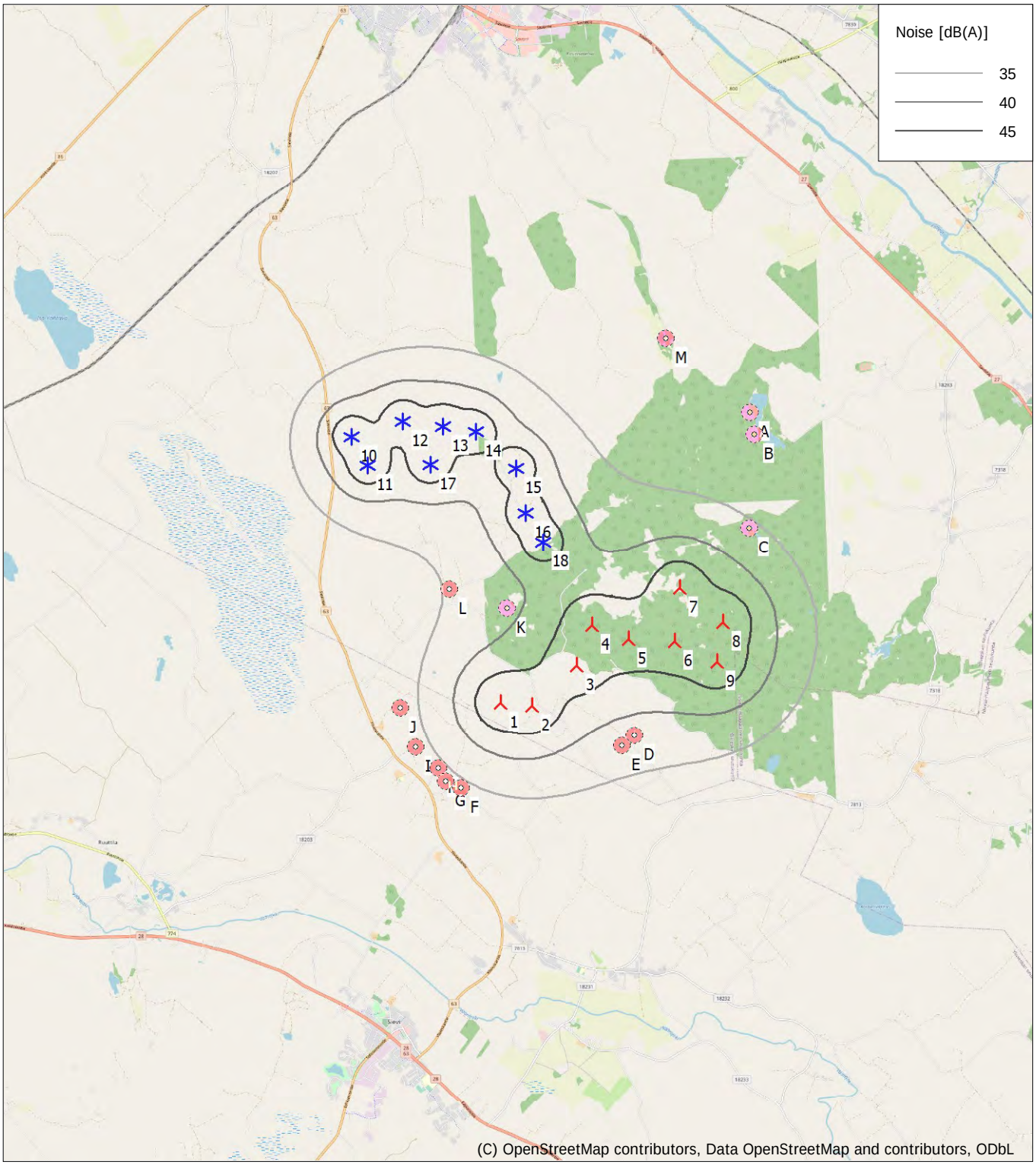
Calculated:
29.1.2024 14.11/3.6.377

DECIBEL - Map 8,0 m/s

Calculation: Pajukoski II VE2_GE158-6.1MWx9xHH221_20230215 +YV Pajukoski I V126 3,3MWx9xHH137(105,9dB)



0 1 2 3 4 km

Map: EMD OpenStreetMap , Print scale 1:100 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 380 968 North: 7 097 091

New WTG Existing WTG Noise sensitive area

Noise calculation model: ISO 9613-2 General. Wind speed: 8,0 m/s
Height above sea level from active line object

Liite 4: Pajukoski II tuulivoimahanke – melun leviämismallinnuksen (ISO 9613-2, YM 2/2014) tulokset WindPro-raporttina vaihtoehdossa VE3.

Project:

Pajukoski tv-hanke

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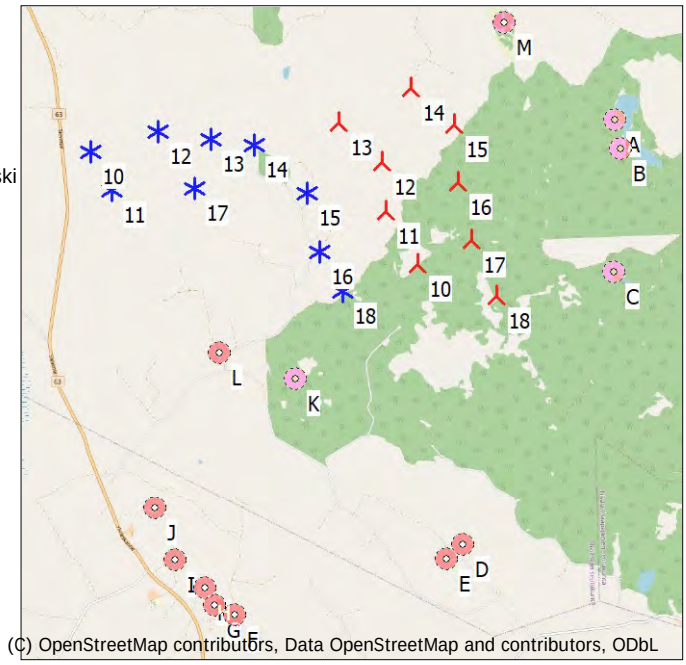
Calculated:
29.1.2024 14.12/3.6.377

DECIBEL - Main Result

Calculation: Pajukoski II VE3_GE158-6.1MWx9xHH221_20230215 +YV Pajukoski I V126 3,3MWx9xHH137(105,9dB)

Noise calculation model:
ISO 9613-2 General
Wind speed (in 10 m height):
8,0 m/s
Ground attenuation:
General, terrain specific
Ground factor for porous ground: 0,4
Area object with hard ground: Area object (Roughness): REGIONS_Pajukoski
Area type with hard ground: Vesistöt
Ground factor for hard ground: 0,0
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure tones penalty is added to total noise impact at receptors
Noise sensitive area
Height above ground level, when no value in NSA object:
4,0 m; Don't allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



Scale 1:100 000

New WTG
Existing WTG
Noise sensitive area

WTGs

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Noise data Creator	Name	Wind speed	LwA,ref
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]
10	382 059	7 097 720	120,0	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
10	377 791	7 099 387	87,5	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
11	378 057	7 098 862	90,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
11	381 666	7 098 437	107,7	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
12	378 683	7 099 618	85,9	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
12	381 641	7 099 097	110,0	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
13	379 394	7 099 490	94,6	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
13	381 097	7 099 635	104,3	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
14	379 949	7 099 376	100,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
14	382 064	7 100 051	105,0	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
15	382 623	7 099 549	108,6	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
15	380 638	7 098 723	105,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
16	382 638	7 098 790	111,8	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
16	380 775	7 097 932	105,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
17	379 139	7 098 839	92,5	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
17	382 790	7 098 020	125,0	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0
18	381 062	7 097 401	107,5	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	105,9
18	383 095	7 097 262	120,7	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	109,0

Calculation Results

Sound level

Noise sensitive area No.	Name	East	North	Z	Demands Immission height	Sound level Noise	From WTGs	Distance to noise demand
				[m]	[m]	[dB(A)]	[dB(A)]	[m]
A	Lomarakennus A (Lampinjärvi)	384 750	7 099 539	90,0	4,0	40,0	34,2	1 023
B	Lomarakennus B (Lampinkallio)	384 818	7 099 152	93,7	4,0	40,0	34,3	1 017
C	Lomarakennus C (Latvalampi)	384 650	7 097 533	96,0	4,0	40,0	35,6	651
D	Asuinrakennus D (Noppala)	382 520	7 093 979	105,2	4,0	40,0	28,3	2 440
E	Muu rakennus E (Noppala)	382 290	7 093 807	109,7	4,0	40,0	27,8	2 642
F	Asuinrakennus F (Maijannevantie)	379 455	7 093 166	96,2	4,0	40,0	25,0	3 801
G	Asuinrakennus G (Maijannevantie)	379 203	7 093 300	92,9	4,0	40,0	25,0	3 775
H	Asuinrakennus H (Hietasaari)	379 076	7 093 530	92,5	4,0	40,0	25,4	3 622
I	Asuinrakennus I (Lahdenperä)	378 699	7 093 923	88,0	4,0	40,0	25,8	3 472
J	Lomarakennus J (Junno)	378 456	7 094 615	89,4	4,0	40,0	26,9	3 069
K	Lomarakennus K (Isomännikkö)	380 394	7 096 271	106,1	4,0	40,0	35,7	583
L	Asuinrakennus L (Malkasaari)	379 392	7 096 642	100,9	4,0	40,0	34,3	1 002
M	Asuinrakennus M (Latvala)	383 344	7 100 875	82,6	4,0	40,0	36,9	435

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Calculated:
29.1.2024 14.12/3.6.377

DECIBEL - Main Result

Calculation: Pajukoski II VE3_GE158-6.1MWx9xHH221_20230215 +YV Pajukoski I V126 3,3MWx9xHH137(105,9dB)

Distances (m)

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M
10	3248	3108	2598	3769	3920	5246	5262	5143	5070	4756	2207	2877	3407
10	6961	7031	7105	7184	7168	6439	6248	5996	5539	4818	4060	3178	5749
11	6728	6768	6726	6615	6593	5865	5679	5428	4980	4265	3489	2590	5658
11	3275	3232	3118	4539	4672	5716	5697	5549	5402	4991	2512	2897	2960
12	6068	6153	6321	6821	6839	6498	6339	6100	5695	5008	3759	3059	4828
12	3140	3177	3391	5193	5330	6321	6289	6129	5952	5498	3089	3329	2462
13	5357	5435	5609	6336	6378	6324	6193	5968	5610	4964	3371	2848	4186
13	3654	3752	4128	5832	5949	6674	6612	6431	6195	5672	3437	3445	2566
14	4804	4875	5050	5978	6041	6229	6121	5910	5594	4989	3136	2790	3712
14	2734	2897	3609	6089	6248	7363	7332	7173	6991	6524	4132	4331	1522
15	2127	2231	2859	5571	5752	7126	7124	6986	6859	6458	3964	4346	1509
15	4193	4202	4185	5103	5186	5681	5609	5422	5176	4651	2464	2425	3458
16	2241	2210	2372	4812	4995	6462	6476	6353	6261	5909	3374	3892	2201
16	4288	4224	3896	4321	4394	4945	4891	4718	4514	4047	1704	1891	3907
17	5655	5688	5664	5920	5937	5681	5539	5309	4935	4278	2858	2211	4672
17	2480	2323	1923	4050	4243	5889	5928	5827	5790	5512	2966	3667	2908
18	4263	4145	3591	3719	3798	4529	4502	4350	4204	3814	1312	1834	4157
18	2815	2558	1578	3333	3548	5480	5554	5485	5520	5341	2877	3755	3622

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Calculated:
29.1.2024 14.12/3.6.377

DECIBEL - Assumptions for noise calculation

Calculation: Pajukoski II VE3_GE158-6.1MWx9xHH221_20230215 +YV Pajukoski I V126 3,3MWx9xHH137(105,9dB)

Noise calculation model:
ISO 9613-2 General
Wind speed (in 10 m height):
8,0 m/s
Ground attenuation:
General, terrain specific
Ground factor for porous ground: 0,4
Area object with hard ground: Area object (Roughness): REGIONS_Pajukoski II_melu ja varjostus_1.w2r (8)
Area type with hard ground: Vesistöt
Ground factor for hard ground: 0,0
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure tones penalty is added to total noise impact at receptors
Noise sensitive area
Height above ground level, when no value in NSA object:
4,0 m; Don't allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)
Octave data required
Frequency dependent air absorption

63	125	250	500	1 000	2 000	4 000	8 000
[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]
0,10	0,38	1,12	2,36	4,08	8,78	26,60	95,00

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89

WTG: GE WIND ENERGY 6.1-158 HH221 6100 158.0 !O!
Noise: 6.1-158 NRO 107dB + 2 dB

Source	Source/Date	Creator	Edited
Noise_Emission-NRO_4.x_5.x_6.x-158-50Hz_EN_r01	10.8.2021	USER	27.12.2023 13.30

					Octave data							
Status	Hub height [m]	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones	63 [dB]	125 [dB]	250 [dB]	500 [dB]	1000 [dB]	2000 [dB]	4000 [dB]	8000 [dB]
From Windcat	221,0	8,0	109,0	No	92,2	96,9	100,9	103,1	104,4	100,5	90,6	69,2

WTG: VESTAS V126-3.3 HH137 3300 126.0 !O!
Noise: Mode 0 - 11-2014 No STE

Source	Source/Date	Creator	Edited
Manufacturer	1.4.2014	USER	22.1.2024 13.06

Based on Document no.: 0034-7616 V09.

					Octave data							
Status	Hub height [m]	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones	63 [dB]	125 [dB]	250 [dB]	500 [dB]	1000 [dB]	2000 [dB]	4000 [dB]	8000 [dB]
From Windcat	137,0	8,0	105,9	Yes	87,9	94,1	95,7	99,2	101,8	98,1	91,2	90,3

Noise sensitive area: A Lomarakennus A (Lampinjärvi)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

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DECIBEL - Assumptions for noise calculation

Calculation: Pajukoski II VE3_GE158-6.1MWx9xHH221_20230215 +YV Pajukoski I V126 3,3MWx9xHH137(105,9dB)

Noise sensitive area: B Lomarakennus B (Lampinkallio)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: C Lomarakennus C (Latvalampi)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: D Asuinrakennus D (Noppala)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: E Muu rakennus E (Noppala)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: F Asuinrakennus F (Maijannevantie)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: G Asuinrakennus G (Maijannevantie)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: H Asuinrakennus H (Hietasaari)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: I Asuinrakennus I (Lahdenperä)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

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Calculated:
29.1.2024 14.12/3.6.377

DECIBEL - Assumptions for noise calculation

Calculation: Pajukoski II VE3_GE158-6.1MWx9xHH221_20230215 +YV Pajukoski I V126 3,3MWx9xHH137(105,9dB)

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: J Lomarakennus J (Junno)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: K Lomarakennus K (Isomännikkö)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: L Asuinrakennus L (Malkasaari)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

Noise sensitive area: M Asuinrakennus M (Latvala)

Predefined calculation standard:
Immission height(a.g.l.): Use standard value from calculation model
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)
No distance demand
Pure tone penalty: 0 dB

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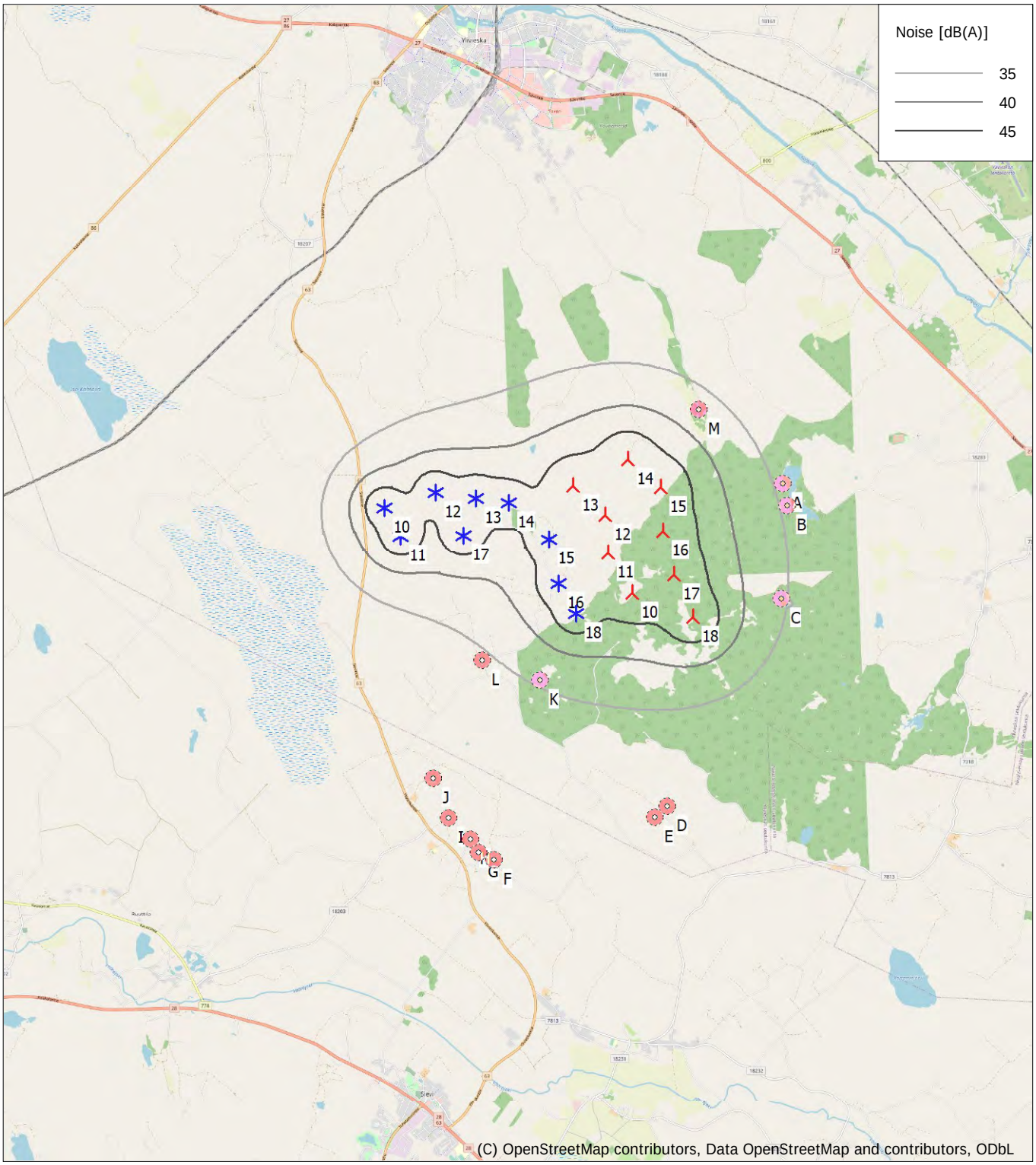
Calculated:
29.1.2024 14.12/3.6.377

DECIBEL - Map 8,0 m/s

Calculation: Pajukoski II VE3_GE158-6.1MWx9xHH221_20230215 +YV Pajukoski I V126 3,3MWx9xHH137(105,9dB)



0 1 2 3 4 km

Map: EMD OpenStreetMap , Print scale 1:100 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 380 443 North: 7 098 358

New WTG Existing WTG Noise sensitive area

Noise calculation model: ISO 9613-2 General. Wind speed: 8,0 m/s
Height above sea level from active line object

Liite 5: Pajukoski II tuulivoimahanke – matalataajuisen melun rakennuskohtaiset arvot nykytilanteessa.

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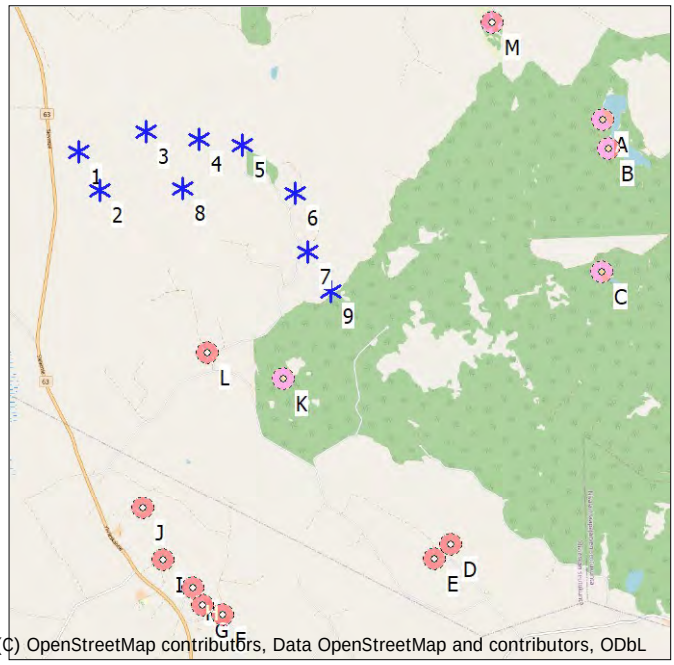
Henna-Riikka Rintamäki / henna-riikka.rintamaki@fcg.fi
Calculated:
30.1.2024 11.38/3.6.377

DECIBEL - Main Result

Calculation: LF_Pajukoski II nykytilanne Pajukoski I V126-3.3MWx9xHH137 (105,9 dB)

Noise calculation model:
Finland Low frequency
Wind speed (in 10 m height):
8,0 m/s
Spectral distribution:
From 20,0 Hz to 200,0 Hz
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure tone penalty is subtracted from demand
Model: 5,0 dB(A)
Height above ground level, when no value in NSA object:
4,0 m; Don't allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89

WTGs

	East	North	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]
1	377 791	7 099 387	87,5	VESTAS V126-3.3 HH137...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
2	378 057	7 098 862	90,0	VESTAS V126-3.3 HH137...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
3	378 683	7 099 618	85,9	VESTAS V126-3.3 HH137...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
4	379 394	7 099 490	94,6	VESTAS V126-3.3 HH137...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
5	379 949	7 099 376	100,0	VESTAS V126-3.3 HH137...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
6	380 638	7 098 723	105,0	VESTAS V126-3.3 HH137...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
7	380 775	7 097 932	105,0	VESTAS V126-3.3 HH137...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
8	379 139	7 098 839	92,5	VESTAS V126-3.3 HH137...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
9	381 062	7 097 401	107,5	VESTAS V126-3.3 HH137...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2

Calculation Results

Sound level

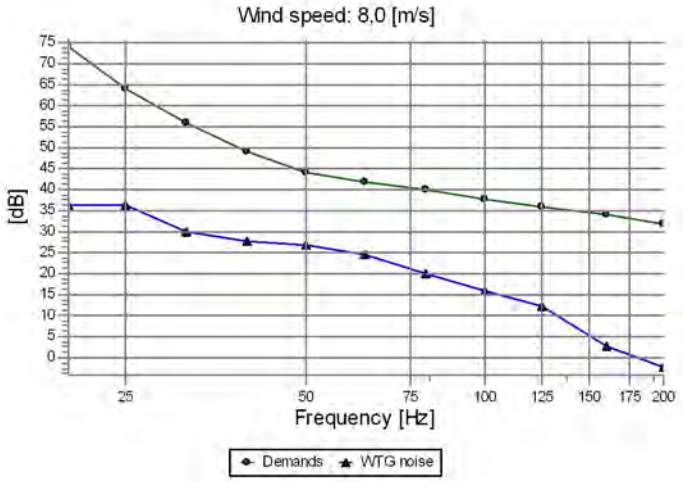
Noise sensitive area No.	Name	East	North	Z [m]	Immission height [m]	Most critical demand Frequency [Hz]	Noise [dB]	Predicted sound level WTG noise [dB]
A	Lomarakennus A (Lampinjärvi)	384 750	7 099 539	90,0	4,0	50,0	44,0	27,1
B	Lomarakennus B (Lampinkallio)	384 818	7 099 152	93,7	4,0	50,0	44,0	27,1
C	Lomarakennus C (Latvalampi)	384 650	7 097 533	96,0	4,0	50,0	44,0	27,4
D	Asuinrakennus D (Noppala)	382 520	7 093 979	105,2	4,0	50,0	44,0	26,6
E	Muu rakennus E (Noppala)	382 290	7 093 807	109,7	4,0	50,0	44,0	26,5
F	Asuinrakennus F (Maijannevantie)	379 455	7 093 166	96,2	4,0	50,0	44,0	26,2
G	Asuinrakennus G (Maijannevantie)	379 203	7 093 300	92,9	4,0	50,0	44,0	26,3
H	Asuinrakennus H (Hietasaari)	379 076	7 093 530	92,5	4,0	50,0	44,0	26,7
I	Asuinrakennus I (Lahdenperä)	378 699	7 093 923	88,0	4,0	50,0	44,0	27,2
J	Lomarakennus J (Junno)	378 456	7 094 615	89,4	4,0	50,0	44,0	28,3
K	Lomarakennus K (Isomännikkö)	380 394	7 096 271	106,1	4,0	50,0	44,0	34,0
L	Asuinrakennus L (Malkasaari)	379 392	7 096 642	100,9	4,0	50,0	44,0	33,8
M	Asuinrakennus M (Latvala)	383 344	7 100 875	82,6	4,0	50,0	44,0	28,7

*)Spectral distribution, please see details in report "Detailed results"

DECIBEL - Detailed results, graphic

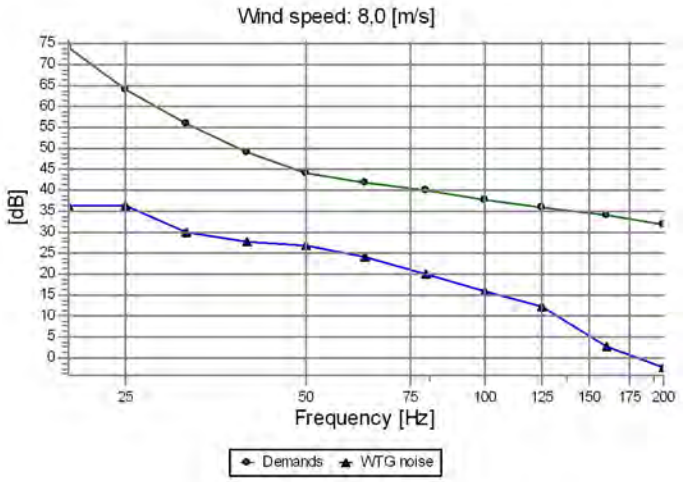
Calculation: LF_Pajukoski II nykytilanne Pajukoski I V126-3.3MWx9xHH137 (105,9 dB) Noise calculation model: Finland Low frequency 8,0 m/s

A Lomarakennus A (Lampinjärvi)



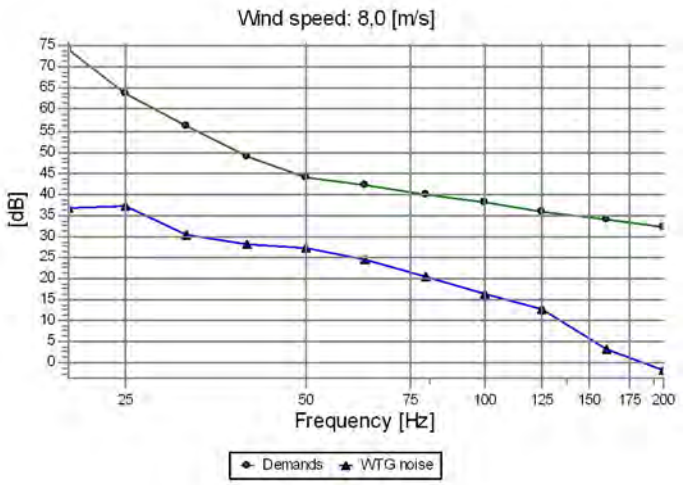
Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	36,3	Yes
25,0	64,0	36,7	Yes
31,5	56,0	30,2	Yes
40,0	49,0	28,0	Yes
50,0	44,0	27,1	Yes
63,0	42,0	24,4	Yes
80,0	40,0	20,0	Yes
100,0	38,0	15,8	Yes
125,0	36,0	12,6	Yes
160,0	34,0	2,6	Yes
200,0	32,0	-2,0	Yes

B Lomarakennus B (Lampinkallio)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	36,3	Yes
25,0	64,0	36,7	Yes
31,5	56,0	30,2	Yes
40,0	49,0	28,0	Yes
50,0	44,0	27,1	Yes
63,0	42,0	24,4	Yes
80,0	40,0	20,0	Yes
100,0	38,0	15,8	Yes
125,0	36,0	12,6	Yes
160,0	34,0	2,7	Yes
200,0	32,0	-1,9	Yes

C Lomarakennus C (Latvalampi)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	36,6	Yes
25,0	64,0	37,0	Yes
31,5	56,0	30,5	Yes
40,0	49,0	28,3	Yes
50,0	44,0	27,4	Yes
63,0	42,0	24,7	Yes
80,0	40,0	20,3	Yes
100,0	38,0	16,2	Yes
125,0	36,0	13,0	Yes
160,0	34,0	3,1	Yes
200,0	32,0	-1,5	Yes

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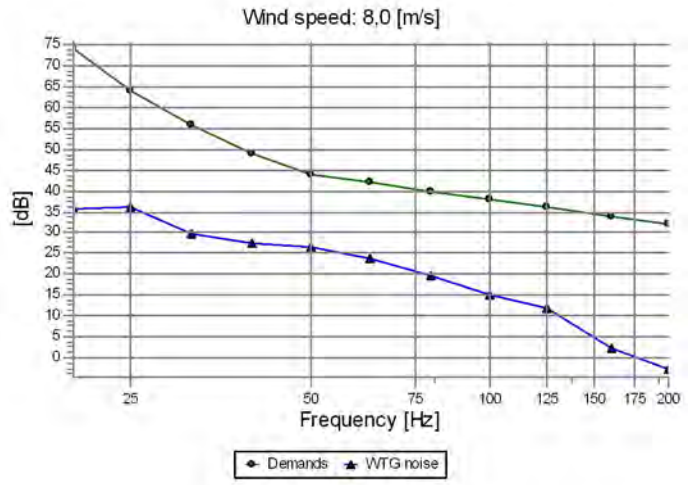
Calculated:
30.1.2024 11.38/3.6.377

DECIBEL - Detailed results, graphic

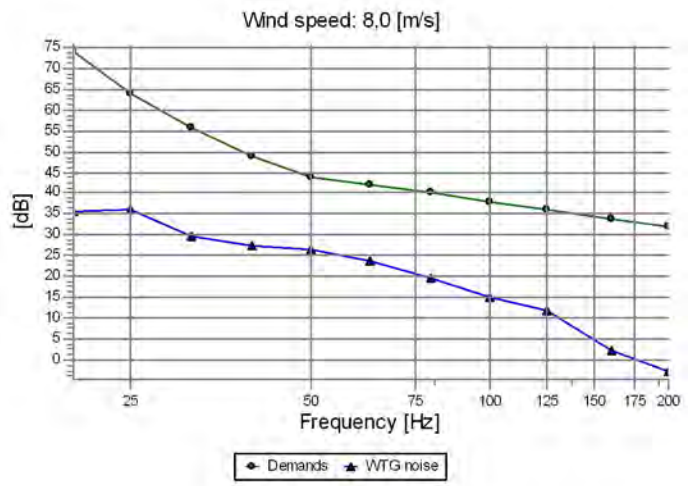
Calculation: LF_Pajukoski II nykytilanne Pajukoski I V126-3.3MWx9xHH137 (105,9 dB) Noise calculation model: Finland Low frequency 8,0 m/s

D Asuinrakennus D (Noppala)



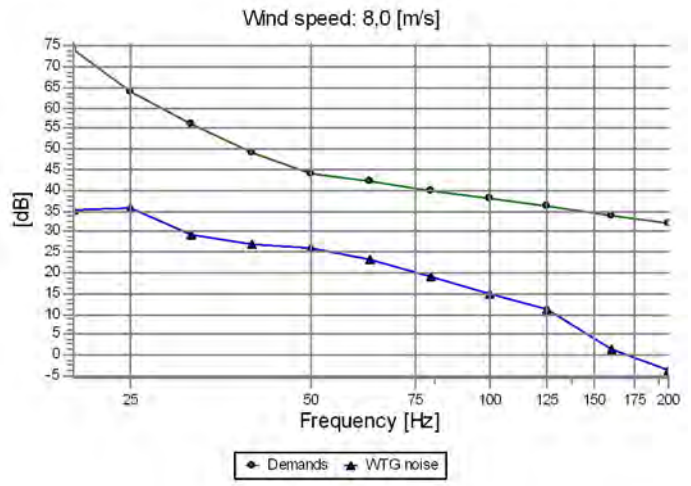
Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	35,8	Yes
25,0	64,0	36,2	Yes
31,5	56,0	29,7	Yes
40,0	49,0	27,5	Yes
50,0	44,0	26,6	Yes
63,0	42,0	23,9	Yes
80,0	40,0	19,5	Yes
100,0	38,0	15,3	Yes
125,0	36,0	12,0	Yes
160,0	34,0	2,1	Yes
200,0	32,0	-2,6	Yes

E Muu rakennus E (Noppala)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	35,7	Yes
25,0	64,0	36,1	Yes
31,5	56,0	29,6	Yes
40,0	49,0	27,4	Yes
50,0	44,0	26,5	Yes
63,0	42,0	23,8	Yes
80,0	40,0	19,4	Yes
100,0	38,0	15,2	Yes
125,0	36,0	11,9	Yes
160,0	34,0	1,9	Yes
200,0	32,0	-2,8	Yes

F Asuinrakennus F (Maijannevantie)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	35,4	Yes
25,0	64,0	35,7	Yes
31,5	56,0	29,3	Yes
40,0	49,0	27,1	Yes
50,0	44,0	26,2	Yes
63,0	42,0	23,4	Yes
80,0	40,0	19,0	Yes
100,0	38,0	14,8	Yes
125,0	36,0	11,4	Yes
160,0	34,0	1,4	Yes
200,0	32,0	-3,4	Yes

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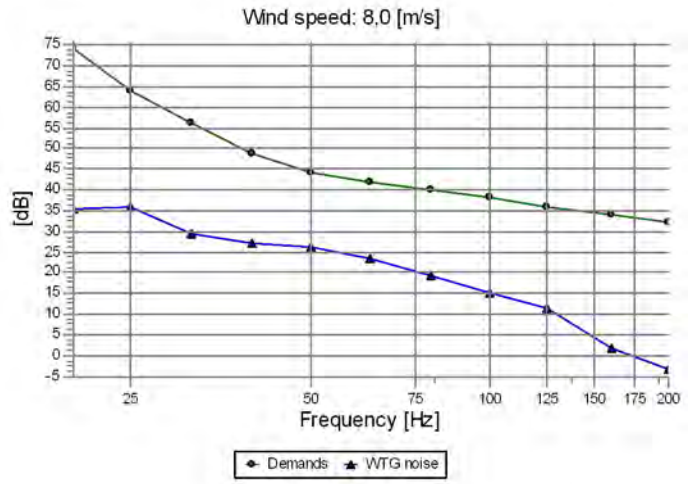
Calculated:
30.1.2024 11.38/3.6.377

DECIBEL - Detailed results, graphic

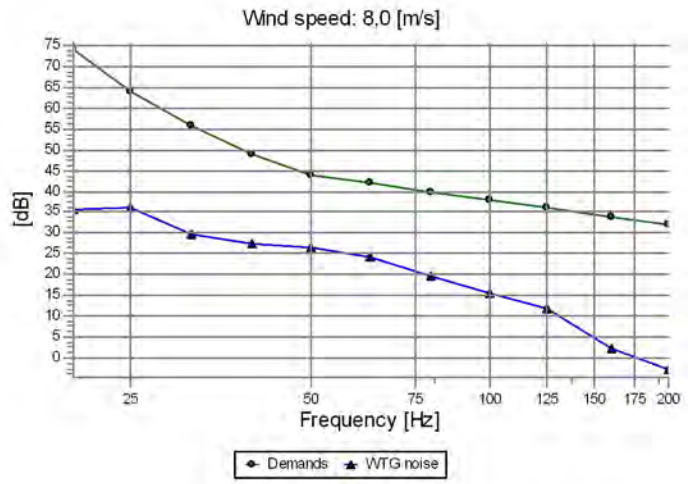
Calculation: LF_Pajukoski II nykytilanne Pajukoski I V126-3.3MWx9xHH137 (105,9 dB) Noise calculation model: Finland Low frequency 8,0 m/s

G Asuinrakennus G (Maijannevantie)



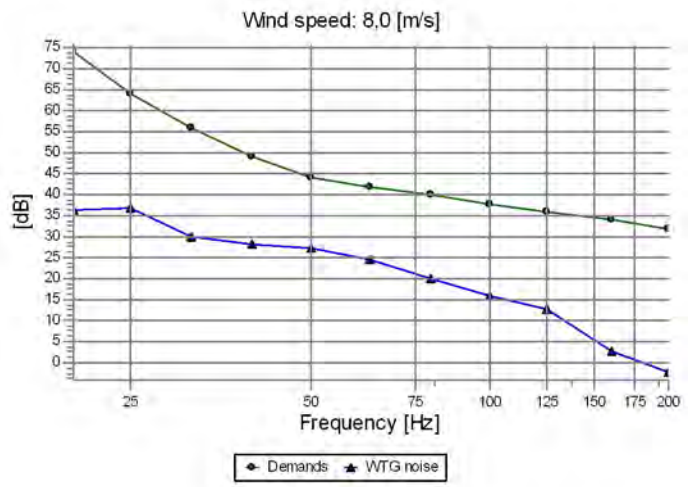
Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	35,5	Yes
25,0	64,0	35,9	Yes
31,5	56,0	29,5	Yes
40,0	49,0	27,2	Yes
50,0	44,0	26,3	Yes
63,0	42,0	23,6	Yes
80,0	40,0	19,1	Yes
100,0	38,0	14,9	Yes
125,0	36,0	11,6	Yes
160,0	34,0	1,6	Yes
200,0	32,0	-3,2	Yes

H Asuinrakennus H (Hietasaari)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	35,8	Yes
25,0	64,0	36,2	Yes
31,5	56,0	29,8	Yes
40,0	49,0	27,6	Yes
50,0	44,0	26,7	Yes
63,0	42,0	24,0	Yes
80,0	40,0	19,5	Yes
100,0	38,0	15,3	Yes
125,0	36,0	12,0	Yes
160,0	34,0	2,0	Yes
200,0	32,0	-2,7	Yes

I Asuinrakennus I (Lahdenperä)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	36,4	Yes
25,0	64,0	36,8	Yes
31,5	56,0	30,3	Yes
40,0	49,0	28,1	Yes
50,0	44,0	27,2	Yes
63,0	42,0	24,5	Yes
80,0	40,0	20,1	Yes
100,0	38,0	15,9	Yes
125,0	36,0	12,6	Yes
160,0	34,0	2,7	Yes
200,0	32,0	-2,0	Yes

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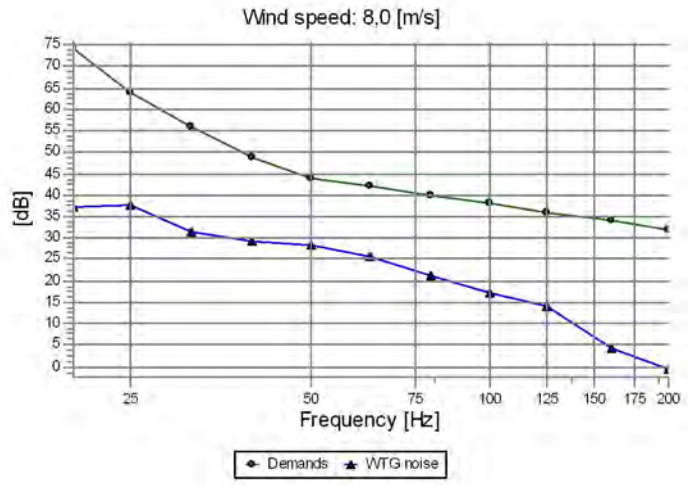
Calculated:
30.1.2024 11.38/3.6.377

DECIBEL - Detailed results, graphic

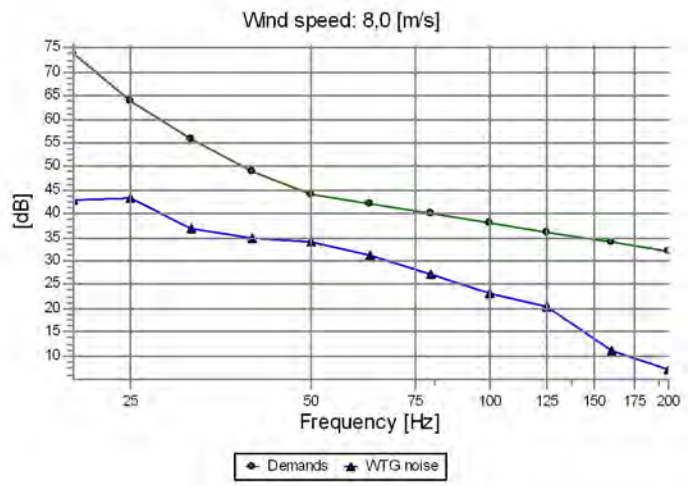
Calculation: LF_Pajukoski II nykytilanne Pajukoski I V126-3.3MWx9xHH137 (105,9 dB) Noise calculation model: Finland Low frequency 8,0 m/s

J Lomarakennus J (Junno)



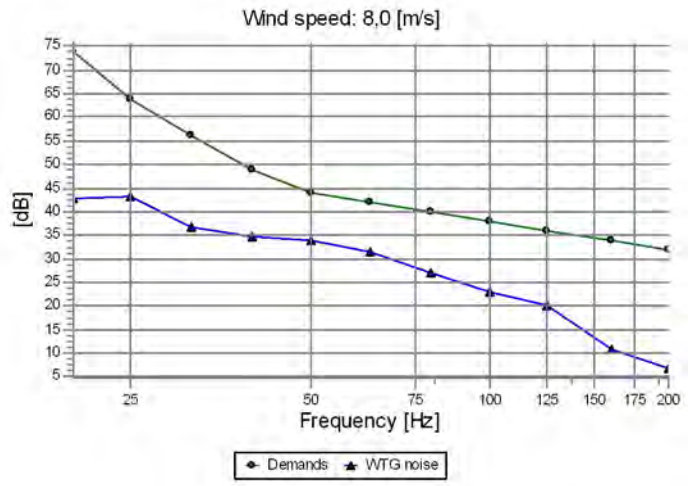
Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	37,4	Yes
25,0	64,0	37,8	Yes
31,5	56,0	31,4	Yes
40,0	49,0	29,2	Yes
50,0	44,0	28,3	Yes
63,0	42,0	25,6	Yes
80,0	40,0	21,2	Yes
100,0	38,0	17,1	Yes
125,0	36,0	13,9	Yes
160,0	34,0	4,1	Yes
200,0	32,0	-0,4	Yes

K Lomarakennus K (Isomännikkö)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	43,0	Yes
25,0	64,0	43,4	Yes
31,5	56,0	37,0	Yes
40,0	49,0	34,8	Yes
50,0	44,0	34,0	Yes
63,0	42,0	31,4	Yes
80,0	40,0	27,1	Yes
100,0	38,0	23,2	Yes
125,0	36,0	20,3	Yes
160,0	34,0	10,9	Yes
200,0	32,0	7,0	Yes

L Asuinrakennus L (Malkasaari)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	42,8	Yes
25,0	64,0	43,3	Yes
31,5	56,0	36,8	Yes
40,0	49,0	34,7	Yes
50,0	44,0	33,8	Yes
63,0	42,0	31,3	Yes
80,0	40,0	26,9	Yes
100,0	38,0	23,0	Yes
125,0	36,0	20,1	Yes
160,0	34,0	10,7	Yes
200,0	32,0	6,7	Yes

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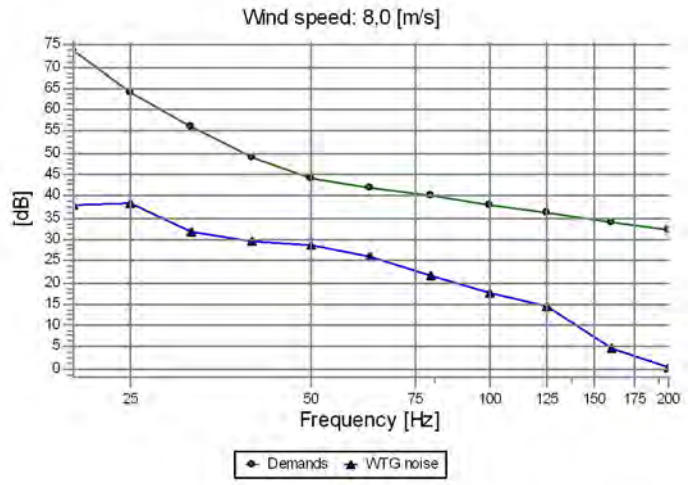
Calculated:
30.1.2024 11.38/3.6.377

DECIBEL - Detailed results, graphic

Calculation: LF_Pajukoski II nykytilanne Pajukoski I V126-3.3MWx9xHH137 (105,9 dB) Noise calculation model: Finland Low frequency 8,0 m/s M Asuinrakennus M (Latvala)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	37,8	Yes
25,0	64,0	38,2	Yes
31,5	56,0	31,7	Yes
40,0	49,0	29,6	Yes
50,0	44,0	28,7	Yes
63,0	42,0	26,0	Yes
80,0	40,0	21,6	Yes
100,0	38,0	17,5	Yes
125,0	36,0	14,4	Yes
160,0	34,0	4,6	Yes
200,0	32,0	0,1	Yes

Liite 6: Pajukoski II tuulivoimahanke – matalataajuisen melun rakennuskohtaiset arvot vaihtoehdossa VE1.

Project:

Pajukoski tv-hanke

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Henna-Riikka Rintamäki / henna-riikka.rintamaki@fcg.fi

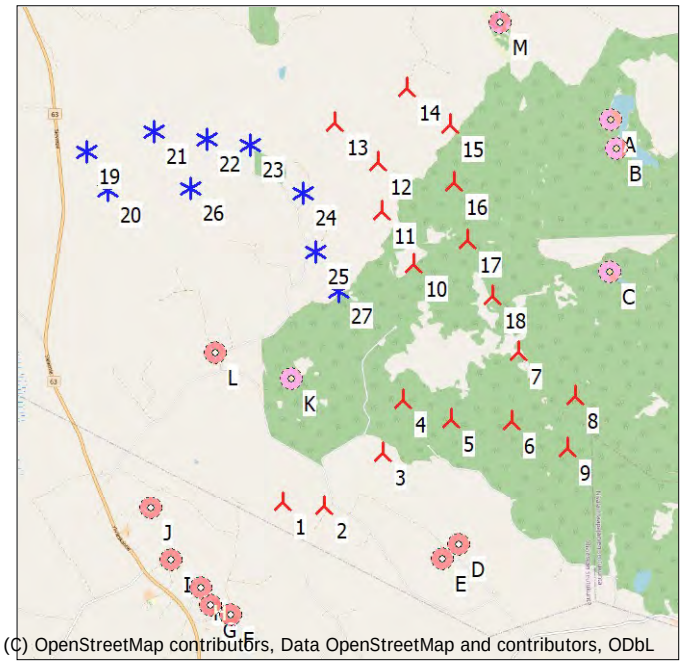
Calculated:
29.1.2024 11.36/3.6.377

DECIBEL - Main Result

Calculation: LF_Pajukoski II_VE1_GE158-6.1MWx18xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB)

Noise calculation model:
Finland Low frequency
Wind speed (in 10 m height):
8,0 m/s
Spectral distribution:
From 20,0 Hz to 200,0 Hz
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure tone penalty is subtracted from demand
Model: 5,0 dB(A)
Height above ground level, when no value in NSA object:
4,0 m; Don't allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



Scale 1:100 000

New WTG
Existing WTG
Noise sensitive area

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89

WTGs

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Noise data Creator	Name	Wind speed	LwA,ref
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]
1	380 209	7 094 637	107,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
2	380 766	7 094 564	106,8	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
3	381 556	7 095 242	112,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
4	381 855	7 095 926	117,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
5	382 487	7 095 665	119,8	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
6	383 284	7 095 590	122,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
7	383 404	7 096 507	124,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
8	384 145	7 095 898	110,0	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
9	384 021	7 095 208	112,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
10	382 059	7 097 720	120,0	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
11	381 666	7 098 437	107,7	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
12	381 641	7 099 097	110,0	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
13	381 097	7 099 635	104,3	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
14	382 064	7 100 051	105,0	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
15	382 623	7 099 549	108,6	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
16	382 638	7 098 790	111,8	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
17	382 790	7 098 020	125,0	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
18	383 095	7 097 262	120,7	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
19	377 791	7 099 387	87,5	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
20	378 057	7 098 862	90,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
21	378 683	7 099 618	85,9	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
22	379 394	7 099 490	94,6	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
23	379 949	7 099 376	100,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
24	380 638	7 098 723	105,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
25	380 775	7 097 932	105,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
26	379 139	7 098 839	92,5	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
27	381 062	7 097 401	107,5	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2

Calculation Results

Sound level

Noise sensitive area						Most critical demand		Predicted sound level
No.	Name	East	North	Z	Immission height	Frequency	Noise	WTG noise
				[m]	[m]	[Hz]	[dB]	[dB]
A	Lomarakennus A (Lampinjärvi)	384 750	7 099 539	90,0	4,0	50,0	44,0	39,8
B	Lomarakennus B (Lampinkallio)	384 818	7 099 152	93,7	4,0	50,0	44,0	40,0
C	Lomarakennus C (Latvalampi)	384 650	7 097 533	96,0	4,0	50,0	44,0	42,1
D	Asuinrakennus D (Noppala)	382 520	7 093 979	105,2	4,0	50,0	44,0	41,9
E	Muu rakennus E (Noppala)	382 290	7 093 807	109,7	4,0	50,0	44,0	41,5

To be continued on next page...

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Calculated:
29.1.2024 11.36/3.6.377

DECIBEL - Main Result

Calculation: LF_Pajukoski II_VE1_GE158-6.1MWx18xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB)

...continued from previous page

Noise sensitive area						Most critical demand		Predicted sound level
No.	Name	East	North	Z	Immission height	Frequency	Noise	WTG noise
				[m]	[m]	[Hz]	[dB]	[dB]
F	Asuinrakennus F (Maijannevantie)	379 455	7 093 166	96,2	4,0	50,0	44,0	38,7
G	Asuinrakennus G (Maijannevantie)	379 203	7 093 300	92,9	4,0	50,0	44,0	38,5
H	Asuinrakennus H (Hietasaari)	379 076	7 093 530	92,5	4,0	50,0	44,0	38,7
I	Asuinrakennus I (Lahdenperä)	378 699	7 093 923	88,0	4,0	50,0	44,0	38,4
J	Lomarakennus J (Junno)	378 456	7 094 615	89,4	4,0	50,0	44,0	38,5
K	Lomarakennus K (Isomännikkö)	380 394	7 096 271	106,1	4,0	50,0	44,0	42,9
L	Asuinrakennus L (Malkasaari)	379 392	7 096 642	100,9	4,0	50,0	44,0	40,7
M	Asuinrakennus M (Latvala)	383 344	7 100 875	82,6	4,0	50,0	44,0	40,8

*)Spectral distribution, please see details in report "Detailed results"

Distances (m)

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M
1	6682	6452	5302	2403	2240	1653	1673	1584	1670	1753	1644	2165	6981
2	6374	6121	4889	1849	1702	1917	2010	1981	2164	2311	1747	2491	6817
3	5354	5092	3850	1589	1612	2954	3051	3014	3147	3163	1552	2577	5910
4	4630	4380	3224	2057	2163	3658	3732	3669	3738	3643	1501	2565	5168
5	4487	4194	2858	1686	1868	3929	4047	4024	4169	4166	2179	3246	5280
6	4212	3878	2375	1783	2041	4532	4680	4685	4879	4925	2969	4032	5285
7	3317	2999	1614	2678	2921	5173	5285	5253	5368	5297	3019	4014	4368
8	3691	3323	1711	2515	2795	5428	5583	5595	5793	5832	3770	4811	5041
9	4392	4024	2409	1940	2227	5002	5182	5222	5475	5597	3780	4846	5707
10	3248	3108	2598	3769	3920	5246	5262	5143	5070	4756	2207	2877	3407
11	3275	3232	3118	4539	4672	5716	5697	5549	5402	4991	2512	2897	2960
12	3140	3177	3391	5193	5330	6321	6289	6129	5952	5498	3089	3329	2462
13	3654	3752	4128	5832	5949	6674	6612	6431	6195	5672	3437	3445	2566
14	2734	2897	3609	6089	6248	7363	7332	7173	6991	6524	4132	4331	1522
15	2127	2231	2859	5571	5752	7126	7124	6986	6859	6458	3964	4346	1509
16	2241	2210	2372	4812	4995	6462	6476	6353	6261	5909	3374	3892	2201
17	2480	2323	1923	4050	4243	5889	5928	5827	5790	5512	2966	3667	2908
18	2815	2558	1578	3333	3548	5480	5554	5485	5520	5341	2877	3755	3622
19	6961	7031	7105	7184	7168	6439	6248	5996	5539	4818	4060	3178	5749
20	6728	6768	6726	6615	6593	5865	5679	5428	4980	4265	3489	2590	5658
21	6068	6153	6321	6821	6839	6498	6339	6100	5695	5008	3759	3059	4828
22	5357	5435	5609	6336	6378	6324	6193	5968	5610	4964	3371	2848	4186
23	4804	4875	5050	5978	6041	6229	6121	5910	5594	4989	3136	2790	3712
24	4193	4202	4185	5103	5186	5681	5609	5422	5176	4651	2464	2425	3458
25	4288	4224	3896	4321	4394	4945	4891	4718	4514	4047	1704	1891	3907
26	5655	5688	5664	5920	5937	5681	5539	5309	4935	4278	2858	2211	4672
27	4263	4145	3591	3719	3798	4529	4502	4350	4204	3814	1312	1834	4157

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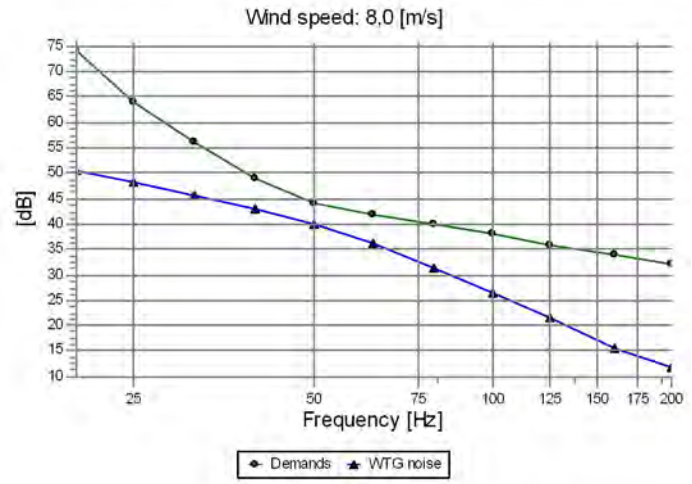
29.1.2024 11.36/3.6.377

DECIBEL - Detailed results, graphic

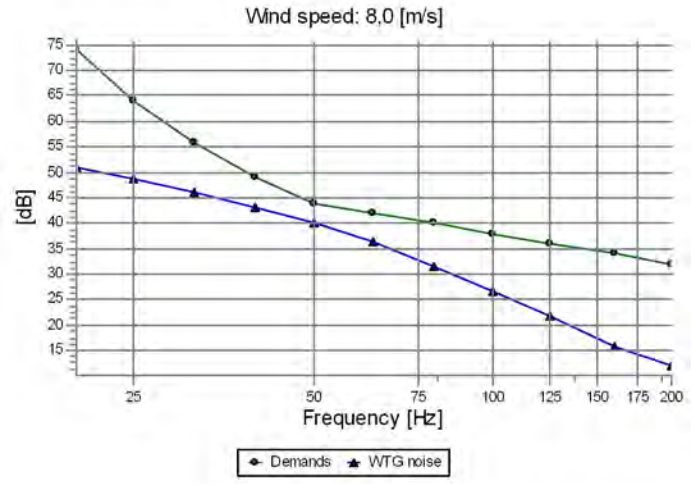
Calculation: LF_Pajukoski II_VE1_GE158-6.1MWx18xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB) Noise calculation model: Finland Low frequency 8,0 m/s

A Lomarakennus A (Lampinjärvi)



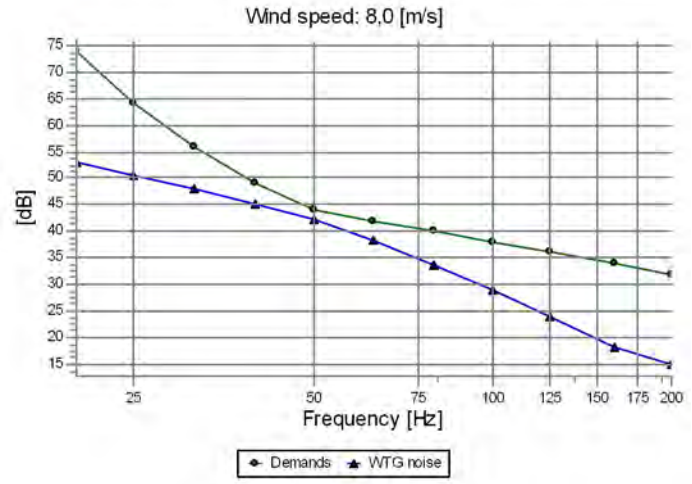
Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	50,6	Yes
25,0	64,0	48,4	Yes
31,5	56,0	45,7	Yes
40,0	49,0	42,9	Yes
50,0	44,0	39,8	Yes
63,0	42,0	36,0	Yes
80,0	40,0	31,4	Yes
100,0	38,0	26,6	Yes
125,0	36,0	21,6	Yes
160,0	34,0	15,4	Yes
200,0	32,0	11,9	Yes

B Lomarakennus B (Lampinkallio)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	50,9	Yes
25,0	64,0	48,6	Yes
31,5	56,0	46,0	Yes
40,0	49,0	43,1	Yes
50,0	44,0	40,0	Yes
63,0	42,0	36,3	Yes
80,0	40,0	31,6	Yes
100,0	38,0	26,8	Yes
125,0	36,0	21,8	Yes
160,0	34,0	15,7	Yes
200,0	32,0	12,2	Yes

C Lomarakennus C (Latvalampi)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	52,9	Yes
25,0	64,0	50,7	Yes
31,5	56,0	48,0	Yes
40,0	49,0	45,2	Yes
50,0	44,0	42,1	Yes
63,0	42,0	38,4	Yes
80,0	40,0	33,8	Yes
100,0	38,0	29,0	Yes
125,0	36,0	24,0	Yes
160,0	34,0	18,1	Yes
200,0	32,0	14,8	Yes

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Calculated:
29.1.2024 11.36/3.6.377

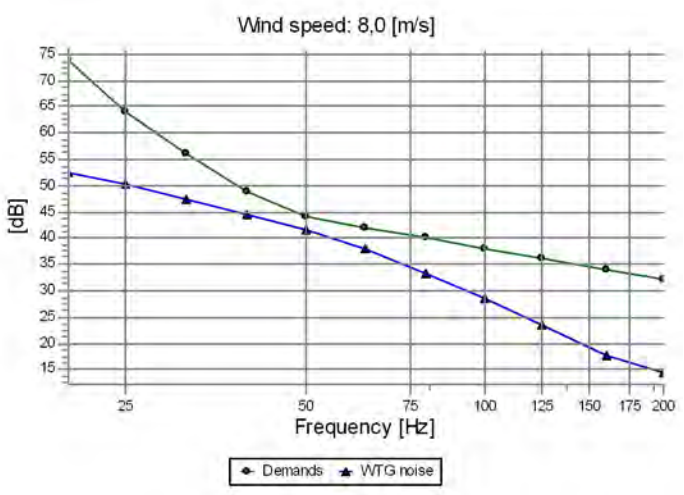
DECIBEL - Detailed results, graphic

Calculation: LF_Pajukoski II_VE1_GE158-6.1MWx18xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB) Noise calculation model: Finland Low frequency 8,0 m/s

D Asuinrakennus D (Noppala)

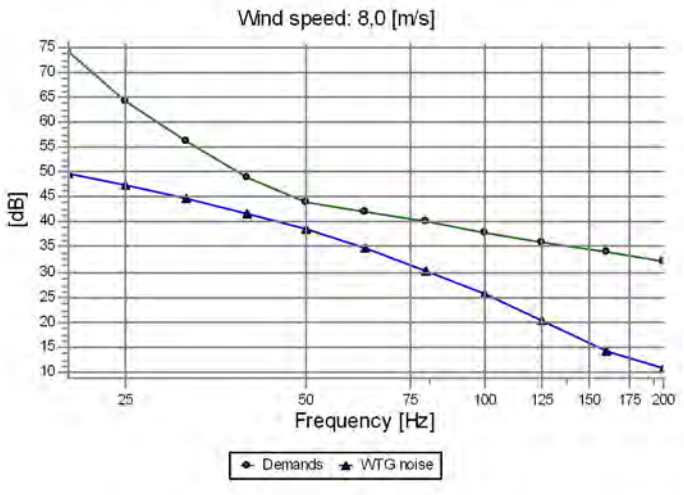
Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	52,8	Yes
25,0	64,0	50,5	Yes
31,5	56,0	47,9	Yes
40,0	49,0	45,0	Yes
50,0	44,0	41,9	Yes
63,0	42,0	38,2	Yes
80,0	40,0	33,6	Yes
100,0	38,0	28,8	Yes
125,0	36,0	23,8	Yes
160,0	34,0	18,0	Yes
200,0	32,0	14,7	Yes

E Muu rakennus E (Noppala)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	52,4	Yes
25,0	64,0	50,1	Yes
31,5	56,0	47,5	Yes
40,0	49,0	44,6	Yes
50,0	44,0	41,5	Yes
63,0	42,0	37,8	Yes
80,0	40,0	33,2	Yes
100,0	38,0	28,4	Yes
125,0	36,0	23,4	Yes
160,0	34,0	17,5	Yes
200,0	32,0	14,2	Yes

F Asuinrakennus F (Maijannevantie)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	49,5	Yes
25,0	64,0	47,3	Yes
31,5	56,0	44,6	Yes
40,0	49,0	41,8	Yes
50,0	44,0	38,7	Yes
63,0	42,0	34,9	Yes
80,0	40,0	30,3	Yes
100,0	38,0	25,4	Yes
125,0	36,0	20,4	Yes
160,0	34,0	14,3	Yes
200,0	32,0	10,8	Yes

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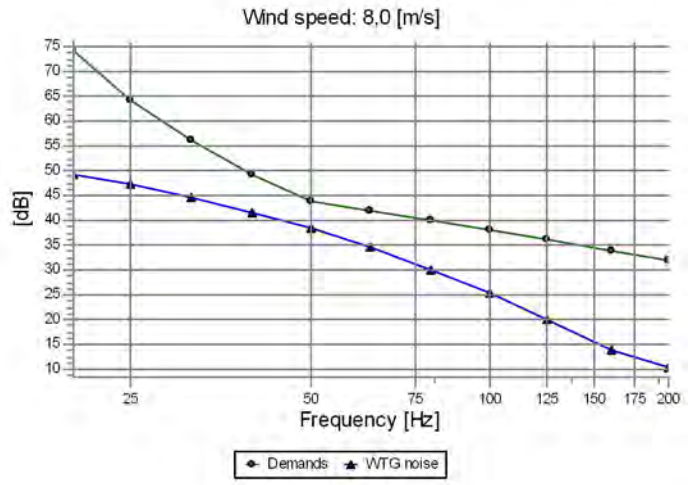
Calculated:
29.1.2024 11.36/3.6.377

DECIBEL - Detailed results, graphic

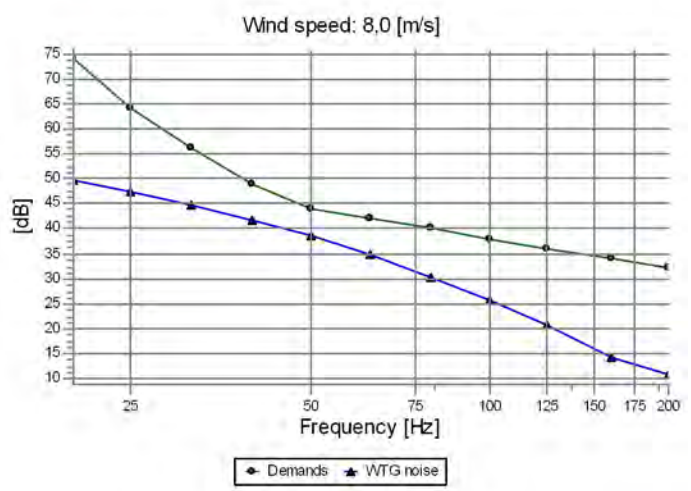
Calculation: LF_Pajukoski II_VE1_GE158-6.1MWx18xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB) Noise calculation model: Finland Low frequency 8,0 m/s

G Asuinrakennus G (Maijannevantie)



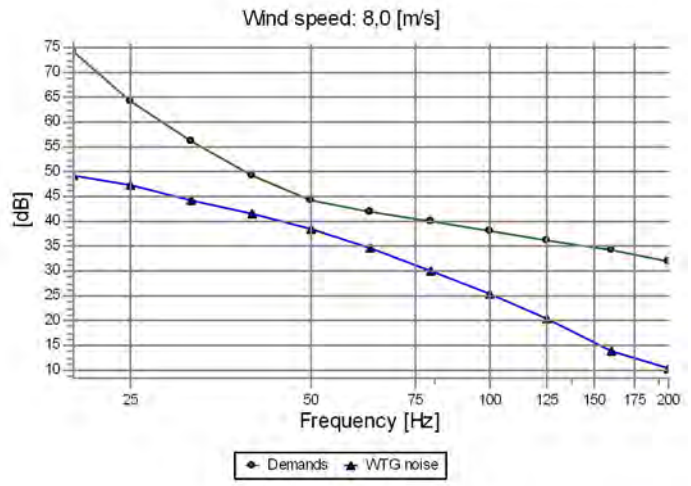
Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	49,4	Yes
25,0	64,0	47,1	Yes
31,5	56,0	44,4	Yes
40,0	49,0	41,6	Yes
50,0	44,0	38,5	Yes
63,0	42,0	34,7	Yes
80,0	40,0	30,1	Yes
100,0	38,0	25,3	Yes
125,0	36,0	20,3	Yes
160,0	34,0	14,1	Yes
200,0	32,0	10,6	Yes

H Asuinrakennus H (Hietasaari)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	49,6	Yes
25,0	64,0	47,4	Yes
31,5	56,0	44,6	Yes
40,0	49,0	41,8	Yes
50,0	44,0	38,7	Yes
63,0	42,0	35,0	Yes
80,0	40,0	30,3	Yes
100,0	38,0	25,5	Yes
125,0	36,0	20,5	Yes
160,0	34,0	14,4	Yes
200,0	32,0	10,9	Yes

I Asuinrakennus I (Lahdenperä)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	49,3	Yes
25,0	64,0	47,1	Yes
31,5	56,0	44,3	Yes
40,0	49,0	41,5	Yes
50,0	44,0	38,4	Yes
63,0	42,0	34,7	Yes
80,0	40,0	30,1	Yes
100,0	38,0	25,2	Yes
125,0	36,0	20,3	Yes
160,0	34,0	14,0	Yes
200,0	32,0	10,5	Yes

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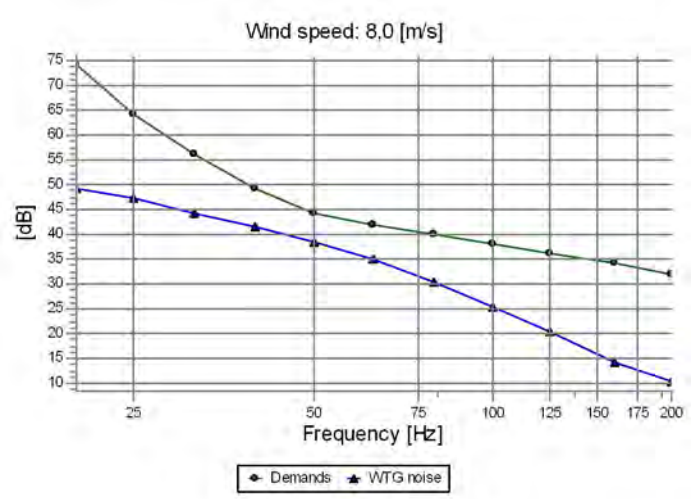
Calculated:
29.1.2024 11.36/3.6.377

DECIBEL - Detailed results, graphic

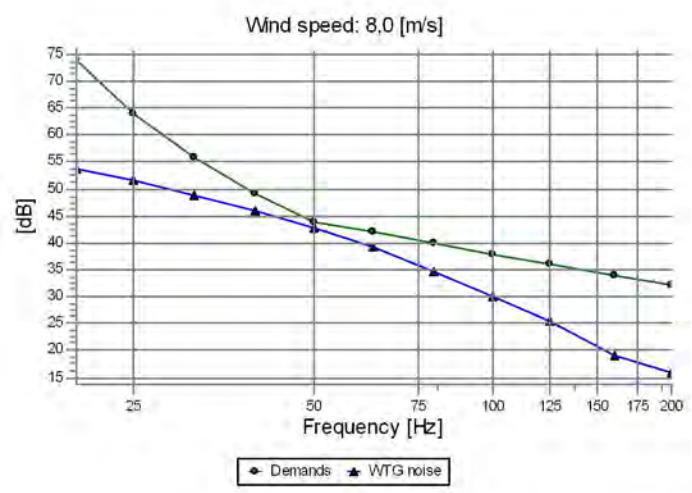
Calculation: LF_Pajukoski II_VE1_GE158-6.1MWx18xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB) Noise calculation model: Finland Low frequency 8,0 m/s

J Lomarakennus J (Junno)



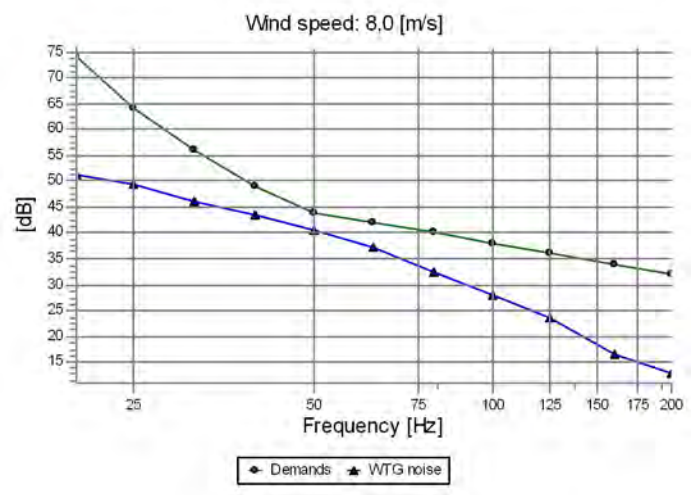
Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	49,3	Yes
25,0	64,0	47,1	Yes
31,5	56,0	44,3	Yes
40,0	49,0	41,5	Yes
50,0	44,0	38,5	Yes
63,0	42,0	34,7	Yes
80,0	40,0	30,1	Yes
100,0	38,0	25,3	Yes
125,0	36,0	20,4	Yes
160,0	34,0	14,0	Yes
200,0	32,0	10,4	Yes

K Lomarakennus K (Isomännikkö)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	53,6	Yes
25,0	64,0	51,6	Yes
31,5	56,0	48,6	Yes
40,0	49,0	45,8	Yes
50,0	44,0	42,9	Yes
63,0	42,0	39,3	Yes
80,0	40,0	34,8	Yes
100,0	38,0	30,1	Yes
125,0	36,0	25,6	Yes
160,0	34,0	19,1	Yes
200,0	32,0	15,8	Yes

L Asuinrakennus L (Malkasaari)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	51,3	Yes
25,0	64,0	49,4	Yes
31,5	56,0	46,2	Yes
40,0	49,0	43,5	Yes
50,0	44,0	40,7	Yes
63,0	42,0	37,2	Yes
80,0	40,0	32,6	Yes
100,0	38,0	28,0	Yes
125,0	36,0	23,7	Yes
160,0	34,0	16,6	Yes
200,0	32,0	13,0	Yes

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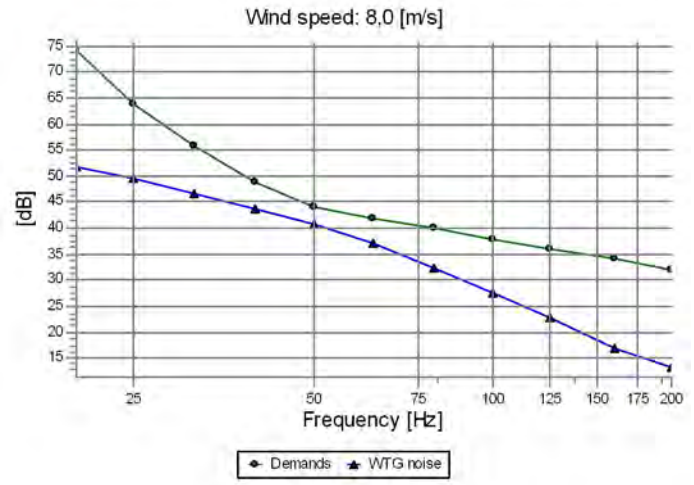
DECIBEL - Detailed results, graphic

Calculation: LF_Pajukoski II_VE1_GE158-6.1MWx18xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB) Noise calculation model: Finland Low frequency 8,0 m/s

M Asuinrakennus M (Latvala)



Frequency	Sound level Demands	WTG noise	Demands fulfilled ?
[Hz]	[dB]	[dB]	
20,0	74,0	51,6	Yes
25,0	64,0	49,4	Yes
31,5	56,0	46,7	Yes
40,0	49,0	43,9	Yes
50,0	44,0	40,8	Yes
63,0	42,0	37,1	Yes
80,0	40,0	32,5	Yes
100,0	38,0	27,7	Yes
125,0	36,0	22,8	Yes
160,0	34,0	16,8	Yes
200,0	32,0	13,4	Yes

Liite 7: Pajukoski II tuulivoimahanke – matalataajuisen melun rakennuskohtaiset arvot vaihtoehdossa VE2.

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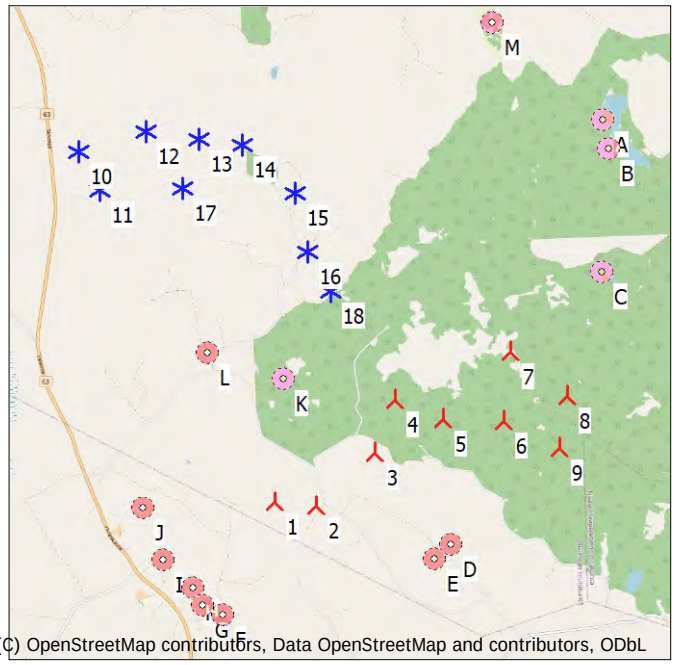
Calculated:
29.1.2024 16.51/3.6.377

DECIBEL - Main Result

Calculation: LF_Pajukoski II_VE2_GE158-6.1MWx9xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB)

Noise calculation model:
Finland Low frequency
Wind speed (in 10 m height):
8,0 m/s
Spectral distribution:
From 20,0 Hz to 200,0 Hz
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure tone penalty is subtracted from demand
Model: 5,0 dB(A)
Height above ground level, when no value in NSA object:
4,0 m; Don't allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



(C) OpenStreetMap contributors, Data OpenStreetMap and contributors, ODbL

Scale 1:100 000
New WTG
Existing WTG
Noise sensitive area

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89

WTGs

	East	North	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]
1	380 209	7 094 637	107,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
2	380 766	7 094 564	106,8	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
3	381 556	7 095 242	112,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
4	381 855	7 095 926	117,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
5	382 487	7 095 665	119,8	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
6	383 284	7 095 590	122,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
7	383 404	7 096 507	124,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
8	384 145	7 095 898	110,0	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
9	384 021	7 095 208	112,5	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
10	377 791	7 099 387	87,5	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
11	378 057	7 098 862	90,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
12	378 683	7 099 618	85,9	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
13	379 394	7 099 490	94,6	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
14	379 949	7 099 376	100,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
15	380 638	7 098 723	105,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
16	380 775	7 097 932	105,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
17	379 139	7 098 839	92,5	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
18	381 062	7 097 401	107,5	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2

Calculation Results

Sound level

Noise sensitive area No.	Name	East	North	Z [m]	Most critical demand Immission height [m]	Frequency [Hz]	Predicted sound level Noise [dB]	WTG noise [dB]
A	Lomarakennus A (Lampinjärvi)	384 750	7 099 539	90,0	4,0	50,0	44,0	34,7
B	Lomarakennus B (Lampinkallio)	384 818	7 099 152	93,7	4,0	50,0	44,0	35,3
C	Lomarakennus C (Latvalampi)	384 650	7 097 533	96,0	4,0	50,0	44,0	39,3
D	Asuinrakennus D (Noppala)	382 520	7 093 979	105,2	4,0	50,0	44,0	41,2
E	Muu rakennus E (Noppala)	382 290	7 093 807	109,7	4,0	50,0	44,0	40,8
F	Asuinrakennus F (Maijannevantie)	379 455	7 093 166	96,2	4,0	50,0	44,0	37,9
G	Asuinrakennus G (Maijannevantie)	379 203	7 093 300	92,9	4,0	50,0	44,0	37,7
H	Asuinrakennus H (Hietasaari)	379 076	7 093 530	92,5	4,0	50,0	44,0	37,9
I	Asuinrakennus I (Lahdenperä)	378 699	7 093 923	88,0	4,0	50,0	44,0	37,5
J	Lomarakennus J (Junno)	378 456	7 094 615	89,4	4,0	50,0	44,0	37,4
K	Lomarakennus K (Isomännikkö)	380 394	7 096 271	106,1	4,0	50,0	44,0	41,5
L	Asuinrakennus L (Malkasaari)	379 392	7 096 642	100,9	4,0	50,0	44,0	38,9
M	Asuinrakennus M (Latvala)	383 344	7 100 875	82,6	4,0	50,0	44,0	33,7

*)Spectral distribution, please see details in report "Detailed results"

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Calculated:
29.1.2024 16.51/3.6.377

DECIBEL - Main Result

Calculation: LF_Pajukoski II_VE2_GE158-6.1MWx9xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB)

Distances (m)

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M
1	6682	6452	5302	2403	2240	1653	1673	1584	1670	1753	1644	2165	6981
2	6374	6121	4889	1849	1702	1917	2010	1981	2164	2311	1747	2491	6817
3	5354	5092	3850	1589	1612	2954	3051	3014	3147	3163	1552	2577	5910
4	4630	4380	3224	2057	2163	3658	3732	3669	3738	3643	1501	2565	5168
5	4487	4194	2858	1686	1868	3929	4047	4024	4169	4166	2179	3246	5280
6	4212	3878	2375	1783	2041	4532	4680	4685	4879	4925	2969	4032	5285
7	3317	2999	1614	2678	2921	5173	5285	5253	5368	5297	3019	4014	4368
8	3691	3323	1711	2515	2795	5428	5583	5595	5793	5832	3770	4811	5041
9	4392	4024	2409	1940	2227	5002	5182	5222	5475	5597	3780	4846	5707
10	6961	7031	7105	7184	7168	6439	6248	5996	5539	4818	4060	3178	5749
11	6728	6768	6726	6615	6593	5865	5679	5428	4980	4265	3489	2590	5658
12	6068	6153	6321	6821	6839	6498	6339	6100	5695	5008	3759	3059	4828
13	5357	5435	5609	6336	6378	6324	6193	5968	5610	4964	3371	2848	4186
14	4804	4875	5050	5978	6041	6229	6121	5910	5594	4989	3136	2790	3712
15	4193	4202	4185	5103	5186	5681	5609	5422	5176	4651	2464	2425	3458
16	4288	4224	3896	4321	4394	4945	4891	4718	4514	4047	1704	1891	3907
17	5655	5688	5664	5920	5937	5681	5539	5309	4935	4278	2858	2211	4672
18	4263	4145	3591	3719	3798	4529	4502	4350	4204	3814	1312	1834	4157

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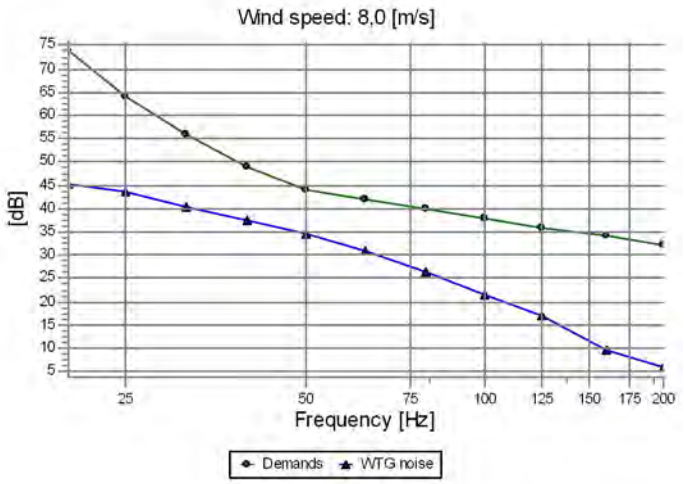
Calculated:
29.1.2024 16.51/3.6.377

DECIBEL - Detailed results, graphic

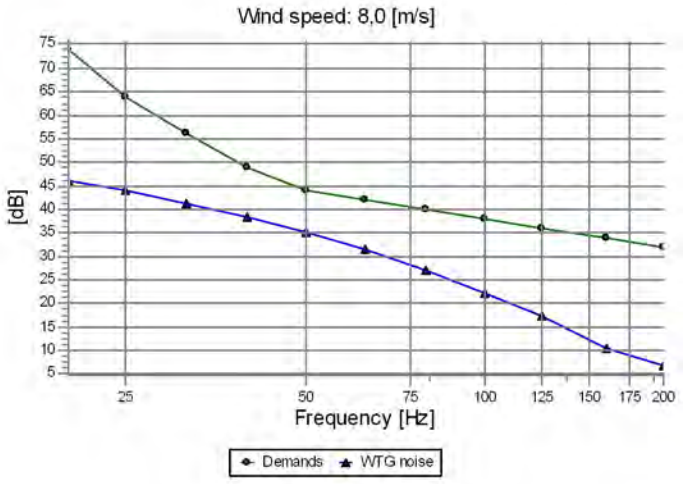
Calculation: LF_Pajukoski II_VE2_GE158-6.1MWx9xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB) Noise calculation model: Finland Low frequency 8,0 m/s

A Lomarakennus A (Lampinjärvi)



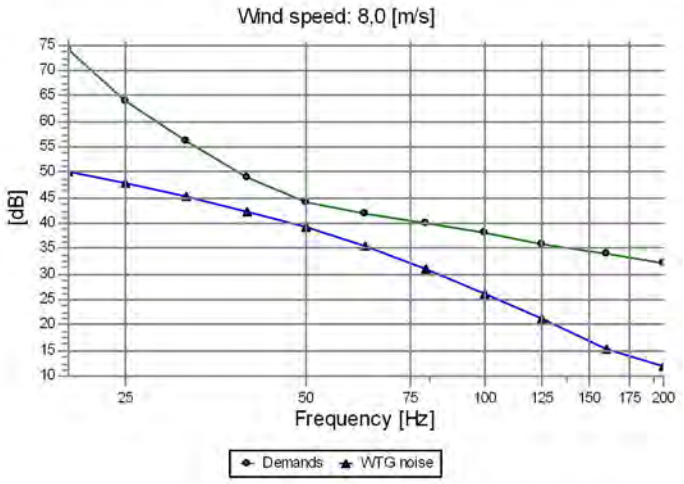
Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	45,4	Yes
25,0	64,0	43,5	Yes
31,5	56,0	40,3	Yes
40,0	49,0	37,5	Yes
50,0	44,0	34,7	Yes
63,0	42,0	31,0	Yes
80,0	40,0	26,4	Yes
100,0	38,0	21,6	Yes
125,0	36,0	16,9	Yes
160,0	34,0	9,8	Yes
200,0	32,0	5,9	Yes

B Lomarakennus B (Lampinkallio)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	46,0	Yes
25,0	64,0	44,0	Yes
31,5	56,0	41,0	Yes
40,0	49,0	38,2	Yes
50,0	44,0	35,3	Yes
63,0	42,0	31,6	Yes
80,0	40,0	26,9	Yes
100,0	38,0	22,2	Yes
125,0	36,0	17,4	Yes
160,0	34,0	10,5	Yes
200,0	32,0	6,7	Yes

C Lomarakennus C (Latvalampi)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	50,0	Yes
25,0	64,0	47,8	Yes
31,5	56,0	45,1	Yes
40,0	49,0	42,3	Yes
50,0	44,0	39,3	Yes
63,0	42,0	35,5	Yes
80,0	40,0	30,9	Yes
100,0	38,0	26,2	Yes
125,0	36,0	21,3	Yes
160,0	34,0	15,3	Yes
200,0	32,0	12,0	Yes

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Calculated:
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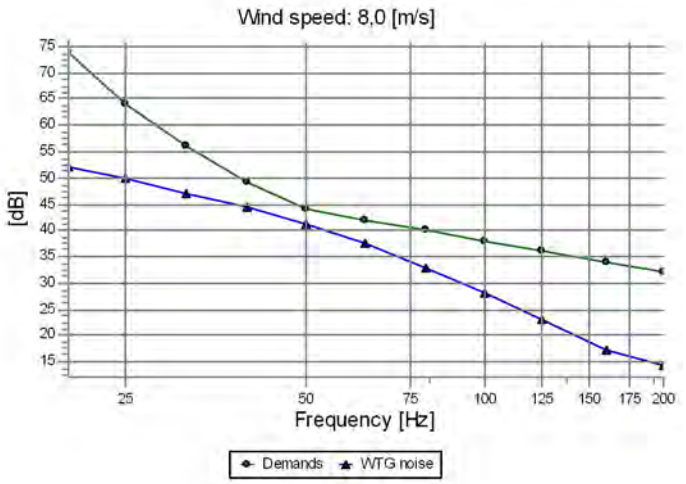
DECIBEL - Detailed results, graphic

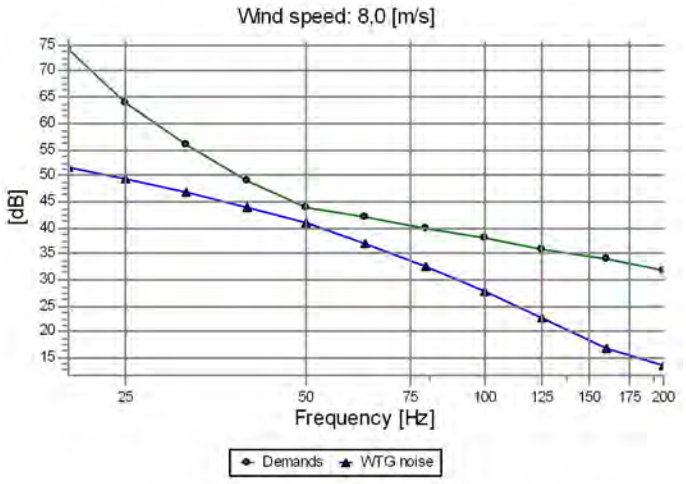
Calculation: LF_Pajukoski II_VE2_GE158-6.1MWx9xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB) Noise calculation model: Finland Low frequency 8,0 m/s

D Asuinrakennus D (Noppala)



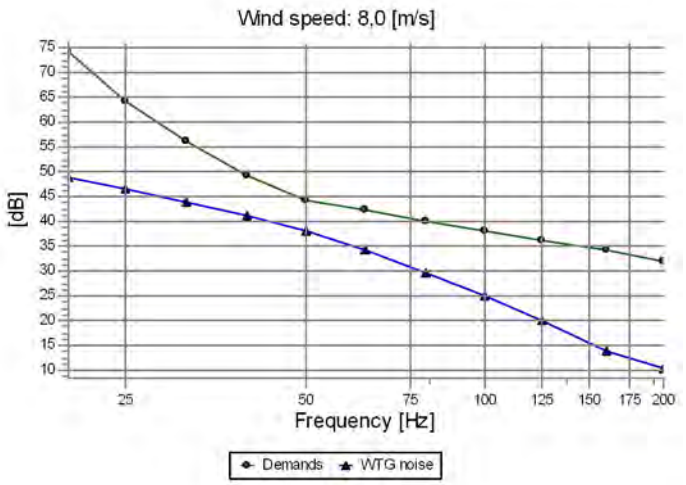
Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	52,0	Yes
25,0	64,0	49,8	Yes
31,5	56,0	47,1	Yes
40,0	49,0	44,3	Yes
50,0	44,0	41,2	Yes
63,0	42,0	37,5	Yes
80,0	40,0	32,9	Yes
100,0	38,0	28,1	Yes
125,0	36,0	23,2	Yes
160,0	34,0	17,4	Yes
200,0	32,0	14,2	Yes

E Muu rakennus E (Noppala)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	51,6	Yes
25,0	64,0	49,4	Yes
31,5	56,0	46,7	Yes
40,0	49,0	43,9	Yes
50,0	44,0	40,8	Yes
63,0	42,0	37,1	Yes
80,0	40,0	32,5	Yes
100,0	38,0	27,7	Yes
125,0	36,0	22,8	Yes
160,0	34,0	17,0	Yes
200,0	32,0	13,7	Yes

F Asuinrakennus F (Maijannevantie)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	48,7	Yes
25,0	64,0	46,5	Yes
31,5	56,0	43,7	Yes
40,0	49,0	40,9	Yes
50,0	44,0	37,9	Yes
63,0	42,0	34,2	Yes
80,0	40,0	29,5	Yes
100,0	38,0	24,8	Yes
125,0	36,0	19,9	Yes
160,0	34,0	13,8	Yes
200,0	32,0	10,4	Yes

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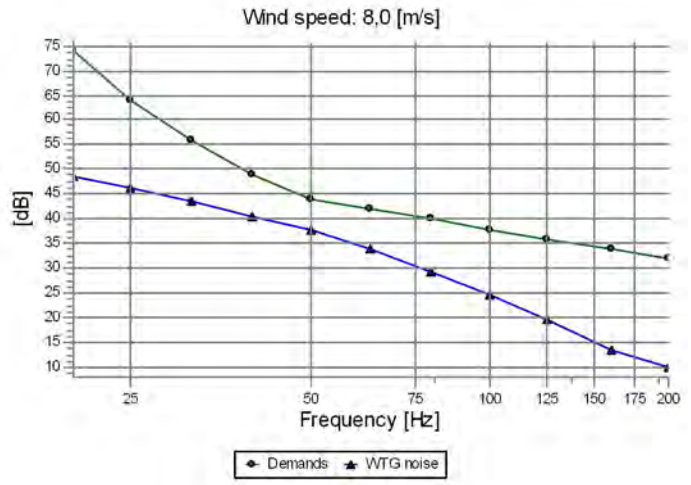
Calculated:
29.1.2024 16.51/3.6.377

DECIBEL - Detailed results, graphic

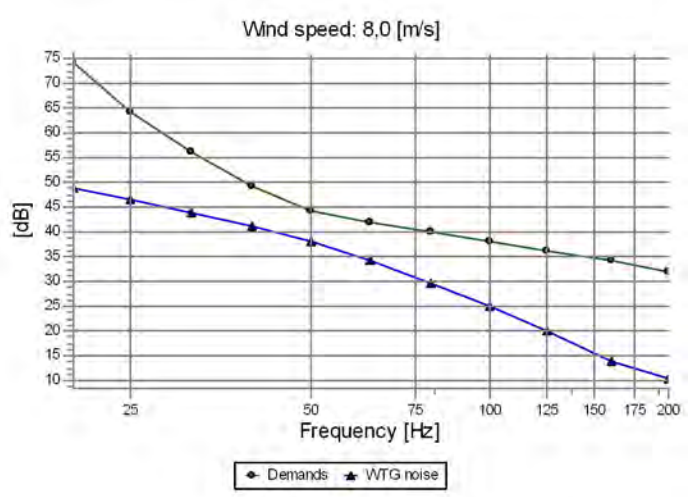
Calculation: LF_Pajukoski II_VE2_GE158-6.1MWx9xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB) Noise calculation model: Finland Low frequency 8,0 m/s

G Asuinrakennus G (Maijannevantie)



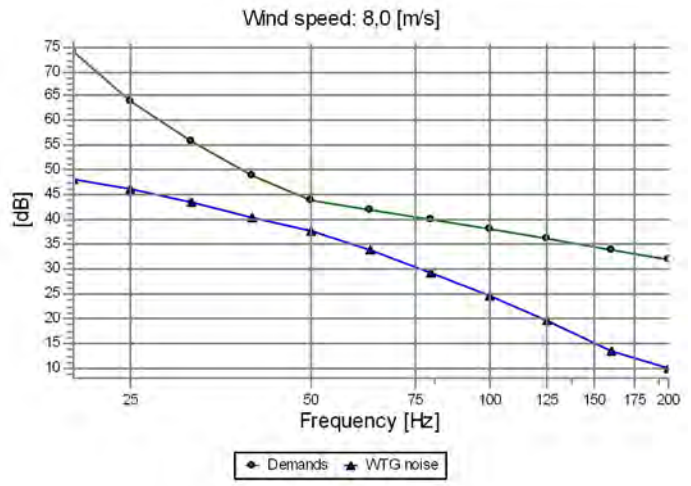
Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	48,5	Yes
25,0	64,0	46,3	Yes
31,5	56,0	43,5	Yes
40,0	49,0	40,7	Yes
50,0	44,0	37,7	Yes
63,0	42,0	34,0	Yes
80,0	40,0	29,3	Yes
100,0	38,0	24,6	Yes
125,0	36,0	19,7	Yes
160,0	34,0	13,5	Yes
200,0	32,0	10,1	Yes

H Asuinrakennus H (Hietasaari)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	48,7	Yes
25,0	64,0	46,5	Yes
31,5	56,0	43,8	Yes
40,0	49,0	40,9	Yes
50,0	44,0	37,9	Yes
63,0	42,0	34,2	Yes
80,0	40,0	29,6	Yes
100,0	38,0	24,8	Yes
125,0	36,0	19,9	Yes
160,0	34,0	13,8	Yes
200,0	32,0	10,4	Yes

I Asuinrakennus I (Lahdenperä)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	48,3	Yes
25,0	64,0	46,2	Yes
31,5	56,0	43,3	Yes
40,0	49,0	40,5	Yes
50,0	44,0	37,5	Yes
63,0	42,0	33,8	Yes
80,0	40,0	29,2	Yes
100,0	38,0	24,5	Yes
125,0	36,0	19,6	Yes
160,0	34,0	13,3	Yes
200,0	32,0	9,9	Yes

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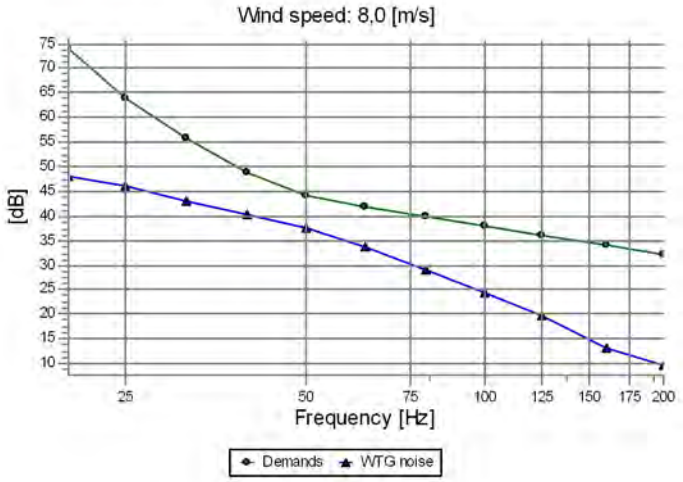
29.1.2024 16.51/3.6.377

DECIBEL - Detailed results, graphic

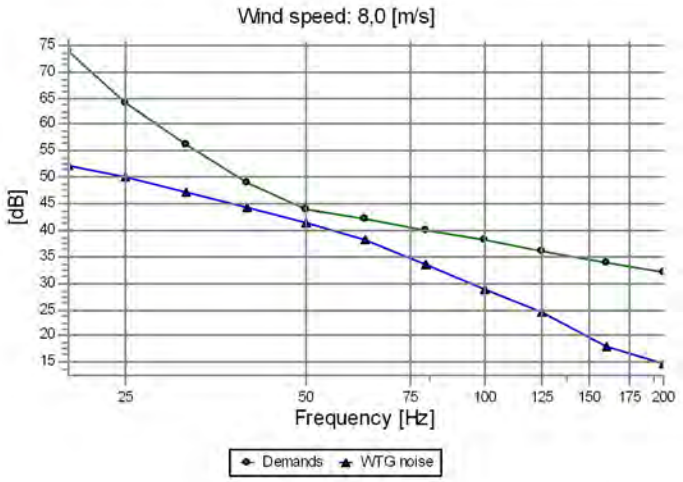
Calculation: LF_Pajukoski II_VE2_GE158-6.1MWx9xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB) Noise calculation model: Finland Low frequency 8,0 m/s

J Lomarakennus J (Junno)



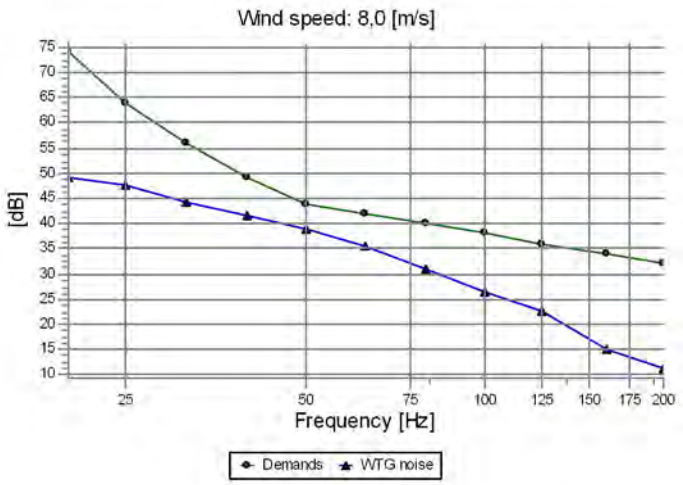
Frequency [Hz]	Demands [dB]	Sound level WTG noise [dB]	Demands fulfilled ?
20,0	74,0	48,1	Yes
25,0	64,0	46,1	Yes
31,5	56,0	43,1	Yes
40,0	49,0	40,3	Yes
50,0	44,0	37,4	Yes
63,0	42,0	33,7	Yes
80,0	40,0	29,1	Yes
100,0	38,0	24,4	Yes
125,0	36,0	19,7	Yes
160,0	34,0	13,2	Yes
200,0	32,0	9,7	Yes

K Lomarakennus K (Isomännikkö)



Frequency [Hz]	Demands [dB]	Sound level WTG noise [dB]	Demands fulfilled ?
20,0	74,0	52,1	Yes
25,0	64,0	50,2	Yes
31,5	56,0	47,1	Yes
40,0	49,0	44,3	Yes
50,0	44,0	41,5	Yes
63,0	42,0	38,0	Yes
80,0	40,0	33,4	Yes
100,0	38,0	28,9	Yes
125,0	36,0	24,5	Yes
160,0	34,0	17,9	Yes
200,0	32,0	14,6	Yes

L Asuinrakennus L (Malkasaari)



Frequency [Hz]	Demands [dB]	Sound level WTG noise [dB]	Demands fulfilled ?
20,0	74,0	49,3	Yes
25,0	64,0	47,7	Yes
31,5	56,0	44,2	Yes
40,0	49,0	41,5	Yes
50,0	44,0	38,9	Yes
63,0	42,0	35,5	Yes
80,0	40,0	31,0	Yes
100,0	38,0	26,5	Yes
125,0	36,0	22,5	Yes
160,0	34,0	15,0	Yes
200,0	32,0	11,4	Yes

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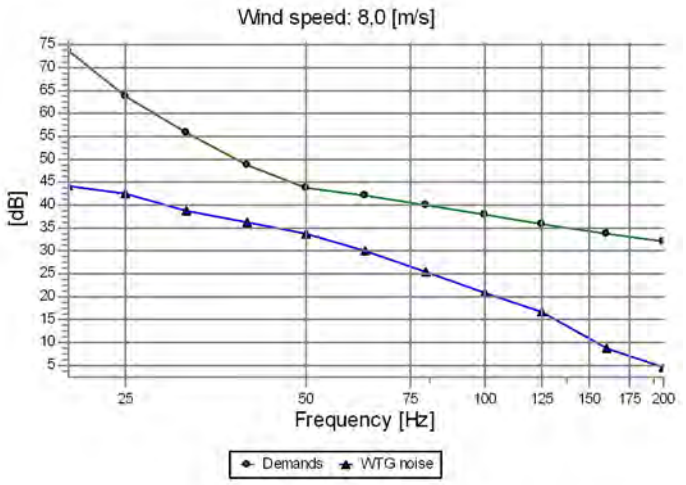
Calculated:
29.1.2024 16.51/3.6.377

DECIBEL - Detailed results, graphic

Calculation: LF_Pajukoski II_VE2_GE158-6.1MWx9xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB) Noise calculation model: Finland Low frequency 8,0 m/s

M Asuinrakennus M (Latvala)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	44,2	Yes
25,0	64,0	42,6	Yes
31,5	56,0	39,0	Yes
40,0	49,0	36,3	Yes
50,0	44,0	33,7	Yes
63,0	42,0	30,2	Yes
80,0	40,0	25,6	Yes
100,0	38,0	20,9	Yes
125,0	36,0	16,6	Yes
160,0	34,0	8,7	Yes
200,0	32,0	4,5	Yes

Liite 8: Pajukoski II tuulivoimahanke – matalataajuisen melun rakennuskohtaiset arvot vaihtoehdossa VE3.

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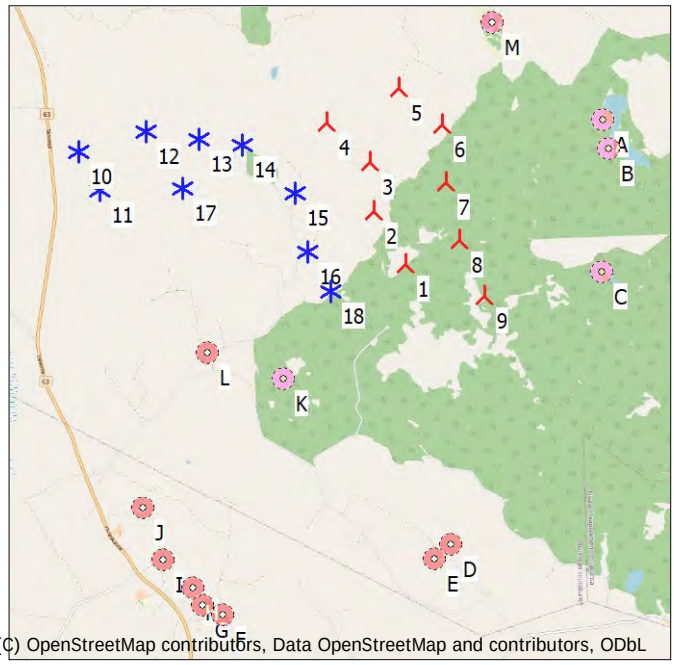
Calculated:
29.1.2024 16.51/3.6.377

DECIBEL - Main Result

Calculation: LF_Pajukoski II_VE3_GE158-6.1MWx9xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB)

Noise calculation model:
Finland Low frequency
Wind speed (in 10 m height):
8,0 m/s
Spectral distribution:
From 20,0 Hz to 200,0 Hz
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure tone penalty is subtracted from demand
Model: 5,0 dB(A)
Height above ground level, when no value in NSA object:
4,0 m; Don't allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



(C) OpenStreetMap contributors, Data OpenStreetMap and contributors, ODbL

Scale 1:100 000

New WTG
Existing WTG
Noise sensitive area

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89

WTGs

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Noise data Creator	Name	Wind speed	LwA,ref
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]
1	382 059	7 097 720	120,0	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
2	381 666	7 098 437	107,7	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
3	381 641	7 099 097	110,0	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
4	381 097	7 099 635	104,3	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
5	382 064	7 100 051	105,0	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
6	382 623	7 099 549	108,6	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
7	382 638	7 098 790	111,8	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
8	382 790	7 098 020	125,0	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
9	383 095	7 097 262	120,7	GE WIND ENERGY 6.1-158 ...	Yes	GE WIND ENERGY	6.1-158 HH221-6 100	6 100	158,0	221,0	USER	6.1-158 NRO 107dB + 2 dB	8,0	100,0
10	377 791	7 099 387	87,5	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
11	378 057	7 098 862	90,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
12	378 683	7 099 618	85,9	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
13	379 394	7 099 490	94,6	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
14	379 949	7 099 376	100,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
15	380 638	7 098 723	105,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
16	380 775	7 097 932	105,0	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
17	379 139	7 098 839	92,5	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2
18	381 062	7 097 401	107,5	VESTAS V126-3.3 HH137 3...	Yes	VESTAS	V126-3.3 HH137-3 300	3 300	126,0	137,0	USER	Mode 0 - 11-2014 No STE	8,0	96,2

Calculation Results

Sound level

Noise sensitive area					Most critical demand		Predicted sound level
No.	Name	East	North	Z	Immission height	Frequency	Noise	WTG noise
				[m]	[m]	[Hz]	[dB]	[dB]
A	Lomarakennus A (Lampinjärvi)	384 750	7 099 539	90,0	4,0	50,0	44,0	38,5
B	Lomarakennus B (Lampinkallio)	384 818	7 099 152	93,7	4,0	50,0	44,0	38,6
C	Lomarakennus C (Latvalampi)	384 650	7 097 533	96,0	4,0	50,0	44,0	39,3
D	Asuinrakennus D (Noppala)	382 520	7 093 979	105,2	4,0	50,0	44,0	34,5
E	Muu rakennus E (Noppala)	382 290	7 093 807	109,7	4,0	50,0	44,0	34,2
F	Asuinrakennus F (Maijannevantie)	379 455	7 093 166	96,2	4,0	50,0	44,0	32,2
G	Asuinrakennus G (Maijannevantie)	379 203	7 093 300	92,9	4,0	50,0	44,0	32,2
H	Asuinrakennus H (Hietasaari)	379 076	7 093 530	92,5	4,0	50,0	44,0	32,5
I	Asuinrakennus I (Lahdenperä)	378 699	7 093 923	88,0	4,0	50,0	44,0	32,7
J	Lomarakennus J (Junno)	378 456	7 094 615	89,4	4,0	50,0	44,0	33,5
K	Lomarakennus K (Isomännikkö)	380 394	7 096 271	106,1	4,0	50,0	44,0	39,0
L	Asuinrakennus L (Malkasaari)	379 392	7 096 642	100,9	4,0	50,0	44,0	38,1
M	Asuinrakennus M (Latvala)	383 344	7 100 875	82,6	4,0	50,0	44,0	40,2

*)Spectral distribution, please see details in report "Detailed results"

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Calculated:
29.1.2024 16.51/3.6.377

DECIBEL - Main Result

Calculation: LF_Pajukoski II_VE3_GE158-6.1MWx9xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB)

Distances (m)

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M
1	3248	3108	2598	3769	3920	5246	5262	5143	5070	4756	2207	2877	3407
2	3275	3232	3118	4539	4672	5716	5697	5549	5402	4991	2512	2897	2960
3	3140	3177	3391	5193	5330	6321	6289	6129	5952	5498	3089	3329	2462
4	3654	3752	4128	5832	5949	6674	6612	6431	6195	5672	3437	3445	2566
5	2734	2897	3609	6089	6248	7363	7332	7173	6991	6524	4132	4331	1522
6	2127	2231	2859	5571	5752	7126	7124	6986	6859	6458	3964	4346	1509
7	2241	2210	2372	4812	4995	6462	6476	6353	6261	5909	3374	3892	2201
8	2480	2323	1923	4050	4243	5889	5928	5827	5790	5512	2966	3667	2908
9	2815	2558	1578	3333	3548	5480	5554	5485	5520	5341	2877	3755	3622
10	6961	7031	7105	7184	7168	6439	6248	5996	5539	4818	4060	3178	5749
11	6728	6768	6726	6615	6593	5865	5679	5428	4980	4265	3489	2590	5658
12	6068	6153	6321	6821	6839	6498	6339	6100	5695	5008	3759	3059	4828
13	5357	5435	5609	6336	6378	6324	6193	5968	5610	4964	3371	2848	4186
14	4804	4875	5050	5978	6041	6229	6121	5910	5594	4989	3136	2790	3712
15	4193	4202	4185	5103	5186	5681	5609	5422	5176	4651	2464	2425	3458
16	4288	4224	3896	4321	4394	4945	4891	4718	4514	4047	1704	1891	3907
17	5655	5688	5664	5920	5937	5681	5539	5309	4935	4278	2858	2211	4672
18	4263	4145	3591	3719	3798	4529	4502	4350	4204	3814	1312	1834	4157

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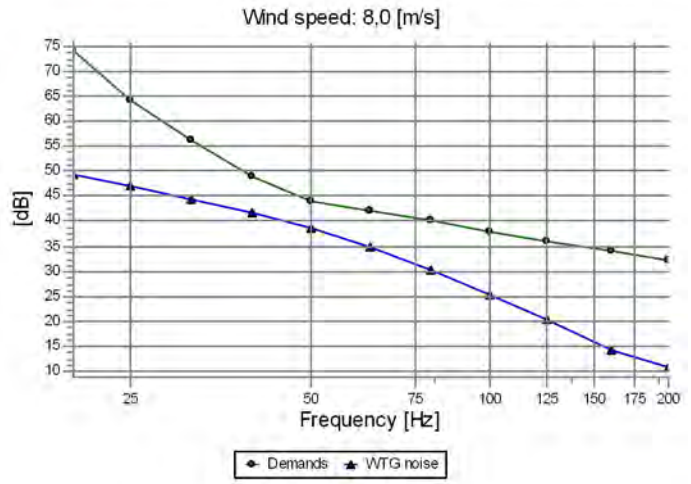
Calculated:
29.1.2024 16.51/3.6.377

DECIBEL - Detailed results, graphic

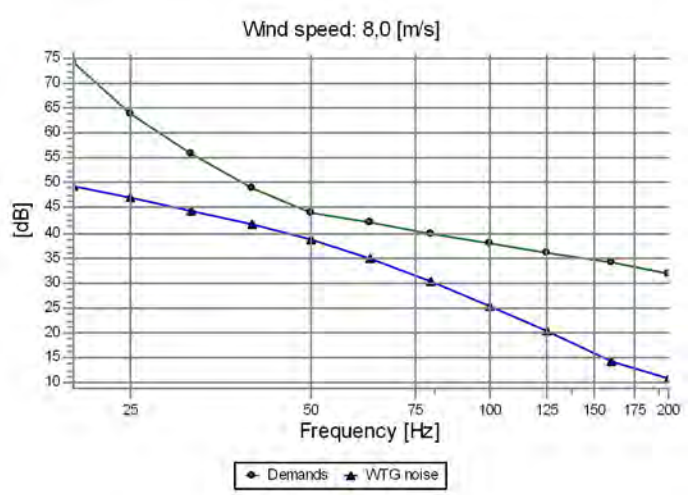
Calculation: LF_Pajukoski II_VE3_GE158-6.1MWx9xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB) Noise calculation model: Finland Low frequency 8,0 m/s

A Lomarakennus A (Lampinjärvi)



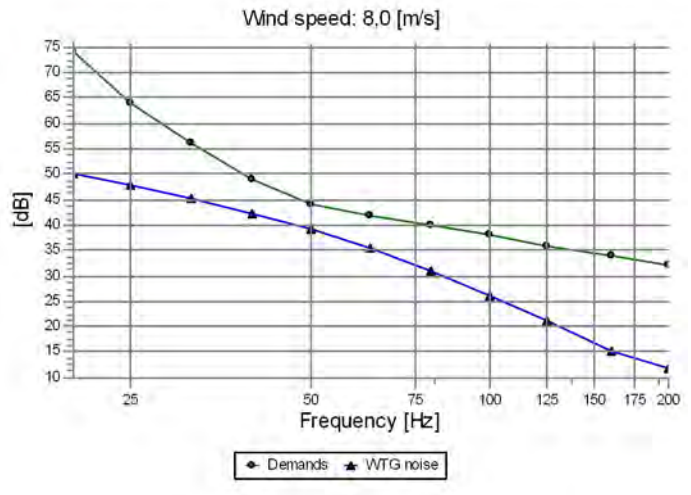
Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	49,3	Yes
25,0	64,0	47,1	Yes
31,5	56,0	44,4	Yes
40,0	49,0	41,5	Yes
50,0	44,0	38,5	Yes
63,0	42,0	34,8	Yes
80,0	40,0	30,2	Yes
100,0	38,0	25,4	Yes
125,0	36,0	20,5	Yes
160,0	34,0	14,4	Yes
200,0	32,0	10,9	Yes

B Lomarakennus B (Lampinkallio)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	49,4	Yes
25,0	64,0	47,2	Yes
31,5	56,0	44,5	Yes
40,0	49,0	41,6	Yes
50,0	44,0	38,6	Yes
63,0	42,0	34,9	Yes
80,0	40,0	30,3	Yes
100,0	38,0	25,5	Yes
125,0	36,0	20,6	Yes
160,0	34,0	14,5	Yes
200,0	32,0	11,0	Yes

C Lomarakennus C (Latvalampi)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	50,0	Yes
25,0	64,0	47,9	Yes
31,5	56,0	45,1	Yes
40,0	49,0	42,3	Yes
50,0	44,0	39,3	Yes
63,0	42,0	35,6	Yes
80,0	40,0	31,0	Yes
100,0	38,0	26,2	Yes
125,0	36,0	21,3	Yes
160,0	34,0	15,3	Yes
200,0	32,0	11,9	Yes

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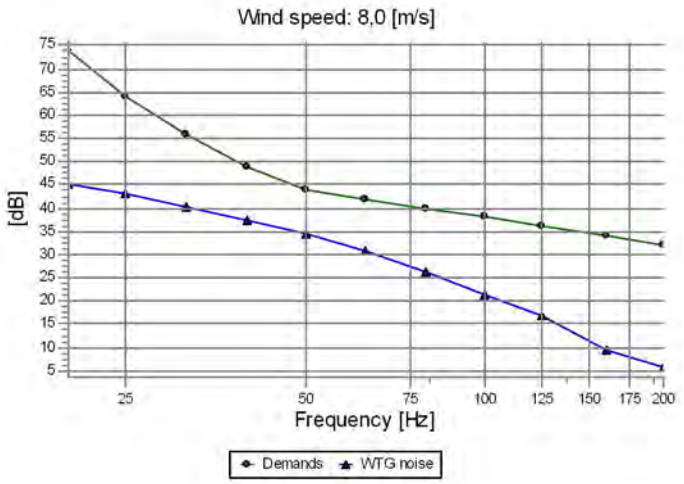
Calculated:
29.1.2024 16.51/3.6.377

DECIBEL - Detailed results, graphic

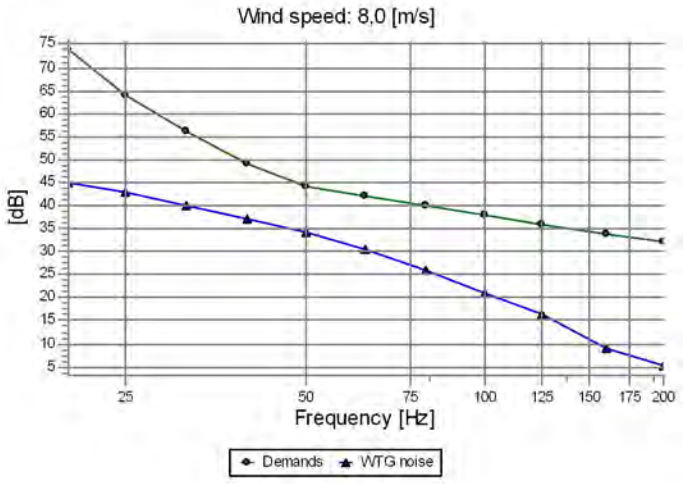
Calculation: LF_Pajukoski II_VE3_GE158-6.1MWx9xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB) Noise calculation model: Finland Low frequency 8,0 m/s

D Asuinrakennus D (Noppala)



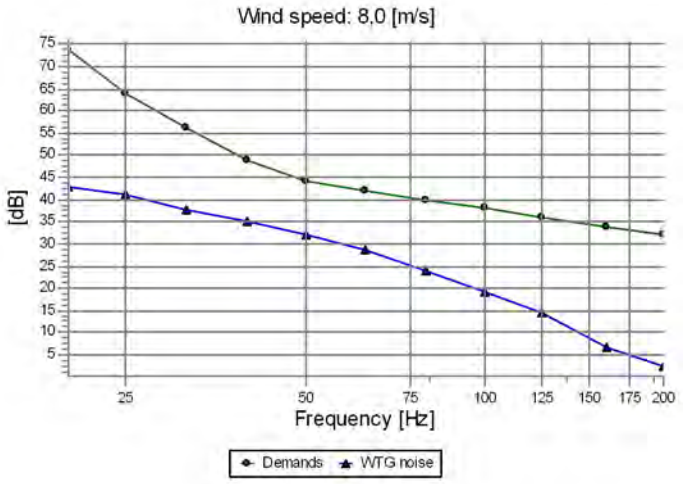
Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	45,2	Yes
25,0	64,0	43,3	Yes
31,5	56,0	40,2	Yes
40,0	49,0	37,4	Yes
50,0	44,0	34,5	Yes
63,0	42,0	30,8	Yes
80,0	40,0	26,1	Yes
100,0	38,0	21,3	Yes
125,0	36,0	16,6	Yes
160,0	34,0	9,6	Yes
200,0	32,0	5,6	Yes

E Muu rakennus E (Noppala)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	44,9	Yes
25,0	64,0	43,0	Yes
31,5	56,0	39,9	Yes
40,0	49,0	37,0	Yes
50,0	44,0	34,2	Yes
63,0	42,0	30,5	Yes
80,0	40,0	25,8	Yes
100,0	38,0	21,0	Yes
125,0	36,0	16,3	Yes
160,0	34,0	9,2	Yes
200,0	32,0	5,2	Yes

F Asuinrakennus F (Maijannevantie)

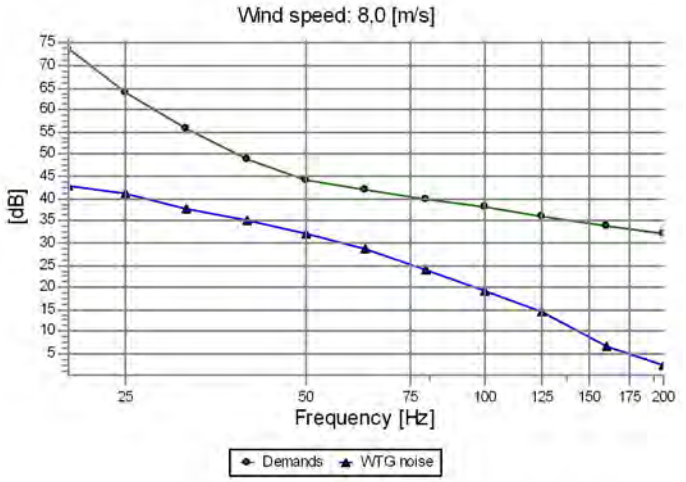


Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	42,9	Yes
25,0	64,0	41,1	Yes
31,5	56,0	37,8	Yes
40,0	49,0	34,9	Yes
50,0	44,0	32,2	Yes
63,0	42,0	28,6	Yes
80,0	40,0	23,9	Yes
100,0	38,0	19,1	Yes
125,0	36,0	14,5	Yes
160,0	34,0	6,6	Yes
200,0	32,0	2,3	Yes

DECIBEL - Detailed results, graphic

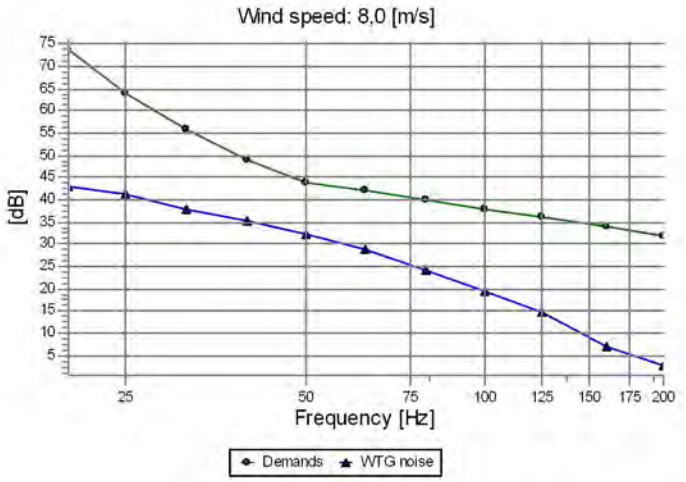
Calculation: LF_Pajukoski II_VE3_GE158-6.1MWx9xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB) Noise calculation model: Finland Low frequency 8,0 m/s

G Asuinrakennus G (Maijannevantie)



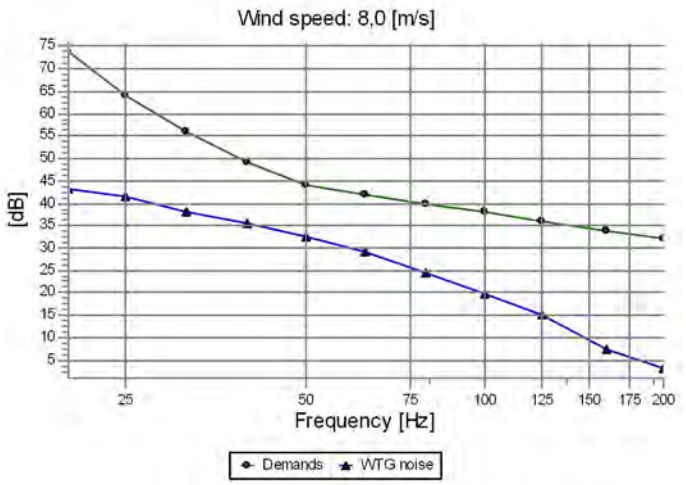
Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	42,9	Yes
25,0	64,0	41,2	Yes
31,5	56,0	37,8	Yes
40,0	49,0	35,0	Yes
50,0	44,0	32,2	Yes
63,0	42,0	28,6	Yes
80,0	40,0	23,9	Yes
100,0	38,0	19,1	Yes
125,0	36,0	14,5	Yes
160,0	34,0	6,7	Yes
200,0	32,0	2,3	Yes

H Asuinrakennus H (Hietasaari)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	43,1	Yes
25,0	64,0	41,4	Yes
31,5	56,0	38,0	Yes
40,0	49,0	35,2	Yes
50,0	44,0	32,5	Yes
63,0	42,0	28,9	Yes
80,0	40,0	24,2	Yes
100,0	38,0	19,4	Yes
125,0	36,0	14,9	Yes
160,0	34,0	7,0	Yes
200,0	32,0	2,7	Yes

I Asuinrakennus I (Lahdenperä)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	43,4	Yes
25,0	64,0	41,7	Yes
31,5	56,0	38,2	Yes
40,0	49,0	35,4	Yes
50,0	44,0	32,7	Yes
63,0	42,0	29,2	Yes
80,0	40,0	24,5	Yes
100,0	38,0	19,7	Yes
125,0	36,0	15,3	Yes
160,0	34,0	7,4	Yes
200,0	32,0	3,0	Yes

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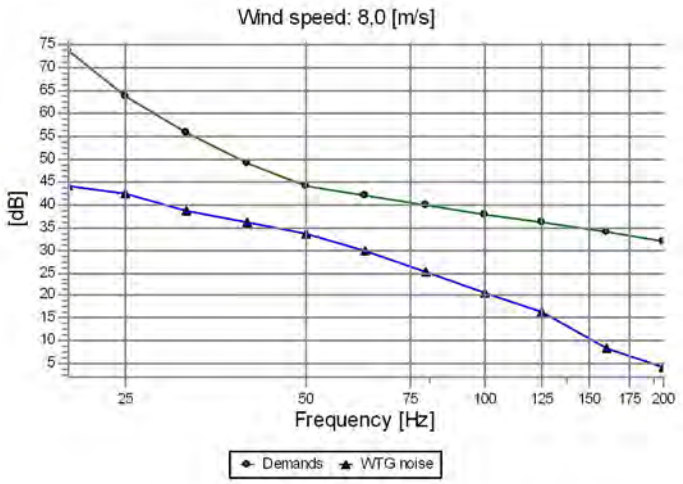
Calculated:
29.1.2024 16.51/3.6.377

DECIBEL - Detailed results, graphic

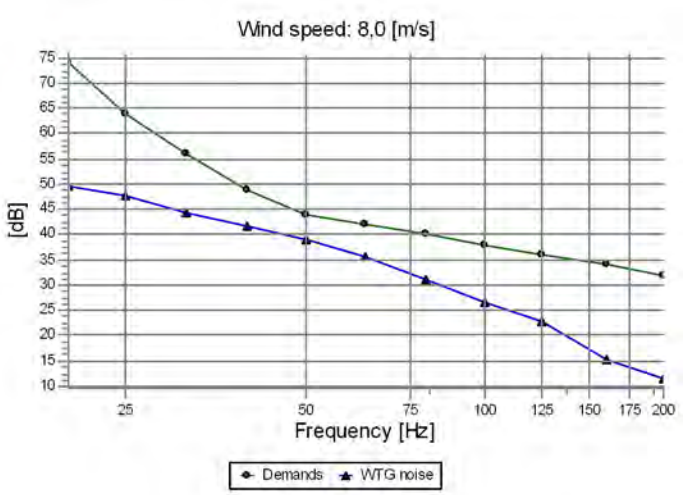
Calculation: LF_Pajukoski II_VE3_GE158-6.1MWx9xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB) Noise calculation model: Finland Low frequency 8,0 m/s

J Lomarakennus J (Junno)



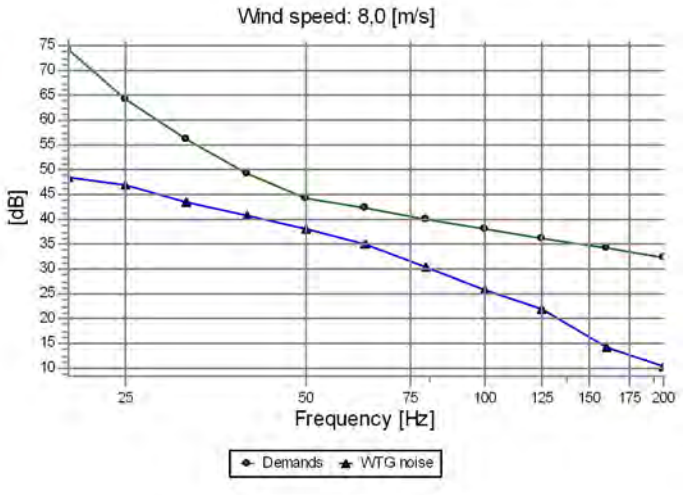
Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	44,0	Yes
25,0	64,0	42,4	Yes
31,5	56,0	38,8	Yes
40,0	49,0	36,1	Yes
50,0	44,0	33,5	Yes
63,0	42,0	30,0	Yes
80,0	40,0	25,3	Yes
100,0	38,0	20,6	Yes
125,0	36,0	16,3	Yes
160,0	34,0	8,4	Yes
200,0	32,0	4,1	Yes

K Lomarakennus K (Isomännikkö)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	49,4	Yes
25,0	64,0	47,8	Yes
31,5	56,0	44,3	Yes
40,0	49,0	41,6	Yes
50,0	44,0	39,0	Yes
63,0	42,0	35,6	Yes
80,0	40,0	31,1	Yes
100,0	38,0	26,7	Yes
125,0	36,0	22,7	Yes
160,0	34,0	15,2	Yes
200,0	32,0	11,6	Yes

L Asuinrakennus L (Malkasaari)



Frequency [Hz]	Sound level Demands [dB]	WTG noise [dB]	Demands fulfilled ?
20,0	74,0	48,3	Yes
25,0	64,0	47,0	Yes
31,5	56,0	43,2	Yes
40,0	49,0	40,5	Yes
50,0	44,0	38,1	Yes
63,0	42,0	34,7	Yes
80,0	40,0	30,2	Yes
100,0	38,0	25,8	Yes
125,0	36,0	21,9	Yes
160,0	34,0	14,1	Yes
200,0	32,0	10,3	Yes

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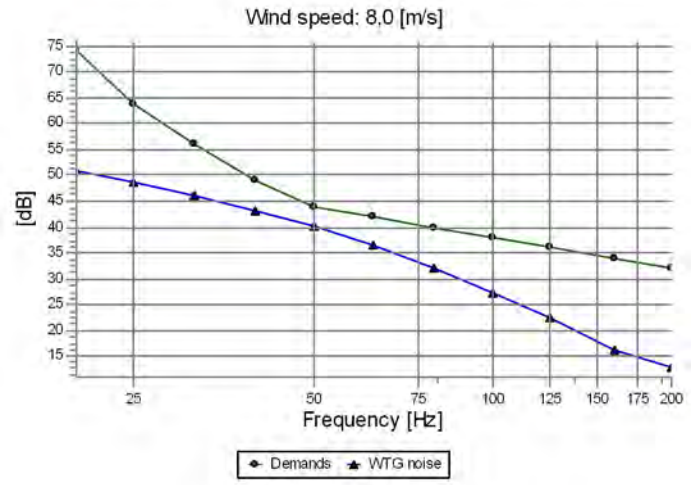
Calculated:
29.1.2024 16.51/3.6.377

DECIBEL - Detailed results, graphic

Calculation: LF_Pajukoski II_VE3_GE158-6.1MWx9xHH221_20230215+Pajukoski I V126-3.3MWx9xHH137(105,9dB) Noise calculation model: Finland Low frequency 8,0 m/s

M Asuinrakennus M (Latvala)



Frequency	Sound level Demands	WTG noise	Demands fulfilled ?
[Hz]	[dB]	[dB]	
20,0	74,0	51,0	Yes
25,0	64,0	48,8	Yes
31,5	56,0	46,1	Yes
40,0	49,0	43,2	Yes
50,0	44,0	40,2	Yes
63,0	42,0	36,5	Yes
80,0	40,0	31,9	Yes
100,0	38,0	27,2	Yes
125,0	36,0	22,4	Yes
160,0	34,0	16,3	Yes
200,0	32,0	13,0	Yes

Liite 9: Pajukoski II tuulivoimahanke – varjostusmallinnuksen tulokset nykytilanteessa ”real case, no forest”.

Project:

Pajukoski tv-hanke

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Calculated:

22.11.2023 15.15/3.6.377

SHADOW - Main Result

Calculation: Pajukoski II nykytilanne Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

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

Sunshine probability S (Average daily sunshine hours) [LULEA]

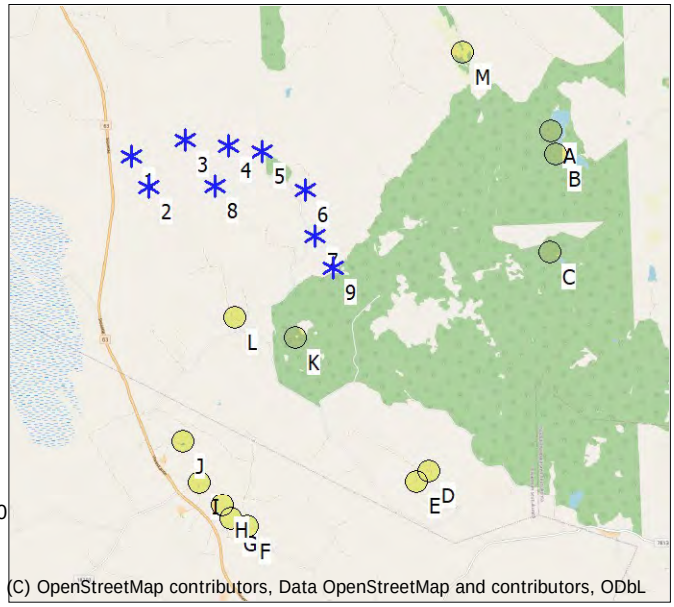
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: CONTOURLINE_Pajukoski tv-hanke_0
Obstacles used in calculation
Receptor grid resolution: 1,0 m

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



Scale 1:125 000

Existing WTG Shadow receptor

WTGs

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	377 791	7 099 387	87,5	VESTAS V126-3.3 Grid...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
2	378 057	7 098 862	90,0	VESTAS V126-3.3 Grid...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
3	378 683	7 099 618	85,9	VESTAS V126-3.3 Grid...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
4	379 394	7 099 490	94,6	VESTAS V126-3.3 Grid...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
5	379 949	7 099 376	100,0	VESTAS V126-3.3 Grid...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
6	380 638	7 098 723	105,0	VESTAS V126-3.3 Grid...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
7	380 775	7 097 932	105,0	VESTAS V126-3.3 Grid...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
8	379 139	7 098 839	92,5	VESTAS V126-3.3 Grid...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
9	381 062	7 097 401	107,5	VESTAS V126-3.3 Grid...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8

Shadow receptor-Input

No.	Name	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]
A	Lomarakennus A (Lampinjärvi)	384 750	7 099 539	90,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
B	Lomarakennus B (Lampinkallio)	384 818	7 099 152	93,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
C	Lomarakennus C (Latvalampi)	384 650	7 097 533	96,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
D	Asuinrakennus D (Noppala)	382 520	7 093 979	105,2	5,0	5,0	1,0	90,0	"Green house mode"	6,0
E	Muu rakennus E (Noppala)	382 290	7 093 807	109,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
F	Asuinrakennus F (Maijannevantie)	379 455	7 093 166	96,2	5,0	5,0	1,0	90,0	"Green house mode"	6,0
G	Asuinrakennus G (Maijannevantie)	379 203	7 093 300	92,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0
H	Asuinrakennus H (Hietasaari)	379 076	7 093 530	92,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
I	Asuinrakennus I (Lahdenperä)	378 699	7 093 923	88,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
J	Lomarakennus J (Junno)	378 456	7 094 615	89,4	5,0	5,0	1,0	90,0	"Green house mode"	6,0
K	Lomarakennus K (Isomännikkö)	380 394	7 096 271	106,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
L	Asuinrakennus L (Malkasaari)	379 392	7 096 642	100,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0
M	Asuinrakennus M (Latvala)	383 344	7 100 875	82,6	5,0	5,0	1,0	90,0	"Green house mode"	6,0

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Calculated:
22.11.2023 15.15/3.6.377

SHADOW - Main Result

Calculation: Pajukoski II nykytilanne Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values Shadow hours per year [h/year]
A	Lomarakennus A (Lampinjärvi)	0:00
B	Lomarakennus B (Lampinkallio)	0:00
C	Lomarakennus C (Latvalampi)	0:00
D	Asuinrakennus D (Noppala)	0:00
E	Muu rakennus E (Noppala)	0:00
F	Asuinrakennus F (Maijannevantie)	0:00
G	Asuinrakennus G (Maijannevantie)	0:00
H	Asuinrakennus H (Hietasaari)	0:00
I	Asuinrakennus I (Lahdenperä)	0:00
J	Lomarakennus J (Junno)	0:00
K	Lomarakennus K (Isomännikkö)	0:00
L	Asuinrakennus L (Malkasaari)	0:00
M	Asuinrakennus M (Latvala)	0:00

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

No.	Name	Expected [h/year]
1	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1)	0:00
2	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (2)	0:00
3	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (3)	0:00
4	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (4)	0:00
5	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (5)	0:00
6	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (6)	0:00
7	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (7)	0:00
8	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (8)	0:00
9	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (9)	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.

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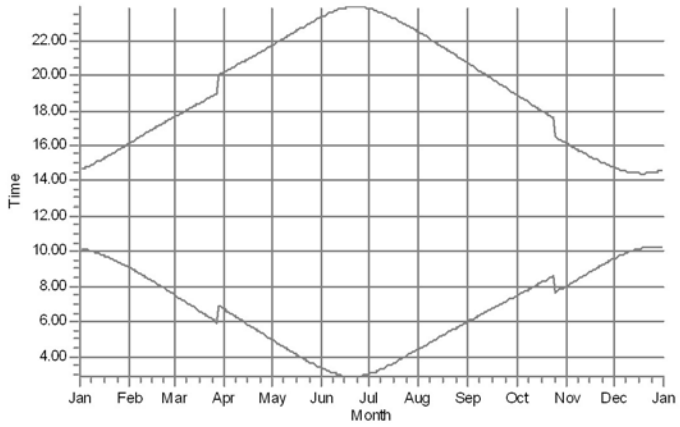
Calculated:
22.11.2023 15.15/3.6.377

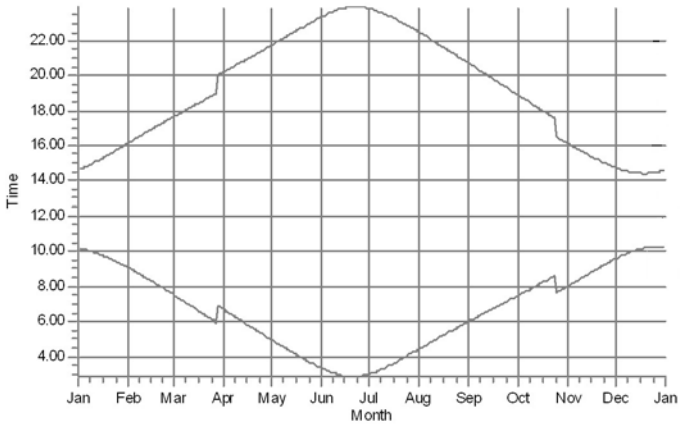
SHADOW - Calendar, graphical

Calculation: Pajukoski II nykytilanne Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

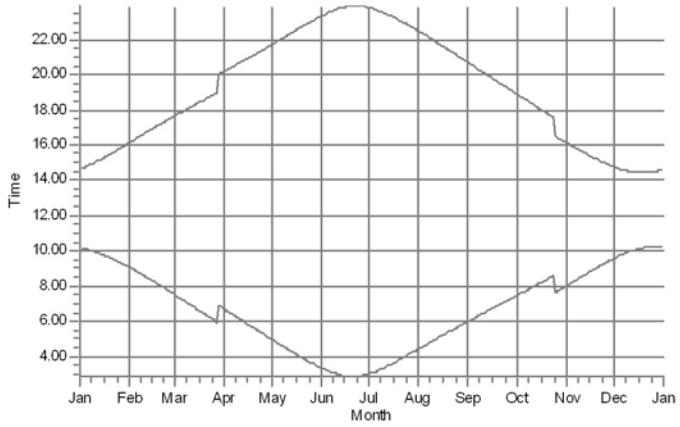
A: Lomarakennus A (Lampinjärvi)



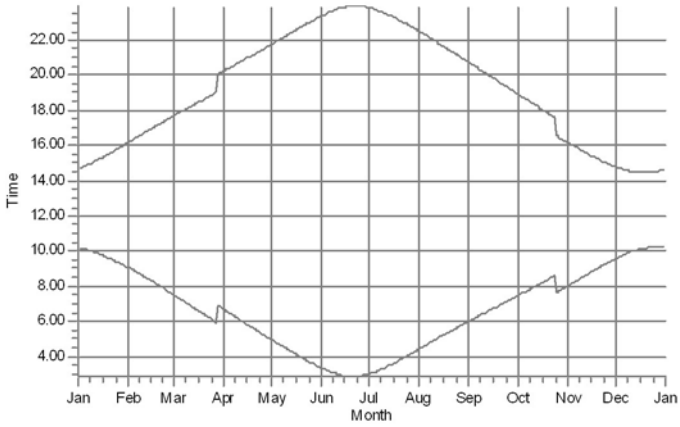
B: Lomarakennus B (Lampinkallio)



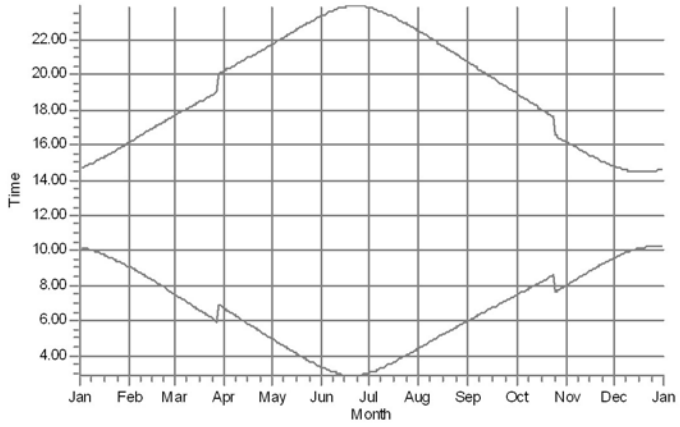
C: Lomarakennus C (Latvalampi)



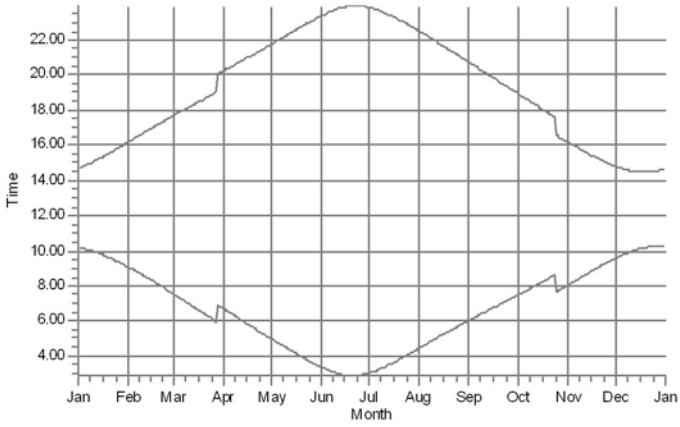
D: Asuinrakennus D (Noppala)



E: Muu rakennus E (Noppala)



F: Asuinrakennus F (Maijannevantie)



WTGs

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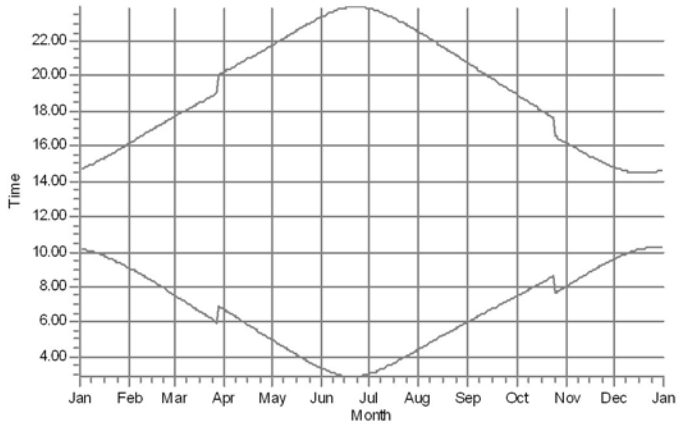
Calculated:
22.11.2023 15.15/3.6.377

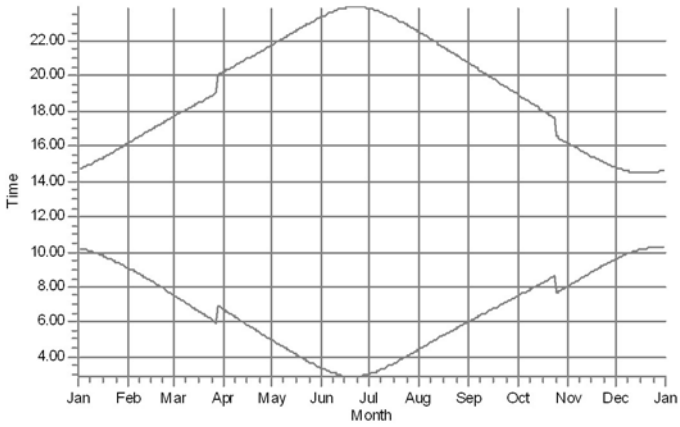
SHADOW - Calendar, graphical

Calculation: Pajukoski II nykytilanne Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

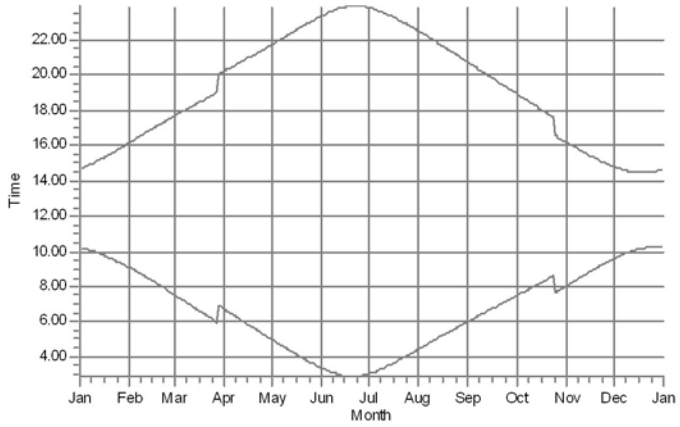
G: Asuinrakennus G (Maijannevantie)



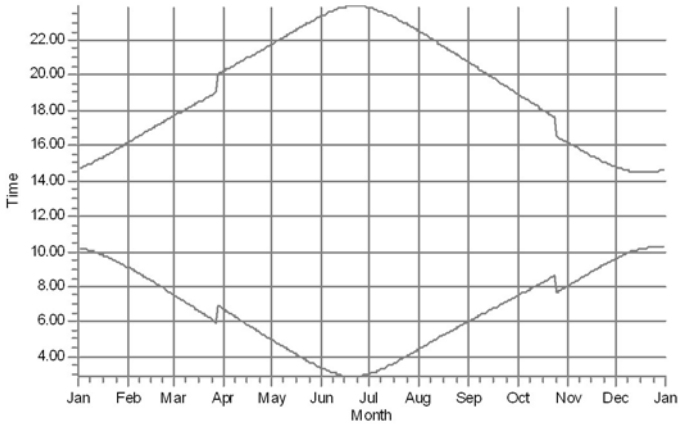
H: Asuinrakennus H (Hietasaari)



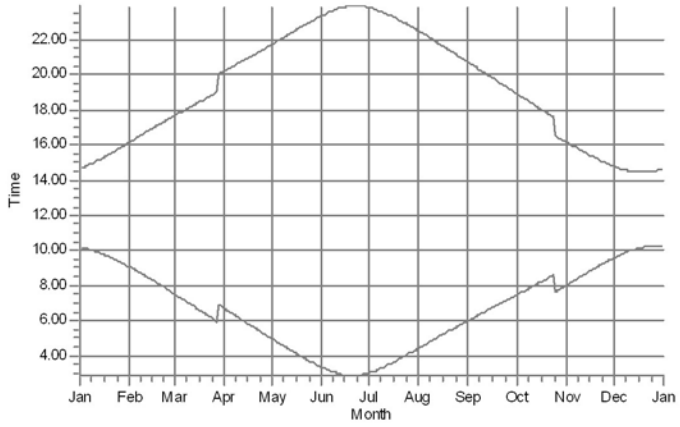
I: Asuinrakennus I (Lahdenperä)



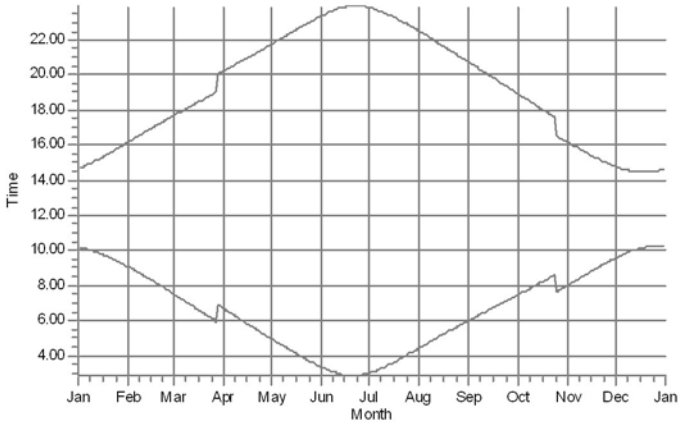
J: Lomarakennus J (Junno)



K: Lomarakennus K (Isomännikkö)



L: Asuinrakennus L (Malkasaari)



WTGs

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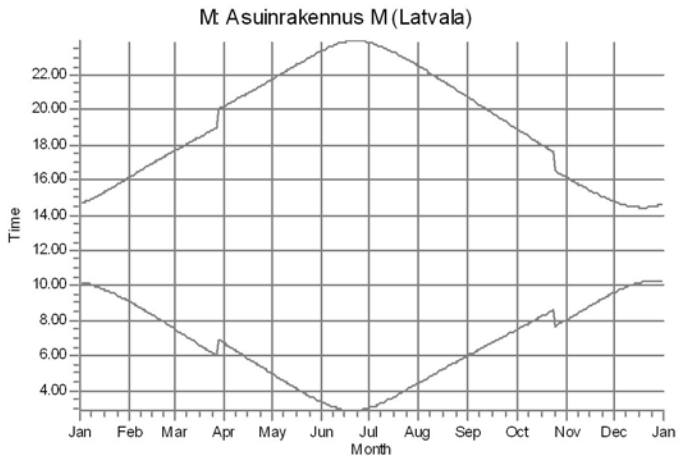
SHADOW - Calendar, graphical

Calculation: Pajukoski II nykytilanne Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

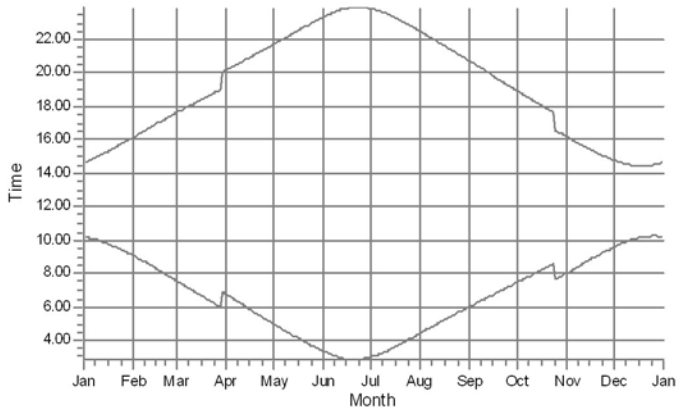


WTGs

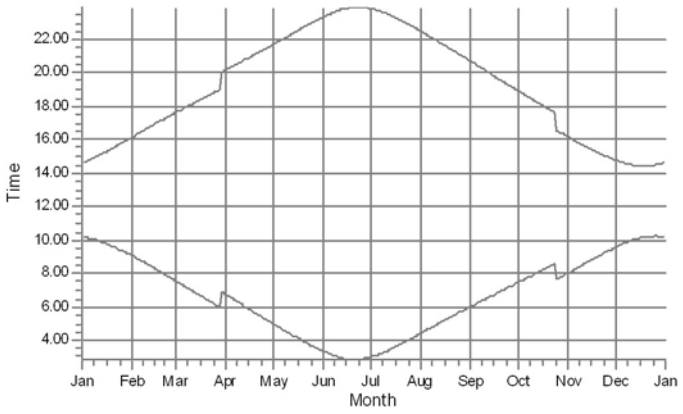
SHADOW - Calendar per WTG, graphical

Calculation: Pajukoski II nykytilanne Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

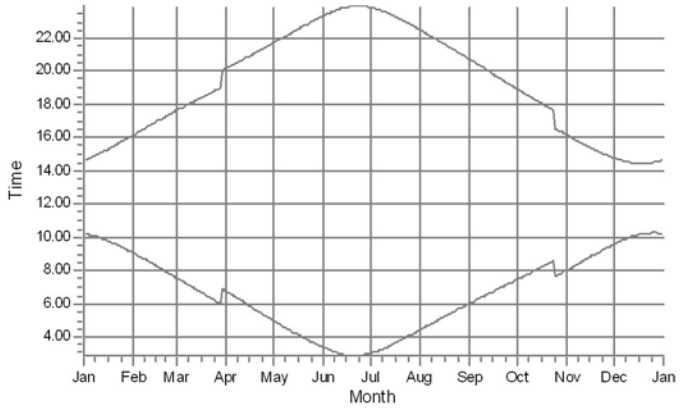
1: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200



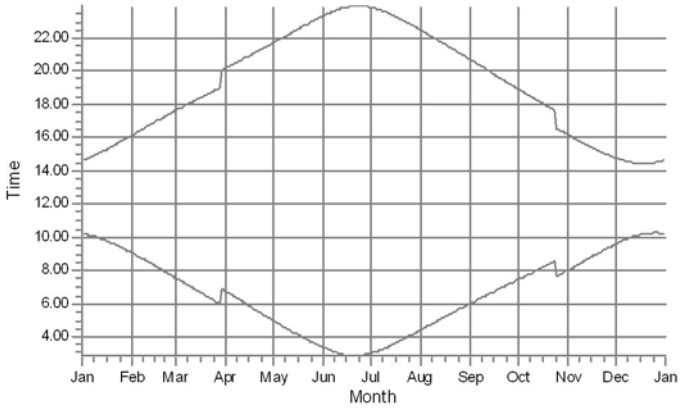
2: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200



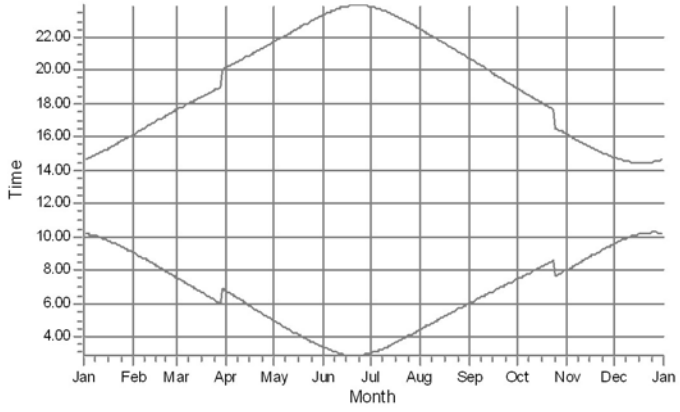
3: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200



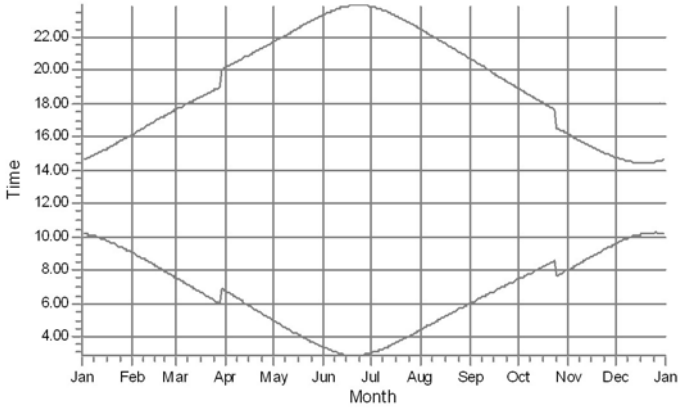
4: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200



5: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200



6: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200



Shadow receptors

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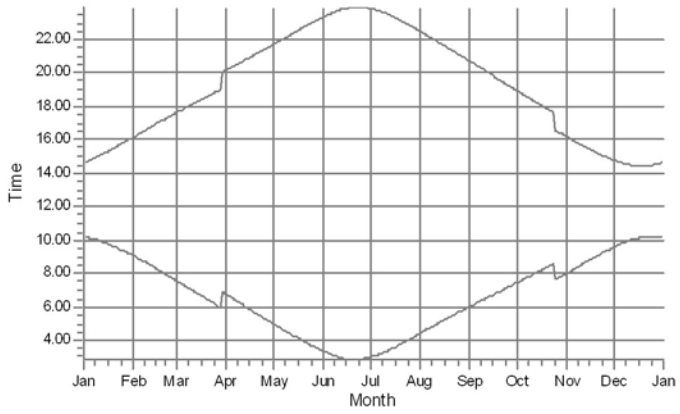
Calculated:
22.11.2023 15.15/3.6.377

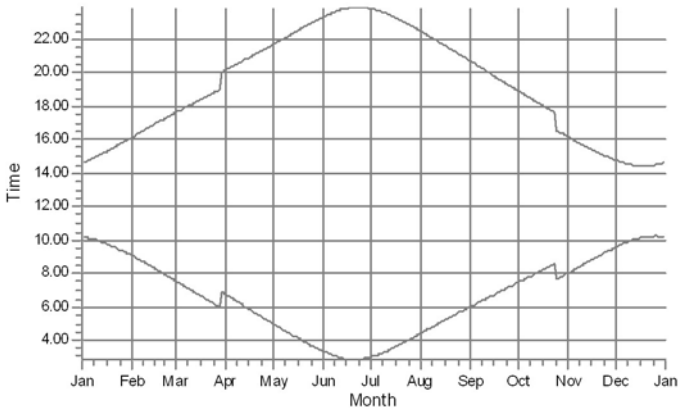
SHADOW - Calendar per WTG, graphical

Calculation: Pajukoski II nykytilanne Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

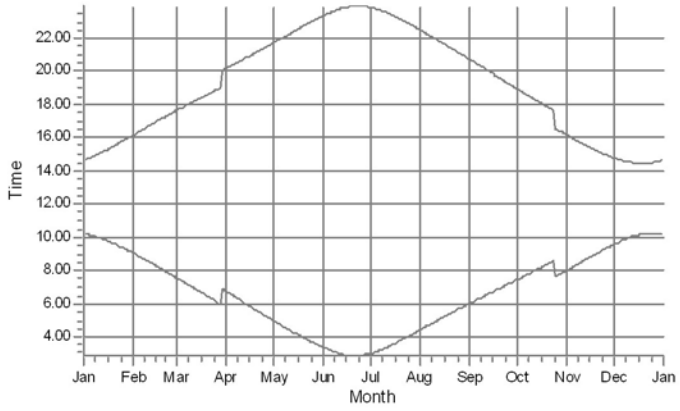
7: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200



8: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200



9: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200



Shadow receptors

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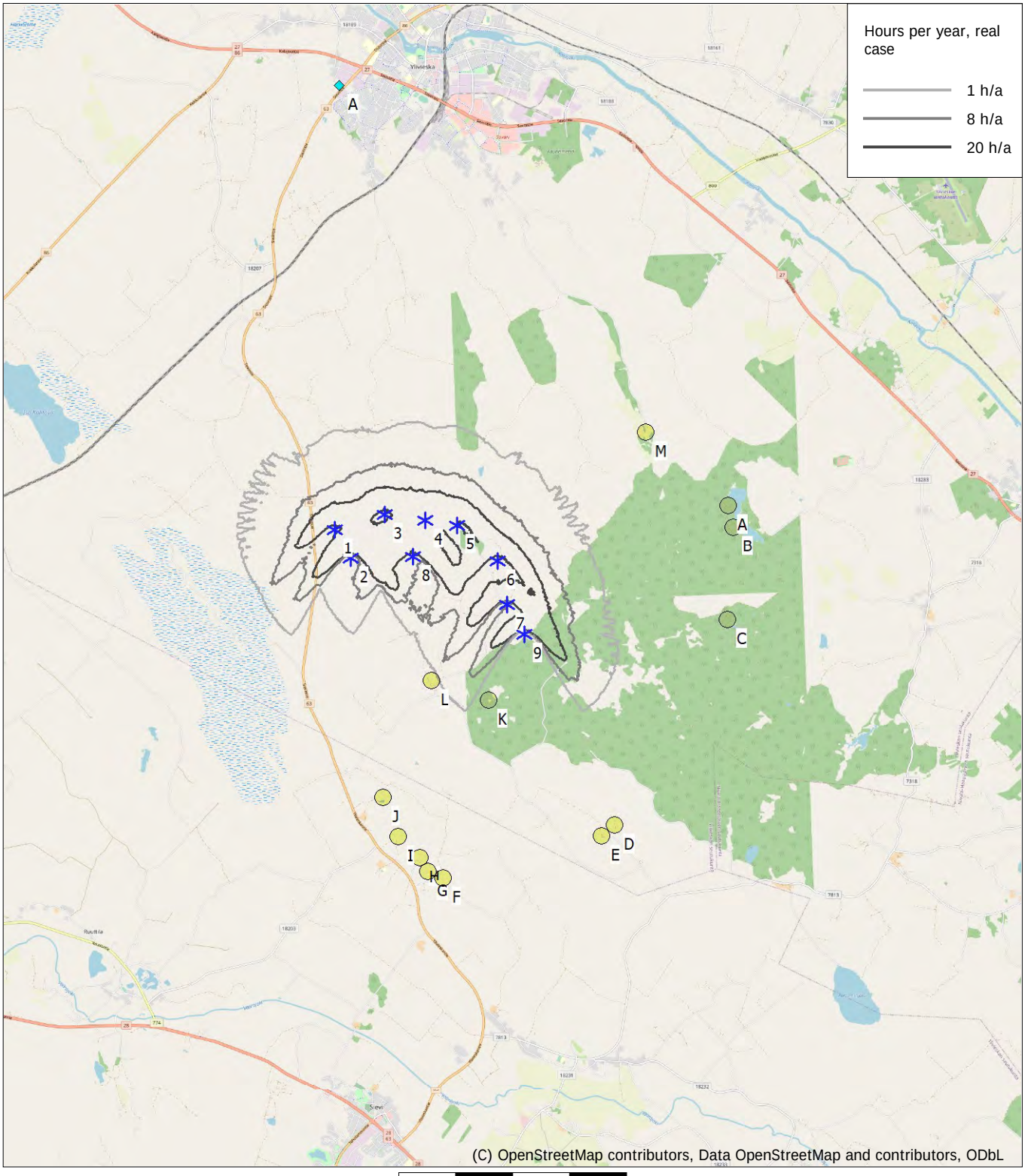
Calculated:
22.11.2023 15.15/3.6.377

SHADOW - Map

Calculation: Pajukoski II nykytilanne Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)



0 1 2 3 4 km

Map: EMD OpenStreetMap , Print scale 1:100 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 381 270 North: 7 098 650

Existing WTG Obstacle Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_Pajukoski tv-hanke_0.wpo (5)

Time step: 4 minutes, Day step: 14 days, Map resolution: 30 m, Visibility resolution: 15 m, Eye height: 1,5 m

Liite 10: Pajukoski II tuulivoimahanke – varjostusmallinnuksen tulokset ”real case, no forest” (VE1).

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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Main Result

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

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

Sunshine probability S (Average daily sunshine hours) [LULEA]

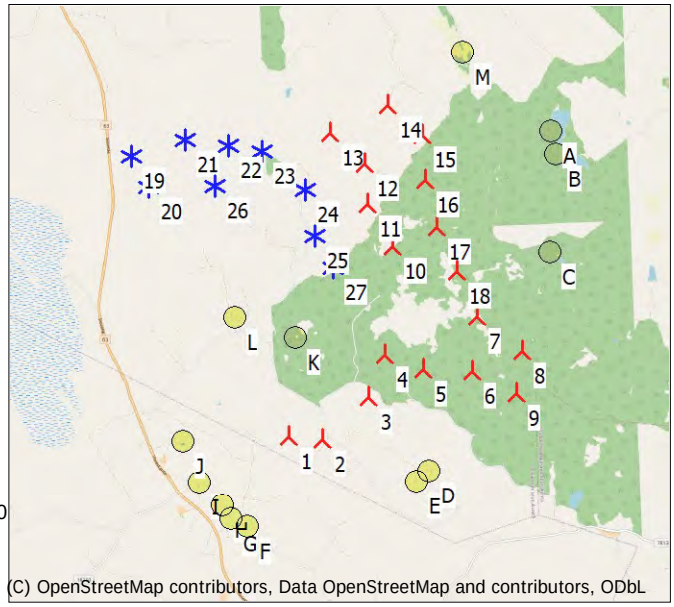
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: CONTOURLINE_Pajukoski tv-hanke_0
Obstacles used in calculation
Receptor grid resolution: 1,0 m

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



Scale 1:125 000

New WTG | Existing WTG | Shadow receptor

WTGs

	East	North	Z [m]	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	380 209	7 094 637	107,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
2	380 766	7 094 564	106,8	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
3	381 556	7 095 242	112,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
4	381 855	7 095 926	117,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
5	382 487	7 095 665	119,8	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
6	383 284	7 095 590	122,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
7	383 404	7 096 507	124,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
8	384 145	7 095 898	110,0	Generic RD200 HH20...	No	Generic	RD200 HH200 kavennet-5 600	5 600	200,0	200,0	2 086	10,4
9	384 021	7 095 208	112,5	Generic RD200 HH20...	No	Generic	RD200 HH200 kavennet-5 600	5 600	200,0	200,0	2 086	10,4
10	382 059	7 097 720	120,0	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
11	381 666	7 098 437	107,7	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
12	381 641	7 099 097	110,0	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
13	381 097	7 099 635	104,3	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
14	382 064	7 100 051	105,0	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
15	382 623	7 099 549	108,6	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
16	382 638	7 098 790	111,8	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
17	382 790	7 098 020	125,0	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
18	383 095	7 097 262	120,7	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
19	377 791	7 099 387	87,5	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
20	378 057	7 098 862	90,0	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
21	378 683	7 099 618	85,9	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
22	379 394	7 099 490	94,6	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
23	379 949	7 099 376	100,0	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
24	380 638	7 098 723	105,0	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
25	380 775	7 097 932	105,0	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
26	379 139	7 098 839	92,5	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
27	381 062	7 097 401	107,5	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8

Shadow receptor-Input

No.	Name	East	North	Z [m]	Width [m]	Height [m]	Elevation a.g.l. [m]	Slope of window [°]	Direction mode	Eye height (ZVI) a.g.l. [m]
A	Lomarakennus A (Lampinjärvi)	384 750	7 099 539	90,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
B	Lomarakennus B (Lampinkallio)	384 818	7 099 152	93,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
C	Lomarakennus C (Latvalampi)	384 650	7 097 533	96,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0

To be continued on next page...

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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Main Result

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

...continued from previous page

No.	Name	East	North	Z [m]	Width [m]	Height [m]	Elevation a.g.l. [m]	Slope of window [°]	Direction mode	Eye height (ZVI) a.g.l. [m]
D	Asuinrakennus D (Noppala)	382 520	7 093 979	105,2	5,0	5,0	1,0	90,0	"Green house mode"	6,0
E	Muu rakennus E (Noppala)	382 290	7 093 807	109,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
F	Asuinrakennus F (Maijannevantie)	379 455	7 093 166	96,2	5,0	5,0	1,0	90,0	"Green house mode"	6,0
G	Asuinrakennus G (Maijannevantie)	379 203	7 093 300	92,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0
H	Asuinrakennus H (Hietasaari)	379 076	7 093 530	92,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
I	Asuinrakennus I (Lahdenperä)	378 699	7 093 923	88,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
J	Lomarakennus J (Junno)	378 456	7 094 615	89,4	5,0	5,0	1,0	90,0	"Green house mode"	6,0
K	Lomarakennus K (Isomännikkö)	380 394	7 096 271	106,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
L	Asuinrakennus L (Malkasaari)	379 392	7 096 642	100,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0
M	Asuinrakennus M (Latvala)	383 344	7 100 875	82,6	5,0	5,0	1,0	90,0	"Green house mode"	6,0

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values: Shadow hours per year [h/year]
A	Lomarakennus A (Lampinjärvi)	0:00
B	Lomarakennus B (Lampinkallio)	0:00
C	Lomarakennus C (Latvalampi)	10:33
D	Asuinrakennus D (Noppala)	12:14
E	Muu rakennus E (Noppala)	5:01
F	Asuinrakennus F (Maijannevantie)	3:19
G	Asuinrakennus G (Maijannevantie)	7:30
H	Asuinrakennus H (Hietasaari)	9:21
I	Asuinrakennus I (Lahdenperä)	6:22
J	Lomarakennus J (Junno)	2:55
K	Lomarakennus K (Isomännikkö)	10:40
L	Asuinrakennus L (Malkasaari)	0:00
M	Asuinrakennus M (Latvala)	6:05

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

No.	Name	Expected [h/year]
1	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (172)	15:32
2	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (173)	26:38
3	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (174)	4:06
4	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (175)	3:13
5	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (176)	0:00
6	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (177)	0:00
7	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (178)	2:37
8	Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (179)	2:08
9	Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (210)	7:47
10	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (181)	0:00
11	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (182)	0:00
12	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (183)	0:00
13	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (184)	0:00
14	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (185)	2:58
15	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (186)	3:06
16	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (187)	0:00
17	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (188)	2:50
18	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (189)	2:52
19	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1)	0:00
20	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (2)	0:00
21	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (3)	0:00
22	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (4)	0:00
23	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (5)	0:00
24	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (6)	0:00
25	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (7)	0:00
26	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (8)	0:00
27	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (9)	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 several WTGs is calculated, the total expected time can, in rare cases, deviate marginally from the individually calculated by each turbine separately.

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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) Shadow receptor: A - Lomarakennus A (Lampinjärvi)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.22	03.01	04.27	06.02	07.28	08.01	09.36
	14.38	16.08	17.38	20.10	21.42	23.19	23.49	22.27	20.41	18.54	16.09	14.45
2	10.11	09.01	07.29	06.40	04.55	03.20	03.03	04.30	06.05	07.31	08.05	09.38
	14.40	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.43
3	10.10	08.58	07.26	06.37	04.52	03.17	03.05	04.33	06.08	07.34	08.08	09.41
	14.42	16.14	17.44	20.16	21.48	23.25	23.46	22.21	20.34	18.47	16.02	14.41
4	10.09	08.55	07.22	06.33	04.48	03.15	03.07	04.36	06.11	07.36	08.11	09.44
	14.44	16.18	17.47	20.19	21.52	23.28	23.44	22.17	20.30	18.44	15.59	14.39
5	10.08	08.52	07.19	06.30	04.45	03.12	03.09	04.40	06.13	07.39	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.40	15.56	14.38
6	10.07	08.49	07.15	06.26	04.42	03.10	03.11	04.43	06.16	07.42	08.17	09.49
	14.49	16.24	17.53	20.25	21.58	23.33	23.40	22.11	20.23	18.37	15.53	14.36
7	10.05	08.46	07.12	06.23	04.38	03.08	03.13	04.46	06.19	07.45	08.21	09.51
	14.51	16.28	17.56	20.28	22.01	23.35	23.38	22.07	20.19	18.33	15.50	14.35
8	10.03	08.43	07.08	06.19	04.35	03.06	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	17.59	20.31	22.04	23.37	23.36	22.04	20.16	18.30	15.47	14.33
9	10.02	08.39	07.05	06.15	04.32	03.04	03.18	04.52	06.25	07.51	08.27	09.56
	14.56	16.34	18.02	20.34	22.08	23.39	23.34	22.01	20.12	18.26	15.44	14.32
10	10.00	08.36	07.01	06.12	04.28	03.03	03.21	04.55	06.28	07.54	08.30	09.58
	14.59	16.37	18.05	20.37	22.11	23.41	23.32	21.57	20.09	18.23	15.40	14.31
11	09.58	08.33	06.58	06.08	04.25	03.01	03.23	04.58	06.31	07.57	08.33	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.37	14.29
12	09.56	08.30	06.54	06.05	04.22	02.58	03.26	05.01	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.17	23.45	23.27	21.50	20.02	18.16	15.34	14.28
13	09.54	08.26	06.51	06.01	04.18	02.57	03.29	05.05	06.36	08.03	08.40	10.04
	15.07	16.47	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.31	14.28
14	09.52	08.23	06.47	05.58	04.15	02.56	03.32	05.08	06.39	08.06	08.43	10.05
	15.10	16.50	18.17	20.49	22.24	23.48	23.22	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20	06.44	05.54	04.12	02.55	03.34	05.11	06.42	08.09	08.46	10.07
	15.13	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.26
16	09.47	08.17	06.40	05.51	04.09	02.54	03.37	05.14	06.45	08.12	08.50	10.08
	15.16	16.57	18.23	20.55	22.30	23.51	23.16	21.37	19.47	18.02	15.23	14.26
17	09.45	08.13	06.37	05.47	04.06	02.53	03.40	05.17	06.48	08.15	08.53	10.10
	15.19	17.00	18.26	20.58	22.34	23.52	23.13	21.33	19.44	17.59	15.20	14.25
18	09.43	08.10	06.33	05.44	04.02	02.53	03.43	05.20	06.51	08.18	08.56	10.11
	15.22	17.03	18.29	21.01	22.37	23.53	23.11	21.30	19.40	17.55	15.17	14.25
19	09.40	08.07	06.30	05.40	03.59	02.53	03.46	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.04	22.40	23.54	23.08	21.26	19.37	17.52	15.14	14.25
20	09.38	08.03	06.26	05.37	03.56	02.53	03.49	05.26	06.56	08.24	09.02	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.33	17.49	15.12	14.25
21	09.35	08.00	06.23	05.33	03.53	02.53	03.52	05.29	06.59	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.45	15.09	14.26
22	09.33	07.56	06.19	05.30	03.50	02.53	03.55	05.32	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.49	23.55	22.59	21.16	19.26	17.42	15.06	14.26
23	09.30	07.53	06.16	05.26	03.47	02.53	03.58	05.35	07.05	08.33	09.12	10.15
	15.38	17.19	18.44	21.17	22.53	23.55	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.44	02.54	04.02	05.38	07.08	08.36	09.15	10.15
	15.41	17.22	18.47	21.20	22.56	23.54	22.53	21.09	19.19	17.35	15.01	14.27
25	09.24	07.46	06.09	05.19	03.41	02.55	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.25	18.50	21.23	22.59	23.54	22.50	21.05	19.16	16.32	14.59	14.28
26	09.22	07.43	06.05	05.16	03.38	02.56	04.08	05.44	07.13	07.42	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.54	22.47	21.02	19.12	16.28	14.56	14.29
27	09.19	07.39	06.02	05.12	03.35	02.57	04.11	05.47	07.16	07.46	09.24	10.15
	15.51	17.32	18.55	21.29	23.05	23.53	22.43	20.58	19.09	16.25	14.54	14.30
28	09.16	07.36	05.58	05.09	03.33	02.58	04.14	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.58	21.32	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.31
29	09.13		06.54	05.05	03.30	03.00	04.17	05.53	07.22	07.52	09.30	10.15
	15.58		20.01	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.49	14.33
30	09.10		06.51	05.02	03.27	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.01		20.04	21.39	23.14	23.50	22.34	20.48	18.58	16.15	14.47	14.34
31	09.07		06.47		03.25		04.24	05.59		07.58		10.13
	16.04		20.07		23.17		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	138
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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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) Shadow receptor: B - Lomarakennus B (Lampinkallio)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.22	03.01	04.27	06.02	07.28	08.01	09.36
	14.38	16.08	17.38	20.10	21.42	23.19	23.49	22.27	20.41	18.54	16.09	14.45
2	10.11	09.01	07.29	06.40	04.55	03.20	03.03	04.30	06.05	07.31	08.04	09.38
	14.40	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.43
3	10.10	08.58	07.26	06.37	04.52	03.17	03.05	04.33	06.08	07.34	08.08	09.41
	14.42	16.14	17.44	20.16	21.48	23.25	23.46	22.21	20.34	18.47	16.02	14.41
4	10.09	08.55	07.22	06.33	04.48	03.15	03.07	04.36	06.11	07.36	08.11	09.44
	14.44	16.18	17.47	20.19	21.52	23.27	23.44	22.17	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.13	07.39	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.26	18.40	15.56	14.38
6	10.06	08.49	07.15	06.26	04.42	03.10	03.11	04.43	06.16	07.42	08.17	09.49
	14.49	16.24	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.36
7	10.05	08.46	07.12	06.23	04.38	03.08	03.13	04.46	06.19	07.45	08.21	09.51
	14.51	16.28	17.56	20.28	22.01	23.35	23.38	22.07	20.19	18.33	15.50	14.35
8	10.03	08.42	07.08	06.19	04.35	03.06	03.16	04.49	06.22	07.48	08.24	09.53
	14.54	16.31	17.59	20.31	22.04	23.37	23.36	22.04	20.16	18.30	15.47	14.33
9	10.02	08.39	07.05	06.15	04.32	03.04	03.18	04.52	06.25	07.51	08.27	09.56
	14.56	16.34	18.02	20.34	22.08	23.39	23.34	22.01	20.12	18.26	15.44	14.32
10	10.00	08.36	07.01	06.12	04.28	03.03	03.21	04.55	06.28	07.54	08.30	09.58
	14.59	16.37	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.40	14.31
11	09.58	08.33	06.58	06.08	04.25	03.01	03.23	04.58	06.31	07.57	08.33	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.37	14.29
12	09.56	08.30	06.54	06.05	04.22	03.00	03.26	05.01	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.17	23.45	23.27	21.50	20.02	18.16	15.34	14.29
13	09.54	08.26	06.51	06.01	04.18	02.57	03.29	05.05	06.36	08.03	08.40	10.04
	15.07	16.47	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.31	14.28
14	09.52	08.23	06.47	05.58	04.15	02.56	03.32	05.08	06.39	08.06	08.43	10.05
	15.10	16.50	18.17	20.49	22.24	23.48	23.21	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20	06.44	05.54	04.12	02.55	03.35	05.11	06.42	08.09	08.46	10.07
	15.13	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.26
16	09.47	08.17	06.40	05.51	04.09	02.54	03.37	05.14	06.45	08.12	08.50	10.08
	15.16	16.57	18.23	20.55	22.30	23.51	23.16	21.37	19.47	18.02	15.23	14.26
17	09.45	08.13	06.37	05.47	04.06	02.54	03.40	05.17	06.48	08.15	08.53	10.10
	15.19	17.00	18.26	20.58	22.33	23.52	23.13	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10	06.33	05.44	04.02	02.53	03.43	05.20	06.51	08.18	08.56	10.11
	15.22	17.03	18.29	21.01	22.37	23.53	23.11	21.30	19.40	17.55	15.17	14.25
19	09.40	08.07	06.30	05.40	03.59	02.53	03.46	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.04	22.40	23.53	23.08	21.26	19.37	17.52	15.14	14.25
20	09.38	08.03	06.26	05.37	03.56	02.53	03.49	05.26	06.56	08.24	09.02	10.13
	15.29	17.10	18.35	21.07	22.43	23.54	23.05	21.23	19.33	17.49	15.12	14.25
21	09.35	08.00	06.23	05.33	03.53	02.53	03.52	05.29	06.59	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.45	15.09	14.26
22	09.32	07.56	06.19	05.30	03.50	02.53	03.55	05.32	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.49	23.55	22.59	21.16	19.26	17.42	15.06	14.26
23	09.30	07.53	06.16	05.26	03.47	02.54	03.59	05.35	07.05	08.33	09.12	10.15
	15.38	17.19	18.44	21.17	22.53	23.55	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.44	02.54	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.22	18.47	21.20	22.56	23.54	22.53	21.09	19.19	17.35	15.01	14.27
25	09.24	07.46	06.09	05.19	03.41	02.55	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.25	18.50	21.23	22.59	23.54	22.50	21.05	19.16	16.32	14.59	14.28
26	09.22	07.43	06.05	05.16	03.38	02.56	04.08	05.44	07.13	07.42	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.54	22.47	21.02	19.12	16.28	14.56	14.29
27	09.19	07.39	06.02	05.12	03.35	02.57	04.11	05.47	07.16	07.46	09.24	10.15
	15.51	17.32	18.55	21.29	23.05	23.53	22.43	20.58	19.09	16.25	14.54	14.30
28	09.16	07.36	05.58	05.09	03.33	02.58	04.14	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.58	21.32	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.54	05.06	03.30	03.00	04.17	05.53	07.22	07.52	09.30	10.14
	15.58		20.01	21.36	23.11	23.51	22.37	20.51	19.01	16.19	14.49	14.33
30	09.10		06.51	05.02	03.27	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.01		20.04	21.39	23.14	23.50	22.34	20.48	18.58	16.15	14.47	14.34
31	09.07		06.47		03.25		04.24	05.59		07.58		10.13
	16.04		20.07		23.17		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	138
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: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) Shadow receptor: C - Lomarakennus C (Latvalampi)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January		February		March		April		May	June
1	10.12		09.04		13.23 (8)	07.33	15.36 (7)	06.44	18.18 (18)	04.59	03.22
	14.39		16.08	27	13.50 (8)	17.38	26 16.02 (7)	20.10	22 18.40 (18)	21.42	23.19
2	10.11		09.01		13.24 (8)	07.29	15.37 (7)	06.40	18.19 (18)	04.55	03.20
	14.41		16.11	27	13.51 (8)	17.41	23 16.00 (7)	20.13	18 18.37 (18)	21.45	23.22
3	10.10		08.58		13.25 (8)	07.26	15.38 (7)	06.37	18.22 (18)	04.52	03.17
	14.43		16.15	25	13.50 (8)	17.44	20 15.58 (7)	20.16	13 18.35 (18)	21.48	23.25
4	10.09		08.55		13.25 (8)	07.22	15.41 (7)	06.33		04.49	03.15
	14.45		16.18	24	13.49 (8)	17.47	16 15.57 (7)	20.19		21.51	23.27
5	10.08		08.52		13.26 (8)	07.19	15.44 (7)	06.30		04.45	03.13
	14.47		16.21	22	13.48 (8)	17.50	9 15.53 (7)	20.22		21.55	23.30
6	10.06		08.49		13.28 (8)	07.15		06.26		04.42	03.11
	14.49		16.24	20	13.48 (8)	17.53		20.25		21.58	23.32
7	10.05		08.46		13.30 (8)	07.12		06.23		04.38	03.09
	14.52		16.28	16	13.46 (8)	17.56		20.28		22.01	23.35
8	10.03		08.42		13.32 (8)	07.08		06.19		04.35	03.07
	14.54		16.31	12	13.44 (8)	17.59		20.31		22.04	23.37
9	10.01		08.39			07.05		06.16		04.32	03.05
	14.57		16.34			18.02		20.34		22.08	23.39
10	10.00		08.36			07.01		06.12		04.28	03.03
	14.59		16.38			18.05		20.37		22.11	23.41
11	09.58		08.33			06.58		06.08		04.25	03.01
	15.02		16.41			18.08		20.40		22.14	23.43
12	09.56		08.30			06.54		06.05	19.51 (17)	04.22	03.00
	15.05		16.44			18.11		20.43	9 20.00 (17)	22.17	23.45
13	09.54	13.29 (8)	08.26			06.51		06.01	19.48 (17)	04.19	02.57
	15.08	4 13.33 (8)	16.47			18.14		20.46	14 20.02 (17)	22.20	23.46
14	09.52	13.27 (8)	08.23		15.48 (7)	06.47		05.58	19.46 (17)	04.15	02.56
	15.11	10 13.37 (8)	16.51	4	15.52 (7)	18.17		20.49	18 20.04 (17)	22.24	23.48
15	09.49	13.26 (8)	08.20		15.43 (7)	06.44		05.54	19.45 (17)	04.12	02.55
	15.14	13 13.39 (8)	16.54	13	15.56 (7)	18.20		20.52	20 20.05 (17)	22.27	23.49
16	09.47	13.25 (8)	08.16		15.41 (7)	06.40		05.51	19.43 (17)	04.09	02.55
	15.17	16 13.41 (8)	16.57	17	15.58 (7)	18.23		20.55	22 20.05 (17)	22.30	23.50
17	09.45	13.24 (8)	08.13		15.40 (7)	06.37	17.27 (18)	05.47	19.43 (17)	04.06	02.54
	15.20	19 13.43 (8)	17.00	21	16.01 (7)	18.26	13 17.40 (18)	20.58	23 20.06 (17)	22.33	23.52
18	09.42	13.23 (8)	08.10		15.38 (7)	06.33	17.24 (18)	05.44	19.42 (17)	04.03	02.53
	15.23	21 13.44 (8)	17.03	24	16.02 (7)	18.29	18 17.42 (18)	21.01	24 20.06 (17)	22.37	23.52
19	09.40	13.23 (8)	08.07		15.37 (7)	06.30	17.22 (18)	05.40	19.41 (17)	03.59	02.53
	15.26	22 13.45 (8)	17.07	25	16.02 (7)	18.32	22 17.44 (18)	21.04	25 20.06 (17)	22.40	23.53
20	09.38	13.23 (8)	08.03		15.37 (7)	06.26	17.20 (18)	05.37	19.41 (17)	03.56	02.53
	15.29	23 13.46 (8)	17.10	27	16.04 (7)	18.35	24 17.44 (18)	21.07	25 20.06 (17)	22.43	23.54
21	09.35	13.22 (8)	08.00		15.36 (7)	06.23	17.18 (18)	05.33	19.41 (17)	03.53	02.53
	15.32	25 13.47 (8)	17.13	28	16.04 (7)	18.38	27 17.45 (18)	21.11	25 20.06 (17)	22.46	23.54
22	09.32	13.22 (8)	07.56		15.35 (7)	06.19	17.18 (18)	05.30	19.41 (17)	03.50	02.53
	15.35	26 13.48 (8)	17.16	29	16.04 (7)	18.41	28 17.46 (18)	21.14	24 20.05 (17)	22.49	23.54
23	09.30	13.22 (8)	07.53		15.35 (7)	06.16	17.17 (18)	05.26	19.42 (17)	03.47	02.54
	15.38	26 13.48 (8)	17.19	30	16.05 (7)	18.44	28 17.45 (18)	21.17	23 20.05 (17)	22.52	23.54
24	09.27	13.22 (8)	07.50		15.35 (7)	06.12	17.17 (18)	05.23	19.41 (17)	03.44	02.55
	15.42	27 13.49 (8)	17.22	29	16.04 (7)	18.47	29 17.46 (18)	21.20	22 20.03 (17)	22.55	23.54
25	09.24	13.21 (8)	07.46		15.34 (7)	06.09	17.16 (18)	05.19	19.42 (17)	03.41	02.55
	15.45	28 13.49 (8)	17.25	30	16.04 (7)	18.50	29 17.45 (18)	21.23	21 20.03 (17)	22.59	23.54
26	09.21	13.21 (8)	07.43		15.35 (7)	06.05	17.16 (18)	05.16	19.43 (17)	03.39	02.56
	15.48	29 13.50 (8)	17.29	29	16.04 (7)	18.53	29 17.45 (18)	21.26	19 20.02 (17)	23.02	23.53
27	09.19	13.21 (8)	07.39		15.35 (7)	06.02	17.15 (18)	05.13	19.44 (17)	03.36	02.57
	15.51	29 13.50 (8)	17.32	28	16.03 (7)	18.55	29 17.44 (18)	21.29	16 20.00 (17)	23.05	23.53
28	09.16	13.22 (8)	07.36		15.35 (7)	05.58	17.16 (18)	05.09	19.46 (17)	03.33	02.59
	15.55	29 13.51 (8)	17.35	27	16.02 (7)	18.58	28 17.44 (18)	21.32	12 19.58 (17)	23.08	23.52
29	09.13	13.22 (8)				06.54	18.16 (18)	05.06	19.50 (17)	03.30	03.00
	15.58	29 13.51 (8)				20.01	27 18.43 (18)	21.36	5 19.55 (17)	23.11	23.51
30	09.10	13.22 (8)				06.51	18.17 (18)	05.02		03.27	03.00
	16.01	29 13.51 (8)				20.04	25 18.42 (18)	21.39		23.13	23.50
31	09.07	13.23 (8)				06.47	18.17 (18)			03.25	
	16.05	28 13.51 (8)				20.07	24 18.41 (18)			23.16	
Potential sun hours	172		238			363		451		568	621
Total, worst case		433		534		474		400			
Sun reduction		0,11		0,31		0,36		0,43			
Oper. time red.		0,94		0,94		0,94		0,94			
Wind dir. red.		0,64		0,63		0,61		0,61			
Total reduction		0,07		0,18		0,21		0,25			
Total, real		28		97		98		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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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) Shadow receptor: C - Lomarakennus C (Latvalampi)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	July	August		September		October		November		December
1	03.02	04.27		06.02		07.28		08.01		09.35
	23.48	22.27		20.41		18.54		16.09		14.45
2	03.03	04.30		06.05		07.31		08.04	13.07 (8)	09.38
	23.47	22.24		20.37		18.51		16.06	1 13.08 (8)	14.43
3	03.05	04.33		06.08		07.34		08.08	13.01 (8)	09.41
	23.45	22.21		20.34		18.47		16.02	13 13.14 (8)	14.42
4	03.07	04.37		06.11		07.36		08.11	12.59 (8)	09.44
	23.44	22.17		20.30		18.44		15.59	17 13.16 (8)	14.40
5	03.09	04.40		06.13		07.39		08.14	12.58 (8)	09.46
	23.42	22.14		20.26		18.40		15.56	20 13.18 (8)	14.38
6	03.11	04.43		06.16		07.42		08.17	12.57 (8)	09.49
	23.40	22.11		20.23		18.37		15.53	22 13.19 (8)	14.36
7	03.14	04.46		06.19		07.45		08.20	12.56 (8)	09.51
	23.38	22.07		20.19		18.33		15.50	24 13.20 (8)	14.35
8	03.16	04.49		06.22		07.48		08.24	12.55 (8)	09.53
	23.36	22.04		20.16		18.30		15.47	26 13.21 (8)	14.33
9	03.19	04.52		06.25	18.16 (18)	07.51	16.17 (7)	08.27	12.55 (8)	09.56
	23.33	22.01		20.12	12 18.28 (18)	18.27	13 16.30 (7)	15.44	27 13.22 (8)	14.32
10	03.21	04.55		06.28	18.13 (18)	07.54	16.14 (7)	08.30	12.55 (8)	09.58
	23.31	21.57		20.09	17 18.30 (18)	18.23	18 16.32 (7)	15.41	27 13.22 (8)	14.31
11	03.24	04.58		06.31	18.11 (18)	07.57	16.12 (7)	08.33	12.54 (8)	10.00
	23.29	21.54		20.05	21 18.32 (18)	18.20	21 16.33 (7)	15.38	28 13.22 (8)	14.30
12	03.26	05.02		06.34	18.08 (18)	08.00	16.10 (7)	08.37	12.54 (8)	10.02
	23.26	21.50		20.02	24 18.32 (18)	18.16	24 16.34 (7)	15.35	29 13.23 (8)	14.29
13	03.29	05.05		06.36	18.07 (18)	08.03	16.09 (7)	08.40	12.54 (8)	10.03
	23.24	21.47		19.58	26 18.33 (18)	18.13	25 16.34 (7)	15.32	29 13.23 (8)	14.28
14	03.32	05.08	19.56 (17)	06.39	18.06 (18)	08.06	16.07 (7)	08.43	12.54 (8)	10.05
	23.21	21.43	8 20.04 (17)	19.55	27 18.33 (18)	18.09	28 16.35 (7)	15.29	29 13.23 (8)	14.27
15	03.35	05.11	19.53 (17)	06.42	18.05 (18)	08.09	16.07 (7)	08.46	12.54 (8)	10.07
	23.19	21.40	13 20.06 (17)	19.51	29 18.34 (18)	18.06	29 16.36 (7)	15.26	29 13.23 (8)	14.27
16	03.38	05.14	19.51 (17)	06.45	18.05 (18)	08.12	16.07 (7)	08.49	12.54 (8)	10.08
	23.16	21.37	17 20.08 (17)	19.47	29 18.34 (18)	18.02	29 16.36 (7)	15.23	29 13.23 (8)	14.26
17	03.41	05.17	19.49 (17)	06.48	18.04 (18)	08.15	16.06 (7)	08.53	12.55 (8)	10.09
	23.13	21.33	19 20.08 (17)	19.44	29 18.33 (18)	17.59	29 16.35 (7)	15.20	28 13.23 (8)	14.26
18	03.44	05.20	19.48 (17)	06.51	18.03 (18)	08.18	16.06 (7)	08.56	12.55 (8)	10.11
	23.10	21.30	21 20.09 (17)	19.40	30 18.33 (18)	17.56	29 16.35 (7)	15.17	28 13.23 (8)	14.26
19	03.47	05.23	19.47 (17)	06.54	18.03 (18)	08.21	16.06 (7)	08.59	12.56 (8)	10.12
	23.07	21.26	23 20.10 (17)	19.37	30 18.33 (18)	17.52	29 16.35 (7)	15.15	26 13.22 (8)	14.26
20	03.50	05.26	19.47 (17)	06.56	18.03 (18)	08.24	16.06 (7)	09.02	12.57 (8)	10.13
	23.05	21.23	24 20.11 (17)	19.33	29 18.32 (18)	17.49	28 16.34 (7)	15.12	26 13.23 (8)	14.26
21	03.53	05.29	19.46 (17)	06.59	18.04 (18)	08.27	16.07 (7)	09.05	12.57 (8)	10.13
	23.02	21.19	24 20.10 (17)	19.30	28 18.32 (18)	17.45	28 16.35 (7)	15.09	25 13.22 (8)	14.26
22	03.56	05.32	19.45 (17)	07.02	18.03 (18)	08.30	16.07 (7)	09.09	12.59 (8)	10.14
	22.59	21.16	25 20.10 (17)	19.26	27 18.30 (18)	17.42	26 16.33 (7)	15.06	23 13.22 (8)	14.26
23	03.59	05.35	19.45 (17)	07.05	18.04 (18)	08.33	16.07 (7)	09.12	12.59 (8)	10.14
	22.56	21.12	25 20.10 (17)	19.23	25 18.29 (18)	17.39	25 16.32 (7)	15.04	22 13.21 (8)	14.27
24	04.02	05.38	19.45 (17)	07.08	18.05 (18)	08.36	16.08 (7)	09.15	13.01 (8)	10.15
	22.53	21.09	24 20.09 (17)	19.19	22 18.27 (18)	17.35	23 16.31 (7)	15.01	20 13.21 (8)	14.28
25	04.05	05.41	19.45 (17)	07.11	18.06 (18)	07.39	15.09 (7)	09.18	13.02 (8)	10.15
	22.49	21.05	24 20.09 (17)	19.16	19 18.25 (18)	16.32	20 15.29 (7)	14.59	19 13.21 (8)	14.28
26	04.08	05.44	19.45 (17)	07.13	18.08 (18)	07.42	15.11 (7)	09.21	13.03 (8)	10.15
	22.46	21.02	24 20.09 (17)	19.12	15 18.23 (18)	16.29	17 15.28 (7)	14.57	16 13.19 (8)	14.29
27	04.11	05.47	19.46 (17)	07.16	18.11 (18)	07.45	15.13 (7)	09.24	13.05 (8)	10.15
	22.43	20.58	22 20.08 (17)	19.09	8 18.19 (18)	16.25	12 15.25 (7)	14.54	13 13.18 (8)	14.31
28	04.14	05.50	19.46 (17)	07.19		07.49		09.27	13.07 (8)	10.15
	22.40	20.55	20 20.06 (17)	19.05		16.22		14.52	10 13.17 (8)	14.32
29	04.18	05.53	19.47 (17)	07.22		07.52		09.30	13.10 (8)	10.14
	22.37	20.51	18 20.05 (17)	19.02		16.19		14.50	4 13.14 (8)	14.33
30	04.21	05.56	19.48 (17)	07.25		07.55		09.33		10.14
	22.34	20.48	15 20.03 (17)	18.58		16.15		14.48		14.35
31	04.24	05.59	19.51 (17)			07.58				10.13
	22.30	20.44	9 20.00 (17)			16.12				14.36
Potential sun hours	607	508		393		305		199		139
Total, worst case			355		447		453		610	
Sun reduction			0,42		0,32		0,28		0,18	
Oper. time red.			0,94		0,94		0,94		0,94	
Wind dir. red.			0,61		0,61		0,62		0,64	
Total reduction			0,24		0,19		0,16		0,11	
Total, real			86		83		75		68	

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

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

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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) Shadow receptor: D - Asuinrakennus D (Noppala)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April			May			June		
1	10.12	09.04	07.33	06.44			04.59		19.58 (2)	03.23		04.41 (9)
	14.39	16.08	17.38	20.10			21.42	17	20.15 (2)	23.19	26	05.07 (9)
2	10.11	09.01	07.29	06.41			04.56		20.00 (2)	03.21		04.41 (9)
	14.41	16.12	17.41	20.13			21.45	13	20.13 (2)	23.21	26	05.07 (9)
3	10.10	08.58	07.26	06.37			04.52		20.03 (2)	03.18		04.41 (9)
	14.43	16.15	17.44	20.16			21.48	7	20.10 (2)	23.24	26	05.07 (9)
4	10.09	08.55	07.22	06.33			04.49			03.16		04.41 (9)
	14.45	16.18	17.47	20.19			21.51			23.27	26	05.07 (9)
5	10.07	08.52	07.19	06.30			04.46			03.14		04.41 (9)
	14.48	16.22	17.50	20.22			21.55			23.29	27	05.08 (9)
6	10.06	08.49	07.15	06.26			04.42			03.11		04.42 (9)
	14.50	16.25	17.53	20.25			21.58			23.32	26	05.08 (9)
7	10.04	08.46	07.12	06.23			04.39			03.09		04.41 (9)
	14.52	16.28	17.56	20.28			22.01			23.34	26	05.07 (9)
8	10.03	08.42	07.08	06.19			04.36			03.07		04.42 (9)
	14.55	16.31	17.59	20.31			22.04			23.36	26	05.08 (9)
9	10.01	08.39	07.05	06.16			04.32			03.06		04.42 (9)
	14.57	16.35	18.02	20.34			22.07			23.38	26	05.08 (9)
10	09.59	08.36	07.01	06.12			04.29			03.04		04.42 (9)
	15.00	16.38	18.05	20.37			22.11			23.40	26	05.08 (9)
11	09.58	08.33	06.58	06.09			04.26			03.02		04.42 (9)
	15.03	16.41	18.08	20.40			22.14			23.42	27	22.20 (3)
12	09.56	08.30	06.55	06.05			04.22			03.01		04.43 (9)
	15.05	16.44	18.11	20.43			22.17			23.44	32	22.24 (3)
13	09.54	08.26	06.51	06.02			04.19			02.58		04.43 (9)
	15.08	16.48	18.14	20.46			22.20			23.46	35	22.25 (3)
14	09.51	08.23	06.48	05.58			04.16			02.57		04.44 (9)
	15.11	16.51	18.17	20.49			22.23			23.47	35	22.26 (3)
15	09.49	08.20	06.44	05.55		20.04 (2)	04.13			02.56		04.43 (9)
	15.14	16.54	18.20	20.52	10	20.14 (2)	22.27			23.49	37	22.26 (3)
16	09.47	08.16	06.40	05.51		20.02 (2)	04.09			02.55		04.44 (9)
	15.17	16.57	18.23	20.55	15	20.17 (2)	22.30			23.50	38	22.28 (3)
17	09.45	08.13	06.37	05.48		19.59 (2)	04.06			02.55		04.45 (9)
	15.20	17.01	18.26	20.58	19	20.18 (2)	22.33			23.51	37	22.28 (3)
18	09.42	08.10	06.33	05.44		19.58 (2)	04.03		04.50 (9)	02.54		04.44 (9)
	15.23	17.04	18.29	21.01	22	20.20 (2)	22.36	5	04.55 (9)	23.52	38	22.28 (3)
19	09.40	08.07	06.30	05.41		19.57 (2)	04.00		04.47 (9)	02.54		04.44 (9)
	15.26	17.07	18.32	21.04	23	20.20 (2)	22.39	11	04.58 (9)	23.52	38	22.28 (3)
20	09.37	08.03	06.26	05.37		19.57 (2)	03.57		04.46 (9)	02.54		04.44 (9)
	15.29	17.10	18.35	21.07	24	20.21 (2)	22.43	14	05.00 (9)	23.53	40	22.29 (3)
21	09.35	08.00	06.23	05.34		19.55 (2)	03.54		04.45 (9)	02.54		04.46 (9)
	15.33	17.13	18.38	21.10	26	20.21 (2)	22.46	16	05.01 (9)	23.53	39	22.30 (3)
22	09.32	07.56	06.19	05.30		19.55 (2)	03.51		04.43 (9)	02.54		04.46 (9)
	15.36	17.16	18.41	21.14	26	20.21 (2)	22.49	18	05.01 (9)	23.54	39	22.30 (3)
23	09.30	07.53	06.16	05.27		19.55 (2)	03.48		04.43 (9)	02.55		04.45 (9)
	15.39	17.19	18.44	21.17	26	20.21 (2)	22.52	19	05.02 (9)	23.54	39	22.30 (3)
24	09.27	07.50	06.12	05.23		19.55 (2)	03.45		04.42 (9)	02.55		04.46 (9)
	15.42	17.23	18.47	21.20	26	20.21 (2)	22.55	21	05.03 (9)	23.53	38	22.30 (3)
25	09.24	07.46	06.09	05.20		19.54 (2)	03.42		04.42 (9)	02.56		04.46 (9)
	15.45	17.26	18.50	21.23	26	20.20 (2)	22.58	22	05.04 (9)	23.53	38	22.30 (3)
26	09.21	07.43	06.05	05.16		19.54 (2)	03.39		04.42 (9)	02.57		04.46 (9)
	15.49	17.29	18.53	21.26	25	20.19 (2)	23.01	23	05.05 (9)	23.53	39	22.30 (3)
27	09.19	07.39	06.02	05.13		19.55 (2)	03.36		04.41 (9)	02.58		04.46 (9)
	15.52	17.32	18.56	21.29	24	20.19 (2)	23.04	24	05.05 (9)	23.52	37	22.29 (3)
28	09.16	07.36	05.58	05.09		19.55 (2)	03.34		04.41 (9)	03.00		04.46 (9)
	15.55	17.35	18.59	21.32	23	20.18 (2)	23.07	24	05.05 (9)	23.51	36	22.29 (3)
29	09.13		06.55	05.06		19.56 (2)	03.31		04.41 (9)	03.00		04.46 (9)
	15.58		20.01	21.35	21	20.17 (2)	23.10	25	05.06 (9)	23.50	35	22.28 (3)
30	09.10		06.51	05.03		19.57 (2)	03.28		04.41 (9)	03.01		04.46 (9)
	16.02		20.04	21.39	19	20.16 (2)	23.13	25	05.06 (9)	23.49	34	22.28 (3)
31	09.07		06.48				03.26		04.40 (9)			
	16.05		20.07				23.16	26	05.06 (9)			
Potential sun hours	173	239	363	450			568			621		
Total, worst case					355			310			992	
Sun reduction					0,43			0,48			0,51	
Oper. time red.					0,94			0,94			0,94	
Wind dir. red.					0,62			0,62			0,63	
Total reduction					0,25			0,28			0,30	
Total, real					89			86			299	

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: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) Shadow receptor: D - Asuinrakennus D (Noppala)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	July		August		September	October	November	December
1	03.03		04.46 (9)	04.28		06.02	07.28	08.01	09.35
	23.48	30	22.26 (3)	22.27		20.41	18.55	16.09	14.46
2	03.04		04.47 (9)	04.31		06.05	07.31	08.04	09.38
	23.46	26	05.13 (9)	22.24		20.37	18.51	16.06	14.44
3	03.06		04.47 (9)	04.34		06.08	07.34	08.08	09.41
	23.45	26	05.13 (9)	22.20		20.34	18.48	16.03	14.42
4	03.08		04.47 (9)	04.37		06.11	07.37	08.11	09.43
	23.43	26	05.13 (9)	22.17		20.30	18.44	16.00	14.40
5	03.10		04.48 (9)	04.40		06.14	07.39	08.14	09.46
	23.41	26	05.14 (9)	22.14		20.27	18.41	15.56	14.39
6	03.12		04.47 (9)	04.43		06.17	07.42	08.17	09.48
	23.39	27	05.14 (9)	22.11		20.23	18.37	15.53	14.37
7	03.15		04.48 (9)	04.46		06.20	07.45	08.20	09.51
	23.37	26	05.14 (9)	22.07		20.19	18.34	15.50	14.35
8	03.17		04.47 (9)	04.50		06.22	07.48	08.24	09.53
	23.35	27	05.14 (9)	22.04		20.16	18.30	15.47	14.34
9	03.19		04.48 (9)	04.53		06.25	07.51	08.27	09.55
	23.33	26	05.14 (9)	22.00		20.12	18.27	15.44	14.33
10	03.22		04.48 (9)	04.56	20.11 (2)	06.28	07.54	08.30	09.57
	23.31	26	05.14 (9)	21.57	9	20.20 (2)	20.09	18.23	15.41	14.31
11	03.24		04.49 (9)	04.59		20.08 (2)	06.31	07.57	08.33	09.59
	23.28	26	05.15 (9)	21.54	14	20.22 (2)	20.05	18.20	15.38	14.30
12	03.27		04.49 (9)	05.02		20.06 (2)	06.34	08.00	08.36	10.01
	23.26	26	05.15 (9)	21.50	17	20.23 (2)	20.02	18.16	15.35	14.29
13	03.30		04.49 (9)	05.05		20.05 (2)	06.37	08.03	08.40	10.03
	23.23	26	05.15 (9)	21.47	20	20.25 (2)	19.58	18.13	15.32	14.29
14	03.33		04.50 (9)	05.08		20.04 (2)	06.40	08.06	08.43	10.05
	23.21	25	05.15 (9)	21.43	22	20.26 (2)	19.55	18.09	15.29	14.28
15	03.35		04.50 (9)	05.11		20.02 (2)	06.42	08.09	08.46	10.06
	23.18	25	05.15 (9)	21.40	24	20.26 (2)	19.51	18.06	15.26	14.27
16	03.38		04.50 (9)	05.14		20.02 (2)	06.45	08.12	08.49	10.08
	23.16	24	05.14 (9)	21.37	24	20.26 (2)	19.48	18.03	15.23	14.27
17	03.41		04.50 (9)	05.17		20.02 (2)	06.48	08.15	08.53	10.09
	23.13	24	05.14 (9)	21.33	25	20.27 (2)	19.44	17.59	15.21	14.26
18	03.44		04.51 (9)	05.20		20.00 (2)	06.51	08.18	08.56	10.10
	23.10	22	05.13 (9)	21.30	26	20.26 (2)	19.41	17.56	15.18	14.26
19	03.47		04.52 (9)	05.23		20.00 (2)	06.54	08.21	08.59	10.11
	23.07	22	05.14 (9)	21.26	26	20.26 (2)	19.37	17.52	15.15	14.26
20	03.50		04.52 (9)	05.27		20.00 (2)	06.57	08.24	09.02	10.12
	23.04	21	05.13 (9)	21.23	26	20.26 (2)	19.33	17.49	15.12	14.26
21	03.53		04.53 (9)	05.30		20.01 (2)	06.59	08.27	09.05	10.13
	23.01	19	05.12 (9)	21.19	25	20.26 (2)	19.30	17.46	15.10	14.27
22	03.56		04.54 (9)	05.33		20.00 (2)	07.02	08.30	09.08	10.14
	22.58	18	05.12 (9)	21.16	25	20.25 (2)	19.26	17.42	15.07	14.27
23	03.59		04.55 (9)	05.36		20.00 (2)	07.05	08.33	09.11	10.14
	22.55	16	05.11 (9)	21.12	25	20.25 (2)	19.23	17.39	15.04	14.28
24	04.02		04.56 (9)	05.39		20.01 (2)	07.08	08.36	09.15	10.14
	22.52	13	05.09 (9)	21.09	23	20.24 (2)	19.19	17.36	15.02	14.28
25	04.06		04.59 (9)	05.42		20.01 (2)	07.11	07.39	09.18	10.15
	22.49	8	05.07 (9)	21.05	21	20.22 (2)	19.16	16.32	14.59	14.29
26	04.09			05.44		20.02 (2)	07.14	07.42	09.21	10.15
	22.46			21.02	19	20.21 (2)	19.12	16.29	14.57	14.30
27	04.12			05.47		20.03 (2)	07.16	07.45	09.24	10.15
	22.43			20.58	16	20.19 (2)	19.09	16.26	14.55	14.31
28	04.15			05.50		20.06 (2)	07.19	07.49	09.27	10.14
	22.40			20.55	10	20.16 (2)	19.05	16.22	14.52	14.32
29	04.18			05.53			07.22	07.52	09.30	10.14
	22.37			20.51			19.02	16.19	14.50	14.34
30	04.21			05.56			07.25	07.55	09.32	10.13
	22.33			20.48			18.58	16.16	14.48	14.35
31	04.24			05.59				07.58		10.13
	22.30			20.44				16.12		14.37
Potential sun hours	606			507			393	305	199	139
Total, worst case		581			397					
Sun reduction		0,49			0,42					
Oper. time red.		0,94			0,94					
Wind dir. red.		0,62			0,62					
Total reduction		0,28			0,24					
Total, real		164			97					

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

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

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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) Shadow receptor: E - Muu rakennus E (Noppala)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	20.22 (2)	03.23	03.03	04.28	20.33 (2)	06.02	07.28	08.01	09.35
	14.39	16.08	17.38	20.10	21.42 27	20.49 (2)	23.19	23.48	22.27 25	20.58 (2)	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.41	04.56	20.21 (2)	03.21	03.04	04.31	20.31 (2)	06.05	07.31	08.04	09.38
	14.41	16.12	17.41	20.13	21.45 28	20.49 (2)	23.21	23.46	22.24 26	20.57 (2)	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	20.21 (2)	03.18	03.06	04.34	20.31 (2)	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48 28	20.49 (2)	23.24	23.45	22.20 27	20.58 (2)	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	20.21 (2)	03.16	03.08	04.37	20.31 (2)	06.11	07.37	08.11	09.43
	14.45	16.18	17.47	20.19	21.51 28	20.49 (2)	23.27	23.43	22.17 28	20.59 (2)	20.30	18.44	16.00	14.40
5	10.07	08.52	07.19	06.30	04.46	20.20 (2)	03.14	03.10	04.40	20.30 (2)	06.14	07.39	08.14	09.46
	14.48	16.22	17.50	20.22	21.55 29	20.49 (2)	23.29	23.41	22.14 28	20.58 (2)	20.27	18.41	15.57	14.39
6	10.06	08.49	07.15	06.26	04.42	20.20 (2)	03.11	03.12	04.43	20.30 (2)	06.17	07.42	08.17	09.48
	14.50	16.25	17.53	20.25	21.58 29	20.49 (2)	23.32	23.39	22.11 29	20.59 (2)	20.23	18.37	15.53	14.37
7	10.04	08.46	07.12	06.23	04.39	20.20 (2)	03.09	03.15	04.46	20.30 (2)	06.20	07.45	08.20	09.51
	14.52	16.28	17.56	20.28	22.01 29	20.49 (2)	23.34	23.37	22.07 29	20.59 (2)	20.19	18.34	15.50	14.35
8	10.03	08.42	07.08	06.19	04.36	20.20 (2)	03.07	03.17	04.50	20.30 (2)	06.22	07.48	08.24	09.53
	14.55	16.31	17.59	20.31	22.04 28	20.48 (2)	23.36	23.35	22.04 28	20.58 (2)	20.16	18.30	15.47	14.34
9	10.01	08.39	07.05	06.16	04.32	20.21 (2)	03.06	03.19	04.53	20.30 (2)	06.25	07.51	08.27	09.55
	14.57	16.35	18.02	20.34	22.07 28	20.49 (2)	23.38	23.33	22.00 28	20.58 (2)	20.12	18.27	15.44	14.33
10	09.59	08.36	07.02	06.12	04.29	20.21 (2)	03.04	03.22	04.56	20.30 (2)	06.28	07.54	08.30	09.57
	15.00	16.38	18.05	20.37	22.11 27	20.48 (2)	23.40	23.31	21.57 28	20.58 (2)	20.09	18.23	15.41	14.32
11	09.58	08.33	06.58	06.09	04.26	20.22 (2)	03.02	03.25	04.59	20.30 (2)	06.31	07.57	08.33	09.59
	15.03	16.41	18.08	20.40	22.14 25	20.47 (2)	23.42	23.28	21.54 27	20.57 (2)	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	20.22 (2)	03.01	03.27	05.02	20.30 (2)	06.34	08.00	08.36	10.01
	15.05	16.44	18.11	20.43	22.17 24	20.46 (2)	23.44	23.26	21.50 27	20.57 (2)	20.02	18.16	15.35	14.29
13	09.54	08.26	06.51	06.02	04.19	20.23 (2)	02.58	03.30	05.05	20.31 (2)	06.37	08.03	08.40	10.03
	15.08	16.48	18.14	20.46	22.20 23	20.46 (2)	23.46	23.23	21.47 25	20.56 (2)	19.58	18.13	15.32	14.29
14	09.51	08.23	06.48	05.58	04.16	20.24 (2)	02.57	03.33	05.08	20.32 (2)	06.40	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.23 21	20.45 (2)	23.47	23.21	21.43 24	20.56 (2)	19.55	18.09	15.29	14.28
15	09.49	08.20	06.44	05.55	04.13	20.25 (2)	02.56	03.35	05.11	20.32 (2)	06.42	08.09	08.46	10.06
	15.14	16.54	18.20	20.52	22.27 19	20.44 (2)	23.49	23.18	21.40 22	20.54 (2)	19.51	18.06	15.26	14.27
16	09.47	08.16	06.41	05.51	04.09	20.26 (2)	02.55	03.38	05.14	20.33 (2)	06.45	08.12	08.49	10.08
	15.17	16.57	18.23	20.55	22.30 17	20.43 (2)	23.50	23.16	21.37 20	20.53 (2)	19.48	18.03	15.23	14.27
17	09.45	08.13	06.37	05.48	04.06	20.28 (2)	02.55	03.41	05.17	20.35 (2)	06.48	08.15	08.53	10.09
	15.20	17.01	18.26	20.58	22.33 13	20.41 (2)	23.51	23.13	21.33 16	20.51 (2)	19.44	17.59	15.21	14.27
18	09.42	08.10	06.33	05.44	04.03	20.30 (2)	02.54	03.44	05.20	20.37 (2)	06.51	08.18	08.56	10.10
	15.23	17.04	18.29	21.01	22.36 10	20.40 (2)	23.52	23.10	21.30 10	20.47 (2)	19.41	17.56	15.18	14.26
19	09.40	08.07	06.30	05.41	04.00		02.54	03.47	05.24		06.54	08.21	08.59	10.11
	15.26	17.07	18.32	21.04	22.39		23.52	23.07	21.26		19.37	17.52	15.15	14.26
20	09.37	08.03	06.26	05.37	03.57		02.54	03.50	05.27		06.57	08.24	09.02	10.12
	15.29	17.10	18.35	21.07	22.43		23.53	23.04	21.23		19.33	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54		02.54	03.53	05.30		06.59	08.27	09.05	10.13
	15.33	17.13	18.38	21.11	22.46		23.53	23.01	21.19		19.30	17.46	15.10	14.27
22	09.32	07.56	06.19	05.30	03.51		02.54	03.56	05.33		07.02	08.30	09.08	10.14
	15.36	17.16	18.41	21.14	22.49		23.54	22.58	21.16		19.26	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48		02.55	03.59	05.36		07.05	08.33	09.11	10.14
	15.39	17.20	18.44	21.17	22.52		23.54	22.55	21.12		19.23	17.39	15.04	14.28
24	09.27	07.50	06.12	05.23	03.45		02.56	04.02	05.39		07.08	08.36	09.15	10.14
	15.42	17.23	18.47	21.20	22.55		23.53	22.52	21.09		19.19	17.36	15.02	14.28
25	09.24	07.46	06.09	05.20 20.30 (2)	03.42		02.56	04.06 20.43 (2)	05.42		07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23 12 20.42 (2)	22.58		23.53	22.49 5 20.48 (2)	21.05		19.16	16.32	14.59	14.29
26	09.21	07.43	06.05	05.16 20.27 (2)	03.39		02.57	04.09 20.39 (2)	05.45		07.14	07.42	09.21	10.15
	15.49	17.29	18.53	21.26 17 20.44 (2)	23.01		23.53	22.46 12 20.51 (2)	21.02		19.12	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13 20.26 (2)	03.36		02.58	04.12 20.38 (2)	05.47		07.16	07.45	09.24	10.14
	15.52	17.32	18.56	21.29 20 20.46 (2)	23.04		23.52	22.43 15 20.53 (2)	20.58		19.09	16.26	14.55	14.31
28	09.16	07.36	05.58	05.09 20.25 (2)	03.34		03.00	04.15 20.36 (2)	05.50		07.19	07.49	09.27	10.14
	15.55	17.35	18.59	21.32 22 20.47 (2)	23.07		23.51	22.40 18 20.54 (2)	20.55		19.05	16.22	14.52	14.32
29	09.13		06.55	05.06 20.24 (2)	03.31		03.00	04.18 20.35 (2)	05.53		07.22	07.52	09.30	10.14
	15.58		20.01	21.35 24 20.48 (2)	23.10		23.50	22.37 20 20.55 (2)	20.51		19.02	16.19	14.50	14.34
30	09.10		06.51	05.03 20.23 (2)	03.28		03.01	04.21 20.34 (2)	05.56		07.25	07.55	09.32	10.13
	16.02		20.04	21.39 25 20.48 (2)	23.13		23.49	22.33 22 20.56 (2)	20.48		18.58	16.16	14.48	14.35
31	09.07		06.48		03.26			04.24 20.33 (2)	05.59			07.58		10.13
	16.05		20.07		23.16			22.30 24 20.57 (2)	20.44			16.13		14.37
Potential sun hours	173	239	363	450	568	621	606	507	393	305	199	139
Total, worst case				120	433		116	447				
Sun reduction				0,43	0,48		0,49	0,42				
Oper. time red.				0,94	0,94		0,94	0,94				
Wind dir. red.				0,64	0,64		0,64	0,64				
Total reduction				0,26	0,29		0,29	0,25				
Total, real				31	124		34	112				

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

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

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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) Shadow receptor: F - Asuinrakennus F (Maijannevantie)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June		July		August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23		03.03	04.20 (2)	04.28	06.02	07.28	08.01	09.35
	14.40	16.09	17.38	20.11	21.42	23.19		23.48	19 04.39 (2)	22.27	20.41	18.55	16.10	14.46
2	10.11	09.01	07.29	06.41	04.56	03.21	04.22 (2)	03.05	04.20 (2)	04.31	06.05	07.31	08.05	09.38
	14.42	16.12	17.41	20.14	21.45	23.22	2 04.24 (2)	23.46	19 04.39 (2)	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.53	03.19	04.20 (2)	03.07	04.20 (2)	04.34	06.08	07.34	08.08	09.41
	14.44	16.15	17.44	20.16	21.48	23.24	8 04.28 (2)	23.45	18 04.38 (2)	22.21	20.34	18.48	16.03	14.43
4	10.09	08.55	07.23	06.34	04.49	03.16	04.19 (2)	03.08	04.22 (2)	04.37	06.11	07.37	08.11	09.43
	14.46	16.19	17.48	20.19	21.52	23.27	11 04.30 (2)	23.43	17 04.39 (2)	22.17	20.30	18.44	16.00	14.41
5	10.07	08.52	07.19	06.30	04.46	03.14	04.17 (2)	03.11	04.22 (2)	04.40	06.14	07.40	08.14	09.46
	14.48	16.22	17.51	20.22	21.55	23.29	13 04.30 (2)	23.41	16 04.38 (2)	22.14	20.27	18.41	15.57	14.39
6	10.06	08.49	07.16	06.27	04.43	03.12	04.17 (2)	03.13	04.22 (2)	04.44	06.17	07.43	08.17	09.48
	14.50	16.25	17.54	20.25	21.58	23.32	14 04.31 (2)	23.39	15 04.37 (2)	22.11	20.23	18.37	15.54	14.37
7	10.05	08.46	07.12	06.23	04.39	03.10	04.17 (2)	03.15	04.23 (2)	04.47	06.20	07.46	08.21	09.51
	14.53	16.28	17.57	20.28	22.01	23.34	15 04.32 (2)	23.37	14 04.37 (2)	22.07	20.20	18.34	15.51	14.36
8	10.03	08.43	07.09	06.20	04.36	03.08	04.16 (2)	03.17	04.25 (2)	04.50	06.23	07.48	08.24	09.53
	14.55	16.32	18.00	20.31	22.04	23.36	17 04.33 (2)	23.35	12 04.37 (2)	22.04	20.16	18.30	15.47	14.34
9	10.01	08.39	07.05	06.16	04.33	03.06	04.16 (2)	03.20	04.26 (2)	04.53	06.26	07.51	08.27	09.55
	14.58	16.35	18.03	20.34	22.08	23.39	18 04.34 (2)	23.33	9 04.35 (2)	22.01	20.13	18.27	15.44	14.33
10	10.00	08.36	07.02	06.13	04.29	03.04	04.16 (2)	03.22	04.28 (2)	04.56	06.28	07.54	08.30	09.57
	15.00	16.38	18.06	20.37	22.11	23.41	18 04.34 (2)	23.31	6 04.34 (2)	21.57	20.09	18.24	15.41	14.32
11	09.58	08.33	06.58	06.09	04.26	03.03	04.15 (2)	03.25		04.59	06.31	07.57	08.33	09.59
	15.03	16.41	18.09	20.40	22.14	23.42	20 04.35 (2)	23.29		21.54	20.06	18.20	15.38	14.31
12	09.56	08.30	06.55	06.06	04.23	03.01	04.15 (2)	03.28		05.02	06.34	08.00	08.37	10.01
	15.06	16.45	18.12	20.43	22.17	23.44	20 04.35 (2)	23.26		21.50	20.02	18.17	15.35	14.30
13	09.54	08.27	06.51	06.02	04.19	03.00	04.15 (2)	03.30		05.05	06.37	08.03	08.40	10.03
	15.09	16.48	18.15	20.46	22.20	23.46	20 04.35 (2)	23.24		21.47	19.58	18.13	15.32	14.29
14	09.52	08.23	06.48	05.58	04.16	02.58	04.15 (2)	03.33		05.08	06.40	08.06	08.43	10.05
	15.11	16.51	18.18	20.49	22.24	23.47	21 04.36 (2)	23.21		21.44	19.55	18.10	15.29	14.28
15	09.49	08.20	06.44	05.55	04.13	02.57	04.15 (2)	03.36		05.12	06.43	08.09	08.46	10.06
	15.14	16.54	18.20	20.52	22.27	23.49	21 04.36 (2)	23.18		21.40	19.51	18.06	15.27	14.28
16	09.47	08.17	06.41	05.51	04.10	02.56	04.15 (2)	03.39		05.15	06.45	08.12	08.50	10.08
	15.17	16.58	18.23	20.55	22.30	23.50	21 04.36 (2)	23.16		21.37	19.48	18.03	15.24	14.27
17	09.45	08.13	06.37	05.48	04.07	02.55	04.16 (2)	03.42		05.18	06.48	08.15	08.53	10.09
	15.20	17.01	18.26	20.58	22.33	23.51	21 04.37 (2)	23.13		21.33	19.44	17.59	15.21	14.27
18	09.42	08.10	06.34	05.44	04.03	02.55	04.16 (2)	03.45		05.21	06.51	08.18	08.56	10.10
	15.23	17.04	18.29	21.01	22.36	23.52	21 04.37 (2)	23.10		21.30	19.41	17.56	15.18	14.27
19	09.40	08.07	06.30	05.41	04.00	02.55	04.16 (2)	03.48		05.24	06.54	08.21	08.59	10.11
	15.27	17.07	18.32	21.05	22.40	23.53	22 04.38 (2)	23.07		21.26	19.37	17.53	15.15	14.27
20	09.37	08.03	06.27	05.37	03.57	02.55	04.16 (2)	03.51		05.27	06.57	08.24	09.02	10.12
	15.30	17.10	18.35	21.08	22.43	23.53	22 04.38 (2)	23.04		21.23	19.34	17.49	15.13	14.27
21	09.35	08.00	06.23	05.34	03.54	02.55	04.16 (2)	03.54		05.30	07.00	08.27	09.05	10.13
	15.33	17.13	18.38	21.11	22.46	23.53	22 04.38 (2)	23.01		21.19	19.30	17.46	15.10	14.27
22	09.32	07.57	06.20	05.30	03.51	02.55	04.16 (2)	03.57		05.33	07.02	08.30	09.09	10.14
	15.36	17.17	18.41	21.14	22.49	23.54	22 04.38 (2)	22.58		21.16	19.27	17.43	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48	02.55	04.16 (2)	04.00		05.36	07.05	08.33	09.12	10.14
	15.39	17.20	18.44	21.17	22.52	23.54	22 04.38 (2)	22.55		21.12	19.23	17.39	15.05	14.28
24	09.27	07.50	06.13	05.24	03.45	02.56	04.17 (2)	04.03		05.39	07.08	08.36	09.15	10.14
	15.42	17.23	18.47	21.20	22.55	23.53	22 04.39 (2)	22.52		21.09	19.20	17.36	15.02	14.29
25	09.24	07.47	06.09	05.20	03.42	02.57	04.17 (2)	04.06		05.42	07.11	07.39	09.18	10.15
	15.46	17.26	18.50	21.23	22.58	23.53	21 04.38 (2)	22.49		21.05	19.16	16.32	15.00	14.29
26	09.22	07.43	06.06	05.17	03.40	02.58	04.17 (2)	04.09		05.45	07.14	07.43	09.21	10.15
	15.49	17.29	18.53	21.26	23.01	23.53	22 04.39 (2)	22.46		21.02	19.13	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.37	02.59	04.18 (2)	04.12		05.48	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.04	23.52	21 04.39 (2)	22.43		20.58	19.09	16.26	14.55	14.32
28	09.16	07.36	05.58	05.10	03.34	03.00	04.18 (2)	04.15		05.51	07.20	07.49	09.27	10.14
	15.55	17.35	18.59	21.33	23.07	23.51	21 04.39 (2)	22.40		20.55	19.05	16.23	14.53	14.33
29	09.13		06.55	05.06	03.31	03.00	04.19 (2)	04.18		05.54	07.22	07.52	09.30	10.14
	15.59		20.02	21.36	23.10	23.50	20 04.39 (2)	22.37		20.51	19.02	16.19	14.51	14.34
30	09.10		06.51	05.03	03.29	03.01	04.19 (2)	04.22		05.57	07.25	07.55	09.33	10.13
	16.02		20.05	21.39	23.13	23.49	20 04.39 (2)	22.34		20.48	18.58	16.16	14.48	14.36
31	09.07		06.48		03.26			04.25		05.59		07.58		10.13
	16.05		20.08		23.16			22.30		20.44		16.13		14.37
Potential sun hours	173	239	363	450	568	621		606		507	393	305	199	139
Total, worst case							538		145					
Sun reduction							0,51		0,49					
Oper. time red.							0,94		0,94					
Wind dir. red.							0,61		0,61					
Total reduction							0,30		0,28					
Total, real							159		41					

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

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

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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) Shadow receptor: G - Asuinrakennus G (Maijannevantie)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	04.42 (2) | 03.03	04.49 (2) | 04.28	06.02	07.28	08.01	09.35
	14.40	16.09	17.38	20.11	21.42	23.19 25	05.07 (2) | 23.48 25	05.14 (2) | 22.27	20.41	18.55	16.10	14.46
2	10.11	09.01	07.29	06.41	04.56	03.21	04.42 (2) | 03.05	04.49 (2) | 04.31	06.05	07.31	08.05	09.38
	14.42	16.12	17.41	20.14	21.45	23.22 25	05.07 (2) | 23.46 25	05.14 (2) | 22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.53	03.19	04.43 (2) | 03.07	04.49 (2) | 04.34	06.08	07.34	08.08	09.41
	14.44	16.15	17.44	20.16	21.48	23.24 25	05.08 (2) | 23.45 25	05.14 (2) | 22.21	20.34	18.48	16.03	14.43
4	10.09	08.55	07.23	06.34	04.49	03.16	04.43 (2) | 03.08	04.50 (2) | 04.37	06.11	07.37	08.11	09.43
	14.46	16.19	17.48	20.19	21.52	23.27 26	05.09 (2) | 23.43 25	05.15 (2) | 22.17	20.30	18.44	16.00	14.41
5	10.08	08.52	07.19	06.30	04.46	03.14	04.43 (2) | 03.11	04.49 (2) | 04.40	06.14	07.40	08.14	09.46
	14.48	16.22	17.51	20.22	21.55	23.29 25	05.08 (2) | 23.41 25	05.14 (2) | 22.14	20.27	18.41	15.57	14.39
6	10.06	08.49	07.16	06.27	04.43	03.12	04.43 (2) | 03.13	04.49 (2) | 04.44	06.17	07.43	08.17	09.48
	14.50	16.25	17.54	20.25	21.58	23.32 26	05.09 (2) | 23.39 25	05.14 (2) | 22.11	20.23	18.37	15.54	14.37
7	10.05	08.46	07.12	06.23	04.39	03.10	04.44 (2) | 03.15	04.50 (2) | 04.47	06.20	07.46	08.21	09.51
	14.53	16.28	17.57	20.28	22.01	23.34 25	05.09 (2) | 23.37 25	05.15 (2) | 22.07	20.20	18.34	15.51	14.36
8	10.03	08.43	07.09	06.20	04.36	03.08	04.44 (2) | 03.17	04.50 (2) | 04.50	06.23	07.48	08.24	09.53
	14.55	16.32	18.00	20.31	22.04	23.36 25	05.09 (2) | 23.35 25	05.15 (2) | 22.04	20.16	18.31	15.47	14.34
9	10.01	08.39	07.05	06.16	04.33	03.06	04.44 (2) | 03.20	04.49 (2) | 04.53	06.26	07.51	08.27	09.55
	14.58	16.35	18.03	20.34	22.08	23.39 25	05.09 (2) | 23.33 26	05.15 (2) | 22.01	20.13	18.27	15.44	14.33
10	10.00	08.36	07.02	06.13	04.29	03.04	04.45 (2) | 03.22	04.50 (2) | 04.56	06.28	07.54	08.30	09.57
	15.00	16.38	18.06	20.37	22.11	23.41 24	05.09 (2) | 23.31 25	05.15 (2) | 21.57	20.09	18.24	15.41	14.32
11	09.58	08.33	06.58	06.09	04.26	03.03	04.45 (2) | 03.25	04.50 (2) | 04.59	06.31	07.57	08.33	09.59
	15.03	16.41	18.09	20.40	22.14	23.42 24	05.09 (2) | 23.29 25	05.15 (2) | 21.54	20.06	18.20	15.38	14.31
12	09.56	08.30	06.55	06.06	04.23	03.01	04.45 (2) | 03.28	04.50 (2) | 05.02	06.34	08.00	08.37	10.01
	15.06	16.45	18.12	20.43	22.17	23.44 24	05.09 (2) | 23.26 25	05.15 (2) | 21.50	20.02	18.17	15.35	14.30
13	09.54	08.27	06.51	06.02	04.19	03.00	04.45 (2) | 03.30	04.51 (2) | 05.05	06.37	08.03	08.40	10.03
	15.09	16.48	18.15	20.46	22.20	23.46 24	05.09 (2) | 23.24 25	05.16 (2) | 21.47	19.58	18.13	15.32	14.29
14	09.52	08.23	06.48	05.58	04.16	02.58	04.45 (2) | 03.33	04.51 (2) | 05.09	06.40	08.06	08.43	10.05
	15.11	16.51	18.18	20.49	22.24	23.47 25	05.10 (2) | 23.21 24	05.15 (2) | 21.44	19.55	18.10	15.29	14.28
15	09.49	08.20	06.44	05.55	04.13	02.57	04.45 (2) | 03.36	04.51 (2) | 05.12	06.43	08.09	08.46	10.06
	15.14	16.54	18.21	20.52	22.27	23.49 24	05.09 (2) | 23.18 24	05.15 (2) | 21.40	19.51	18.06	15.27	14.28
16	09.47	08.17	06.41	05.51	04.10	02.56	04.46 (2) | 03.39	04.51 (2) | 05.15	06.45	08.12	08.50	10.08
	15.17	16.58	18.23	20.55	22.30	23.50 24	05.10 (2) | 23.16 24	05.15 (2) | 21.37	19.48	18.03	15.24	14.27
17	09.45	08.13	06.37	05.48	04.07	02.55	04.46 (2) | 03.42	04.52 (2) | 05.18	06.48	08.15	08.53	10.09
	15.20	17.01	18.26	20.58	22.33	23.51 24	05.10 (2) | 23.13 23	05.15 (2) | 21.33	19.44	17.59	15.21	14.27
18	09.42	08.10	06.34	05.44	04.03	04.51 (2) | 02.55	04.47 (2) | 03.45	04.53 (2) | 05.21	06.51	08.18	08.56	10.10
	15.23	17.04	18.29	21.02	22.36 5	04.56 (2) | 23.52 23	05.10 (2) | 23.10 22	05.15 (2) | 21.30	19.41	17.56	15.18	14.27
19	09.40	08.07	06.30	05.41	04.00	04.49 (2) | 02.55	04.47 (2) | 03.48	04.53 (2) | 05.24	06.54	08.21	08.59	10.11
	15.27	17.07	18.32	21.05	22.40 11	05.00 (2) | 23.53 24	05.11 (2) | 23.07 22	05.15 (2) | 21.26	19.37	17.53	15.15	14.27
20	09.38	08.03	06.27	05.37	03.57	04.47 (2) | 02.55	04.47 (2) | 03.51	04.54 (2) | 05.27	06.57	08.24	09.02	10.12
	15.30	17.10	18.35	21.08	22.43 14	05.01 (2) | 23.53 24	05.11 (2) | 23.04 20	05.14 (2) | 21.23	19.34	17.49	15.13	14.27
21	09.35	08.00	06.23	05.34	03.54	04.46 (2) | 02.55	04.47 (2) | 03.54	04.54 (2) | 05.30	07.00	08.27	09.05	10.13
	15.33	17.14	18.38	21.11	22.46 16	05.02 (2) | 23.53 24	05.11 (2) | 23.02 19	05.13 (2) | 21.19	19.30	17.46	15.10	14.27
22	09.32	07.57	06.20	05.30	03.51	04.45 (2) | 02.55	04.47 (2) | 03.57	04.56 (2) | 05.33	07.03	08.30	09.09	10.14
	15.36	17.17	18.41	21.14	22.49 18	05.03 (2) | 23.54 24	05.11 (2) | 22.59 17	05.13 (2) | 21.16	19.27	17.43	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48	04.44 (2) | 02.55	04.47 (2) | 04.00	04.56 (2) | 05.36	07.05	08.33	09.12	10.14
	15.39	17.20	18.44	21.17	22.52 19	05.03 (2) | 23.54 24	05.11 (2) | 22.56 16	05.12 (2) | 21.12	19.23	17.39	15.05	14.28
24	09.27	07.50	06.13	05.24	03.45	04.43 (2) | 02.56	04.48 (2) | 04.03	04.58 (2) | 05.39	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.55 21	05.04 (2) | 23.54 24	05.12 (2) | 22.52 13	05.11 (2) | 21.09	19.20	17.36	15.02	14.29
25	09.24	07.47	06.09	05.20	03.42	04.43 (2) | 02.57	04.48 (2) | 04.06	05.00 (2) | 05.42	07.11	07.39	09.18	10.15
	15.46	17.26	18.50	21.23	22.58 22	05.05 (2) | 23.53 23	05.11 (2) | 22.49 9	05.09 (2) | 21.05	19.16	16.33	15.00	14.29
26	09.22	07.43	06.06	05.17	03.40	04.43 (2) | 02.58	04.48 (2) | 04.09	05.45	07.14	07.43	09.21	10.15
	15.49	17.29	18.53	21.26	23.01 22	05.05 (2) | 23.53 24	05.12 (2) | 22.46	21.02	19.13	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.37	04.43 (2) | 02.59	04.48 (2) | 04.12	05.48	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.04 23	05.06 (2) | 23.52 24	05.12 (2) | 22.43	20.58	19.09	16.26	14.55	14.32
28	09.16	07.36	05.58	05.10	03.34	04.42 (2) | 03.00	04.49 (2) | 04.15	05.51	07.20	07.49	09.27	10.14
	15.55	17.35	18.59	21.33	23.07 24	05.06 (2) | 23.51 24	05.13 (2) | 22.40	20.55	19.05	16.23	14.53	14.33
29	09.13		06.55	05.06	03.31	04.42 (2) | 03.00	04.49 (2) | 04.18	05.54	07.22	07.52	09.30	10.14
	15.59		20.02	21.36	23.10 24	05.06 (2) | 23.50 24	05.13 (2) | 22.37	20.51	19.02	16.19	14.51	14.34
30	09.10		06.51	05.03	03.29	04.42 (2) | 03.01	04.49 (2) | 04.22	05.57	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.13 25	05.07 (2) | 23.49 25	05.14 (2) | 22.34	20.48	18.58	16.16	14.48	14.36
31	09.07		06.48		03.26	04.43 (2) |	04.25	06.00		07.58		10.13
	16.05		20.08		23.16 25	05.08 (2) |	22.30	20.44		16.13		14.37
Potential sun hours	173	239	363	450	568	621	606	507	393	305	199	139
Total, worst case					269	731	559					
Sun reduction					0,48	0,51	0,49					
Oper. time red.					0,94	0,94	0,94					
Wind dir. red.					0,62	0,62	0,62					
Total reduction					0,28	0,30	0,28					
Total, real					75	218	158					

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

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

Project:
Pajukoski tv-hanke

Licensed user:
FCG Finnish Consulting Group Oy
Osmontie 34, PO Box 950
FI-00601 Helsinki
+358104095666
Henna-Riikka Rintamäki / henna-riikka.rintamaki@fcg.fi
Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) Shadow receptor: H - Asuinrakennus H (Hietasaari)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	05.17 (2)	03.03	04.31 (1)	04.28	05.24 (2)	06.02	07.28	08.01	09.35
	14.40	16.09	17.38	20.11	21.42	23.19 15	05.32 (2)	23.48 22	04.53 (1)	22.27 20	05.44 (2)	20.41	18.55	16.10	14.46
2	10.11	09.01	07.29	06.41	04.56	03.21	04.32 (1)	03.05	04.31 (1)	04.31	05.25 (2)	06.05	07.31	08.05	09.38
	14.42	16.12	17.41	20.14	21.45	23.22 20	05.31 (2)	23.46 22	04.53 (1)	22.24 19	05.44 (2)	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.53	03.19	04.31 (1)	03.07	04.31 (1)	04.34	05.25 (2)	06.08	07.34	08.08	09.41
	14.44	16.15	17.44	20.16	21.48	23.24 23	05.31 (2)	23.45 21	04.52 (1)	22.21 17	05.42 (2)	20.34	18.48	16.03	14.42
4	10.09	08.55	07.23	06.34	04.49	03.16	04.30 (1)	03.08	04.33 (1)	04.37	05.27 (2)	06.11	07.37	08.11	09.43
	14.46	16.19	17.48	20.19	21.52	23.27 22	05.30 (2)	23.43 20	04.53 (1)	22.17 14	05.41 (2)	20.30	18.44	16.00	14.41
5	10.08	08.52	07.19	06.30	04.46	03.14	04.28 (1)	03.11	04.33 (1)	04.40	05.29 (2)	06.14	07.40	08.14	09.46
	14.48	16.22	17.51	20.22	21.55	23.29 22	05.28 (2)	23.41 19	04.52 (1)	22.14 10	05.39 (2)	20.27	18.41	15.57	14.39
6	10.06	08.49	07.16	06.27	04.43	03.12	04.28 (1)	03.13	04.33 (1)	04.44		06.17	07.43	08.17	09.48
	14.50	16.25	17.54	20.25	21.58	23.32 17	04.45 (1)	23.40 18	04.51 (1)	22.11		20.23	18.37	15.54	14.37
7	10.05	08.46	07.12	06.23	04.39 05.21 (2)	03.10	04.28 (1)	03.15	04.35 (1)	04.47		06.20	07.46	08.21	09.51
	14.53	16.28	17.57	20.28	22.01 5 05.26 (2)	23.34 18	04.46 (1)	23.38 21	05.34 (2)	22.07		20.20	18.34	15.51	14.36
8	10.03	08.43	07.09	06.20	04.36 05.18 (2)	03.08	04.27 (1)	03.17	04.36 (1)	04.50		06.23	07.48	08.24	09.53
	14.55	16.32	18.00	20.31	22.04 12 05.30 (2)	23.36 20	04.47 (1)	23.35 23	05.36 (2)	22.04		20.16	18.31	15.47	14.34
9	10.01	08.39	07.05	06.16	04.33 05.16 (2)	03.06	04.27 (1)	03.20	04.37 (1)	04.53		06.26	07.51	08.27	09.55
	14.58	16.35	18.03	20.34	22.08 16 05.32 (2)	23.39 21	04.48 (1)	23.33 23	05.37 (2)	22.01		20.13	18.27	15.44	14.33
10	10.00	08.36	07.02	06.13	04.29 05.15 (2)	03.04	04.27 (1)	03.22	04.39 (1)	04.56		06.28	07.54	08.30	09.58
	15.00	16.38	18.06	20.37	22.11 18 05.33 (2)	23.41 21	04.48 (1)	23.31 22	05.39 (2)	21.57		20.09	18.24	15.41	14.32
11	09.58	08.33	06.58	06.09	04.26 05.13 (2)	03.03	04.26 (1)	03.25	04.42 (1)	04.59		06.31	07.57	08.33	10.00
	15.03	16.41	18.09	20.40	22.14 20 05.33 (2)	23.43 23	04.49 (1)	23.29 18	05.40 (2)	21.54		20.06	18.20	15.38	14.31
12	09.56	08.30	06.55	06.06	04.23 05.13 (2)	03.01	04.26 (1)	03.28	05.25 (2)	05.02		06.34	08.00	08.37	10.01
	15.06	16.45	18.12	20.43	22.17 22 05.35 (2)	23.44 23	04.49 (1)	23.26 16	05.41 (2)	21.50		20.02	18.17	15.35	14.30
13	09.54	08.27	06.51	06.02	04.19 05.12 (2)	03.00	04.26 (1)	03.30	05.24 (2)	05.05		06.37	08.03	08.40	10.03
	15.09	16.48	18.15	20.46	22.21 23 05.35 (2)	23.46 23	04.49 (1)	23.24 18	05.42 (2)	21.47		19.58	18.13	15.32	14.29
14	09.52	08.23	06.48	05.58	04.16 05.12 (2)	02.58	04.26 (1)	03.33	05.24 (2)	05.09		06.40	08.06	08.43	10.05
	15.11	16.51	18.18	20.49	22.24 23 05.35 (2)	23.47 24	04.50 (1)	23.21 18	05.42 (2)	21.44		19.55	18.10	15.29	14.28
15	09.49	08.20	06.44	05.55	04.13 05.12 (2)	02.57	04.26 (1)	03.36	05.23 (2)	05.12		06.43	08.09	08.46	10.06
	15.14	16.54	18.21	20.52	22.27 24 05.36 (2)	23.49 24	04.50 (1)	23.18 20	05.43 (2)	21.40		19.51	18.06	15.27	14.28
16	09.47	08.17	06.41	05.51	04.10 05.11 (2)	02.56	04.26 (1)	03.39	05.23 (2)	05.15		06.45	08.12	08.50	10.08
	15.17	16.58	18.23	20.55	22.30 25 05.36 (2)	23.50 25	04.51 (1)	23.16 21	05.44 (2)	21.37		19.48	18.03	15.24	14.27
17	09.45	08.13	06.37	05.48	04.07 05.11 (2)	02.55	04.26 (1)	03.42	05.22 (2)	05.18		06.48	08.15	08.53	10.09
	15.20	17.01	18.26	20.58	22.33 25 05.36 (2)	23.51 25	04.51 (1)	23.13 22	05.44 (2)	21.33		19.44	17.59	15.21	14.27
18	09.42	08.10	06.34	05.44	04.03 05.11 (2)	02.55	04.27 (1)	03.45	05.23 (2)	05.21		06.51	08.18	08.56	10.10
	15.23	17.04	18.29	21.02	22.37 25 05.36 (2)	23.52 25	04.52 (1)	23.10 22	05.45 (2)	21.30		19.41	17.56	15.18	14.27
19	09.40	08.07	06.30	05.41	04.00 05.11 (2)	02.55	04.27 (1)	03.48	05.22 (2)	05.24		06.54	08.21	08.59	10.11
	15.27	17.07	18.32	21.05	22.40 26 05.37 (2)	23.53 25	04.52 (1)	23.07 23	05.45 (2)	21.26		19.37	17.53	15.15	14.27
20	09.38	08.03	06.27	05.37	03.57 05.11 (2)	02.54	04.27 (1)	03.51	05.22 (2)	05.27		06.57	08.24	09.02	10.12
	15.30	17.10	18.35	21.08	22.43 25 05.36 (2)	23.53 25	04.52 (1)	23.04 24	05.46 (2)	21.23		19.34	17.49	15.13	14.27
21	09.35	08.00	06.23	05.34	03.54 05.11 (2)	02.55	04.27 (1)	03.54	05.21 (2)	05.30		07.00	08.27	09.05	10.13
	15.33	17.14	18.38	21.11	22.46 25 05.36 (2)	23.54 25	04.52 (1)	23.02 25	05.46 (2)	21.19		19.30	17.46	15.10	14.27
22	09.32	07.57	06.20	05.31	03.51 05.12 (2)	02.55	04.27 (1)	03.57	05.22 (2)	05.33		07.03	08.30	09.09	10.14
	15.36	17.17	18.41	21.14	22.49 24 05.36 (2)	23.54 25	04.52 (1)	22.59 24	05.46 (2)	21.16		19.27	17.43	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48 05.11 (2)	02.55	04.27 (1)	04.00	05.21 (2)	05.36		07.05	08.33	09.12	10.14
	15.39	17.20	18.44	21.17	22.52 24 05.35 (2)	23.54 25	04.52 (1)	22.56 25	05.46 (2)	21.12		19.23	17.39	15.05	14.28
24	09.27	07.50	06.13	05.24	03.45 05.12 (2)	02.56	04.28 (1)	04.03	05.22 (2)	05.39		07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.55 23 05.35 (2)	23.54 25	04.53 (1)	22.53 25	05.47 (2)	21.09		19.20	17.36	15.02	14.29
25	09.24	07.47	06.09	05.20	03.42 05.12 (2)	02.57	04.27 (1)	04.06	05.21 (2)	05.42		07.11	07.39	09.18	10.15
	15.46	17.26	18.50	21.23	22.58 23 05.35 (2)	23.53 25	04.52 (1)	22.49 25	05.46 (2)	21.05		19.16	16.33	15.00	14.29
26	09.22	07.43	06.06	05.17	03.40 05.13 (2)	02.58	04.28 (1)	04.09	05.22 (2)	05.45		07.14	07.43	09.21	10.15
	15.49	17.29	18.53	21.26	23.01 22 05.35 (2)	23.53 25	04.53 (1)	22.46 25	05.47 (2)	21.02		19.13	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.37 05.13 (2)	02.59	04.29 (1)	04.12	05.21 (2)	05.48		07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.05 22 05.35 (2)	23.52 24	04.53 (1)	22.43 25	05.46 (2)	20.58		19.09	16.26	14.55	14.32
28	09.16	07.36	05.58	05.10	03.34 05.14 (2)	03.00	04.29 (1)	04.15	05.22 (2)	05.51		07.20	07.49	09.27	10.14
	15.55	17.35	18.59	21.33	23.07 20 05.34 (2)	23.51 24	04.53 (1)	22.40 25	05.47 (2)	20.55		19.05	16.23	14.53	14.33
29	09.13		06.55	05.06	03.31 05.14 (2)	03.00	04.30 (1)	04.18	05.22 (2)	05.54		07.22	07.52	09.30	10.14
	15.59		20.02	21.36	23.10 20 05.34 (2)	23.50 23	04.53 (1)	22.37 24	05.46 (2)	20.51		19.02	16.19	14.51	14.34
30	09.10		06.51	05.03	03.29 05.15 (2)	03.01	04.30 (1)	04.22	05.23 (2)	05.57		07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.13 18 05.33 (2)	23.49 23	04.53 (1)	22.34 23	05.46 (2)	20.48		18.58	16.16	14.48	14.36
31	09.07		06.48		03.26 05.16 (2)			04.25	05.23 (2)	06.00			07.58		10.13
	16.05		20.08		23.16 17 05.33 (2)			22.30 22	05.45 (2)	20.44			16.13		14.37
Potential sun hours	173	239	363	450	568	621	606	507	393	305	199	139
Total, worst case					527	685	681	80				
Sun reduction					0,48	0,51	0,49	0,42				
Oper. time red.					0,94	0,94	0,94	0,94				
Wind dir. red.					0,62	0,61	0,62	0,62				
Total reduction					0,28	0,29	0,28	0,25				
Total, real					148	201	192	20				

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

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

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) Shadow receptor: I - Asuinrakennus I (Lahdenperä)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	05.47 (1)	03.03	04.28	05.45 (1)	06.02	07.28	08.01	09.35
	14.40	16.09	17.38	20.11	21.42 7	05.54 (1)	23.19	23.48	22.27 30	06.15 (1)	20.41	18.55	16.10	14.46
2	10.11	09.01	07.30	06.41	04.56	05.43 (1)	03.21	03.05	04.31	05.46 (1)	06.05	07.31	08.05	09.38
	14.42	16.12	17.41	20.14	21.45 14	05.57 (1)	23.22	23.47	22.24 29	06.15 (1)	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.53	05.41 (1)	03.18	03.06	04.34	05.45 (1)	06.08	07.34	08.08	09.41
	14.44	16.15	17.45	20.17	21.48 18	05.59 (1)	23.24	23.45	22.21 29	06.14 (1)	20.34	18.48	16.03	14.42
4	10.09	08.55	07.23	06.34	04.49	05.39 (1)	03.16	03.08	04.37	05.46 (1)	06.11	07.37	08.11	09.44
	14.46	16.19	17.48	20.20	21.52 21	06.00 (1)	23.27	23.43	22.17 28	06.14 (1)	20.30	18.44	16.00	14.41
5	10.08	08.52	07.19	06.30	04.46	05.38 (1)	03.14	03.10	04.40	05.47 (1)	06.14	07.40	08.14	09.46
	14.48	16.22	17.51	20.22	21.55 23	06.01 (1)	23.30	23.42	22.14 26	06.13 (1)	20.27	18.41	15.57	14.39
6	10.06	08.49	07.16	06.27	04.43	05.37 (1)	03.12	03.13	04.44	05.46 (1)	06.17	07.43	08.17	09.49
	14.50	16.25	17.54	20.25	21.58 25	06.02 (1)	23.32	23.40	22.11 26	06.12 (1)	20.23	18.37	15.54	14.37
7	10.05	08.46	07.12	06.23	04.39	05.36 (1)	03.10	03.15	04.47	05.47 (1)	06.20	07.46	08.21	09.51
	14.53	16.28	17.57	20.28	22.01 26	06.02 (1)	23.34	23.38	22.07 25	06.12 (1)	20.20	18.34	15.51	14.36
8	10.03	08.43	07.09	06.20	04.36	05.36 (1)	03.08	03.17	04.50	05.49 (1)	06.23	07.48	08.24	09.53
	14.55	16.32	18.00	20.31	22.04 27	06.03 (1)	23.37	23.36	22.04 22	06.11 (1)	20.16	18.31	15.47	14.34
9	10.01	08.39	07.05	06.16	04.33	05.36 (1)	03.06	03.20	04.53	05.49 (1)	06.26	07.51	08.27	09.55
	14.58	16.35	18.03	20.34	22.08 28	06.04 (1)	23.39	23.33	22.01 20	06.09 (1)	20.13	18.27	15.44	14.33
10	10.00	08.36	07.02	06.13	04.29	05.35 (1)	03.04	03.22	04.56	05.51 (1)	06.28	07.54	08.30	09.58
	15.00	16.38	18.06	20.37	22.11 29	06.04 (1)	23.41	23.31	21.57 17	06.08 (1)	20.09	18.24	15.41	14.32
11	09.58	08.33	06.58	06.09	04.26	05.35 (1)	03.03	03.25	04.59	05.53 (1)	06.31	07.57	08.34	10.00
	15.03	16.42	18.09	20.40	22.14 29	06.04 (1)	23.43	23.29	21.54 13	06.06 (1)	20.06	18.20	15.38	14.31
12	09.56	08.30	06.55	06.06	04.23	05.35 (1)	03.01	03.27	05.02	05.56 (1)	06.34	08.00	08.37	10.02
	15.06	16.45	18.12	20.43	22.17 30	06.05 (1)	23.44	23.26	21.51 5	06.01 (1)	20.02	18.17	15.35	14.30
13	09.54	08.27	06.51	06.02	04.19	05.35 (1)	03.00	03.30 05.55 (1)	05.05		06.37	08.03	08.40	10.03
	15.09	16.48	18.15	20.46	22.21 29	06.04 (1)	23.46	23.24 7 06.02 (1)	21.47		19.59	18.13	15.32	14.29
14	09.52	08.23	06.48	05.59	04.16	05.34 (1)	02.57	03.33	05.53 (1)	05.09		06.40	08.06	08.43	10.05
	15.11	16.51	18.18	20.49	22.24 30	06.04 (1)	23.48	23.21 11 06.04 (1)	21.44			19.55	18.10	15.29	14.28
15	09.50	08.20	06.44	05.55	04.13	05.35 (1)	02.57	03.36	05.52 (1)	05.12		06.43	08.09	08.46	10.07
	15.14	16.54	18.21	20.52	22.27 29	06.04 (1)	23.49	23.19 13 06.05 (1)	21.40			19.51	18.06	15.27	14.28
16	09.47	08.17	06.41	05.51	04.10	05.35 (1)	02.56	03.39	05.51 (1)	05.15		06.46	08.12	08.50	10.08
	15.17	16.58	18.24	20.55	22.30 29	06.04 (1)	23.50	23.16 16 06.07 (1)	21.37			19.48	18.03	15.24	14.27
17	09.45	08.13	06.37	05.48	04.07	05.36 (1)	02.55	03.42	05.50 (1)	05.18		06.48	08.15	08.53	10.09
	15.20	17.01	18.26	20.59	22.33 28	06.04 (1)	23.51	23.13 18 06.08 (1)	21.33			19.44	18.00	15.21	14.27
18	09.43	08.10	06.34	05.44	04.03	05.35 (1)	02.55	03.45	05.50 (1)	05.21		06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37 28	06.03 (1)	23.52	23.10 20 06.10 (1)	21.30			19.41	17.56	15.18	14.27
19	09.40	08.07	06.30	05.41	04.00	05.36 (1)	02.55	03.47	05.49 (1)	05.24		06.54	08.21	08.59	10.12
	15.27	17.07	18.32	21.05	22.40 28	06.04 (1)	23.53	23.07 21 06.10 (1)	21.26			19.37	17.53	15.15	14.27
20	09.38	08.03	06.27	05.37	03.57	05.36 (1)	02.54	03.50	05.48 (1)	05.27		06.57	08.24	09.02	10.12
	15.30	17.10	18.35	21.08	22.43 27	06.03 (1)	23.53	23.05 23 06.11 (1)	21.23			19.34	17.49	15.13	14.27
21	09.35	08.00	06.23	05.34	03.54	05.37 (1)	02.55	03.54	05.47 (1)	05.30		07.00	08.27	09.06	10.13
	15.33	17.14	18.38	21.11	22.46 26	06.03 (1)	23.54	23.02 24 06.11 (1)	21.20			19.30	17.46	15.10	14.27
22	09.32	07.57	06.20	05.31	03.51	05.38 (1)	02.55	03.57	05.47 (1)	05.33		07.03	08.30	09.09	10.14
	15.36	17.17	18.41	21.14	22.49 24	06.02 (1)	23.54	22.59 25 06.12 (1)	21.16			19.27	17.43	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48	05.37 (1)	02.55	04.00	05.46 (1)	05.36		07.05	08.33	09.12	10.14
	15.39	17.20	18.44	21.17	22.52 24	06.01 (1)	23.54	22.56 27 06.13 (1)	21.13			19.23	17.39	15.05	14.28
24	09.27	07.50	06.13	05.24	03.45	05.38 (1)	02.56	04.03	05.47 (1)	05.39		07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.55 23	06.01 (1)	23.54	22.53 27 06.14 (1)	21.09			19.20	17.36	15.02	14.29
25	09.24	07.47	06.09	05.20	03.42	05.39 (1)	02.57	04.06	05.46 (1)	05.42		07.11	07.40	09.18	10.15
	15.46	17.26	18.50	21.23	22.59 21	06.00 (1)	23.53	22.50 28 06.14 (1)	21.06			19.16	16.33	15.00	14.29
26	09.22	07.43	06.06	05.17	03.39	05.40 (1)	02.58	04.09	05.46 (1)	05.45		07.14	07.43	09.21	10.15
	15.49	17.29	18.53	21.26	23.02 19	05.59 (1)	23.53	22.46 28 06.14 (1)	21.02			19.13	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.37	05.41 (1)	02.59	04.12	05.45 (1)	05.48		07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.05 17	05.58 (1)	23.52	22.43 29 06.14 (1)	20.59			19.09	16.26	14.55	14.32
28	09.16	07.36	05.59	05.10	03.34	05.42 (1)	03.00	04.15	05.46 (1)	05.51		07.20	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08 15	05.57 (1)	23.51	22.40 29 06.15 (1)	20.55			19.06	16.23	14.53	14.33
29	09.13		06.55	05.06	03.31	05.44 (1)	03.00	04.18	05.45 (1)	05.54		07.23	07.52	09.30	10.14
	15.59		20.02	21.36	23.11 12	05.56 (1)	23.50	22.37 29 06.14 (1)	20.52			19.02	16.19	14.51	14.34
30	09.10		06.51	05.03	03.29	05.45 (1)	03.01	04.22	05.45 (1)	05.57		07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.13 9	05.54 (1)	23.49	22.34 30 06.15 (1)	20.48			18.58	16.16	14.48	14.36
31	09.07		06.48		03.26	05.49 (1)		04.25	05.45 (1)	06.00			07.58		10.13
	16.05		20.08		23.16 3	05.52 (1)		22.31 29 06.14 (1)	20.44				16.13		14.37
Potential sun hours	173	239	363	450	568	621	606	507	393	305	199	139
Total, worst case					698		434	270				
Sun reduction					0,48		0,49	0,42				
Oper. time red.					0,94		0,94	0,94				
Wind dir. red.					0,62		0,62	0,62				
Total reduction					0,28		0,28	0,24				
Total, real					195		122	66				

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

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

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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) Shadow receptor: J - Lomarakennus J (Junno)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April		May	June	July	August		September		October	November	December
1	10.12	09.04	07.33	06.44		07.22 (1)	04.59	03.23	03.03	04.28		06.02	07.11 (1)	07.28	08.02	09.36
	14.40	16.09	17.38	20.11	11	07.33 (1)	21.42	23.19	23.48	22.27		20.41	26 07.37 (1)	18.55	16.10	14.46
2	10.11	09.01	07.30	06.41		07.19 (1)	04.56	03.21	03.05	04.31		06.05	07.10 (1)	07.31	08.05	09.38
	14.41	16.12	17.41	20.14	17	07.36 (1)	21.45	23.22	23.47	22.24		20.37	27 07.37 (1)	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37		07.17 (1)	04.53	03.18	03.06	04.34		06.08	07.09 (1)	07.34	08.08	09.41
	14.43	16.15	17.45	20.17	20	07.37 (1)	21.49	23.25	23.45	22.21		20.34	27 07.36 (1)	18.48	16.03	14.42
4	10.09	08.55	07.23	06.34		07.16 (1)	04.49	03.16	03.08	04.37		06.11	07.09 (1)	07.37	08.11	09.44
	14.46	16.19	17.48	20.20	22	07.38 (1)	21.52	23.27	23.43	22.18		20.30	27 07.36 (1)	18.44	16.00	14.41
5	10.08	08.52	07.19	06.30		07.14 (1)	04.46	03.14	03.10	04.40		06.14	07.09 (1)	07.40	08.14	09.46
	14.48	16.22	17.51	20.23	24	07.38 (1)	21.55	23.30	23.42	22.14		20.27	27 07.36 (1)	18.41	15.57	14.39
6	10.06	08.49	07.16	06.27		07.13 (1)	04.43	03.12	03.13	04.44		06.17	07.10 (1)	07.43	08.18	09.49
	14.50	16.25	17.54	20.25	26	07.39 (1)	21.58	23.32	23.40	22.11		20.23	25 07.35 (1)	18.38	15.54	14.37
7	10.05	08.46	07.12	06.23		07.12 (1)	04.39	03.10	03.15	04.47		06.20	07.09 (1)	07.46	08.21	09.51
	14.53	16.28	17.57	20.28	27	07.39 (1)	22.01	23.34	23.38	22.08		20.20	24 07.33 (1)	18.34	15.51	14.36
8	10.03	08.43	07.09	06.20		07.12 (1)	04.36	03.08	03.17	04.50		06.23	07.10 (1)	07.49	08.24	09.53
	14.55	16.32	18.00	20.31	27	07.39 (1)	22.05	23.37	23.36	22.04		20.16	22 07.32 (1)	18.31	15.47	14.34
9	10.02	08.40	07.05	06.16		07.12 (1)	04.32	03.06	03.20	04.53		06.26	07.11 (1)	07.51	08.27	09.56
	14.58	16.35	18.03	20.34	27	07.39 (1)	22.08	23.39	23.33	22.01		20.13	20 07.31 (1)	18.27	15.44	14.33
10	10.00	08.36	07.02	06.13		07.11 (1)	04.29	03.04	03.22	04.56		06.28	07.12 (1)	07.54	08.30	09.58
	15.00	16.38	18.06	20.37	27	07.38 (1)	22.11	23.41	23.31	21.57		20.09	16 07.28 (1)	18.24	15.41	14.32
11	09.58	08.33	06.58	06.09		07.12 (1)	04.26	03.02	03.25	04.59		06.31	07.14 (1)	07.57	08.34	10.00
	15.03	16.41	18.09	20.40	26	07.38 (1)	22.14	23.43	23.29	21.54		20.06	12 07.26 (1)	18.20	15.38	14.31
12	09.56	08.30	06.55	06.06		07.11 (1)	04.23	03.01	03.27	05.02		06.34		08.00	08.37	10.02
	15.06	16.45	18.12	20.43	26	07.37 (1)	22.17	23.45	23.26	21.51		20.02		18.17	15.35	14.30
13	09.54	08.27	06.51	06.02		07.12 (1)	04.19	03.00	03.30	05.05		06.37		08.03	08.40	10.03
	15.09	16.48	18.15	20.46	24	07.36 (1)	22.21	23.46	23.24	21.47		19.59		18.13	15.32	14.29
14	09.52	08.23	06.48	05.59		07.13 (1)	04.16	02.57	03.33	05.08		06.40		08.06	08.43	10.05
	15.11	16.51	18.18	20.49	22	07.35 (1)	22.24	23.48	23.21	21.44		19.55		18.10	15.29	14.28
15	09.50	08.20	06.44	05.55		07.13 (1)	04.13	02.56	03.36	05.12		06.43		08.09	08.47	10.07
	15.14	16.54	18.21	20.53	20	07.33 (1)	22.27	23.49	23.19	21.40		19.51		18.06	15.26	14.28
16	09.47	08.17	06.41	05.51		07.14 (1)	04.10	02.56	03.39	05.15		06.46		08.12	08.50	10.08
	15.17	16.58	18.24	20.56	18	07.32 (1)	22.30	23.50	23.16	21.37		19.48		18.03	15.24	14.27
17	09.45	08.14	06.37	05.48		07.17 (1)	04.07	02.55	03.41	05.18		06.48		08.15	08.53	10.09
	15.20	17.01	18.26	20.59	12	07.29 (1)	22.34	23.51	23.13	21.33		19.44		18.00	15.21	14.27
18	09.43	08.10	06.34	05.44		07.19 (1)	04.03	02.55	03.44	05.21		06.51		08.18	08.56	10.11
	15.23	17.04	18.29	21.02	5	07.24 (1)	22.37	23.52	23.10	21.30		19.41		17.56	15.18	14.27
19	09.40	08.07	06.30	05.41			04.00	02.54	03.47	05.24		06.54		08.21	08.59	10.12
	15.27	17.07	18.32	21.05			22.40	23.53	23.08	21.27		19.37		17.53	15.15	14.27
20	09.38	08.04	06.27	05.37			03.57	02.54	03.50	05.27		06.57		08.24	09.02	10.13
	15.30	17.10	18.35	21.08			22.43	23.53	23.05	21.23		19.34		17.49	15.13	14.27
21	09.35	08.00	06.23	05.34			03.54	02.54	03.53	05.30		07.00		08.27	09.06	10.13
	15.33	17.14	18.38	21.11			22.46	23.54	23.02	21.20		19.30		17.46	15.10	14.27
22	09.33	07.57	06.20	05.31			03.51	02.55	03.57	05.33		07.03		08.30	09.09	10.14
	15.36	17.17	18.41	21.14			22.49	23.54	22.59	21.16		19.27		17.43	15.07	14.27
23	09.30	07.53	06.16	05.27			03.48	02.55	04.00	05.36		07.05		08.33	09.12	10.14
	15.39	17.20	18.44	21.17			22.52	23.54	22.56	21.13		19.23		17.39	15.05	14.28
24	09.27	07.50	06.13	05.24			03.45	02.56	04.03	05.39		07.08		08.36	09.15	10.15
	15.42	17.23	18.47	21.20			22.56	23.54	22.53	21.09		19.20		17.36	15.02	14.29
25	09.24	07.47	06.09	05.20			03.42	02.57	04.06	05.42	07.22 (1)	07.11		07.40	09.18	10.15
	15.46	17.26	18.50	21.23			22.59	23.54	22.50	21.06	7 07.29 (1)	19.16		16.33	15.00	14.29
26	09.22	07.43	06.06	05.17			03.39	02.57	04.09	05.45	07.19 (1)	07.14		07.43	09.21	10.15
	15.49	17.29	18.53	21.26			23.02	23.53	22.47	21.02	13 07.32 (1)	19.13		16.29	14.57	14.30
27	09.19	07.40	06.02	05.13			03.37	02.59	04.12	05.48	07.16 (1)	07.17		07.46	09.24	10.15
	15.52	17.32	18.56	21.30			23.05	23.52	22.43	20.59	18 07.34 (1)	19.09		16.26	14.55	14.31
28	09.16	07.36	05.59	05.10			03.34	03.00	04.15	05.51	07.15 (1)	07.20		07.49	09.27	10.15
	15.55	17.35	18.59	21.33			23.08	23.52	22.40	20.55	20 07.35 (1)	19.06		16.23	14.53	14.33
29	09.13		06.55	05.06			03.31	03.00	04.18	05.54	07.14 (1)	07.23		07.52	09.30	10.14
	15.59		20.02	21.36			23.11	23.51	22.37	20.52	22 07.36 (1)	19.02		16.19	14.51	14.34
30	09.10		06.51	05.03			03.28	03.01	04.22	05.57	07.12 (1)	07.25		07.55	09.33	10.14
	16.02		20.05	21.39			23.14	23.49	22.34	20.48	24 07.36 (1)	18.59		16.16	14.48	14.36
31	09.07		06.48				03.26		04.25	06.00	07.11 (1)			07.58		10.13
	16.05		20.08				23.16		22.31	20.45	26 07.37 (1)			16.13		14.37
Potential sun hours	173	239	363	450			568	621	606	508		393		305	199	139
Total, worst case					381						130		253			
Sun reduction					0,43						0,42		0,32			
Oper. time red.					0,94						0,94		0,94			
Wind dir. red.					0,62						0,62		0,62			
Total reduction					0,25						0,25		0,19			
Total, real					96						32		48			

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

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

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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) Shadow receptor: K - Lomarakennus K (Isomännikkö)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January			February			March			April			May	June
1	10.12			09.04		11.22 (2)	07.33		08.57 (3)	06.44		08.07 (4)	04.59	03.23
	14.39			16.08	49	13.05 (1)	17.38	27	09.24 (3)	20.11	25	08.32 (4)	21.42	23.19
2	10.11			09.01		11.22 (2)	07.29		08.57 (3)	06.41		08.07 (4)	04.56	03.20
	14.41			16.12	47	13.04 (1)	17.41	26	09.23 (3)	20.13	23	08.30 (4)	21.45	23.22
3	10.10			08.58		11.23 (2)	07.26		08.58 (3)	06.37		08.09 (4)	04.52	03.18
	14.43			16.15	42	13.03 (1)	17.44	24	09.22 (3)	20.16	19	08.28 (4)	21.48	23.25
4	10.09			08.55		11.24 (2)	07.23		08.59 (3)	06.34		08.10 (4)	04.49	03.16
	14.45			16.18	36	13.01 (1)	17.47	21	09.20 (3)	20.19	15	08.25 (4)	21.52	23.27
5	10.08		12.42 (1)	08.52		11.26 (2)	07.19		09.01 (3)	06.30		08.15 (4)	04.46	03.13
	14.47	4	12.46 (1)	16.22	28	12.59 (1)	17.50	16	09.17 (3)	20.22	5	08.20 (4)	21.55	23.30
6	10.06		12.39 (1)	08.49		11.30 (2)	07.16		09.04 (3)	06.27			04.42	03.11
	14.50	9	12.48 (1)	16.25	13	12.55 (1)	17.53	10	09.14 (3)	20.25			21.58	23.32
7	10.05		12.38 (1)	08.46			07.12			06.23			04.39	03.09
	14.52	12	12.50 (1)	16.28			17.56			20.28			22.01	23.35
8	10.03		12.38 (1)	08.43			07.09			06.19			04.36	03.07
	14.55	15	12.53 (1)	16.31			18.00			20.31			22.05	23.37
9	10.02		12.37 (1)	08.39			07.05			06.16			04.32	03.05
	14.57	17	12.54 (1)	16.35			18.03			20.34			22.08	23.39
10	10.00		11.24 (2)	08.36			07.02			06.12			04.29	03.04
	15.00	27	12.56 (1)	16.38			18.06			20.37			22.11	23.41
11	09.58		11.22 (2)	08.33			06.58			06.09			04.26	03.02
	15.03	31	12.56 (1)	16.41			18.09			20.40			22.14	23.43
12	09.56		11.21 (2)	08.30			06.55			06.05			04.22	03.00
	15.05	36	12.58 (1)	16.44			18.11			20.43			22.17	23.45
13	09.54		11.20 (2)	08.27			06.51			06.02			04.19	02.58
	15.08	40	12.59 (1)	16.48			18.14			20.46			22.21	23.46
14	09.52		11.19 (2)	08.23			06.48			05.58			04.16	02.57
	15.11	43	12.59 (1)	16.51			18.17			20.49			22.24	23.48
15	09.50		11.19 (2)	08.20		09.06 (3)	06.44			05.55			04.13	02.56
	15.14	45	13.00 (1)	16.54	11	09.17 (3)	18.20			20.52			22.27	23.49
16	09.47		11.18 (2)	08.17		09.04 (3)	06.41			05.51			04.09	02.55
	15.17	48	13.01 (1)	16.57	16	09.20 (3)	18.23			20.55			22.30	23.51
17	09.45		11.18 (2)	08.13		09.02 (3)	06.37		07.18 (4)	05.48			04.06	02.55
	15.20	50	13.02 (1)	17.01	20	09.22 (3)	18.26	12	07.30 (4)	20.59			22.34	23.52
18	09.43		11.18 (2)	08.10		09.00 (3)	06.34		07.15 (4)	05.44			04.03	02.54
	15.23	52	13.03 (1)	17.04	23	09.23 (3)	18.29	17	07.32 (4)	21.02			22.37	23.52
19	09.40		11.18 (2)	08.07		08.58 (3)	06.30		07.13 (4)	05.41			04.00	02.54
	15.26	53	13.03 (1)	17.07	26	09.24 (3)	18.32	21	07.34 (4)	21.05			22.40	23.53
20	09.38		11.18 (2)	08.03		08.58 (3)	06.27		07.11 (4)	05.37			03.57	02.54
	15.29	55	13.04 (1)	17.10	27	09.25 (3)	18.35	24	07.35 (4)	21.08			22.43	23.54
21	09.35		11.18 (2)	08.00		08.57 (3)	06.23		07.10 (4)	05.34			03.54	02.54
	15.32	56	13.05 (1)	17.13	28	09.25 (3)	18.38	26	07.36 (4)	21.11			22.46	23.54
22	09.33		11.18 (2)	07.57		08.56 (3)	06.20		07.08 (4)	05.30			03.51	02.54
	15.36	57	13.05 (1)	17.16	29	09.25 (3)	18.41	28	07.36 (4)	21.14			22.49	23.54
23	09.30		11.18 (2)	07.53		08.56 (3)	06.16		07.08 (4)	05.27			03.48	02.55
	15.39	57	13.05 (1)	17.20	30	09.26 (3)	18.44	29	07.37 (4)	21.17			22.53	23.54
24	09.27		11.18 (2)	07.50		08.56 (3)	06.12		07.06 (4)	05.23			03.45	02.55
	15.42	58	13.05 (1)	17.23	30	09.26 (3)	18.47	31	07.37 (4)	21.20			22.56	23.54
25	09.24		11.18 (2)	07.47		08.55 (3)	06.09		07.06 (4)	05.20			03.42	02.56
	15.45	58	13.06 (1)	17.26	31	09.26 (3)	18.50	31	07.37 (4)	21.23			22.59	23.54
26	09.22		11.18 (2)	07.43		08.56 (3)	06.05		07.06 (4)	05.16			03.39	02.57
	15.49	58	13.06 (1)	17.29	30	09.26 (3)	18.53	31	07.37 (4)	21.26			23.02	23.53
27	09.19		11.19 (2)	07.40		08.56 (3)	06.02		07.05 (4)	05.13			03.36	02.58
	15.52	58	13.07 (1)	17.32	29	09.25 (3)	18.56	31	07.36 (4)	21.29			23.05	23.53
28	09.16		11.19 (2)	07.36		08.57 (3)	05.58		07.05 (4)	05.09			03.33	02.59
	15.55	57	13.06 (1)	17.35	28	09.25 (3)	18.59	31	07.36 (4)	21.33			23.08	23.52
29	09.13		11.19 (2)				06.55		08.05 (4)	05.06			03.31	03.01
	15.58	56	13.06 (1)				20.02	30	08.35 (4)	21.36			23.11	23.51
30	09.10		11.20 (2)				06.51		08.06 (4)	05.03			03.28	03.01
	16.02	54	13.06 (1)				20.05	28	08.34 (4)	21.39			23.14	23.50
31	09.07		11.20 (2)				06.48		08.06 (4)				03.25	
	16.05	52	13.05 (1)				20.08	27	08.33 (4)				23.16	
Potential sun hours	173			239			363			451			568	621
Total, worst case		1158			573			521			87			
Sun reduction		0,11			0,31			0,36			0,43			
Oper. time red.		0,94			0,94			0,94			0,94			
Wind dir. red.		0,66			0,65			0,62			0,61			
Total reduction		0,07			0,19			0,21			0,25			
Total, real		78			108			109			22			

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

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

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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) Shadow receptor: K - Lomarakennus K (Isomännikkö)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	July	August	September			October			November			December		
1	03.02	04.28	06.02			07.28			08.01			09.36		11.04 (2)
	23.48	22.27	20.41			18.55			16.09			14.46	32	12.39 (1)
2	03.04	04.31	06.05			07.31			08.05			09.38		11.06 (2)
	23.47	22.24	20.37			18.51			16.06			14.44	26	12.38 (1)
3	03.06	04.34	06.08			07.34			08.08			09.41		12.21 (1)
	23.45	22.21	20.34			18.48			16.03			14.42	16	12.37 (1)
4	03.08	04.37	06.11			07.37			08.11			09.44		12.23 (1)
	23.44	22.18	20.30			18.44			16.00			14.40	14	12.37 (1)
5	03.10	04.40	06.14			07.40			08.14		10.59 (2)	09.46		12.24 (1)
	23.42	22.14	20.27			18.41			15.57	16	12.26 (1)	14.39	12	12.36 (1)
6	03.12	04.43	06.17			07.43			08.17		10.56 (2)	09.49		12.26 (1)
	23.40	22.11	20.23			18.37			15.53	30	12.30 (1)	14.37	9	12.35 (1)
7	03.14	04.46	06.20		08.11 (4)	07.45		09.43 (3)	08.21		10.55 (2)	09.51		12.28 (1)
	23.38	22.08	20.20	4	08.15 (4)	18.34	4	09.47 (3)	15.50	37	12.32 (1)	14.35	5	12.33 (1)
8	03.17	04.50	06.23		08.06 (4)	07.48		09.38 (3)	08.24		10.54 (2)	09.53		
	23.36	22.04	20.16	14	08.20 (4)	18.30	14	09.52 (3)	15.47	42	12.34 (1)	14.34		
9	03.19	04.53	06.25		08.03 (4)	07.51		09.35 (3)	08.27		10.53 (2)	09.56		
	23.34	22.01	20.13	19	08.22 (4)	18.27	19	09.54 (3)	15.44	46	12.35 (1)	14.33		
10	03.22	04.56	06.28		08.01 (4)	07.54		09.33 (3)	08.30		10.52 (2)	09.58		
	23.31	21.57	20.09	22	08.23 (4)	18.23	22	09.55 (3)	15.41	50	12.36 (1)	14.31		
11	03.24	04.59	06.31		07.59 (4)	07.57		09.31 (3)	08.34		10.52 (2)	10.00		
	23.29	21.54	20.06	25	08.24 (4)	18.20	25	09.56 (3)	15.38	53	12.37 (1)	14.30		
12	03.27	05.02	06.34		07.58 (4)	08.00		09.30 (3)	08.37		10.51 (2)	10.02		
	23.26	21.51	20.02	27	08.25 (4)	18.16	27	09.57 (3)	15.35	54	12.37 (1)	14.29		
13	03.30	05.05	06.37		07.57 (4)	08.03		09.30 (3)	08.40		10.51 (2)	10.04		
	23.24	21.47	19.58	29	08.26 (4)	18.13	28	09.58 (3)	15.32	57	12.38 (1)	14.28		
14	03.32	05.08	06.40		07.55 (4)	08.06		09.29 (3)	08.43		10.51 (2)	10.05		
	23.21	21.44	19.55	30	08.25 (4)	18.10	29	09.58 (3)	15.29	57	12.38 (1)	14.28		
15	03.35	05.11	06.43		07.55 (4)	08.09		09.28 (3)	08.46		10.51 (2)	10.07		
	23.19	21.40	19.51	30	08.25 (4)	18.06	30	09.58 (3)	15.26	57	12.38 (1)	14.27		
16	03.38	05.14	06.45		07.54 (4)	08.12		09.27 (3)	08.50		10.52 (2)	10.08		
	23.16	21.37	19.48	32	08.26 (4)	18.03	31	09.58 (3)	15.23	57	12.39 (1)	14.27		
17	03.41	05.17	06.48		07.54 (4)	08.15		09.27 (3)	08.53		10.52 (2)	10.10		
	23.13	21.33	19.44	31	08.25 (4)	17.59	30	09.57 (3)	15.21	58	12.39 (1)	14.26		
18	03.44	05.20	06.51		07.53 (4)	08.18		09.27 (3)	08.56		10.51 (2)	10.11		
	23.10	21.30	19.41	31	08.24 (4)	17.56	31	09.58 (3)	15.18	59	12.39 (1)	14.26		
19	03.47	05.24	06.54		07.53 (4)	08.21		09.27 (3)	08.59		10.53 (2)	10.12		
	23.08	21.26	19.37	31	08.24 (4)	17.52	30	09.57 (3)	15.15	57	12.40 (1)	14.26		
20	03.50	05.27	06.57		07.53 (4)	08.24		09.27 (3)	09.02		10.53 (2)	10.13		
	23.05	21.23	19.34	30	08.23 (4)	17.49	29	09.56 (3)	15.12	57	12.40 (1)	14.26		
21	03.53	05.30	07.00		07.54 (4)	08.27		09.28 (3)	09.06		10.53 (2)	10.13		
	23.02	21.19	19.30	28	08.22 (4)	17.46	28	09.56 (3)	15.10	56	12.40 (1)	14.26		
22	03.56	05.33	07.02		07.54 (4)	08.30		09.28 (3)	09.09		10.54 (2)	10.14		
	22.59	21.16	19.27	27	08.21 (4)	17.42	27	09.55 (3)	15.07	55	12.40 (1)	14.27		
23	03.59	05.36	07.05		07.55 (4)	08.33		09.30 (3)	09.12		10.54 (2)	10.15		
	22.56	21.13	19.23	25	08.20 (4)	17.39	24	09.54 (3)	15.04	54	12.40 (1)	14.27		
24	04.02	05.39	07.08		07.55 (4)	08.36		09.30 (3)	09.15		10.55 (2)	10.15		
	22.53	21.09	19.19	23	08.18 (4)	17.36	23	09.53 (3)	15.02	52	12.40 (1)	14.28		
25	04.05	05.42	07.11		07.57 (4)	07.39		08.32 (3)	09.18		10.56 (2)	10.15		
	22.50	21.06	19.16	19	08.16 (4)	16.32	20	08.52 (3)	14.59	50	12.40 (1)	14.29		
26	04.09	05.45	07.14		07.59 (4)	07.43		08.34 (3)	09.21		10.57 (2)	10.15		
	22.47	21.02	19.12	14	08.13 (4)	16.29	15	08.49 (3)	14.57	47	12.39 (1)	14.30		
27	04.12	05.48	07.17		08.05 (4)	07.46		08.37 (3)	09.24		10.58 (2)	10.15		
	22.43	20.58	19.09	2	08.07 (4)	16.26	9	08.46 (3)	14.55	45	12.39 (1)	14.31		
28	04.15	05.50	07.20			07.49			09.27		10.59 (2)	10.15		
	22.40	20.55	19.05			16.22			14.52	43	12.39 (1)	14.32		
29	04.18	05.53	07.22			07.52			09.30		11.01 (2)	10.14		
	22.37	20.51	19.02			16.19			14.50	40	12.39 (1)	14.34		
30	04.21	05.56	07.25			07.55			09.33		11.02 (2)	10.14		
	22.34	20.48	18.58			16.16			14.48	36	12.39 (1)	14.35		
31	04.24	05.59				07.58						10.13		
	22.31	20.44				16.13						14.37		
Potential sun hours	606	508	393			305			199			139		
Total, worst case				493			495			1265			114	
Sun reduction				0,32			0,28			0,18			0,04	
Oper. time red.				0,94			0,94			0,94			0,94	
Wind dir. red.				0,61			0,64			0,66			0,66	
Total reduction				0,19			0,17			0,12			0,02	
Total, real				92			84			146			3	

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

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

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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) Shadow receptor: L - Asuinrakennus L (Malkasaari)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	03.02	04.28	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.11	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.30	06.41	04.56	03.20	03.04	04.31	06.05	07.31	08.05	09.38
	14.41	16.12	17.41	20.14	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18	03.06	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.17	21.49	23.25	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.23	06.34	04.49	03.16	03.08	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.20	21.52	23.27	23.44	22.18	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.46	03.13	03.10	04.40	06.14	07.40	08.14	09.46
	14.47	16.22	17.51	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.57	14.39
6	10.07	08.49	07.16	06.27	04.42	03.11	03.12	04.43	06.17	07.43	08.18	09.49
	14.50	16.25	17.54	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.46	08.21	09.51
	14.52	16.28	17.57	20.28	22.01	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.03	08.43	07.09	06.20	04.36	03.07	03.17	04.50	06.23	07.48	08.24	09.54
	14.55	16.32	18.00	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51	08.27	09.56
	14.57	16.35	18.03	20.34	22.08	23.39	23.34	22.01	20.13	18.27	15.44	14.33
10	10.00	08.36	07.02	06.12	04.29	03.04	03.22	04.56	06.28	07.54	08.30	09.58
	15.00	16.38	18.06	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.26	03.02	03.24	04.59	06.31	07.57	08.34	10.00
	15.03	16.41	18.09	20.40	22.14	23.43	23.29	21.54	20.06	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.01	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.45	18.12	20.43	22.18	23.45	23.27	21.51	20.02	18.17	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.58	03.30	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.15	20.46	22.21	23.47	23.24	21.47	19.59	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.16	02.57	03.33	05.08	06.40	08.06	08.43	10.05
	15.11	16.51	18.18	20.49	22.24	23.48	23.22	21.44	19.55	18.10	15.29	14.28
15	09.50	08.20	06.44	05.55	04.13	02.56	03.35	05.11	06.43	08.09	08.47	10.07
	15.14	16.54	18.20	20.53	22.27	23.49	23.19	21.40	19.51	18.06	15.26	14.27
16	09.47	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.08
	15.17	16.57	18.23	20.56	22.30	23.51	23.16	21.37	19.48	18.03	15.23	14.27
17	09.45	08.14	06.37	05.48	04.06	02.55	03.41	05.18	06.48	08.15	08.53	10.10
	15.20	17.01	18.26	20.59	22.34	23.52	23.13	21.33	19.44	17.59	15.21	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.21	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.18	14.26
19	09.40	08.07	06.30	05.41	04.00	02.54	03.47	05.24	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.53	23.08	21.27	19.37	17.53	15.15	14.26
20	09.38	08.04	06.27	05.37	03.57	02.54	03.50	05.27	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54	02.54	03.53	05.30	07.00	08.27	09.06	10.14
	15.33	17.13	18.38	21.11	22.46	23.54	23.02	21.20	19.30	17.46	15.10	14.27
22	09.33	07.57	06.20	05.30	03.51	02.54	03.56	05.33	07.02	08.30	09.09	10.14
	15.36	17.17	18.41	21.14	22.50	23.54	22.59	21.16	19.27	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48	02.55	03.59	05.36	07.05	08.33	09.12	10.15
	15.39	17.20	18.44	21.17	22.53	23.54	22.56	21.13	19.23	17.39	15.04	14.27
24	09.27	07.50	06.13	05.23	03.45	02.55	04.02	05.39	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.54	22.53	21.09	19.20	17.36	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.56	04.06	05.42	07.11	07.40	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.06	05.16	03.39	02.57	04.09	05.45	07.14	07.43	09.21	10.15
	15.49	17.29	18.53	21.26	23.02	23.53	22.47	21.02	19.13	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.12	05.48	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.26	14.55	14.31
28	09.16	07.36	05.58	05.10	03.33	02.59	04.15	05.51	07.20	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.31	03.01	04.18	05.54	07.22	07.52	09.30	10.15
	15.59		20.02	21.36	23.11	23.51	22.37	20.52	19.02	16.19	14.50	14.34
30	09.10		06.51	05.03	03.28	03.01	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.08		23.17		22.31	20.45		16.13		14.37
Potential sun hours	173	238	363	451	568	621	607	508	393	305	199	139
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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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) Shadow receptor: M - Asuinrakennus M (Latvala)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January		February		March		April	May	June
1	10.13		09.04		14.09 (15)	07.33	15.58 (14)	06.44	04.59	03.22
	14.38		16.08	27	14.36 (15)	17.38	31 16.29 (14)	20.10	21.42	23.20
2	10.12		09.01		14.09 (15)	07.29	15.58 (14)	06.40	04.55	03.19
	14.40		16.11	28	14.37 (15)	17.41	30 16.28 (14)	20.13	21.45	23.23
3	10.11		08.58		14.08 (15)	07.26	15.58 (14)	06.37	04.52	03.17
	14.42		16.14	29	14.37 (15)	17.44	31 16.29 (14)	20.16	21.49	23.25
4	10.10		08.55		14.07 (15)	07.22	15.58 (14)	06.33	04.48	03.15
	14.44		16.18	31	14.38 (15)	17.47	30 16.28 (14)	20.19	21.52	23.28
5	10.08		08.52		14.08 (15)	07.19	15.57 (14)	06.30	04.45	03.12
	14.47		16.21	31	14.39 (15)	17.50	30 16.27 (14)	20.22	21.55	23.30
6	10.07		08.49		14.08 (15)	07.15	15.58 (14)	06.26	04.42	03.10
	14.49		16.24	31	14.39 (15)	17.53	29 16.27 (14)	20.25	21.58	23.33
7	10.05		08.46		14.07 (15)	07.12	15.58 (14)	06.23	04.38	03.08
	14.51		16.28	32	14.39 (15)	17.56	28 16.26 (14)	20.28	22.01	23.35
8	10.04		08.43		14.07 (15)	07.09	15.59 (14)	06.19	04.35	03.06
	14.54		16.31	32	14.39 (15)	17.59	26 16.25 (14)	20.31	22.05	23.38
9	10.02		08.40		14.08 (15)	07.05	16.00 (14)	06.16	04.32	03.04
	14.56		16.34	32	14.40 (15)	18.02	24 16.24 (14)	20.34	22.08	23.40
10	10.00		08.36		14.08 (15)	07.02	16.01 (14)	06.12	04.28	03.02
	14.59		16.38	31	14.39 (15)	18.05	21 16.22 (14)	20.37	22.11	23.42
11	09.58		08.33		14.08 (15)	06.58	16.03 (14)	06.08	04.25	03.01
	15.02		16.41	31	14.39 (15)	18.08	16 16.19 (14)	20.40	22.14	23.44
12	09.56		08.30		14.08 (15)	06.55	16.07 (14)	06.05	04.22	02.58
	15.05		16.44	30	14.38 (15)	18.11	9 16.16 (14)	20.43	22.18	23.45
13	09.54		08.27		14.09 (15)	06.51		06.01	04.18	02.57
	15.07		16.47	29	14.38 (15)	18.14		20.46	22.21	23.47
14	09.52		08.23		14.10 (15)	06.48		05.58	04.15	02.56
	15.10		16.51	28	14.38 (15)	18.17		20.49	22.24	23.49
15	09.50		08.20		14.10 (15)	06.44		05.54	04.12	02.55
	15.13		16.54	26	14.36 (15)	18.20		20.52	22.27	23.50
16	09.48		08.17		14.12 (15)	06.40		05.51	04.09	02.54
	15.16		16.57	24	14.36 (15)	18.23		20.55	22.31	23.51
17	09.45		08.13		14.13 (15)	06.37		05.47	04.06	02.53
	15.19		17.00	21	14.34 (15)	18.26		20.58	22.34	23.52
18	09.43		08.10		14.15 (15)	06.33		05.44	04.02	02.53
	15.22		17.03	17	14.32 (15)	18.29		21.02	22.37	23.53
19	09.40		08.07		14.19 (15)	06.30		05.40	03.59	02.53
	15.26		17.07	10	14.29 (15)	18.32		21.05	22.40	23.54
20	09.38		08.03			06.26		05.37	03.56	02.53
	15.29		17.10			18.35		21.08	22.43	23.55
21	09.35		08.00		16.09 (14)	06.23		05.33	03.53	02.53
	15.32		17.13	10	16.19 (14)	18.38		21.11	22.47	23.55
22	09.33		07.57		16.06 (14)	06.19		05.30	03.50	02.53
	15.35		17.16	16	16.22 (14)	18.41		21.14	22.50	23.55
23	09.30		07.53		16.04 (14)	06.16		05.26	03.47	02.53
	15.38		17.19	20	16.24 (14)	18.44		21.17	22.53	23.55
24	09.27		07.50		16.02 (14)	06.12		05.23	03.44	02.54
	15.41		17.22	24	16.26 (14)	18.47		21.20	22.56	23.55
25	09.25		07.46		16.01 (14)	06.09		05.19	03.41	02.55
	15.45		17.25	25	16.26 (14)	18.50		21.23	22.59	23.55
26	09.22	14.19 (15)	07.43		16.00 (14)	06.05		05.16	03.38	02.56
	15.48	4 14.23 (15)	17.29	28	16.28 (14)	18.53		21.26	23.02	23.54
27	09.19	14.15 (15)	07.40		15.59 (14)	06.02		05.12	03.35	02.57
	15.51	13 14.28 (15)	17.32	29	16.28 (14)	18.56		21.30	23.05	23.53
28	09.16	14.13 (15)	07.36		15.58 (14)	05.58		05.09	03.33	02.58
	15.55	17 14.30 (15)	17.35	30	16.28 (14)	18.59		21.33	23.08	23.52
29	09.13	14.12 (15)				06.55		05.06	03.30	03.00
	15.58	20 14.32 (15)				20.02		21.36	23.11	23.51
30	09.10	14.10 (15)				06.51		05.02	03.27	03.00
	16.01	23 14.33 (15)				20.04		21.39	23.14	23.50
31	09.07	14.10 (15)				06.47			03.24	
	16.04	25 14.35 (15)				20.07			23.17	
Potential sun hours	172		238		363		451	569	622	
Total, worst case	102		702		305					
Sun reduction	0,11		0,31		0,36					
Oper. time red.	0,94		0,94		0,94					
Wind dir. red.	0,65		0,64		0,62					
Total reduction	0,07		0,18		0,21					
Total, real	7		130		64					

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

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

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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) Shadow receptor: M - Asuinrakennus M (Latvala)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	July	August	September	October		November		December
1	03.01	04.27	06.02	07.28		16.49 (14)	08.01	13.37 (15)	09.36
	23.49	22.28	20.41	18.55	4	16.53 (14)	16.09	32	14.09 (15)	14.45
2	03.03	04.30	06.05	07.31		16.43 (14)	08.05	13.37 (15)	09.39
	23.48	22.24	20.37	18.51	15	16.58 (14)	16.06	32	14.09 (15)	14.43
3	03.05	04.33	06.08	07.34		16.40 (14)	08.08	13.37 (15)	09.41
	23.46	22.21	20.34	18.48	20	17.00 (14)	16.02	32	14.09 (15)	14.41
4	03.07	04.36	06.11	07.37		16.38 (14)	08.11	13.37 (15)	09.44
	23.44	22.18	20.30	18.44	23	17.01 (14)	15.59	32	14.09 (15)	14.39
5	03.09	04.40	06.14	07.40		16.37 (14)	08.14	13.37 (15)	09.47
	23.42	22.14	20.27	18.41	25	17.02 (14)	15.56	32	14.09 (15)	14.38
6	03.11	04.43	06.16	07.42		16.35 (14)	08.18	13.38 (15)	09.49
	23.41	22.11	20.23	18.37	27	17.02 (14)	15.53	30	14.08 (15)	14.36
7	03.13	04.46	06.19	07.45		16.34 (14)	08.21	13.38 (15)	09.52
	23.39	22.08	20.20	18.34	29	17.03 (14)	15.50	30	14.08 (15)	14.35
8	03.16	04.49	06.22	07.48		16.33 (14)	08.24	13.39 (15)	09.54
	23.36	22.04	20.16	18.30	30	17.03 (14)	15.47	29	14.08 (15)	14.33
9	03.18	04.52	06.25	07.51		16.32 (14)	08.27	13.39 (15)	09.56
	23.34	22.01	20.12	18.27	31	17.03 (14)	15.44	28	14.07 (15)	14.32
10	03.21	04.55	06.28	07.54		16.32 (14)	08.30	13.40 (15)	09.58
	23.32	21.57	20.09	18.23	31	17.03 (14)	15.40	27	14.07 (15)	14.30
11	03.23	04.58	06.31	07.57		16.31 (14)	08.34	13.41 (15)	10.00
	23.29	21.54	20.05	18.20	31	17.02 (14)	15.37	25	14.06 (15)	14.29
12	03.26	05.02	06.34	08.00		16.31 (14)	08.37	13.42 (15)	10.02
	23.27	21.51	20.02	18.16	31	17.02 (14)	15.34	23	14.05 (15)	14.28
13	03.29	05.05	06.37	08.03		16.31 (14)	08.40	13.43 (15)	10.04
	23.24	21.47	19.58	18.13	30	17.01 (14)	15.31	20	14.03 (15)	14.28
14	03.32	05.08	06.39	08.06		16.32 (14)	08.43	13.46 (15)	10.06
	23.22	21.44	19.55	18.09	29	17.01 (14)	15.29	17	14.03 (15)	14.27
15	03.34	05.11	06.42	08.09		16.32 (14)	08.47	13.48 (15)	10.07
	23.19	21.40	19.51	18.06	28	17.00 (14)	15.26	12	14.00 (15)	14.26
16	03.37	05.14	06.45	08.12		16.32 (14)	08.50	13.52 (15)	10.09
	23.16	21.37	19.48	18.02	27	16.59 (14)	15.23	4	13.56 (15)	14.26
17	03.40	05.17	06.48	08.15		16.33 (14)	08.53		10.10
	23.14	21.33	19.44	17.59	25	16.58 (14)	15.20		14.25
18	03.43	05.20	06.51	08.18		16.35 (14)	08.56		10.11
	23.11	21.30	19.41	17.56	22	16.57 (14)	15.17		14.25
19	03.46	05.23	06.54	08.21		16.36 (14)	08.59		10.12
	23.08	21.26	19.37	17.52	19	16.55 (14)	15.14		14.25
20	03.49	05.26	06.56	08.24		16.37 (14)	09.03		10.13
	23.05	21.23	19.33	17.49	15	16.52 (14)	15.12		14.25
21	03.52	05.29	06.59	08.27		16.42 (14)	09.06		10.14
	23.02	21.20	19.30	17.45	6	16.48 (14)	15.09		14.26
22	03.55	05.32	07.02	08.30			09.09		10.15
	22.59	21.16	19.26	17.42			15.06		14.26
23	03.58	05.35	07.05	08.33		14.48 (15)	09.12		10.15
	22.56	21.13	19.23	17.39	12	15.00 (15)	15.04		14.27
24	04.02	05.38	07.08	08.36		14.45 (15)	09.15		10.15
	22.53	21.09	19.19	17.35	17	15.02 (15)	15.01		14.27
25	04.05	05.41	07.11	07.39		13.43 (15)	09.18		10.16
	22.50	21.05	19.16	16.32	22	14.05 (15)	14.59		14.28
26	04.08	05.44	07.14	07.43		13.41 (15)	09.21		10.16
	22.47	21.02	19.12	16.29	24	14.05 (15)	14.56		14.29
27	04.11	05.47	07.16	07.46		13.40 (15)	09.24		10.15
	22.44	20.58	19.09	16.25	27	14.07 (15)	14.54		14.30
28	04.14	05.50	07.19	07.49		13.39 (15)	09.27		10.15
	22.41	20.55	19.05	16.22	28	14.07 (15)	14.52		14.31
29	04.17	05.53	07.22	07.52		13.38 (15)	09.30		10.15
	22.37	20.51	19.02	16.19	30	14.08 (15)	14.49		14.33
30	04.21	05.56	07.25	07.55		13.38 (15)	09.33		10.14
	22.34	20.48	18.58	16.15	31	14.09 (15)	14.47		14.34
31	04.24	05.59		07.58		13.37 (15)			10.14
	22.31	20.44		16.12	31	14.08 (15)			14.36
Potential sun hours	607	508	393	305			199		138
Total, worst case					720			405	
Sun reduction					0,28			0,18	
Oper. time red.					0,94			0,94	
Wind dir. red.					0,63			0,65	
Total reduction					0,17			0,11	
Total, real					120			45	

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

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

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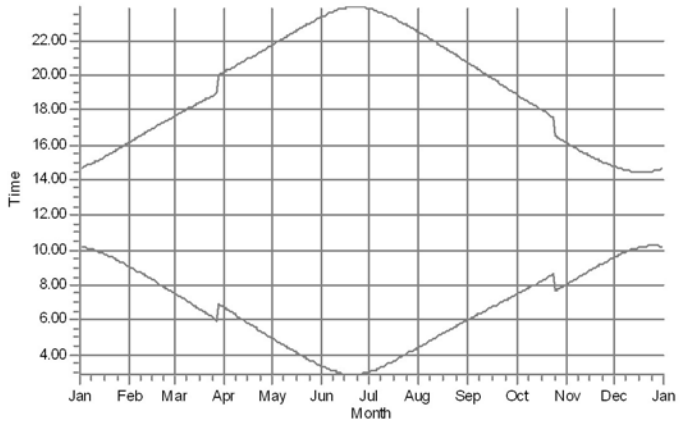
Calculated:
22.11.2023 17.03/3.6.377

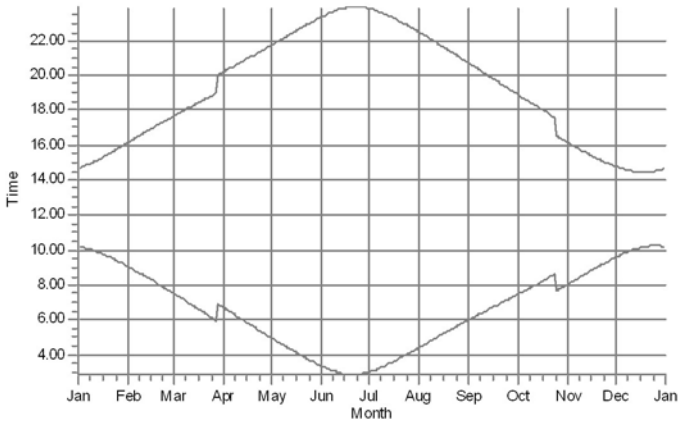
SHADOW - Calendar, graphical

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

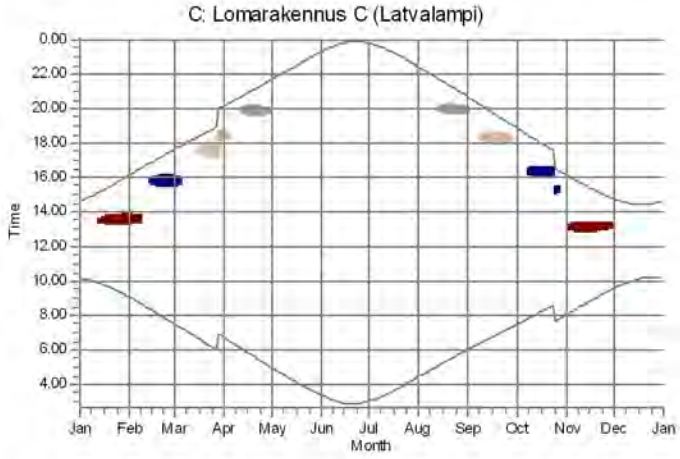
A: Lomarakennus A (Lampinjärvi)



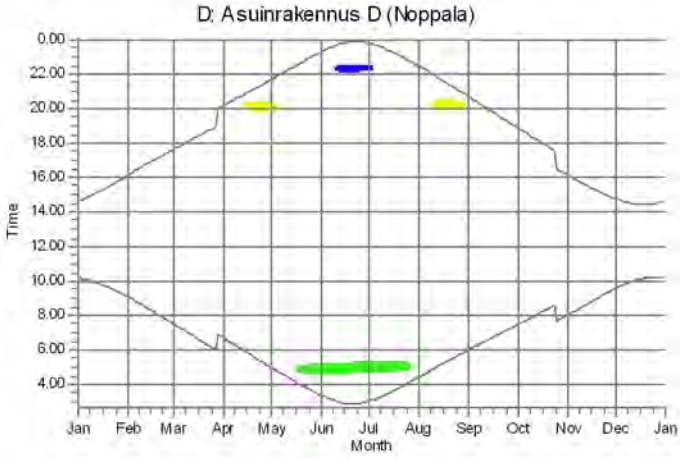
B: Lomarakennus B (Lampinkallio)



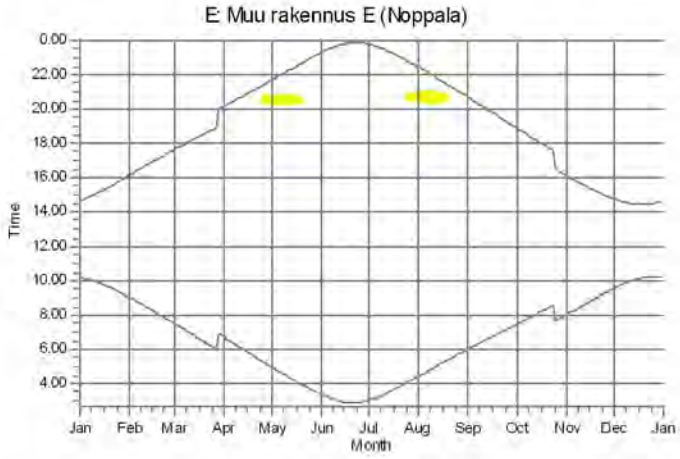
C: Lomarakennus C (Latvalampi)



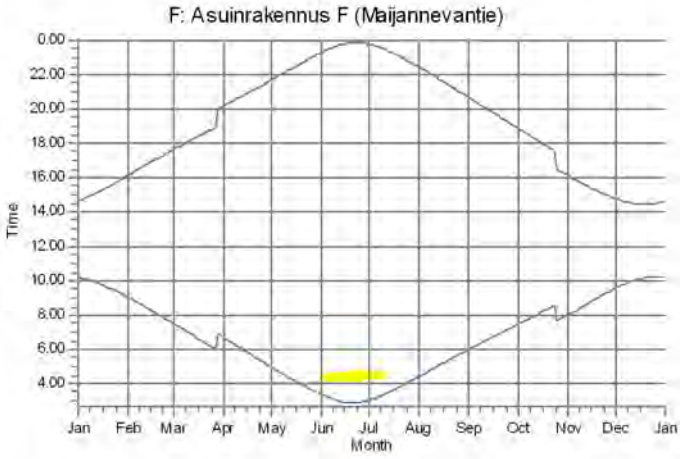
D: Asuinrakennus D (Noppala)



E: Muu rakennus E (Noppala)



F: Asuinrakennus F (Maijannevantie)



WTGs

- 2: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (173)
- 3: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (174)
- 7: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (178)
- 8: Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (179)
- 17: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (188)
- 18: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (189)
- 9: Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (210)

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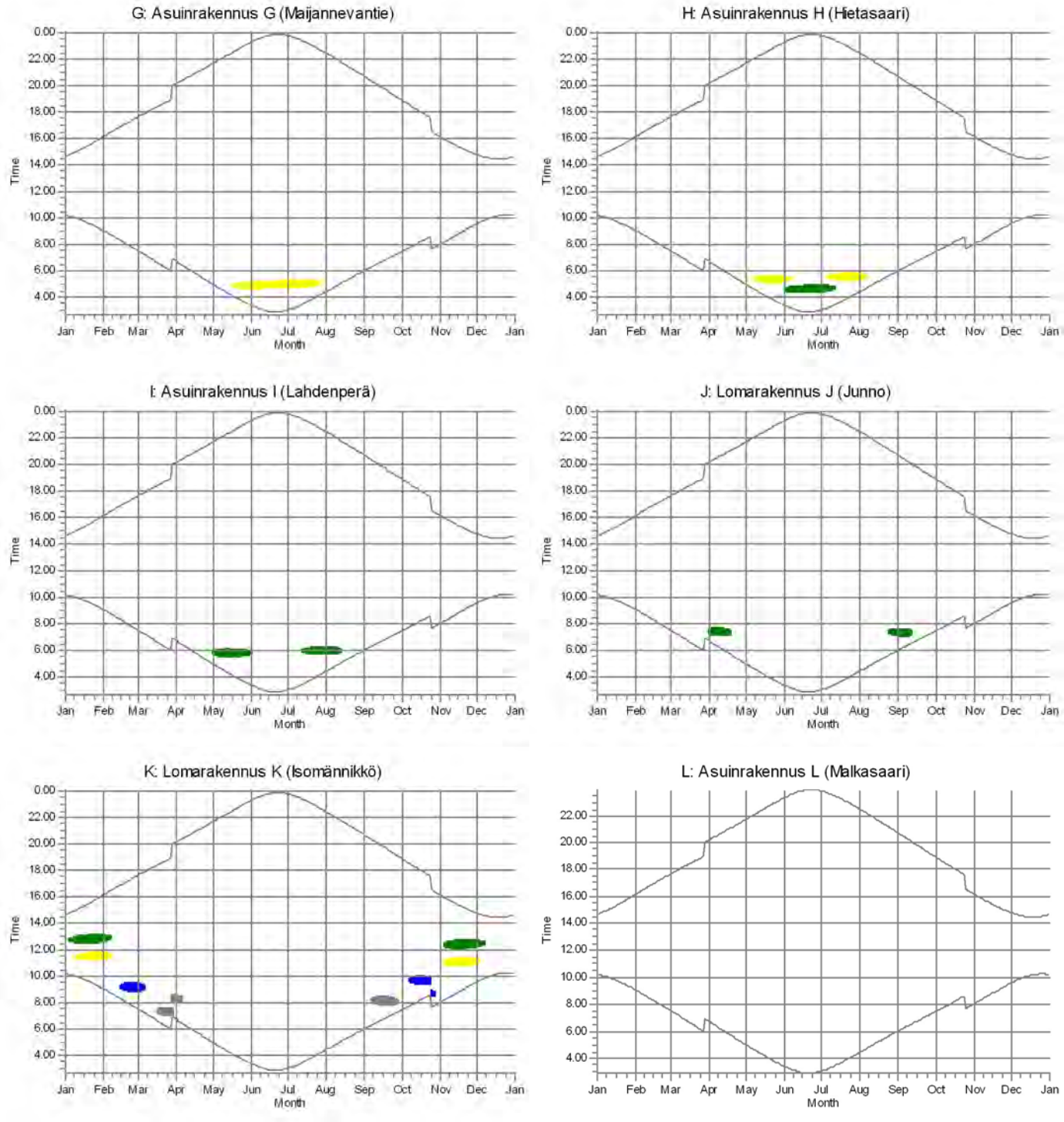
Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar, graphical

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)



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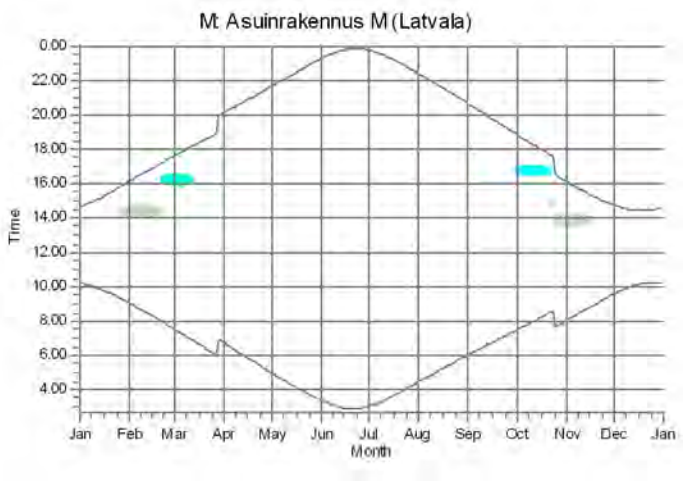
SHADOW - Calendar, graphical

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)



WTGs

14: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (185)

15: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (186)

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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 1 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (172)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January		February		March	April		May		June	
1	10.12		09.04	12.40-13.05/25	07.33	06.44	07.22-07.33/11	04.59	05.47-05.54/7	03.23	
	14.39		16.08		17.38	20.11		21.42		23.19	
2	10.11		09.01	12.41-13.04/23	07.29	06.41	07.19-07.36/17	04.56	05.43-05.57/14	03.21	04.32-04.39/7
	14.41		16.12		17.41	20.13		21.45		23.22	
3	10.10		08.58	12.42-13.03/21	07.26	06.37	07.17-07.37/20	04.52	05.41-05.59/18	03.18	04.31-04.42/11
	14.43		16.15		17.44	20.16		21.48		23.24	
4	10.09		08.55	12.44-13.01/17	07.23	06.34	07.16-07.38/22	04.49	05.39-06.00/21	03.16	04.30-04.43/13
	14.45		16.18		17.47	20.19		21.52		23.27	
5	10.08	12.42-12.46/4	08.52	12.46-12.59/13	07.19	06.30	07.14-07.38/24	04.46	05.38-06.01/23	03.14	04.28-04.44/16
	14.48		16.22		17.50	20.22		21.55		23.30	
6	10.06	12.39-12.48/9	08.49	12.51-12.55/4	07.16	06.27	07.13-07.39/26	04.42	05.37-06.02/25	03.12	04.28-04.45/17
	14.50		16.25		17.53	20.25		21.58		23.32	
7	10.05	12.38-12.50/12	08.46		07.12	06.23	07.12-07.39/27	04.39	05.36-06.02/26	03.09	04.28-04.46/18
	14.52		16.28		17.57	20.28		22.01		23.34	
8	10.03	12.38-12.53/15	08.43		07.09	06.20	07.12-07.39/27	04.36	05.36-06.03/27	03.08	04.27-04.47/20
	14.55		16.32		18.00	20.31		22.04		23.37	
9	10.01	12.37-12.54/17	08.39		07.05	06.16	07.12-07.39/27	04.32	05.36-06.04/28	03.06	04.27-04.48/21
	14.57		16.35		18.03	20.34		22.08		23.39	
10	10.00	12.37-12.56/19	08.36		07.02	06.12	07.11-07.38/27	04.29	05.35-06.04/29	03.04	04.27-04.48/21
	15.00		16.38		18.06	20.37		22.11		23.41	
11	09.58	12.36-12.56/20	08.33		06.58	06.09	07.12-07.38/26	04.26	05.35-06.04/29	03.02	04.26-04.49/23
	15.03		16.41		18.09	20.40		22.14		23.43	
12	09.56	12.36-12.58/22	08.30		06.55	06.05	07.11-07.37/26	04.22	05.35-06.05/30	03.01	04.26-04.49/23
	15.06		16.45		18.12	20.43		22.17		23.44	
13	09.54	12.36-12.59/23	08.27		06.51	06.02	07.12-07.36/24	04.19	05.35-06.04/29	02.58	04.26-04.49/23
	15.08		16.48		18.14	20.46		22.21		23.46	
14	09.52	12.35-12.59/24	08.23		06.48	05.58	07.13-07.35/22	04.16	05.34-06.04/30	02.57	04.26-04.50/24
	15.11		16.51		18.17	20.49		22.24		23.48	
15	09.49	12.35-13.00/25	08.20		06.44	05.55	07.13-07.33/20	04.13	05.35-06.04/29	02.56	04.26-04.50/24
	15.14		16.54		18.20	20.52		22.27		23.49	
16	09.47	12.35-13.01/26	08.17		06.41	05.51	07.14-07.32/18	04.10	05.35-06.04/29	02.56	04.26-04.51/25
	15.17		16.57		18.23	20.55		22.30		23.50	
17	09.45	12.35-13.02/27	08.13		06.37	05.48	07.17-07.29/12	04.06	05.36-06.04/28	02.55	04.26-04.51/25
	15.20		17.01		18.26	20.58		22.33		23.51	
18	09.43	12.35-13.03/28	08.10		06.34	05.44	07.19-07.24/5	04.03	05.35-06.03/28	02.54	04.27-04.52/25
	15.23		17.04		18.29	21.02		22.37		23.52	
19	09.40	12.35-13.03/28	08.07		06.30	05.41		04.00	05.36-06.04/28	02.54	04.27-04.52/25
	15.26		17.07		18.32	21.05		22.40		23.53	
20	09.38	12.35-13.04/29	08.03		06.27	05.37		03.57	05.36-06.03/27	02.54	04.27-04.52/25
	15.30		17.10		18.35	21.08		22.43		23.53	
21	09.35	12.35-13.05/30	08.00		06.23	05.34		03.54	05.37-06.03/26	02.54	04.27-04.52/25
	15.33		17.13		18.38	21.11		22.46		23.54	
22	09.32	12.35-13.05/30	07.57		06.20	05.30		03.51	05.38-06.02/24	02.55	04.27-04.52/25
	15.36		17.17		18.41	21.14		22.49		23.54	
23	09.30	12.35-13.05/30	07.53		06.16	05.27		03.48	05.37-06.01/24	02.55	04.27-04.52/25
	15.39		17.20		18.44	21.17		22.52		23.54	
24	09.27	12.35-13.05/30	07.50		06.13	05.23		03.45	05.38-06.01/23	02.56	04.28-04.53/25
	15.42		17.23		18.47	21.20		22.55		23.54	
25	09.24	12.36-13.06/30	07.47		06.09	05.20		03.42	05.39-06.00/21	02.56	04.27-04.52/25
	15.46		17.26		18.50	21.23		22.59		23.53	
26	09.22	12.36-13.06/30	07.43		06.05	05.16		03.39	05.40-05.59/19	02.57	04.28-04.53/25
	15.49		17.29		18.53	21.26		23.02		23.53	
27	09.19	12.37-13.07/30	07.40		06.02	05.13		03.36	05.41-05.58/17	02.58	04.29-04.53/24
	15.52		17.32		18.56	21.29		23.05		23.52	
28	09.16	12.37-13.06/29	07.36		05.58	05.10		03.34	05.42-05.57/15	03.00	04.29-04.53/24
	15.55		17.35		18.59	21.33		23.08		23.51	
29	09.13	12.38-13.06/28			06.55	05.06		03.31	05.44-05.56/12	03.00	04.30-04.53/23
	15.59				20.02	21.36		23.10		23.50	
30	09.10	12.38-13.06/28			06.51	05.03		03.28	05.45-05.54/9	03.01	04.30-04.53/23
	16.02				20.05	21.39		23.13		23.49	
31	09.07	12.39-13.05/26			06.48			03.26	05.49-05.52/3		
	16.05				20.08			23.16			
Potential sun hours	173		239		363	450		568		621	
Sum of minutes with flicker	649		103		0	381		698		630	

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 1 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (172)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	July		August		September		October	November		December	
1	03.03	04.31-04.53/22	04.28	05.45-06.15/30	06.02	07.11-07.37/26	07.28	08.01		09.35	12.19-12.39/20
	23.48		22.27		20.41		18.55	16.09		14.46	
2	03.04	04.31-04.53/22	04.31	05.46-06.15/29	06.05	07.10-07.37/27	07.31	08.05		09.38	12.20-12.38/18
	23.47		22.24		20.37		18.51	16.06		14.44	
3	03.06	04.31-04.52/21	04.34	05.45-06.14/29	06.08	07.09-07.36/27	07.34	08.08		09.41	12.21-12.37/16
	23.45		22.21		20.34		18.48	16.03		14.42	
4	03.08	04.33-04.53/20	04.37	05.46-06.14/28	06.11	07.09-07.36/27	07.37	08.11		09.44	12.23-12.37/14
	23.43		22.17		20.30		18.44	16.00		14.40	
5	03.10	04.33-04.52/19	04.40	05.47-06.13/26	06.14	07.09-07.36/27	07.40	08.14	12.20-12.26/6	09.46	12.24-12.36/12
	23.42		22.14		20.27		18.41	15.57		14.39	
6	03.12	04.33-04.51/18	04.43	05.46-06.12/26	06.17	07.10-07.35/25	07.43	08.17	12.16-12.30/14	09.49	12.26-12.35/9
	23.40		22.11		20.23		18.37	15.53		14.37	
7	03.15	04.35-04.51/16	04.47	05.47-06.12/25	06.20	07.09-07.33/24	07.45	08.21	12.14-12.32/18	09.51	12.28-12.33/5
	23.38		22.07		20.20		18.34	15.50		14.36	
8	03.17	04.36-04.51/15	04.50	05.49-06.11/22	06.23	07.10-07.32/22	07.48	08.24	12.13-12.34/21	09.53	
	23.36		22.04		20.16		18.30	15.47		14.34	
9	03.19	04.37-04.49/12	04.53	05.49-06.09/20	06.25	07.11-07.31/20	07.51	08.27	12.12-12.35/23	09.55	
	23.33		22.01		20.13		18.27	15.44		14.33	
10	03.22	04.39-04.48/9	04.56	05.51-06.08/17	06.28	07.12-07.28/16	07.54	08.30	12.11-12.36/25	09.58	
	23.31		21.57		20.09		18.23	15.41		14.32	
11	03.25	04.42-04.45/3	04.59	05.53-06.06/13	06.31	07.14-07.26/12	07.57	08.33	12.10-12.37/27	10.00	
	23.29		21.54		20.05		18.20	15.38		14.31	
12	03.27		05.02	05.56-06.01/5	06.34		08.00	08.37	12.10-12.37/27	10.02	
	23.26		21.50		20.02		18.17	15.35		14.30	
13	03.30	05.55-06.02/7	05.05		06.37		08.03	08.40	12.09-12.38/29	10.03	
	23.24		21.47		19.58		18.13	15.32		14.29	
14	03.33	05.53-06.04/11	05.08		06.40		08.06	08.43	12.09-12.38/29	10.05	
	23.21		21.44		19.55		18.10	15.29		14.28	
15	03.36	05.52-06.05/13	05.11		06.43		08.09	08.46	12.09-12.38/29	10.07	
	23.19		21.40		19.51		18.06	15.26		14.27	
16	03.38	05.51-06.07/16	05.14		06.45		08.12	08.50	12.10-12.39/29	10.08	
	23.16		21.37		19.48		18.03	15.23		14.27	
17	03.41	05.50-06.08/18	05.18		06.48		08.15	08.53	12.09-12.39/30	10.09	
	23.13		21.33		19.44		17.59	15.21		14.27	
18	03.44	05.50-06.10/20	05.21		06.51		08.18	08.56	12.09-12.39/30	10.11	
	23.10		21.30		19.41		17.56	15.18		14.26	
19	03.47	05.49-06.10/21	05.24		06.54		08.21	08.59	12.10-12.40/30	10.12	
	23.07		21.26		19.37		17.53	15.15		14.26	
20	03.50	05.48-06.11/23	05.27		06.57		08.24	09.02	12.10-12.40/30	10.12	
	23.05		21.23		19.34		17.49	15.12		14.26	
21	03.53	05.47-06.11/24	05.30		07.00		08.27	09.05	12.10-12.40/30	10.13	
	23.02		21.19		19.30		17.46	15.10		14.27	
22	03.56	05.47-06.12/25	05.33		07.02		08.30	09.09	12.11-12.40/29	10.14	
	22.59		21.16		19.27		17.42	15.07		14.27	
23	03.59	05.46-06.13/27	05.36		07.05		08.33	09.12	12.11-12.40/29	10.14	
	22.56		21.12		19.23		17.39	15.05		14.28	
24	04.03	05.47-06.14/27	05.39		07.08		08.36	09.15	12.12-12.40/28	10.15	
	22.53		21.09		19.19		17.36	15.02		14.28	
25	04.06	05.46-06.14/28	05.42	07.22-07.29/7	07.11		07.39	09.18	12.13-12.40/27	10.15	
	22.49		21.05		19.16		16.32	15.00		14.29	
26	04.09	05.46-06.14/28	05.45	07.19-07.32/13	07.14		07.43	09.21	12.13-12.39/26	10.15	
	22.46		21.02		19.12		16.29	14.57		14.30	
27	04.12	05.45-06.14/29	05.48	07.16-07.34/18	07.17		07.46	09.24	12.14-12.39/25	10.15	
	22.43		20.58		19.09		16.26	14.55		14.31	
28	04.15	05.46-06.15/29	05.51	07.15-07.35/20	07.20		07.49	09.27	12.15-12.39/24	10.15	
	22.40		20.55		19.05		16.22	14.53		14.33	
29	04.18	05.45-06.14/29	05.54	07.14-07.36/22	07.22		07.52	09.30	12.16-12.39/23	10.14	
	22.37		20.51		19.02		16.19	14.50		14.34	
30	04.21	05.45-06.15/30	05.56	07.12-07.36/24	07.25		07.55	09.33	12.18-12.39/21	10.14	
	22.34		20.48		18.58		16.16	14.48		14.35	
31	04.25	05.45-06.14/29	05.59	07.11-07.37/26			07.58			10.13	
	22.30		20.44				16.13			14.37	
Potential sun hours	606		508		393		305	199		139	
Sum of minutes with flicker	611		400		253		0	659		94	

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 2 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (173)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June
1	10.12	09.04 11.22-11.46/24	07.33	06.44	04.59 20.22-20.49/27	03.23 05.17-05.32/15
	14.39	16.08	17.38	20.10	21.42 19.58-20.15/17	23.19 04.42-05.07/25
2	10.11	09.01 11.22-11.46/24	07.29	06.41	04.56 20.21-20.49/28	03.21 05.18-05.31/13 04.22-04.24/2
	14.41	16.12	17.41	20.13	21.45 20.00-20.13/13	23.22 04.42-05.07/25
3	10.10	08.58 11.23-11.44/21	07.26	06.37	04.52 20.21-20.49/28	03.18 05.19-05.31/12 04.20-04.28/8
	14.43	16.15	17.44	20.16	21.48 20.03-20.10/7	23.24 04.43-05.08/25
4	10.09	08.55 11.24-11.43/19	07.22	06.34	04.49 20.21-20.49/28	03.16 05.21-05.30/9 04.19-04.30/11
	14.45	16.18	17.47	20.19	21.52	23.27 04.43-05.09/26
5	10.08	08.52 11.26-11.41/15	07.19	06.30	04.46 20.20-20.49/29	03.14 05.22-05.28/6 04.17-04.30/13
	14.48	16.22	17.50	20.22	21.55	23.29 04.43-05.08/25
6	10.06	08.49 11.30-11.39/9	07.16	06.27	04.42 20.20-20.49/29	03.11 04.43-05.09/26
	14.50	16.25	17.53	20.25	21.58	23.32 04.17-04.31/14
7	10.05	08.46	07.12	06.23	04.39 05.21-05.26/5	03.09 04.44-05.09/25
	14.52	16.28	17.56	20.28	22.01 20.20-20.49/29	23.34 04.17-04.32/15
8	10.03	08.43	07.09	06.19	04.36 05.18-05.30/12	03.07 04.44-05.09/25
	14.55	16.31	17.59	20.31	22.04 20.20-20.48/28	23.37 04.16-04.33/17
9	10.01	08.39	07.05	06.16	04.32 05.16-05.32/16	03.06 04.44-05.09/25
	14.57	16.35	18.02	20.34	22.08 20.21-20.49/28	23.39 04.16-04.34/18
10	10.00 11.24-11.32/8	08.36	07.02	06.12	04.29 05.15-05.33/18	03.04 04.45-05.09/24
	15.00	16.38	18.05	20.37	22.11 20.21-20.48/27	23.41 04.16-04.34/18
11	09.58 11.22-11.33/11	08.33	06.58	06.09	04.26 05.13-05.33/20	03.02 04.45-05.09/24
	15.03	16.41	18.08	20.40	22.14 20.22-20.47/25	23.43 04.15-04.35/20
12	09.56 11.21-11.35/14	08.30	06.55	06.05	04.22 05.13-05.35/22	03.01 04.45-05.09/24
	15.06	16.45	18.11	20.43	22.17 20.22-20.46/24	23.44 04.15-04.35/20
13	09.54 11.20-11.37/17	08.26	06.51	06.02	04.19 05.12-05.35/23	02.58 04.45-05.09/24
	15.08	16.48	18.14	20.46	22.20 20.23-20.46/23	23.46 04.15-04.35/20
14	09.52 11.19-11.38/19	08.23	06.48	05.58	04.16 05.12-05.35/23	02.57 04.45-05.10/25
	15.11	16.51	18.17	20.49	22.24 20.24-20.45/21	23.48 04.15-04.36/21
15	09.49 11.19-11.39/20	08.20	06.44	05.55 20.04-20.14/10	04.13 05.12-05.36/24	02.56 04.45-05.09/24
	15.14	16.54	18.20	20.52	22.27 20.25-20.44/19	23.49 04.15-04.36/21
16	09.47 11.18-11.40/22	08.17	06.41	05.51 20.02-20.17/15	04.10 05.11-05.36/25	02.55 04.46-05.10/24
	15.17	16.57	18.23	20.55	22.30 20.26-20.43/17	23.50 04.15-04.36/21
17	09.45 11.18-11.41/23	08.13	06.37	05.48 19.59-20.18/19	04.06 05.11-05.36/25	02.55 04.46-05.10/24
	15.20	17.01	18.26	20.58	22.33 20.28-20.41/13	23.51 04.16-04.37/21
18	09.42 11.18-11.42/24	08.10	06.34	05.44 19.58-20.20/22	04.03 05.11-05.36/25 20.30-20.40/10	02.54 04.47-05.10/23
	15.23	17.04	18.29	21.01	22.37 04.51-04.56/5	23.52 04.16-04.37/21
19	09.40 11.18-11.43/25	08.07	06.30	05.41 19.57-20.20/23	04.00 05.11-05.37/26	02.54 04.47-05.11/24
	15.26	17.07	18.32	21.05	22.40 04.49-05.00/11	23.53 04.16-04.38/22
20	09.38 11.18-11.44/26	08.03	06.27	05.37 19.57-20.21/24	03.57 05.11-05.36/25	02.54 04.47-05.11/24
	15.29	17.10	18.35	21.08	22.43 04.47-05.01/14	23.53 04.16-04.38/22
21	09.35 11.18-11.44/26	08.00	06.23	05.34 19.55-20.21/26	03.54 05.11-05.36/25	02.54 04.47-05.11/24
	15.33	17.13	18.38	21.11	22.46 04.46-05.02/16	23.54 04.16-04.38/22
22	09.32 11.18-11.45/27	07.57	06.20	05.30 19.55-20.21/26	03.51 05.12-05.36/24	02.54 04.47-05.11/24
	15.36	17.16	18.41	21.14	22.49 04.45-05.03/18	23.54 04.16-04.38/22
23	09.30 11.18-11.45/27	07.53	06.16	05.27 19.55-20.21/26	03.48 05.11-05.35/24	02.55 04.47-05.11/24
	15.39	17.20	18.44	21.17	22.52 04.44-05.03/19	23.54 04.16-04.38/22
24	09.27 11.18-11.46/28	07.50	06.12	05.23 19.55-20.21/26	03.45 05.12-05.35/23	02.56 04.48-05.12/24
	15.42	17.23	18.47	21.20	22.55 04.43-05.04/21	23.54 04.17-04.39/22
25	09.24 11.18-11.46/28	07.46	06.09	05.20 20.30-20.42/12	03.42 05.12-05.35/23	02.56 04.48-05.11/23
	15.45	17.26	18.50	21.23 19.54-20.20/26	22.58 04.43-05.05/22	23.53 04.17-04.38/21
26	09.22 11.18-11.46/28	07.43	06.05	05.16 20.27-20.44/17	03.39 05.13-05.35/22	02.57 04.48-05.12/24
	15.49	17.29	18.53	21.26 19.54-20.19/25	23.02 04.43-05.05/22	23.53 04.17-04.39/22
27	09.19 11.19-11.47/28	07.40	06.02	05.13 20.26-20.46/20	03.36 05.13-05.35/22	02.58 04.48-05.12/24
	15.52	17.32	18.56	21.29 19.55-20.19/24	23.05 04.43-05.06/23	23.52 04.18-04.39/21
28	09.16 11.19-11.47/28	07.36	05.58	05.10 20.25-20.47/22	03.34 05.14-05.34/20	03.00 04.49-05.13/24
	15.55	17.35	18.59	21.32 19.55-20.18/23	23.07 04.42-05.06/24	23.51 04.18-04.39/21
29	09.13 11.19-11.47/28		06.55	05.06 20.24-20.48/24	03.31 05.14-05.34/20	03.00 04.49-05.13/24
	15.59		20.02	21.36 19.56-20.17/21	23.10 04.42-05.06/24	23.50 04.19-04.39/20
30	09.10 11.20-11.46/26		06.51	05.03 20.23-20.48/25	03.28 05.15-05.33/18	03.01 04.49-05.14/25
	16.02		20.05	21.39 19.57-20.16/19	23.13 04.42-05.07/25	23.49 04.19-04.39/20
31	09.07 11.20-11.46/26		06.48		03.26 05.16-05.33/17	
	16.05		20.08		23.16 04.43-05.08/25	
Potential sun hours	173	239	363	450	568	621
Sum of minutes with flicker	509	112	0	475	1266	1324

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 2 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (173)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	July	August	September	October	November	December
1	03.03 04.49-05.14/25	04.28 05.24-05.44/20	06.02	07.28	08.01	09.35 11.04-11.16/12
	23.48 04.20-04.39/19	22.27 20.33-20.58/25	20.41	18.55	16.09	14.46
2	03.04 04.49-05.14/25	04.31 05.25-05.44/19	06.05	07.31	08.05	09.38 11.06-11.14/8
	23.47 04.20-04.39/19	22.24 20.31-20.57/26	20.37	18.51	16.06	14.44
3	03.06 04.49-05.14/25	04.34 05.25-05.42/17	06.08	07.34	08.08	09.41
	23.45 04.20-04.38/18	22.21 20.31-20.58/27	20.34	18.48	16.03	14.42
4	03.08 04.50-05.15/25	04.37 05.27-05.41/14	06.11	07.37	08.11	09.43
	23.43 04.22-04.39/17	22.17 20.31-20.59/28	20.30	18.44	16.00	14.40
5	03.10 04.49-05.14/25	04.40 05.29-05.39/10	06.14	07.40	08.14 10.59-11.09/10	09.46
	23.41 04.22-04.38/16	22.14 20.30-20.58/28	20.27	18.41	15.57	14.39
6	03.12 04.49-05.14/25	04.43 20.30-20.59/29	06.17	07.43	08.17 10.56-11.12/16	09.48
	23.40 04.22-04.37/15	22.11	20.23	18.37	15.53	14.37
7	03.15 05.29-05.34/5 04.23-04.37/14	04.47 20.30-20.59/29	06.20	07.45	08.21 10.55-11.14/19	09.51
	23.38 04.50-05.15/25	22.07	20.20	18.34	15.50	14.36
8	03.17 05.28-05.36/8 04.25-04.37/12	04.50 20.30-20.58/28	06.23	07.48	08.24 10.54-11.15/21	09.53
	23.35 04.50-05.15/25	22.04	20.16	18.30	15.47	14.34
9	03.19 05.26-05.37/11 04.26-04.35/9	04.53 20.30-20.58/28	06.25	07.51	08.27 10.53-11.16/23	09.55
	23.33 04.49-05.15/26	22.01	20.13	18.27	15.44	14.33
10	03.22 05.26-05.39/13 04.28-04.34/6	04.56 20.30-20.58/28	06.28	07.54	08.30 10.52-11.17/25	09.58
	23.31 04.50-05.15/25	21.57 20.11-20.20/9	20.09	18.23	15.41	14.32
11	03.25 05.25-05.40/15	04.59 20.30-20.57/27	06.31	07.57	08.33 10.52-11.18/26	10.00
	23.29 04.50-05.15/25	21.54 20.08-20.22/14	20.05	18.20	15.38	14.30
12	03.27 05.25-05.41/16	05.02 20.30-20.57/27	06.34	08.00	08.37 10.51-11.18/27	10.01
	23.26 04.50-05.15/25	21.50 20.06-20.23/17	20.02	18.16	15.35	14.29
13	03.30 05.24-05.42/18	05.05 20.31-20.56/25	06.37	08.03	08.40 10.51-11.19/28	10.03
	23.24 04.51-05.16/25	21.47 20.05-20.25/20	19.58	18.13	15.32	14.29
14	03.33 05.24-05.42/18	05.08 20.32-20.56/24	06.40	08.06	08.43 10.51-11.19/28	10.05
	23.21 04.51-05.15/24	21.44 20.04-20.26/22	19.55	18.10	15.29	14.28
15	03.36 05.23-05.43/20	05.11 20.32-20.54/22	06.43	08.09	08.46 10.51-11.19/28	10.07
	23.18 04.51-05.15/24	21.40 20.02-20.26/24	19.51	18.06	15.26	14.27
16	03.38 05.23-05.44/21	05.14 20.33-20.53/20	06.45	08.12	08.50 10.52-11.20/28	10.08
	23.16 04.51-05.15/24	21.37 20.02-20.26/24	19.48	18.03	15.23	14.27
17	03.41 05.22-05.44/22	05.18 20.35-20.51/16	06.48	08.15	08.53 10.52-11.20/28	10.09
	23.13 04.52-05.15/23	21.33 20.02-20.27/25	19.44	17.59	15.21	14.27
18	03.44 05.23-05.45/22	05.21 20.37-20.47/10	06.51	08.18	08.56 10.51-11.20/29	10.10
	23.10 04.53-05.15/22	21.30 20.00-20.26/26	19.41	17.56	15.18	14.26
19	03.47 05.22-05.45/23	05.24 20.00-20.26/26	06.54	08.21	08.59 10.53-11.20/27	10.11
	23.07 04.53-05.15/22	21.26	19.37	17.53	15.15	14.26
20	03.50 05.22-05.46/24	05.27 20.00-20.26/26	06.57	08.24	09.02 10.53-11.20/27	10.12
	23.04 04.54-05.14/20	21.23	19.34	17.49	15.12	14.26
21	03.53 05.21-05.46/25	05.30 20.01-20.26/25	07.00	08.27	09.05 10.53-11.19/26	10.13
	23.02 04.54-05.13/19	21.19	19.30	17.46	15.10	14.27
22	03.56 05.22-05.46/24	05.33 20.00-20.25/25	07.02	08.30	09.09 10.54-11.20/26	10.14
	22.59 04.56-05.13/17	21.16	19.27	17.42	15.07	14.27
23	03.59 05.21-05.46/25	05.36 20.00-20.25/25	07.05	08.33	09.12 10.54-11.19/25	10.14
	22.56 04.56-05.12/16	21.12	19.23	17.39	15.05	14.28
24	04.03 05.22-05.47/25	05.39 20.01-20.24/23	07.08	08.36	09.15 10.55-11.19/24	10.15
	22.53 04.58-05.11/13	21.09	19.19	17.36	15.02	14.28
25	04.06 05.21-05.46/25 20.43-20.48/5	05.42 20.01-20.22/21	07.11	07.39	09.18 10.56-11.19/23	10.15
	22.49 05.00-05.09/9	21.05	19.16	16.32	15.00	14.29
26	04.09 05.22-05.47/25	05.45 20.02-20.21/19	07.14	07.42	09.21 10.57-11.18/21	10.15
	22.46 20.39-20.51/12	21.02	19.12	16.29	14.57	14.30
27	04.12 05.21-05.46/25	05.48 20.03-20.19/16	07.17	07.46	09.24 10.58-11.18/20	10.15
	22.43 20.38-20.53/15	20.58	19.09	16.26	14.55	14.31
28	04.15 05.22-05.47/25	05.51 20.06-20.16/10	07.19	07.49	09.27 10.59-11.18/19	10.14
	22.40 20.36-20.54/18	20.55	19.05	16.22	14.53	14.33
29	04.18 05.22-05.46/24	05.53	07.22	07.52	09.30 11.01-11.18/17	10.14
	22.37 20.35-20.55/20	20.51	19.02	16.19	14.50	14.34
30	04.21 05.23-05.46/23	05.56	07.25	07.55	09.33 11.02-11.17/15	10.14
	22.34 20.34-20.56/22	20.48	18.58	16.16	14.48	14.35
31	04.24 05.23-05.45/22	05.59		07.58		10.13
	22.30 20.33-20.57/24	20.44		16.13		14.37
Potential sun hours	606	508	393	305	199	139
Sum of minutes with flicker	1324	924	0	0	606	20

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 3 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (174)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33 08.57-09.24/27	06.44	04.59	03.23	03.02 22.22-22.26/4	04.27	06.02	07.28	08.01	09.35
	14.39	16.08	17.38	20.10	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29 08.57-09.23/26	06.41	04.56	03.20	03.04	04.31	06.05	07.31	08.05	09.38
	14.41	16.12	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26 08.58-09.22/24	06.37	04.52	03.18	03.06	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.24	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22 08.59-09.20/21	06.34	04.49	03.16	03.08	04.37	06.11	07.37	08.11	09.43
	14.45	16.18	17.47	20.19	21.52	23.27	23.43	22.17	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19 09.01-09.17/16	06.30	04.46	03.13	03.10	04.40	06.14	07.40	08.14	09.46
	14.47	16.22	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.39
6	10.06	08.49	07.16 09.04-09.14/10	06.26	04.42	03.11	03.12	04.43	06.17	07.42	08.17	09.49
	14.50	16.25	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.45 09.43-09.47/4	08.21	09.51
	14.52	16.28	17.56	20.28	22.01	23.34	23.38	22.07	20.20	18.34	15.50	14.35
8	10.03	08.43	07.09	06.19	04.36	03.07	03.17	04.50	06.22	07.48 09.38-09.52/14	08.24	09.53
	14.55	16.31	17.59	20.31	22.04	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.01	08.39	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51 09.35-09.54/19	08.27	09.55
	14.57	16.35	18.02	20.34	22.08	23.39	23.33	22.01	20.12	18.27	15.44	14.33
10	10.00	08.36	07.02	06.12	04.29	03.04	03.22	04.56	06.28	07.54 09.33-09.55/22	08.30	09.58
	15.00	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.26	03.02 22.19-22.20/1	03.24	04.59	06.31	07.57 09.31-09.56/25	08.33	10.00
	15.03	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.01 22.18-22.24/6	03.27	05.02	06.34	08.00 09.30-09.57/27	08.37	10.02
	15.05	16.44	18.11	20.43	22.17	23.44	23.26	21.50	20.02	18.16	15.35	14.29
13	09.54	08.26	06.51	06.02	04.19	02.58 22.16-22.25/9	03.30	05.05	06.37	08.03 09.30-09.58/28	08.40	10.03
	15.08	16.48	18.14	20.46	22.20	23.46	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.16	02.57 22.16-22.26/10	03.33	05.08	06.40	08.06 09.29-09.58/29	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.21	21.44	19.55	18.10	15.29	14.28
15	09.49	08.20 09.06-09.17/11	06.44	05.55	04.13	02.56 22.15-22.26/11	03.35	05.11	06.42	08.09 09.28-09.58/30	08.46	10.07
	15.14	16.54	18.20	20.52	22.27	23.49	23.18	21.40	19.51	18.06	15.26	14.27
16	09.47	08.17 09.04-09.20/16	06.41	05.51	04.09	02.55 22.15-22.28/13	03.38	05.14	06.45	08.12 09.27-09.58/31	08.50	10.08
	15.17	16.57	18.23	20.55	22.30	23.50	23.16	21.37	19.48	18.03	15.23	14.27
17	09.45	08.13 09.02-09.22/20	06.37	05.48	04.06	02.55 22.16-22.28/12	03.41	05.17	06.48	08.15 09.27-09.57/30	08.53	10.09
	15.20	17.01	18.26	20.58	22.33	23.51	23.13	21.33	19.44	17.59	15.20	14.26
18	09.42	08.10 09.00-09.23/23	06.34	05.44	04.03	02.54 22.15-22.28/13	03.44	05.20	06.51	08.18 09.27-09.58/31	08.56	10.10
	15.23	17.04	18.29	21.01	22.37	23.52	23.10	21.30	19.41	17.56	15.18	14.26
19	09.40	08.07 08.58-09.24/26	06.30	05.41	04.00	02.54 22.15-22.28/13	03.47	05.23	06.54	08.21 09.27-09.57/30	08.59	10.12
	15.26	17.07	18.32	21.04	22.40	23.53	23.07	21.26	19.37	17.52	15.15	14.26
20	09.38	08.03 08.58-09.25/27	06.27	05.37	03.57	02.54 22.15-22.29/14	03.50	05.27	06.57	08.24 09.27-09.56/29	09.02	10.12
	15.29	17.10	18.35	21.08	22.43	23.53	23.04	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00 08.57-09.25/28	06.23	05.34	03.54	02.54 22.16-22.30/14	03.53	05.30	06.59	08.27 09.28-09.56/28	09.05	10.13
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.46	15.10	14.27
22	09.32	07.57 08.56-09.25/29	06.19	05.30	03.51	02.54 22.16-22.30/14	03.56	05.33	07.02	08.30 09.28-09.55/27	09.09	10.14
	15.36	17.16	18.41	21.14	22.49	23.54	22.59	21.16	19.26	17.42	15.07	14.27
23	09.30	07.53 08.56-09.26/30	06.16	05.27	03.48	02.55 22.16-22.30/14	03.59	05.36	07.05	08.33 09.30-09.54/24	09.12	10.14
	15.39	17.20	18.44	21.17	22.52	23.54	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50 08.56-09.26/30	06.12	05.23	03.45	02.55 22.17-22.30/13	04.02	05.39	07.08	08.36 09.30-09.53/23	09.15	10.15
	15.42	17.23	18.47	21.20	22.55	23.54	22.53	21.09	19.19	17.36	15.02	14.28
25	09.24	07.46 08.55-09.26/31	06.09	05.20	03.42	02.56 22.17-22.30/13	04.05	05.42	07.11	07.39 08.32-08.52/20	09.18	10.15
	15.45	17.26	18.50	21.23	22.58	23.53	22.49	21.05	19.16	16.32	14.59	14.29
26	09.22	07.43 08.56-09.26/30	06.05	05.16	03.39	02.57 22.17-22.30/13	04.09	05.45	07.14	07.42 08.34-08.49/15	09.21	10.15
	15.49	17.29	18.53	21.26	23.02	23.53	22.46	21.02	19.12	16.29	14.57	14.30
27	09.19	07.40 08.56-09.25/29	06.02	05.13	03.36	02.58 22.17-22.29/12	04.12	05.47	07.17	07.46 08.37-08.46/9	09.24	10.15
	15.52	17.32	18.56	21.29	23.05	23.52	22.43	20.58	19.09	16.26	14.55	14.31
28	09.16	07.36 08.57-09.25/28	05.58	05.09	03.33	02.59 22.18-22.29/11	04.15	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.32	23.08	23.51	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.31	03.01 22.19-22.28/9	04.18	05.53	07.22	07.52	09.30	10.14
	15.58		20.02	21.36	23.10	23.50	22.37	20.51	19.02	16.19	14.50	14.34
30	09.10		06.51	05.03	03.28	03.01 22.20-22.28/8	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.13	23.49	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.07		23.16		22.30	20.44		16.12		14.37
Potential sun hours	173	239	363	450	568	621	606	508	393	305	199	139
Sum of minutes with flicker	0	358	124	0	0	223	4	0	0	495	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 4 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (175)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March		April		May	June	July	August	September		October	November	December
1	10.12	09.04	07.33		06.44	08.07-08.32/25	04.59	03.23	03.02	04.27	06.02		07.28	08.01	09.35
	14.39	16.08	17.38		20.10		21.42	23.19	23.48	22.27	20.41		18.55	16.09	14.46
2	10.11	09.01	07.29		06.41	08.07-08.30/23	04.56	03.20	03.04	04.31	06.05		07.31	08.05	09.38
	14.41	16.12	17.41		20.13		21.45	23.22	23.47	22.24	20.37		18.51	16.06	14.44
3	10.10	08.58	07.26		06.37	08.09-08.28/19	04.52	03.18	03.06	04.34	06.08		07.34	08.08	09.41
	14.43	16.15	17.44		20.16		21.48	23.25	23.45	22.21	20.34		18.48	16.03	14.42
4	10.09	08.55	07.22		06.33	08.10-08.25/15	04.49	03.16	03.08	04.37	06.11		07.37	08.11	09.44
	14.45	16.18	17.47		20.19		21.52	23.27	23.43	22.17	20.30		18.44	16.00	14.40
5	10.08	08.52	07.19		06.30	08.15-08.20/5	04.45	03.13	03.10	04.40	06.14		07.40	08.14	09.46
	14.47	16.21	17.50		20.22		21.55	23.30	23.42	22.14	20.27		18.41	15.56	14.38
6	10.06	08.49	07.15		06.26		04.42	03.11	03.12	04.43	06.17		07.42	08.17	09.49
	14.50	16.25	17.53		20.25		21.58	23.32	23.40	22.11	20.23		18.37	15.53	14.37
7	10.05	08.46	07.12		06.23		04.39	03.09	03.14	04.46	06.20	08.11-08.15/4	07.45	08.21	09.51
	14.52	16.28	17.56		20.28		22.01	23.34	23.38	22.07	20.20		18.34	15.50	14.35
8	10.03	08.43	07.09		06.19		04.35	03.07	03.17	04.49	06.22	08.06-08.20/14	07.48	08.24	09.53
	14.55	16.31	17.59		20.31		22.04	23.37	23.36	22.04	20.16		18.30	15.47	14.34
9	10.01	08.39	07.05		06.16		04.32	03.05	03.19	04.53	06.25	08.03-08.22/19	07.51	08.27	09.56
	14.57	16.35	18.02		20.34		22.08	23.39	23.33	22.01	20.12		18.27	15.44	14.32
10	10.00	08.36	07.02		06.12		04.29	03.04	03.22	04.56	06.28	08.01-08.23/22	07.54	08.30	09.58
	15.00	16.38	18.05		20.37		22.11	23.41	23.31	21.57	20.09		18.23	15.41	14.31
11	09.58	08.33	06.58		06.09		04.26	03.02	03.24	04.59	06.31	07.59-08.24/25	07.57	08.33	10.00
	15.02	16.41	18.08		20.40		22.14	23.43	23.29	21.54	20.05		18.20	15.38	14.30
12	09.56	08.30	06.55		06.05		04.22	03.00	03.27	05.02	06.34	07.58-08.25/27	08.00	08.37	10.02
	15.05	16.44	18.11		20.43		22.17	23.45	23.26	21.50	20.02		18.16	15.35	14.29
13	09.54	08.26	06.51		06.02		04.19	02.58	03.30	05.05	06.37	07.57-08.26/29	08.03	08.40	10.03
	15.08	16.48	18.14		20.46		22.21	23.46	23.24	21.47	19.58		18.13	15.32	14.28
14	09.52	08.23	06.48		05.58		04.16	02.57	03.32	05.08	06.40	07.55-08.25/30	08.06	08.43	10.05
	15.11	16.51	18.17		20.49		22.24	23.48	23.21	21.44	19.55		18.09	15.29	14.28
15	09.49	08.20	06.44		05.55		04.13	02.56	03.35	05.11	06.42	07.55-08.25/30	08.09	08.46	10.07
	15.14	16.54	18.20		20.52		22.27	23.49	23.19	21.40	19.51		18.06	15.26	14.27
16	09.47	08.17	06.41		05.51		04.09	02.55	03.38	05.14	06.45	07.54-08.26/32	08.12	08.50	10.08
	15.17	16.57	18.23		20.55		22.30	23.50	23.16	21.37	19.48		18.03	15.23	14.27
17	09.45	08.13	06.37	07.18-07.30/12	05.48		04.06	02.54	03.41	05.17	06.48	07.54-08.25/31	08.15	08.53	10.09
	15.20	17.01	18.26		20.58		22.33	23.51	23.13	21.33	19.44		17.59	15.20	14.26
18	09.43	08.10	06.34	07.15-07.32/17	05.44		04.03	02.54	03.44	05.20	06.51	07.53-08.24/31	08.18	08.56	10.11
	15.23	17.04	18.29		21.01		22.37	23.52	23.10	21.30	19.41		17.56	15.18	14.26
19	09.40	08.07	06.30	07.13-07.34/21	05.41		04.00	02.54	03.47	05.23	06.54	07.53-08.24/31	08.21	08.59	10.12
	15.26	17.07	18.32		21.04		22.40	23.53	23.07	21.26	19.37		17.52	15.15	14.26
20	09.38	08.03	06.26	07.11-07.35/24	05.37		03.57	02.54	03.50	05.26	06.57	07.53-08.23/30	08.24	09.02	10.13
	15.29	17.10	18.35		21.08		22.43	23.54	23.05	21.23	19.34		17.49	15.12	14.26
21	09.35	08.00	06.23	07.10-07.36/26	05.34		03.54	02.54	03.53	05.29	06.59	07.54-08.22/28	08.27	09.05	10.13
	15.32	17.13	18.38		21.11		22.46	23.54	23.02	21.19	19.30		17.46	15.09	14.26
22	09.32	07.57	06.19	07.08-07.36/28	05.30		03.51	02.54	03.56	05.32	07.02	07.54-08.21/27	08.30	09.09	10.14
	15.36	17.16	18.41		21.14		22.49	23.54	22.59	21.16	19.26		17.42	15.07	14.27
23	09.30	07.53	06.16	07.08-07.37/29	05.27		03.48	02.55	03.59	05.36	07.05	07.55-08.20/25	08.33	09.12	10.14
	15.39	17.19	18.44		21.17		22.52	23.54	22.56	21.12	19.23		17.39	15.04	14.27
24	09.27	07.50	06.12	07.06-07.37/31	05.23		03.45	02.55	04.02	05.38	07.08	07.55-08.18/23	08.36	09.15	10.15
	15.42	17.23	18.47		21.20		22.55	23.54	22.53	21.09	19.19		17.36	15.02	14.28
25	09.24	07.46	06.09	07.06-07.37/31	05.20		03.42	02.56	04.05	05.41	07.11	07.57-08.16/19	07.39	09.18	10.15
	15.45	17.26	18.50		21.23		22.59	23.54	22.50	21.05	19.16		16.32	14.59	14.29
26	09.22	07.43	06.05	07.06-07.37/31	05.16		03.39	02.57	04.09	05.44	07.14	07.59-08.13/14	07.42	09.21	10.15
	15.49	17.29	18.53		21.26		23.02	23.53	22.46	21.02	19.12		16.29	14.57	14.30
27	09.19	07.40	06.02	07.05-07.36/31	05.13		03.36	02.58	04.12	05.47	07.17	08.05-08.07/2	07.46	09.24	10.15
	15.52	17.32	18.56		21.29		23.05	23.52	22.43	20.58	19.09		16.26	14.55	14.31
28	09.16	07.36	05.58	07.05-07.36/31	05.09		03.33	02.59	04.15	05.50	07.19		07.49	09.27	10.15
	15.55	17.35	18.59		21.32		23.08	23.52	22.40	20.55	19.05		16.22	14.52	14.32
29	09.13		06.55	08.05-08.35/30	05.06		03.31	03.01	04.18	05.53	07.22		07.52	09.30	10.14
	15.58		20.02		21.36		23.11	23.51	22.37	20.51	19.02		16.19	14.50	14.34
30	09.10		06.51	08.06-08.34/28	05.03		03.28	03.01	04.21	05.56	07.25		07.55	09.33	10.14
	16.02		20.05		21.39		23.13	23.49	22.34	20.48	18.58		16.16	14.48	14.35
31	09.07		06.48	08.06-08.33/27			03.25		04.24	05.59			07.58		10.13
	16.05		20.07				23.16		22.30	20.44			16.12		14.37
Potential sun hours	173	239	363		451		568	621	606	508	393		305	199	139
Sum of minutes with flicker	0	0	397		87		0	0	0	0	493		0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 5 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (176)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.01	09.35
	14.39	16.08	17.38	20.10	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.41	04.56	03.20	03.04	04.31	06.05	07.31	08.04	09.38
	14.41	16.12	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18	03.06	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.24	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	03.16	03.08	04.37	06.11	07.37	08.11	09.43
	14.45	16.18	17.47	20.19	21.51	23.27	23.43	22.17	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.10	04.40	06.14	07.39	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.06	08.49	07.15	06.26	04.42	03.11	03.12	04.43	06.17	07.42	08.17	09.48
	14.50	16.25	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.19	07.45	08.20	09.51
	14.52	16.28	17.56	20.28	22.01	23.34	23.38	22.07	20.19	18.34	15.50	14.35
8	10.03	08.42	07.08	06.19	04.35	03.07	03.17	04.49	06.22	07.48	08.24	09.53
	14.55	16.31	17.59	20.31	22.04	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.01	08.39	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51	08.27	09.55
	14.57	16.35	18.02	20.34	22.08	23.39	23.33	22.01	20.12	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.04	03.22	04.56	06.28	07.54	08.30	09.58
	15.00	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02	03.24	04.59	06.31	07.57	08.33	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.01
	15.05	16.44	18.11	20.43	22.17	23.44	23.26	21.50	20.02	18.16	15.35	14.29
13	09.54	08.26	06.51	06.02	04.19	02.58	03.30	05.05	06.37	08.03	08.40	10.03
	15.08	16.48	18.14	20.46	22.20	23.46	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.16	02.57	03.32	05.08	06.40	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.21	21.44	19.55	18.09	15.29	14.28
15	09.49	08.20	06.44	05.55	04.12	02.56	03.35	05.11	06.42	08.09	08.46	10.07
	15.14	16.54	18.20	20.52	22.27	23.49	23.18	21.40	19.51	18.06	15.26	14.27
16	09.47	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.49	10.08
	15.17	16.57	18.23	20.55	22.30	23.50	23.16	21.37	19.48	18.03	15.23	14.27
17	09.45	08.13	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.09
	15.20	17.00	18.26	20.58	22.33	23.51	23.13	21.33	19.44	17.59	15.20	14.26
18	09.42	08.10	06.33	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.10
	15.23	17.04	18.29	21.01	22.36	23.52	23.10	21.30	19.41	17.56	15.18	14.26
19	09.40	08.07	06.30	05.41	04.00	02.54	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.04	22.40	23.53	23.07	21.26	19.37	17.52	15.15	14.26
20	09.38	08.03	06.26	05.37	03.57	02.54	03.50	05.26	06.57	08.24	09.02	10.12
	15.29	17.10	18.35	21.08	22.43	23.53	23.04	21.23	19.33	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54	02.54	03.53	05.29	06.59	08.27	09.05	10.13
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.46	15.09	14.26
22	09.32	07.57	06.19	05.30	03.51	02.54	03.56	05.32	07.02	08.30	09.09	10.14
	15.36	17.16	18.41	21.14	22.49	23.54	22.59	21.16	19.26	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48	02.55	03.59	05.35	07.05	08.33	09.12	10.14
	15.39	17.19	18.44	21.17	22.52	23.54	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.45	02.55	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.55	23.54	22.53	21.09	19.19	17.35	15.02	14.28
25	09.24	07.46	06.09	05.20	03.42	02.56	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.58	23.53	22.49	21.05	19.16	16.32	14.59	14.29
26	09.21	07.43	06.05	05.16	03.39	02.57	04.08	05.44	07.14	07.42	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.53	22.46	21.02	19.12	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.12	05.47	07.16	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.05	23.52	22.43	20.58	19.09	16.26	14.55	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.32	23.08	23.51	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.31	03.01	04.18	05.53	07.22	07.52	09.30	10.14
	15.58		20.02	21.36	23.10	23.50	22.37	20.51	19.02	16.19	14.50	14.34
30	09.10		06.51	05.02	03.28	03.01	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.04	21.39	23.13	23.49	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.07		23.16		22.30	20.44		16.12		14.37
Potential sun hours	173	239	363	451	568	621	606	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 6 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (177)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.01	09.35
	14.39	16.08	17.38	20.10	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.40	04.56	03.20	03.04	04.30	06.05	07.31	08.04	09.38
	14.41	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18	03.06	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.24	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	03.16	03.08	04.37	06.11	07.37	08.11	09.43
	14.45	16.18	17.47	20.19	21.51	23.27	23.43	22.17	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.10	04.40	06.14	07.39	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.29	23.41	22.14	20.27	18.41	15.56	14.38
6	10.06	08.49	07.15	06.26	04.42	03.11	03.12	04.43	06.17	07.42	08.17	09.48
	14.50	16.25	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.19	07.45	08.20	09.51
	14.52	16.28	17.56	20.28	22.01	23.34	23.38	22.07	20.19	18.34	15.50	14.35
8	10.03	08.42	07.08	06.19	04.35	03.07	03.17	04.49	06.22	07.48	08.24	09.53
	14.54	16.31	17.59	20.31	22.04	23.37	23.35	22.04	20.16	18.30	15.47	14.34
9	10.01	08.39	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51	08.27	09.55
	14.57	16.35	18.02	20.34	22.07	23.39	23.33	22.01	20.12	18.27	15.44	14.32
10	10.00	08.36	07.01	06.12	04.29	03.03	03.22	04.56	06.28	07.54	08.30	09.57
	15.00	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02	03.24	04.59	06.31	07.57	08.33	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.54	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.01
	15.05	16.44	18.11	20.43	22.17	23.44	23.26	21.50	20.02	18.16	15.35	14.29
13	09.54	08.26	06.51	06.02	04.19	02.58	03.30	05.05	06.37	08.03	08.40	10.03
	15.08	16.48	18.14	20.46	22.20	23.46	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.47	05.58	04.16	02.57	03.32	05.08	06.39	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.21	21.43	19.55	18.09	15.29	14.28
15	09.49	08.20	06.44	05.55	04.12	02.56	03.35	05.11	06.42	08.09	08.46	10.06
	15.14	16.54	18.20	20.52	22.27	23.49	23.18	21.40	19.51	18.06	15.26	14.27
16	09.47	08.16	06.40	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.49	10.08
	15.17	16.57	18.23	20.55	22.30	23.50	23.16	21.37	19.48	18.03	15.23	14.27
17	09.45	08.13	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.09
	15.20	17.00	18.26	20.58	22.33	23.51	23.13	21.33	19.44	17.59	15.20	14.26
18	09.42	08.10	06.33	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.10
	15.23	17.04	18.29	21.01	22.36	23.52	23.10	21.30	19.40	17.56	15.18	14.26
19	09.40	08.07	06.30	05.41	04.00	02.54	03.47	05.23	06.54	08.21	08.59	10.11
	15.26	17.07	18.32	21.04	22.40	23.53	23.07	21.26	19.37	17.52	15.15	14.26
20	09.37	08.03	06.26	05.37	03.57	02.54	03.50	05.26	06.56	08.24	09.02	10.12
	15.29	17.10	18.35	21.07	22.43	23.53	23.04	21.23	19.33	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54	02.54	03.53	05.29	06.59	08.27	09.05	10.13
	15.32	17.13	18.38	21.11	22.46	23.54	23.01	21.19	19.30	17.46	15.09	14.26
22	09.32	07.56	06.19	05.30	03.51	02.54	03.56	05.32	07.02	08.30	09.08	10.14
	15.35	17.16	18.41	21.14	22.49	23.54	22.58	21.16	19.26	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48	02.54	03.59	05.35	07.05	08.33	09.12	10.14
	15.39	17.19	18.44	21.17	22.52	23.54	22.55	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.45	02.55	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.55	23.54	22.52	21.09	19.19	17.35	15.02	14.28
25	09.24	07.46	06.09	05.20	03.42	02.56	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.58	23.53	22.49	21.05	19.16	16.32	14.59	14.29
26	09.21	07.43	06.05	05.16	03.39	02.57	04.08	05.44	07.14	07.42	09.21	10.15
	15.48	17.29	18.53	21.26	23.01	23.53	22.46	21.02	19.12	16.29	14.57	14.30
27	09.19	07.39	06.02	05.13	03.36	02.58	04.12	05.47	07.16	07.45	09.24	10.15
	15.52	17.32	18.56	21.29	23.04	23.52	22.43	20.58	19.09	16.25	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.19	07.49	09.27	10.14
	15.55	17.35	18.58	21.32	23.07	23.51	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.31	03.01	04.18	05.53	07.22	07.52	09.30	10.14
	15.58		20.01	21.36	23.10	23.50	22.37	20.51	19.02	16.19	14.50	14.34
30	09.10		06.51	05.02	03.28	03.01	04.21	05.56	07.25	07.55	09.32	10.14
	16.02		20.04	21.39	23.13	23.49	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.07		23.16		22.30	20.44		16.12		14.37
Potential sun hours	173	239	363	451	568	621	606	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 7 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (178)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33 15.36-16.02/26	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.01	09.35
	14.39	16.08	17.38	20.10	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29 15.37-16.00/23	06.40	04.56	03.20	03.04	04.30	06.05	07.31	08.04	09.38
	14.41	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26 15.38-15.58/20	06.37	04.52	03.18	03.06	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.25	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22 15.41-15.57/16	06.33	04.49	03.15	03.08	04.37	06.11	07.37	08.11	09.43
	14.45	16.18	17.47	20.19	21.51	23.27	23.43	22.17	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19 15.44-15.53/9	06.30	04.45	03.13	03.10	04.40	06.14	07.39	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.06	08.49	07.15	06.26	04.42	03.11	03.12	04.43	06.17	07.42	08.17	09.49
	14.49	16.25	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.19	07.45	08.20	09.51
	14.52	16.28	17.56	20.28	22.01	23.34	23.38	22.07	20.19	18.34	15.50	14.35
8	10.03	08.42	07.08	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.53
	14.54	16.31	17.59	20.31	22.04	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.01	08.39	07.05	06.16	04.32	03.05	03.19	04.52	06.25	07.51 16.17-16.30/13	08.27	09.55
	14.57	16.34	18.02	20.34	22.08	23.39	23.33	22.01	20.12	18.27	15.44	14.32
10	10.00	08.36	07.01	06.12	04.29	03.03	03.21	04.56	06.28	07.54 16.14-16.32/18	08.30	09.58
	15.00	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02	03.24	04.59	06.31	07.57 16.12-16.33/21	08.33	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.54	06.05	04.22	03.00	03.27	05.02	06.34	08.00 16.10-16.34/24	08.37	10.02
	15.05	16.44	18.11	20.43	22.17	23.45	23.26	21.50	20.02	18.16	15.35	14.29
13	09.54	08.26	06.51	06.02	04.19	02.58	03.29	05.05	06.37	08.03 16.09-16.34/25	08.40	10.03
	15.08	16.47	18.14	20.46	22.20	23.46	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23 15.48-15.52/4	06.47	05.58	04.16	02.57	03.32	05.08	06.39	08.06 16.07-16.35/28	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.21	21.44	19.55	18.09	15.29	14.27
15	09.49	08.20 15.43-15.56/13	06.44	05.55	04.12	02.56	03.35	05.11	06.42	08.09 16.07-16.36/29	08.46	10.07
	15.14	16.54	18.20	20.52	22.27	23.49	23.19	21.40	19.51	18.06	15.26	14.27
16	09.47	08.17 15.41-15.58/17	06.40	05.51	04.09	02.55	03.38	05.14	06.45	08.12 16.07-16.36/29	08.49	10.08
	15.17	16.57	18.23	20.55	22.30	23.50	23.16	21.37	19.48	18.02	15.23	14.26
17	09.45	08.13 15.40-16.01/21	06.37	05.47	04.06	02.54	03.41	05.17	06.48	08.15 16.06-16.35/29	08.53	10.09
	15.20	17.00	18.26	20.58	22.33	23.51	23.13	21.33	19.44	17.59	15.20	14.26
18	09.42	08.10 15.38-16.02/24	06.33	05.44	04.03	02.54	03.44	05.20	06.51	08.18 16.06-16.35/29	08.56	10.11
	15.23	17.04	18.29	21.01	22.37	23.52	23.10	21.30	19.40	17.56	15.17	14.26
19	09.40	08.07 15.37-16.02/25	06.30	05.40	04.00	02.54	03.47	05.23	06.54	08.21 16.06-16.35/29	08.59	10.12
	15.26	17.07	18.32	21.04	22.40	23.53	23.07	21.26	19.37	17.52	15.15	14.26
20	09.38	08.03 15.37-16.04/27	06.26	05.37	03.57	02.53	03.50	05.26	06.56	08.24 16.06-16.34/28	09.02	10.12
	15.29	17.10	18.35	21.07	22.43	23.54	23.05	21.23	19.33	17.49	15.12	14.26
21	09.35	08.00 15.36-16.04/28	06.23	05.33	03.54	02.54	03.53	05.29	06.59	08.27 16.07-16.35/28	09.05	10.13
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.45	15.09	14.26
22	09.32	07.56 15.35-16.04/29	06.19	05.30	03.51	02.54	03.56	05.32	07.02	08.30 16.07-16.33/26	09.09	10.14
	15.35	17.16	18.41	21.14	22.49	23.54	22.59	21.16	19.26	17.42	15.07	14.27
23	09.30	07.53 15.35-16.05/30	06.16	05.27	03.48	02.54	03.59	05.35	07.05	08.33 16.07-16.32/25	09.12	10.14
	15.39	17.19	18.44	21.17	22.52	23.54	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50 15.35-16.04/29	06.12	05.23	03.45	02.55	04.02	05.38	07.08	08.36 16.08-16.31/23	09.15	10.15
	15.42	17.22	18.47	21.20	22.55	23.54	22.53	21.09	19.19	17.35	15.02	14.28
25	09.24	07.46 15.34-16.04/30	06.09	05.20	03.42	02.56	04.05	05.41	07.11	07.39 15.09-15.29/20	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.49	21.05	19.16	16.32	14.59	14.29
26	09.21	07.43 15.35-16.04/29	06.05	05.16	03.39	02.57	04.08	05.44	07.14	07.42 15.11-15.28/17	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.53	22.46	21.02	19.12	16.29	14.57	14.30
27	09.19	07.39 15.35-16.03/28	06.02	05.13	03.36	02.58	04.11	05.47	07.16	07.45 15.13-15.25/12	09.24	10.15
	15.52	17.32	18.56	21.29	23.05	23.52	22.43	20.58	19.09	16.25	14.54	14.31
28	09.16	07.36 15.35-16.02/27	05.58	05.09	03.33	02.59	04.15	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.58	21.32	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.14
	15.58		20.01	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.01		20.04	21.39	23.13	23.49	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.47		03.25		04.24	05.59		07.58		10.13
	16.05		20.07		23.16		22.30	20.44		16.12		14.37
Potential sun hours	173	238	363	451	568	621	607	508	393	305	199	139
Sum of minutes with flicker	0	361	94	0	0	0	0	0	0	453	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 8 - Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (179)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04 13.23-13.50/27	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.01	09.35
	14.39	16.08	17.38	20.10	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01 13.24-13.51/27	07.29	06.40	04.55	03.20	03.04	04.30	06.05	07.31	08.04 13.07-13.08/1	09.38
	14.41	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58 13.25-13.50/25	07.26	06.37	04.52	03.18	03.06	04.34	06.08	07.34	08.08 13.01-13.14/13	09.41
	14.43	16.15	17.44	20.16	21.48	23.24	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55 13.25-13.49/24	07.22	06.33	04.49	03.15	03.08	04.37	06.11	07.36	08.11 12.59-13.16/17	09.43
	14.45	16.18	17.47	20.19	21.51	23.27	23.43	22.17	20.30	18.44	15.59	14.40
5	10.07	08.52 13.26-13.48/22	07.19	06.30	04.45	03.13	03.10	04.40	06.14	07.39	08.14 12.58-13.18/20	09.46
	14.47	16.21	17.50	20.22	21.55	23.29	23.41	22.14	20.26	18.41	15.56	14.38
6	10.06	08.49 13.28-13.48/20	07.15	06.26	04.42	03.11	03.12	04.43	06.16	07.42	08.17 12.57-13.19/22	09.48
	14.49	16.25	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46 13.30-13.46/16	07.12	06.23	04.39	03.09	03.14	04.46	06.19	07.45	08.20 12.56-13.20/24	09.51
	14.52	16.28	17.56	20.28	22.01	23.34	23.38	22.07	20.19	18.34	15.50	14.35
8	10.03	08.42 13.32-13.44/12	07.08	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24 12.55-13.21/26	09.53
	14.54	16.31	17.59	20.31	22.04	23.37	23.35	22.04	20.16	18.30	15.47	14.34
9	10.01	08.39	07.05	06.16	04.32	03.05	03.19	04.52	06.25	07.51	08.27 12.55-13.22/27	09.55
	14.57	16.34	18.02	20.34	22.07	23.39	23.33	22.00	20.12	18.27	15.44	14.32
10	09.59	08.36	07.01	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.30 12.55-13.22/27	09.57
	15.00	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02	03.24	04.59	06.31	07.57	08.33 12.54-13.22/28	09.59
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.54	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.36 12.54-13.23/29	10.01
	15.05	16.44	18.11	20.43	22.17	23.44	23.26	21.50	20.02	18.16	15.35	14.29
13	09.54 13.29-13.33/4	08.26	06.51	06.02	04.19	02.58	03.29	05.05	06.37	08.03	08.40 12.54-13.23/29	10.03
	15.08	16.47	18.14	20.46	22.20	23.46	23.24	21.47	19.58	18.13	15.32	14.28
14	09.51 13.27-13.37/10	08.23	06.47	05.58	04.16	02.57	03.32	05.08	06.39	08.06	08.43 12.54-13.23/29	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.21	21.43	19.55	18.09	15.29	14.27
15	09.49 13.26-13.39/13	08.20	06.44	05.54	04.12	02.56	03.35	05.11	06.42	08.09	08.46 12.54-13.23/29	10.06
	15.14	16.54	18.20	20.52	22.27	23.49	23.18	21.40	19.51	18.06	15.26	14.27
16	09.47 13.25-13.41/16	08.16	06.40	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.49 12.54-13.23/29	10.08
	15.17	16.57	18.23	20.55	22.30	23.50	23.16	21.37	19.47	18.02	15.23	14.26
17	09.45 13.24-13.43/19	08.13	06.37	05.47	04.06	02.54	03.41	05.17	06.48	08.15	08.53 12.55-13.23/28	10.09
	15.20	17.00	18.26	20.58	22.33	23.51	23.13	21.33	19.44	17.59	15.20	14.26
18	09.42 13.23-13.44/21	08.10	06.33	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56 12.55-13.23/28	10.10
	15.23	17.04	18.29	21.01	22.36	23.52	23.10	21.30	19.40	17.56	15.17	14.26
19	09.40 13.23-13.45/22	08.06	06.30	05.40	04.00	02.54	03.47	05.23	06.54	08.21	08.59 12.56-13.22/26	10.11
	15.26	17.07	18.32	21.04	22.40	23.53	23.07	21.26	19.37	17.52	15.15	14.26
20	09.37 13.23-13.46/23	08.03	06.26	05.37	03.57	02.54	03.50	05.26	06.56	08.24	09.02 12.57-13.23/26	10.12
	15.29	17.10	18.35	21.07	22.43	23.53	23.04	21.23	19.33	17.49	15.12	14.26
21	09.35 13.22-13.47/25	08.00	06.23	05.33	03.54	02.54	03.53	05.29	06.59	08.27	09.05 12.57-13.22/25	10.13
	15.32	17.13	18.38	21.10	22.46	23.54	23.01	21.19	19.30	17.45	15.09	14.26
22	09.32 13.22-13.48/26	07.56	06.19	05.30	03.51	02.54	03.56	05.32	07.02	08.30	09.08 12.59-13.22/23	10.14
	15.35	17.16	18.41	21.14	22.49	23.54	22.58	21.16	19.26	17.42	15.07	14.27
23	09.30 13.22-13.48/26	07.53	06.16	05.26	03.48	02.54	03.59	05.35	07.05	08.33	09.12 12.59-13.21/22	10.14
	15.39	17.19	18.44	21.17	22.52	23.54	22.55	21.12	19.23	17.39	15.04	14.27
24	09.27 13.22-13.49/27	07.50	06.12	05.23	03.45	02.55	04.02	05.38	07.08	08.36	09.15 13.01-13.21/20	10.15
	15.42	17.22	18.47	21.20	22.55	23.54	22.52	21.09	19.19	17.35	15.02	14.28
25	09.24 13.21-13.49/28	07.46	06.09	05.20	03.42	02.56	04.05	05.41	07.11	07.39	09.18 13.02-13.21/19	10.15
	15.45	17.26	18.50	21.23	22.58	23.53	22.49	21.05	19.16	16.32	14.59	14.29
26	09.21 13.21-13.50/29	07.43	06.05	05.16	03.39	02.57	04.08	05.44	07.13	07.42	09.21 13.03-13.19/16	10.15
	15.48	17.29	18.53	21.26	23.01	23.53	22.46	21.02	19.12	16.29	14.57	14.30
27	09.19 13.21-13.50/29	07.39	06.02	05.13	03.36	02.58	04.11	05.47	07.16	07.45	09.24 13.05-13.18/13	10.15
	15.52	17.32	18.55	21.29	23.04	23.52	22.43	20.58	19.09	16.25	14.54	14.31
28	09.16 13.22-13.51/29	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.19	07.49	09.27 13.07-13.17/10	10.14
	15.55	17.35	18.58	21.32	23.07	23.51	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13 13.22-13.51/29		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30 13.10-13.14/4	10.14
	15.58		20.01	21.35	23.10	23.50	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10 13.22-13.51/29		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.32	10.14
	16.01		20.04	21.39	23.13	23.49	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07 13.23-13.51/28		06.47		03.25		04.24	05.59		07.58		10.13
	16.05		20.07		23.16		22.30	20.44		16.12		14.37
Potential sun hours	173	239	363	451	568	621	606	508	393	305	199	139
Sum of minutes with flicker	433	173	0	0	0	0	0	0	0	0	610	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 9 - Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (210)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23 04.41-05.07/26	03.02 04.46-05.12/26	04.27	06.02	07.28	08.01	09.35
	14.39	16.08	17.38	20.10	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.40	04.56	03.20 04.41-05.07/26	03.04 04.47-05.13/26	04.30	06.05	07.31	08.04	09.38
	14.41	16.11	17.41	20.13	21.45	23.22	23.46	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18 04.41-05.07/26	03.06 04.47-05.13/26	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.24	23.45	22.20	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	03.16 04.41-05.07/26	03.08 04.47-05.13/26	04.37	06.11	07.36	08.11	09.43
	14.45	16.18	17.47	20.19	21.51	23.27	23.43	22.17	20.30	18.44	15.59	14.40
5	10.07	08.52	07.19	06.30	04.45	03.13 04.41-05.08/27	03.10 04.48-05.14/26	04.40	06.14	07.39	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.29	23.41	22.14	20.26	18.41	15.56	14.38
6	10.06	08.49	07.15	06.26	04.42	03.11 04.42-05.08/26	03.12 04.47-05.14/27	04.43	06.16	07.42	08.17	09.48
	14.50	16.25	17.53	20.25	21.58	23.32	23.39	22.10	20.23	18.37	15.53	14.37
7	10.05	08.45	07.12	06.23	04.39	03.09 04.41-05.07/26	03.14 04.48-05.14/26	04.46	06.19	07.45	08.20	09.51
	14.52	16.28	17.56	20.28	22.01	23.34	23.37	22.07	20.19	18.34	15.50	14.35
8	10.03	08.42	07.08	06.19	04.35	03.07 04.42-05.08/26	03.17 04.47-05.14/27	04.49	06.22	07.48	08.24	09.53
	14.54	16.31	17.59	20.31	22.04	23.36	23.35	22.04	20.16	18.30	15.47	14.34
9	10.01	08.39	07.05	06.16	04.32	03.05 04.42-05.08/26	03.19 04.48-05.14/26	04.52	06.25	07.51	08.27	09.55
	14.57	16.34	18.02	20.34	22.07	23.39	23.33	22.00	20.12	18.27	15.44	14.32
10	09.59	08.36	07.01	06.12	04.29	03.03 04.42-05.08/26	03.22 04.48-05.14/26	04.56	06.28	07.54	08.30	09.57
	15.00	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02 04.42-05.08/26	03.24 04.49-05.15/26	04.59	06.31	07.57	08.33	09.59
	15.02	16.41	18.08	20.40	22.14	23.43	23.28	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.54	06.05	04.22	03.00 04.43-05.09/26	03.27 04.49-05.15/26	05.02	06.34	08.00	08.36	10.01
	15.05	16.44	18.11	20.43	22.17	23.44	23.26	21.50	20.02	18.16	15.35	14.29
13	09.54	08.26	06.51	06.02	04.19	02.58 04.43-05.09/26	03.30 04.49-05.15/26	05.05	06.37	08.03	08.40	10.03
	15.08	16.47	18.14	20.46	22.20	23.46	23.24	21.47	19.58	18.13	15.32	14.28
14	09.51	08.23	06.47	05.58	04.16	02.57 04.44-05.09/25	03.32 04.50-05.15/25	05.08	06.39	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.23	23.47	23.21	21.43	19.55	18.09	15.29	14.28
15	09.49	08.20	06.44	05.55	04.12	02.56 04.43-05.09/26	03.35 04.50-05.15/25	05.11	06.42	08.09	08.46	10.06
	15.14	16.54	18.20	20.52	22.27	23.49	23.18	21.40	19.51	18.06	15.26	14.27
16	09.47	08.16	06.40	05.51	04.09	02.55 04.44-05.09/25	03.38 04.50-05.14/24	05.14	06.45	08.12	08.49	10.08
	15.17	16.57	18.23	20.55	22.30	23.50	23.16	21.36	19.47	18.02	15.23	14.26
17	09.45	08.13	06.37	05.47	04.06	02.54 04.45-05.10/25	03.41 04.50-05.14/24	05.17	06.48	08.15	08.53	10.09
	15.20	17.00	18.26	20.58	22.33	23.51	23.13	21.33	19.44	17.59	15.20	14.26
18	09.42	08.10	06.33	05.44	04.03 04.50-04.55/5	02.54 04.44-05.09/25	03.44 04.51-05.13/22	05.20	06.51	08.18	08.56	10.10
	15.23	17.04	18.29	21.01	22.36	23.52	23.10	21.30	19.40	17.56	15.17	14.26
19	09.40	08.06	06.30	05.40	04.00 04.47-04.58/11	02.54 04.44-05.09/25	03.47 04.52-05.14/22	05.23	06.54	08.21	08.59	10.11
	15.26	17.07	18.32	21.04	22.40	23.53	23.07	21.26	19.37	17.52	15.15	14.26
20	09.37	08.03	06.26	05.37	03.57 04.46-05.00/14	02.54 04.44-05.10/26	03.50 04.52-05.13/21	05.26	06.56	08.24	09.02	10.12
	15.29	17.10	18.35	21.07	22.43	23.53	23.04	21.23	19.33	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54 04.45-05.01/16	02.54 04.46-05.11/25	03.53 04.53-05.12/19	05.29	06.59	08.27	09.05	10.13
	15.32	17.13	18.38	21.10	22.46	23.54	23.01	21.19	19.30	17.45	15.09	14.26
22	09.32	07.56	06.19	05.30	03.51 04.43-05.01/18	02.54 04.46-05.11/25	03.56 04.54-05.12/18	05.32	07.02	08.30	09.08	10.14
	15.35	17.16	18.41	21.14	22.49	23.54	22.58	21.16	19.26	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48 04.43-05.02/19	02.54 04.45-05.10/25	03.59 04.55-05.11/16	05.35	07.05	08.33	09.11	10.14
	15.39	17.19	18.44	21.17	22.52	23.54	22.55	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.45 04.42-05.03/21	02.55 04.46-05.11/25	04.02 04.56-05.09/13	05.38	07.08	08.36	09.15	10.14
	15.42	17.22	18.47	21.20	22.55	23.54	22.52	21.09	19.19	17.35	15.02	14.28
25	09.24	07.46	06.09	05.20	03.42 04.42-05.04/22	02.56 04.46-05.11/25	04.05 04.59-05.07/8	05.41	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.58	23.53	22.49	21.05	19.16	16.32	14.59	14.29
26	09.21	07.43	06.05	05.16	03.39 04.42-05.05/23	02.57 04.46-05.12/26	04.08	05.44	07.14	07.42	09.21	10.15
	15.48	17.29	18.53	21.26	23.01	23.53	22.46	21.02	19.12	16.29	14.57	14.30
27	09.19	07.39	06.02	05.13	03.36 04.41-05.05/24	02.58 04.46-05.11/25	04.12	05.47	07.16	07.45	09.24	10.15
	15.52	17.32	18.55	21.29	23.04	23.52	22.43	20.58	19.09	16.25	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33 04.41-05.05/24	02.59 04.46-05.11/25	04.15	05.50	07.19	07.49	09.27	10.14
	15.55	17.35	18.58	21.32	23.07	23.51	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.31 04.41-05.06/25	03.01 04.46-05.12/26	04.18	05.53	07.22	07.52	09.30	10.14
	15.58		20.01	21.35	23.10	23.50	22.37	20.51	19.02	16.19	14.50	14.34
30	09.10		06.51	05.02	03.28 04.41-05.06/25	03.01 04.46-05.12/26	04.21	05.56	07.25	07.55	09.32	10.13
	16.02		20.04	21.39	23.13	23.49	22.33	20.48	18.58	16.16	14.48	14.35
31	09.07		06.47		03.25 04.40-05.06/26		04.24	05.59		07.58		10.13
	16.05		20.07		23.16		22.30	20.44		16.12		14.37
Potential sun hours	173	239	363	450	568	621	606	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	273	769	577	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 10 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (181)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.01	09.36
	14.39	16.08	17.38	20.10	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.41	04.56	03.20	03.04	04.30	06.05	07.31	08.05	09.38
	14.41	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18	03.05	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.25	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.27	23.44	22.18	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.40	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.06	08.49	07.16	06.26	04.42	03.11	03.12	04.43	06.17	07.42	08.17	09.49
	14.49	16.25	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.19	07.45	08.21	09.51
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.03	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	17.59	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.02	08.39	07.05	06.16	04.32	03.05	03.19	04.52	06.25	07.51	08.27	09.56
	14.57	16.34	18.02	20.34	22.08	23.39	23.34	22.01	20.12	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.30	09.58
	15.00	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.17	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.16	02.56	03.32	05.08	06.40	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.21	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.42	08.09	08.46	10.07
	15.14	16.54	18.20	20.52	22.27	23.49	23.19	21.40	19.51	18.06	15.26	14.27
16	09.47	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.08
	15.17	16.57	18.23	20.55	22.30	23.51	23.16	21.37	19.48	18.03	15.23	14.26
17	09.45	08.13	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.00	18.26	20.58	22.34	23.52	23.13	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.01	22.37	23.53	23.11	21.30	19.41	17.56	15.17	14.26
19	09.40	08.07	06.30	05.41	04.00	02.53	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.53	23.08	21.26	19.37	17.52	15.15	14.26
20	09.38	08.03	06.26	05.37	03.57	02.53	03.50	05.26	06.57	08.24	09.02	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54	02.53	03.53	05.29	06.59	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.46	15.09	14.26
22	09.33	07.57	06.19	05.30	03.50	02.54	03.56	05.32	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.49	23.54	22.59	21.16	19.26	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.47	02.54	03.59	05.35	07.05	08.33	09.12	10.15
	15.39	17.19	18.44	21.17	22.53	23.54	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.45	02.55	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.54	22.53	21.09	19.19	17.35	15.02	14.28
25	09.24	07.46	06.09	05.20	03.42	02.56	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.05	19.16	16.32	14.59	14.29
26	09.22	07.43	06.05	05.16	03.39	02.56	04.08	05.44	07.14	07.43	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.53	22.47	21.02	19.12	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.11	05.47	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.05	23.53	22.43	20.58	19.09	16.25	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.14
	15.58		20.02	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.07		23.17		22.31	20.44		16.12		14.37
Potential sun hours	172	238	363	451	568	621	607	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 11 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (182)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.22	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.10	21.42	23.20	23.49	22.27	20.41	18.55	16.09	14.46
2	10.12	09.01	07.29	06.41	04.56	03.20	03.03	04.30	06.05	07.31	08.05	09.39
	14.41	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18	03.05	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.28	23.44	22.18	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.40	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16	06.26	04.42	03.11	03.12	04.43	06.17	07.43	08.18	09.49
	14.49	16.25	17.53	20.25	21.58	23.33	23.40	22.11	20.23	18.37	15.53	14.36
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.19	07.45	08.21	09.51
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.03	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	17.59	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.52	06.25	07.51	08.27	09.56
	14.57	16.34	18.02	20.34	22.08	23.39	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.30	09.58
	14.59	16.38	18.05	20.37	22.11	23.41	23.32	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.01	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.18	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.16	02.56	03.32	05.08	06.40	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.22	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.42	08.09	08.47	10.07
	15.14	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.08
	15.17	16.57	18.23	20.55	22.30	23.51	23.16	21.37	19.48	18.03	15.23	14.26
17	09.45	08.13	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.00	18.26	20.58	22.34	23.52	23.13	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.17	14.26
19	09.40	08.07	06.30	05.41	04.00	02.53	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.26	19.37	17.52	15.15	14.26
20	09.38	08.03	06.27	05.37	03.57	02.53	03.50	05.26	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.53	02.53	03.53	05.29	06.59	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.20	19.30	17.46	15.09	14.26
22	09.33	07.57	06.19	05.30	03.50	02.54	03.56	05.32	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.26	17.42	15.07	14.26
23	09.30	07.53	06.16	05.27	03.47	02.54	03.59	05.35	07.05	08.33	09.12	10.15
	15.39	17.19	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.44	02.55	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.54	22.53	21.09	19.19	17.35	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.55	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.05	05.16	03.39	02.56	04.08	05.44	07.14	07.43	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.54	22.47	21.02	19.12	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.57	04.11	05.47	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.58	19.09	16.25	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.01		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.08		23.17		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 12 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (183)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.04	07.33	06.44	04.59	03.22	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.10	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.46
2	10.12	09.01	07.29	06.41	04.55	03.20	03.03	04.30	06.05	07.31	08.05	09.39
	14.41	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.11	08.58	07.26	06.37	04.52	03.17	03.05	04.33	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.23	06.33	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.28	23.44	22.18	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.40	08.14	09.47
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16	06.26	04.42	03.11	03.11	04.43	06.17	07.43	08.18	09.49
	14.49	16.25	17.53	20.25	21.58	23.33	23.40	22.11	20.23	18.37	15.53	14.36
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.19	07.45	08.21	09.51
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	17.59	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.33
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.52	06.25	07.51	08.27	09.56
	14.57	16.34	18.02	20.34	22.08	23.39	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.30	09.58
	14.59	16.38	18.05	20.37	22.11	23.42	23.32	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.01	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.26	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.18	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.15	02.56	03.32	05.08	06.40	08.06	08.43	10.06
	15.11	16.51	18.17	20.49	22.24	23.48	23.22	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.42	08.09	08.47	10.07
	15.14	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.54	03.38	05.14	06.45	08.12	08.50	10.09
	15.17	16.57	18.23	20.55	22.31	23.51	23.16	21.37	19.48	18.03	15.23	14.26
17	09.45	08.13	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.00	18.26	20.59	22.34	23.52	23.14	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.53	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.17	14.26
19	09.40	08.07	06.30	05.41	04.00	02.53	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.27	19.37	17.52	15.15	14.26
20	09.38	08.03	06.27	05.37	03.56	02.53	03.50	05.26	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.53	02.53	03.53	05.29	06.59	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.46	23.55	23.02	21.20	19.30	17.46	15.09	14.26
22	09.33	07.57	06.19	05.30	03.50	02.53	03.56	05.32	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.26	17.42	15.07	14.26
23	09.30	07.53	06.16	05.27	03.47	02.54	03.59	05.35	07.05	08.33	09.12	10.15
	15.39	17.19	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.44	02.54	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.55	22.53	21.09	19.19	17.35	15.02	14.28
25	09.25	07.47	06.09	05.20	03.41	02.55	04.05	05.41	07.11	07.40	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.28
26	09.22	07.43	06.05	05.16	03.39	02.56	04.08	05.44	07.14	07.43	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.54	22.47	21.02	19.12	16.29	14.57	14.29
27	09.19	07.40	06.02	05.13	03.36	02.57	04.11	05.47	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.25	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.14	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.01		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.14
	16.05		20.08		23.17		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	138
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 13 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (184)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.04	07.33	06.44	04.59	03.22	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.11	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.46
2	10.12	09.01	07.29	06.41	04.56	03.20	03.03	04.30	06.05	07.31	08.05	09.39
	14.41	16.11	17.41	20.14	21.45	23.23	23.47	22.24	20.37	18.51	16.06	14.44
3	10.11	08.58	07.26	06.37	04.52	03.17	03.05	04.33	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.10	08.55	07.23	06.33	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.28	23.44	22.18	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.40	08.14	09.47
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16	06.26	04.42	03.11	03.11	04.43	06.17	07.43	08.18	09.49
	14.49	16.25	17.53	20.25	21.58	23.33	23.40	22.11	20.23	18.37	15.53	14.36
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.45	08.21	09.52
	14.52	16.28	17.56	20.28	22.02	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	17.59	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.33
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.52	06.25	07.51	08.27	09.56
	14.57	16.34	18.02	20.34	22.08	23.40	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.31	09.58
	14.59	16.38	18.05	20.37	22.11	23.42	23.32	21.58	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.01	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.08	20.40	22.14	23.44	23.29	21.54	20.06	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.26	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.18	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.15	02.56	03.32	05.08	06.40	08.06	08.43	10.06
	15.11	16.51	18.17	20.49	22.24	23.49	23.22	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.42	08.09	08.47	10.07
	15.14	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.54	03.38	05.14	06.45	08.12	08.50	10.09
	15.17	16.57	18.23	20.56	22.31	23.51	23.16	21.37	19.48	18.03	15.23	14.26
17	09.45	08.14	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.00	18.26	20.59	22.34	23.52	23.14	21.34	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.53	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.17	14.26
19	09.41	08.07	06.30	05.41	04.00	02.53	03.47	05.23	06.54	08.21	09.00	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.27	19.37	17.52	15.15	14.26
20	09.38	08.04	06.27	05.37	03.56	02.53	03.50	05.26	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.53	02.53	03.53	05.29	07.00	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.47	23.55	23.02	21.20	19.30	17.46	15.09	14.26
22	09.33	07.57	06.19	05.30	03.50	02.53	03.56	05.32	07.02	08.30	09.09	10.15
	15.35	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.27	17.42	15.07	14.26
23	09.30	07.53	06.16	05.27	03.47	02.54	03.59	05.35	07.05	08.33	09.12	10.15
	15.39	17.19	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.44	02.54	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.55	22.53	21.09	19.19	17.35	15.02	14.28
25	09.25	07.47	06.09	05.20	03.41	02.55	04.05	05.41	07.11	07.40	09.18	10.16
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.28
26	09.22	07.43	06.05	05.16	03.39	02.56	04.08	05.44	07.14	07.43	09.21	10.16
	15.48	17.29	18.53	21.26	23.02	23.54	22.47	21.02	19.12	16.29	14.57	14.29
27	09.19	07.40	06.02	05.13	03.36	02.57	04.11	05.47	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.25	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.14	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.41	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.52	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.01		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.14
	16.05		20.08		23.17		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	138
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 14 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (185)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.04	07.33 15.58-16.29/31	06.44	04.59	03.22	03.01	04.27	06.02	07.28 16.49-16.53/4	08.02	09.36
	14.38	16.08	17.38	20.10	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.45
2	10.12	09.01	07.29 15.58-16.28/30	06.40	04.55	03.20	03.03	04.30	06.05	07.31 16.43-16.58/15	08.05	09.39
	14.40	16.11	17.41	20.13	21.45	23.23	23.48	22.24	20.37	18.51	16.06	14.43
3	10.11	08.58	07.26 15.58-16.29/31	06.37	04.52	03.17	03.05	04.33	06.08	07.34 16.40-17.00/20	08.08	09.41
	14.42	16.15	17.44	20.16	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.41
4	10.09	08.55	07.22 15.58-16.28/30	06.33	04.49	03.15	03.07	04.37	06.11	07.37 16.38-17.01/23	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.28	23.44	22.18	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19 15.57-16.27/30	06.30	04.45	03.13	03.09	04.40	06.14	07.40 16.37-17.02/25	08.14	09.47
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16 15.58-16.27/29	06.26	04.42	03.10	03.11	04.43	06.17	07.43 16.35-17.02/27	08.18	09.49
	14.49	16.25	17.53	20.25	21.58	23.33	23.40	22.11	20.23	18.37	15.53	14.36
7	10.05	08.46	07.12 15.58-16.26/28	06.23	04.38	03.08	03.14	04.46	06.19	07.45 16.34-17.03/29	08.21	09.52
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43	07.09 15.59-16.25/26	06.19	04.35	03.06	03.16	04.49	06.22	07.48 16.33-17.03/30	08.24	09.54
	14.54	16.31	17.59	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.33
9	10.02	08.40	07.05 16.00-16.24/24	06.16	04.32	03.05	03.18	04.52	06.25	07.51 16.32-17.03/31	08.27	09.56
	14.57	16.34	18.02	20.34	22.08	23.40	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.36	07.02 16.01-16.22/21	06.12	04.28	03.03	03.21	04.55	06.28	07.54 16.32-17.03/31	08.30	09.58
	14.59	16.38	18.05	20.37	22.11	23.42	23.32	21.58	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58 16.03-16.19/16	06.09	04.25	03.01	03.24	04.59	06.31	07.57 16.31-17.02/31	08.34	10.00
	15.02	16.41	18.08	20.40	22.14	23.44	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55 16.07-16.16/9	06.05	04.22	03.00	03.26	05.02	06.34	08.00 16.31-17.02/31	08.37	10.02
	15.05	16.44	18.11	20.43	22.18	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03 16.31-17.01/30	08.40	10.04
	15.08	16.47	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.15	02.56	03.32	05.08	06.39	08.06 16.32-17.01/29	08.43	10.06
	15.11	16.51	18.17	20.49	22.24	23.49	23.22	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.42	08.09 16.32-17.00/28	08.47	10.07
	15.13	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.26
16	09.48	08.17	06.41	05.51	04.09	02.54	03.38	05.14	06.45	08.12 16.32-16.59/27	08.50	10.09
	15.16	16.57	18.23	20.55	22.31	23.51	23.16	21.37	19.48	18.03	15.23	14.26
17	09.45	08.13	06.37	05.47	04.06	02.54	03.40	05.17	06.48	08.15 16.33-16.58/25	08.53	10.10
	15.20	17.00	18.26	20.59	22.34	23.52	23.14	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.53	03.43	05.20	06.51	08.18 16.35-16.57/22	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.17	14.25
19	09.40	08.07	06.30	05.40	03.59	02.53	03.46	05.23	06.54	08.21 16.36-16.55/19	09.00	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.27	19.37	17.52	15.15	14.25
20	09.38	08.03	06.26	05.37	03.56	02.53	03.49	05.26	06.57	08.24 16.37-16.52/15	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00 16.09-16.19/10	06.23	05.33	03.53	02.53	03.52	05.29	06.59	08.27 16.42-16.48/6	09.06	10.14
	15.32	17.13	18.38	21.11	22.47	23.55	23.02	21.20	19.30	17.45	15.09	14.26
22	09.33	07.57 16.06-16.22/16	06.19	05.30	03.50	02.53	03.56	05.32	07.02	08.30	09.09	10.15
	15.35	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.26	17.42	15.06	14.26
23	09.30	07.53 16.04-16.24/20	06.16	05.26	03.47	02.54	03.59	05.35	07.05	08.33	09.12	10.15
	15.38	17.19	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.27	07.50 16.02-16.26/24	06.12	05.23	03.44	02.54	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.22	18.47	21.20	22.56	23.55	22.53	21.09	19.19	17.35	15.01	14.27
25	09.25	07.47 16.01-16.26/25	06.09	05.20	03.41	02.55	04.05	05.41	07.11	07.40	09.18	10.16
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.28
26	09.22	07.43 16.00-16.28/28	06.05	05.16	03.38	02.56	04.08	05.44	07.14	07.43	09.21	10.16
	15.48	17.29	18.53	21.26	23.02	23.54	22.47	21.02	19.12	16.29	14.56	14.29
27	09.19	07.40 15.59-16.28/29	06.02	05.13	03.36	02.57	04.11	05.47	07.17	07.46	09.24	10.15
	15.51	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.25	14.54	14.30
28	09.16	07.36 15.58-16.28/30	05.58	05.09	03.33	02.58	04.14	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.41	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.27	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.01		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.15	14.47	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.14
	16.05		20.08		23.17		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	569	622	607	508	393	305	199	138
Sum of minutes with flicker	0	182	305	0	0	0	0	0	0	498	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 15 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (186)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.04 14.09-14.36/27	07.33	06.44	04.59	03.22	03.01	04.27	06.02	07.28	08.01 13.37-14.09/32	09.36
	14.38	16.08	17.38	20.10	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.45
2	10.12	09.01 14.09-14.37/28	07.29	06.40	04.55	03.20	03.03	04.30	06.05	07.31	08.05 13.37-14.09/32	09.39
	14.40	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.43
3	10.11	08.58 14.08-14.37/29	07.26	06.37	04.52	03.17	03.05	04.33	06.08	07.34	08.08 13.37-14.09/32	09.41
	14.42	16.15	17.44	20.16	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.41
4	10.09	08.55 14.07-14.38/31	07.22	06.33	04.49	03.15	03.07	04.37	06.11	07.37	08.11 13.37-14.09/32	09.44
	14.45	16.18	17.47	20.19	21.52	23.28	23.44	22.18	20.30	18.44	15.59	14.40
5	10.08	08.52 14.08-14.39/31	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.40	08.14 13.37-14.09/32	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.07	08.49 14.08-14.39/31	07.16	06.26	04.42	03.10	03.11	04.43	06.17	07.42	08.17 13.38-14.08/30	09.49
	14.49	16.24	17.53	20.25	21.58	23.33	23.40	22.11	20.23	18.37	15.53	14.36
7	10.05	08.46 14.07-14.39/32	07.12	06.23	04.38	03.08	03.14	04.46	06.19	07.45	08.21 13.38-14.08/30	09.51
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43 14.07-14.39/32	07.09	06.19	04.35	03.06	03.16	04.49	06.22	07.48	08.24 13.39-14.08/29	09.54
	14.54	16.31	17.59	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.33
9	10.02	08.40 14.08-14.40/32	07.05	06.16	04.32	03.05	03.18	04.52	06.25	07.51	08.27 13.39-14.07/28	09.56
	14.57	16.34	18.02	20.34	22.08	23.39	23.34	22.01	20.12	18.27	15.44	14.32
10	10.00	08.36 14.08-14.39/31	07.02	06.12	04.28	03.03	03.21	04.55	06.28	07.54	08.30 13.40-14.07/27	09.58
	14.59	16.38	18.05	20.37	22.11	23.42	23.32	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33 14.08-14.39/31	06.58	06.09	04.25	03.01	03.24	04.59	06.31	07.57	08.34 13.41-14.06/25	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30 14.08-14.38/30	06.55	06.05	04.22	03.00	03.26	05.02	06.34	08.00	08.37 13.42-14.05/23	10.02
	15.05	16.44	18.11	20.43	22.18	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27 14.09-14.38/29	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40 13.43-14.03/20	10.04
	15.08	16.47	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23 14.10-14.38/28	06.48	05.58	04.15	02.56	03.32	05.08	06.39	08.06	08.43 13.46-14.03/17	10.06
	15.11	16.51	18.17	20.49	22.24	23.48	23.22	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20 14.10-14.36/26	06.44	05.54	04.12	02.55	03.35	05.11	06.42	08.09	08.47 13.48-14.00/12	10.07
	15.13	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.26
16	09.48	08.17 14.12-14.36/24	06.41	05.51	04.09	02.54	03.38	05.14	06.45	08.12	08.50 13.52-13.56/4	10.09
	15.16	16.57	18.23	20.55	22.30	23.51	23.16	21.37	19.48	18.02	15.23	14.26
17	09.45	08.13 14.13-14.34/21	06.37	05.47	04.06	02.54	03.40	05.17	06.48	08.15	08.53	10.10
	15.20	17.00	18.26	20.58	22.34	23.52	23.14	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10 14.15-14.32/17	06.33	05.44	04.03	02.53	03.43	05.20	06.51	08.18	08.56	10.11
	15.23	17.03	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.17	14.25
19	09.40	08.07 14.19-14.29/10	06.30	05.40	03.59	02.53	03.46	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.26	19.37	17.52	15.15	14.25
20	09.38	08.03	06.26	05.37	03.56	02.53	03.49	05.26	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.33	17.49	15.12	14.26
21	09.35	08.00	06.23	05.33	03.53	02.53	03.53	05.29	06.59	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.46	23.55	23.02	21.19	19.30	17.45	15.09	14.26
22	09.33	07.57	06.19	05.30	03.50	02.53	03.56	05.32	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.26	17.42	15.06	14.26
23	09.30	07.53	06.16	05.26	03.47	02.54	03.59	05.35	07.05	08.33 14.48-15.00/12	09.12	10.15
	15.38	17.19	18.44	21.17	22.53	23.55	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.44	02.54	04.02	05.38	07.08	08.36 14.45-15.02/17	09.15	10.15
	15.42	17.22	18.47	21.20	22.56	23.55	22.53	21.09	19.19	17.35	15.01	14.27
25	09.25	07.46	06.09	05.19	03.41	02.55	04.05	05.41	07.11	07.39 13.43-14.05/22	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.05	19.16	16.32	14.59	14.28
26	09.22 14.19-14.23/4	07.43	06.05	05.16	03.38	02.56	04.08	05.44	07.14	07.43 13.41-14.05/24	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.54	22.47	21.02	19.12	16.29	14.56	14.29
27	09.19 14.15-14.28/13	07.40	06.02	05.13	03.36	02.57	04.11	05.47	07.16	07.46 13.40-14.07/27	09.24	10.15
	15.51	17.32	18.56	21.29	23.05	23.53	22.44	20.58	19.09	16.25	14.54	14.30
28	09.16 14.13-14.30/17	07.36	05.58	05.09	03.33	02.58	04.14	05.50	07.19	07.49 13.39-14.07/28	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13 14.12-14.32/20		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52 13.38-14.08/30	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10 14.10-14.33/23		06.51	05.02	03.27	03.00	04.21	05.56	07.25	07.55 13.38-14.09/31	09.33	10.14
	16.01		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.15	14.47	14.35
31	09.07 14.10-14.35/25		06.48		03.25		04.24	05.59		07.58 13.37-14.08/31		10.14
	16.05		20.07		23.17		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	138
Sum of minutes with flicker	102	520	0	0	0	0	0	0	0	222	405	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 16 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (187)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.22	03.02	04.27	06.02	07.28	08.01	09.36
	14.39	16.08	17.38	20.10	21.42	23.20	23.49	22.27	20.41	18.55	16.09	14.45
2	10.12	09.01	07.29	06.40	04.55	03.20	03.03	04.30	06.05	07.31	08.05	09.38
	14.41	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.43
3	10.10	08.58	07.26	06.37	04.52	03.17	03.05	04.33	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.28	23.44	22.18	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.40	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.07	08.49	07.15	06.26	04.42	03.11	03.11	04.43	06.17	07.42	08.17	09.49
	14.49	16.25	17.53	20.25	21.58	23.33	23.40	22.11	20.23	18.37	15.53	14.36
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.19	07.45	08.21	09.51
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.03	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	17.59	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.33
9	10.02	08.39	07.05	06.16	04.32	03.05	03.19	04.52	06.25	07.51	08.27	09.56
	14.57	16.34	18.02	20.34	22.08	23.39	23.34	22.01	20.12	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.03	03.21	04.55	06.28	07.54	08.30	09.58
	14.59	16.38	18.05	20.37	22.11	23.41	23.32	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.01	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.26	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.17	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.47	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.15	02.56	03.32	05.08	06.39	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.22	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.42	08.09	08.47	10.07
	15.14	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.27
16	09.47	08.17	06.41	05.51	04.09	02.54	03.38	05.14	06.45	08.12	08.50	10.08
	15.17	16.57	18.23	20.55	22.30	23.51	23.16	21.37	19.48	18.02	15.23	14.26
17	09.45	08.13	06.37	05.47	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.00	18.26	20.58	22.34	23.52	23.13	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10	06.33	05.44	04.03	02.53	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.01	22.37	23.53	23.11	21.30	19.41	17.56	15.17	14.26
19	09.40	08.07	06.30	05.40	04.00	02.53	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.26	19.37	17.52	15.15	14.26
20	09.38	08.03	06.26	05.37	03.56	02.53	03.50	05.26	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.33	17.49	15.12	14.26
21	09.35	08.00	06.23	05.33	03.53	02.53	03.53	05.29	06.59	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.45	15.09	14.26
22	09.33	07.57	06.19	05.30	03.50	02.53	03.56	05.32	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.26	17.42	15.07	14.26
23	09.30	07.53	06.16	05.26	03.47	02.54	03.59	05.35	07.05	08.33	09.12	10.15
	15.38	17.19	18.44	21.17	22.53	23.55	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.44	02.54	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.22	18.47	21.20	22.56	23.54	22.53	21.09	19.19	17.35	15.01	14.28
25	09.25	07.46	06.09	05.20	03.41	02.55	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.05	19.16	16.32	14.59	14.28
26	09.22	07.43	06.05	05.16	03.39	02.56	04.08	05.44	07.14	07.43	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.54	22.47	21.02	19.12	16.29	14.57	14.29
27	09.19	07.40	06.02	05.13	03.36	02.57	04.11	05.47	07.16	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.05	23.53	22.44	20.58	19.09	16.25	14.54	14.30
28	09.16	07.36	05.58	05.09	03.33	02.59	04.14	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.27	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.01		20.04	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.07		23.17		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	138
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 17 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (188)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.22	03.02	04.27	06.02	07.28	08.01	09.36
	14.39	16.08	17.38	20.10	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.40	04.55	03.20	03.03	04.30	06.05	07.31	08.05	09.38
	14.41	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.17	03.05	04.33	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.25	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.27	23.44	22.17	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.40	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.06	08.49	07.15	06.26	04.42	03.11	03.12	04.43	06.17	07.42	08.17	09.49
	14.49	16.25	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.36
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.19	07.45	08.21	09.51
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.07	20.20	18.34	15.50	14.35
8	10.03	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	17.59	20.31	22.04	23.37	23.36	22.04	20.16	18.30	15.47	14.33
9	10.02	08.39	07.05	06.16	04.32	03.05	03.19	04.52	06.25	07.51	08.27	09.56
	14.57	16.34	18.02	20.34	22.08	23.39	23.34	22.01	20.12	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.30	09.58
	14.59	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.01	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05 19.51-20.00/9	04.22	03.00	03.26	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.17	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.26	06.51	06.02 19.48-20.02/14	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.47	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58 19.46-20.04/18	04.15	02.56	03.32	05.08 19.56-20.04/8	06.39	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.21	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20	06.44	05.55 19.45-20.05/20	04.12	02.55	03.35	05.11 19.53-20.06/13	06.42	08.09	08.46	10.07
	15.14	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.27
16	09.47	08.17	06.41	05.51 19.43-20.05/22	04.09	02.55	03.38	05.14 19.51-20.08/17	06.45	08.12	08.50	10.08
	15.17	16.57	18.23	20.55	22.30	23.51	23.16	21.37	19.48	18.02	15.23	14.26
17	09.45	08.13	06.37	05.47 19.43-20.06/23	04.06	02.54	03.41	05.17 19.49-20.08/19	06.48	08.15	08.53	10.10
	15.20	17.00	18.26	20.58	22.34	23.52	23.13	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10	06.33	05.44 19.42-20.06/24	04.03	02.54	03.44	05.20 19.48-20.09/21	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.01	22.37	23.53	23.11	21.30	19.41	17.56	15.17	14.26
19	09.40	08.07	06.30	05.40 19.41-20.06/25	04.00	02.53	03.47	05.23 19.47-20.10/23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.53	23.08	21.26	19.37	17.52	15.15	14.26
20	09.38	08.03	06.26	05.37 19.41-20.06/25	03.56	02.53	03.50	05.26 19.47-20.11/24	06.57	08.24	09.02	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.33	17.49	15.12	14.26
21	09.35	08.00	06.23	05.33 19.41-20.06/25	03.53	02.53	03.53	05.29 19.46-20.10/24	06.59	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.45	15.09	14.26
22	09.33	07.57	06.19	05.30 19.41-20.05/24	03.50	02.54	03.56	05.32 19.45-20.10/25	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.49	23.54	22.59	21.16	19.26	17.42	15.07	14.26
23	09.30	07.53	06.16	05.27 19.42-20.05/23	03.47	02.54	03.59	05.35 19.45-20.10/25	07.05	08.33	09.12	10.15
	15.39	17.19	18.44	21.17	22.53	23.54	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23 19.41-20.03/22	03.44	02.55	04.02	05.38 19.45-20.09/24	07.08	08.36	09.15	10.15
	15.42	17.22	18.47	21.20	22.56	23.54	22.53	21.09	19.19	17.35	15.02	14.28
25	09.24	07.46	06.09	05.20 19.42-20.03/21	03.41	02.55	04.05	05.41 19.45-20.09/24	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.05	19.16	16.32	14.59	14.28
26	09.22	07.43	06.05	05.16 19.43-20.02/19	03.39	02.56	04.08	05.44 19.45-20.09/24	07.14	07.42	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.53	22.47	21.02	19.12	16.29	14.57	14.29
27	09.19	07.40	06.02	05.13 19.44-20.00/16	03.36	02.57	04.11	05.47 19.46-20.08/22	07.16	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.05	23.53	22.43	20.58	19.09	16.25	14.54	14.31
28	09.16	07.36	05.58	05.09 19.46-19.58/12	03.33	02.59	04.14	05.50 19.46-20.06/20	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06 19.50-19.55/5	03.30	03.00	04.18	05.53 19.47-20.05/18	07.22	07.52	09.30	10.14
	15.58		20.02	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56 19.48-20.03/15	07.25	07.55	09.33	10.14
	16.01		20.04	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59 19.51-20.00/9		07.58		10.13
	16.05		20.07		23.17		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	568	621	607	508	393	305	199	139
Sum of minutes with flicker	0	0	0	347	0	0	0	355	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 18 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (189)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March		April		May	June	July	August	September		October	November	December
1	10.12	09.04	07.33		06.44	18.18-18.40/22	04.59	03.22	03.02	04.27	06.02		07.28	08.01	09.36
	14.39	16.08	17.38		20.10		21.42	23.19	23.48	22.27	20.41		18.55	16.09	14.46
2	10.11	09.01	07.29		06.40	18.19-18.37/18	04.55	03.20	03.04	04.30	06.05		07.31	08.05	09.38
	14.41	16.11	17.41		20.13		21.45	23.22	23.47	22.24	20.37		18.51	16.06	14.44
3	10.10	08.58	07.26		06.37	18.22-18.35/13	04.52	03.18	03.05	04.34	06.08		07.34	08.08	09.41
	14.43	16.15	17.44		20.16		21.48	23.25	23.45	22.21	20.34		18.48	16.03	14.42
4	10.09	08.55	07.22		06.33		04.49	03.15	03.07	04.37	06.11		07.37	08.11	09.44
	14.45	16.18	17.47		20.19		21.52	23.27	23.44	22.17	20.30		18.44	15.59	14.40
5	10.08	08.52	07.19		06.30		04.45	03.13	03.09	04.40	06.14		07.39	08.14	09.46
	14.47	16.21	17.50		20.22		21.55	23.30	23.42	22.14	20.27		18.41	15.56	14.38
6	10.06	08.49	07.15		06.26		04.42	03.11	03.12	04.43	06.17		07.42	08.17	09.49
	14.49	16.25	17.53		20.25		21.58	23.32	23.40	22.11	20.23		18.37	15.53	14.37
7	10.05	08.46	07.12		06.23		04.39	03.09	03.14	04.46	06.19		07.45	08.21	09.51
	14.52	16.28	17.56		20.28		22.01	23.35	23.38	22.07	20.19		18.34	15.50	14.35
8	10.03	08.43	07.08		06.19		04.35	03.07	03.16	04.49	06.22		07.48	08.24	09.53
	14.54	16.31	17.59		20.31		22.04	23.37	23.36	22.04	20.16		18.30	15.47	14.34
9	10.02	08.39	07.05		06.16		04.32	03.05	03.19	04.52	06.25	18.16-18.28/12	07.51	08.27	09.56
	14.57	16.34	18.02		20.34		22.08	23.39	23.34	22.01	20.12		18.27	15.44	14.32
10	10.00	08.36	07.01		06.12		04.29	03.03	03.21	04.56	06.28	18.13-18.30/17	07.54	08.30	09.58
	15.00	16.38	18.05		20.37		22.11	23.41	23.31	21.57	20.09		18.23	15.41	14.31
11	09.58	08.33	06.58		06.09		04.25	03.02	03.24	04.59	06.31	18.11-18.32/21	07.57	08.33	10.00
	15.02	16.41	18.08		20.40		22.14	23.43	23.29	21.54	20.05		18.20	15.38	14.30
12	09.56	08.30	06.55		06.05		04.22	03.00	03.27	05.02	06.34	18.08-18.32/24	08.00	08.37	10.02
	15.05	16.44	18.11		20.43		22.17	23.45	23.26	21.50	20.02		18.16	15.35	14.29
13	09.54	08.26	06.51		06.02		04.19	02.57	03.29	05.05	06.37	18.07-18.33/26	08.03	08.40	10.03
	15.08	16.47	18.14		20.46		22.21	23.46	23.24	21.47	19.58		18.13	15.32	14.28
14	09.52	08.23	06.47		05.58		04.16	02.56	03.32	05.08	06.39	18.06-18.33/27	08.06	08.43	10.05
	15.11	16.51	18.17		20.49		22.24	23.48	23.21	21.44	19.55		18.09	15.29	14.27
15	09.50	08.20	06.44		05.55		04.12	02.55	03.35	05.11	06.42	18.05-18.34/29	08.09	08.46	10.07
	15.14	16.54	18.20		20.52		22.27	23.49	23.19	21.40	19.51		18.06	15.26	14.27
16	09.47	08.17	06.40		05.51		04.09	02.55	03.38	05.14	06.45	18.05-18.34/29	08.12	08.50	10.08
	15.17	16.57	18.23		20.55		22.30	23.51	23.16	21.37	19.48		18.02	15.23	14.26
17	09.45	08.13	06.37	17.27-17.40/13	05.47		04.06	02.54	03.41	05.17	06.48	18.04-18.33/29	08.15	08.53	10.09
	15.20	17.00	18.26		20.58		22.33	23.52	23.13	21.33	19.44		17.59	15.20	14.26
18	09.43	08.10	06.33	17.24-17.42/18	05.44		04.03	02.54	03.44	05.20	06.51	18.03-18.33/30	08.18	08.56	10.11
	15.23	17.04	18.29		21.01		22.37	23.52	23.10	21.30	19.40		17.56	15.17	14.26
19	09.40	08.07	06.30	17.22-17.44/22	05.40		04.00	02.53	03.47	05.23	06.54	18.03-18.33/30	08.21	08.59	10.12
	15.26	17.07	18.32		21.04		22.40	23.53	23.08	21.26	19.37		17.52	15.15	14.26
20	09.38	08.03	06.26	17.20-17.44/24	05.37		03.57	02.53	03.50	05.26	06.57	18.03-18.32/29	08.24	09.02	10.13
	15.29	17.10	18.35		21.08		22.43	23.54	23.05	21.23	19.33		17.49	15.12	14.26
21	09.35	08.00	06.23	17.18-17.45/27	05.33		03.53	02.53	03.53	05.29	06.59	18.04-18.32/28	08.27	09.06	10.13
	15.32	17.13	18.38		21.11		22.46	23.54	23.02	21.19	19.30		17.45	15.09	14.26
22	09.32	07.57	06.19	17.18-17.46/28	05.30		03.50	02.54	03.56	05.32	07.02	18.03-18.30/27	08.30	09.09	10.14
	15.35	17.16	18.41		21.14		22.49	23.54	22.59	21.16	19.26		17.42	15.07	14.27
23	09.30	07.53	06.16	17.17-17.45/28	05.27		03.47	02.54	03.59	05.35	07.05	18.04-18.29/25	08.33	09.12	10.14
	15.39	17.19	18.44		21.17		22.52	23.54	22.56	21.12	19.23		17.39	15.04	14.27
24	09.27	07.50	06.12	17.17-17.46/29	05.23		03.44	02.55	04.02	05.38	07.08	18.05-18.27/22	08.36	09.15	10.15
	15.42	17.22	18.47		21.20		22.56	23.54	22.53	21.09	19.19		17.35	15.02	14.28
25	09.24	07.46	06.09	17.16-17.45/29	05.20		03.42	02.56	04.05	05.41	07.11	18.06-18.25/19	07.39	09.18	10.15
	15.45	17.26	18.50		21.23		22.59	23.54	22.50	21.05	19.16		16.32	14.59	14.29
26	09.22	07.43	06.05	17.16-17.45/29	05.16		03.39	02.56	04.08	05.44	07.14	18.08-18.23/15	07.42	09.21	10.15
	15.48	17.29	18.53		21.26		23.02	23.53	22.46	21.02	19.12		16.29	14.57	14.30
27	09.19	07.40	06.02	17.15-17.44/29	05.13		03.36	02.58	04.11	05.47	07.16	18.11-18.19/8	07.46	09.24	10.15
	15.52	17.32	18.56		21.29		23.05	23.53	22.43	20.58	19.09		16.25	14.54	14.31
28	09.16	07.36	05.58	17.16-17.44/28	05.09		03.33	02.59	04.15	05.50	07.19		07.49	09.27	10.15
	15.55	17.35	18.59		21.32		23.08	23.52	22.40	20.55	19.05		16.22	14.52	14.32
29	09.13		06.55	18.16-18.43/27	05.06		03.30	03.00	04.18	05.53	07.22		07.52	09.30	10.14
	15.58		20.01		21.36		23.11	23.51	22.37	20.51	19.02		16.19	14.50	14.33
30	09.10		06.51	18.17-18.42/25	05.02		03.28	03.00	04.21	05.56	07.25		07.55	09.33	10.14
	16.01		20.04		21.39		23.14	23.50	22.34	20.48	18.58		16.16	14.48	14.35
31	09.07		06.48	18.17-18.41/24			03.25		04.24	05.59			07.58		10.13
	16.05		20.07				23.16		22.31	20.44			16.12		14.36
Potential sun hours	172	238	363		451		568	621	607	508	393		305	199	139
Sum of minutes with flicker	0	0	380		53		0	0	0	0	447		0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 19 - VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.05	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.11	21.43	23.20	23.49	22.28	20.41	18.55	16.09	14.46
2	10.12	09.02	07.30	06.41	04.56	03.20	03.04	04.31	06.05	07.31	08.05	09.39
	14.41	16.12	17.41	20.14	21.46	23.23	23.48	22.25	20.38	18.52	16.06	14.44
3	10.11	08.59	07.26	06.37	04.52	03.18	03.05	04.34	06.08	07.34	08.08	09.42
	14.43	16.15	17.44	20.17	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.10	08.56	07.23	06.34	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.48	20.20	21.52	23.28	23.44	22.18	20.31	18.45	16.00	14.40
5	10.08	08.52	07.19	06.30	04.46	03.13	03.10	04.40	06.14	07.40	08.15	09.47
	14.47	16.22	17.51	20.23	21.55	23.31	23.43	22.15	20.27	18.41	15.57	14.38
6	10.07	08.49	07.16	06.27	04.42	03.11	03.12	04.43	06.17	07.43	08.18	09.49
	14.50	16.25	17.54	20.26	21.59	23.33	23.41	22.11	20.24	18.38	15.53	14.37
7	10.06	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.46	08.21	09.52
	14.52	16.28	17.57	20.29	22.02	23.35	23.39	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43	07.09	06.20	04.36	03.07	03.16	04.50	06.23	07.49	08.24	09.54
	14.54	16.31	18.00	20.32	22.05	23.38	23.37	22.05	20.16	18.31	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.53	06.26	07.52	08.28	09.56
	14.57	16.35	18.03	20.35	22.08	23.40	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.37	07.02	06.13	04.29	03.03	03.21	04.56	06.28	07.55	08.31	09.58
	15.00	16.38	18.06	20.38	22.11	23.42	23.32	21.58	20.09	18.24	15.41	14.31
11	09.59	08.33	06.58	06.09	04.26	03.02	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.09	20.41	22.15	23.44	23.30	21.54	20.06	18.20	15.38	14.30
12	09.57	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.45	18.12	20.44	22.18	23.46	23.27	21.51	20.02	18.17	15.35	14.29
13	09.55	08.27	06.51	06.02	04.19	02.58	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.15	20.47	22.21	23.47	23.25	21.48	19.59	18.13	15.32	14.28
14	09.52	08.24	06.48	05.58	04.16	02.56	03.32	05.08	06.40	08.06	08.44	10.06
	15.11	16.51	18.18	20.50	22.24	23.49	23.22	21.44	19.55	18.10	15.29	14.28
15	09.50	08.20	06.44	05.55	04.13	02.55	03.35	05.11	06.43	08.09	08.47	10.07
	15.14	16.54	18.21	20.53	22.28	23.50	23.19	21.41	19.52	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.46	08.12	08.50	10.09
	15.17	16.58	18.24	20.56	22.31	23.51	23.17	21.37	19.48	18.03	15.23	14.26
17	09.46	08.14	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.01	18.27	20.59	22.34	23.52	23.14	21.34	19.45	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.21	06.51	08.18	08.57	10.11
	15.23	17.04	18.30	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.18	14.26
19	09.41	08.07	06.30	05.41	04.00	02.53	03.47	05.24	06.54	08.21	09.00	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.27	19.37	17.53	15.15	14.26
20	09.38	08.04	06.27	05.37	03.57	02.53	03.50	05.27	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.44	23.55	23.05	21.23	19.34	17.49	15.12	14.26
21	09.36	08.00	06.23	05.34	03.54	02.53	03.53	05.30	07.00	08.28	09.06	10.14
	15.32	17.13	18.38	21.11	22.47	23.55	23.02	21.20	19.30	17.46	15.10	14.26
22	09.33	07.57	06.20	05.30	03.51	02.54	03.56	05.33	07.03	08.31	09.09	10.15
	15.36	17.17	18.41	21.14	22.50	23.55	22.59	21.16	19.27	17.42	15.07	14.27
23	09.30	07.54	06.16	05.27	03.48	02.54	03.59	05.36	07.05	08.34	09.12	10.15
	15.39	17.20	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.28	07.50	06.13	05.23	03.45	02.55	04.02	05.39	07.08	08.37	09.15	10.16
	15.42	17.23	18.47	21.20	22.56	23.55	22.53	21.09	19.20	17.36	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.56	04.05	05.42	07.11	07.40	09.19	10.16
	15.45	17.26	18.50	21.24	22.59	23.55	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.06	05.16	03.39	02.57	04.08	05.45	07.14	07.43	09.22	10.16
	15.49	17.29	18.53	21.27	23.02	23.54	22.47	21.02	19.13	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.12	05.48	07.17	07.46	09.25	10.16
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.26	14.55	14.31
28	09.16	07.37	05.59	05.10	03.33	02.59	04.15	05.51	07.20	07.49	09.28	10.15
	15.55	17.35	18.59	21.33	23.08	23.53	22.41	20.55	19.06	16.22	14.52	14.32
29	09.14		06.55	05.06	03.31	03.00	04.18	05.54	07.23	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.52	22.38	20.52	19.02	16.19	14.50	14.33
30	09.11		06.51	05.03	03.28	03.00	04.21	05.57	07.25	07.56	09.33	10.15
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.59	16.16	14.48	14.35
31	09.08		06.48		03.25		04.24	05.59		07.59		10.14
	16.05		20.08		23.17		22.31	20.45		16.13		14.37
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	138
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 20 - VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (2)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.05	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.11	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.46
2	10.12	09.02	07.30	06.41	04.56	03.20	03.04	04.31	06.05	07.31	08.05	09.39
	14.41	16.12	17.41	20.14	21.46	23.23	23.48	22.25	20.38	18.52	16.06	14.44
3	10.11	08.59	07.26	06.37	04.52	03.18	03.06	04.34	06.08	07.34	08.08	09.42
	14.43	16.15	17.44	20.17	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.10	08.56	07.23	06.34	04.49	03.15	03.08	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.48	20.20	21.52	23.28	23.44	22.18	20.31	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.46	03.13	03.10	04.40	06.14	07.40	08.15	09.47
	14.47	16.22	17.51	20.23	21.55	23.30	23.42	22.15	20.27	18.41	15.57	14.38
6	10.07	08.49	07.16	06.27	04.42	03.11	03.12	04.43	06.17	07.43	08.18	09.49
	14.50	16.25	17.54	20.26	21.58	23.33	23.41	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.46	08.21	09.52
	14.52	16.28	17.57	20.29	22.02	23.35	23.39	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43	07.09	06.20	04.36	03.07	03.16	04.50	06.23	07.49	08.24	09.54
	14.55	16.31	18.00	20.32	22.05	23.38	23.36	22.05	20.16	18.31	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.53	06.26	07.52	08.27	09.56
	14.57	16.35	18.03	20.35	22.08	23.40	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.37	07.02	06.13	04.29	03.03	03.21	04.56	06.28	07.55	08.31	09.58
	15.00	16.38	18.06	20.38	22.11	23.42	23.32	21.58	20.09	18.24	15.41	14.31
11	09.58	08.33	06.58	06.09	04.26	03.02	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.09	20.41	22.15	23.44	23.30	21.54	20.06	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.45	18.12	20.44	22.18	23.45	23.27	21.51	20.02	18.17	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.58	03.30	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.15	20.47	22.21	23.47	23.25	21.48	19.59	18.13	15.32	14.28
14	09.52	08.24	06.48	05.58	04.16	02.57	03.32	05.08	06.40	08.06	08.44	10.06
	15.11	16.51	18.18	20.50	22.24	23.49	23.22	21.44	19.55	18.10	15.29	14.28
15	09.50	08.20	06.44	05.55	04.13	02.56	03.35	05.11	06.43	08.09	08.47	10.07
	15.14	16.54	18.21	20.53	22.28	23.50	23.19	21.41	19.52	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.46	08.12	08.50	10.09
	15.17	16.58	18.24	20.56	22.31	23.51	23.17	21.37	19.48	18.03	15.23	14.26
17	09.46	08.14	06.37	05.48	04.06	02.54	03.41	05.18	06.48	08.15	08.53	10.10
	15.20	17.01	18.27	20.59	22.34	23.52	23.14	21.34	19.44	17.59	15.21	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.21	06.51	08.18	08.57	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.18	14.26
19	09.41	08.07	06.30	05.41	04.00	02.54	03.47	05.24	06.54	08.21	09.00	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.27	19.37	17.53	15.15	14.26
20	09.38	08.04	06.27	05.37	03.57	02.53	03.50	05.27	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.44	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.36	08.00	06.23	05.34	03.54	02.54	03.53	05.30	07.00	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.47	23.55	23.02	21.20	19.30	17.46	15.10	14.26
22	09.33	07.57	06.20	05.30	03.51	02.54	03.56	05.33	07.03	08.31	09.09	10.15
	15.36	17.17	18.41	21.14	22.50	23.55	22.59	21.16	19.27	17.42	15.07	14.27
23	09.30	07.54	06.16	05.27	03.48	02.54	03.59	05.36	07.05	08.34	09.12	10.15
	15.39	17.20	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.28	07.50	06.13	05.23	03.45	02.55	04.02	05.39	07.08	08.37	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.55	22.53	21.09	19.20	17.36	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.56	04.05	05.42	07.11	07.40	09.18	10.16
	15.45	17.26	18.50	21.24	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.06	05.16	03.39	02.57	04.09	05.45	07.14	07.43	09.22	10.16
	15.49	17.29	18.53	21.27	23.02	23.54	22.47	21.02	19.13	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.12	05.48	07.17	07.46	09.25	10.16
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.26	14.55	14.31
28	09.16	07.37	05.59	05.10	03.33	02.59	04.15	05.51	07.20	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.41	20.55	19.06	16.22	14.52	14.32
29	09.14		06.55	05.06	03.31	03.00	04.18	05.54	07.23	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.38	20.52	19.02	16.19	14.50	14.34
30	09.11		06.51	05.03	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.59	16.16	14.48	14.35
31	09.08		06.48		03.25		04.24	05.59		07.59		10.14
	16.05		20.08		23.17		22.31	20.45		16.13		14.37
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 21 - VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (3)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.05	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.11	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.46
2	10.12	09.02	07.30	06.41	04.56	03.20	03.04	04.31	06.05	07.31	08.05	09.39
	14.41	16.12	17.41	20.14	21.46	23.23	23.48	22.25	20.38	18.51	16.06	14.44
3	10.11	08.59	07.26	06.37	04.52	03.18	03.05	04.34	06.08	07.34	08.08	09.42
	14.43	16.15	17.44	20.17	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.10	08.56	07.23	06.34	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.20	21.52	23.28	23.44	22.18	20.31	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.46	03.13	03.09	04.40	06.14	07.40	08.15	09.47
	14.47	16.22	17.51	20.23	21.55	23.31	23.43	22.15	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16	06.27	04.42	03.11	03.12	04.43	06.17	07.43	08.18	09.49
	14.49	16.25	17.54	20.26	21.59	23.33	23.41	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.46	08.21	09.52
	14.52	16.28	17.57	20.29	22.02	23.35	23.39	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43	07.09	06.20	04.35	03.07	03.16	04.49	06.23	07.49	08.24	09.54
	14.54	16.31	18.00	20.32	22.05	23.38	23.37	22.05	20.16	18.30	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.52	08.27	09.56
	14.57	16.35	18.03	20.35	22.08	23.40	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.37	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.31	09.58
	15.00	16.38	18.06	20.38	22.11	23.42	23.32	21.58	20.09	18.24	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.09	20.41	22.15	23.44	23.30	21.54	20.06	18.20	15.38	14.30
12	09.57	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.12	20.44	22.18	23.46	23.27	21.51	20.02	18.17	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.15	20.47	22.21	23.47	23.25	21.48	19.59	18.13	15.32	14.28
14	09.52	08.24	06.48	05.58	04.16	02.56	03.32	05.08	06.40	08.06	08.44	10.06
	15.11	16.51	18.18	20.50	22.24	23.49	23.22	21.44	19.55	18.10	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.43	08.09	08.47	10.07
	15.14	16.54	18.21	20.53	22.28	23.50	23.19	21.41	19.52	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.09
	15.17	16.57	18.24	20.56	22.31	23.51	23.17	21.37	19.48	18.03	15.23	14.26
17	09.46	08.14	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.01	18.26	20.59	22.34	23.52	23.14	21.34	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.57	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.18	14.26
19	09.41	08.07	06.30	05.41	04.00	02.53	03.47	05.24	06.54	08.21	09.00	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.27	19.37	17.53	15.15	14.26
20	09.38	08.04	06.27	05.37	03.57	02.53	03.50	05.27	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.44	23.55	23.05	21.23	19.34	17.49	15.12	14.26
21	09.36	08.00	06.23	05.34	03.54	02.53	03.53	05.30	07.00	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.47	23.55	23.02	21.20	19.30	17.46	15.09	14.26
22	09.33	07.57	06.20	05.30	03.51	02.54	03.56	05.33	07.03	08.31	09.09	10.15
	15.36	17.17	18.41	21.14	22.50	23.55	22.59	21.16	19.27	17.42	15.07	14.27
23	09.30	07.54	06.16	05.27	03.48	02.54	03.59	05.36	07.05	08.34	09.12	10.15
	15.39	17.20	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.28	07.50	06.13	05.23	03.45	02.55	04.02	05.39	07.08	08.37	09.15	10.16
	15.42	17.23	18.47	21.20	22.56	23.55	22.53	21.09	19.20	17.36	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.55	04.05	05.42	07.11	07.40	09.19	10.16
	15.45	17.26	18.50	21.24	22.59	23.55	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.06	05.16	03.39	02.56	04.08	05.45	07.14	07.43	09.22	10.16
	15.49	17.29	18.53	21.27	23.02	23.54	22.47	21.02	19.13	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.12	05.48	07.17	07.46	09.25	10.16
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.26	14.54	14.31
28	09.16	07.37	05.58	05.09	03.33	02.59	04.15	05.51	07.20	07.49	09.28	10.15
	15.55	17.35	18.59	21.33	23.08	23.53	22.41	20.55	19.06	16.22	14.52	14.32
29	09.14		06.55	05.06	03.30	03.00	04.18	05.53	07.23	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.52	22.38	20.52	19.02	16.19	14.50	14.33
30	09.11		06.51	05.03	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.15
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.08		06.48		03.25		04.24	05.59		07.59		10.14
	16.05		20.08		23.17		22.31	20.45		16.13		14.37
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	138
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 22 - VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (4)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.05	07.33	06.44	04.59	03.22	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.11	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.46
2	10.12	09.02	07.30	06.41	04.56	03.20	03.03	04.30	06.05	07.31	08.05	09.39
	14.41	16.12	17.41	20.14	21.46	23.23	23.48	22.24	20.38	18.51	16.06	14.44
3	10.11	08.59	07.26	06.37	04.52	03.18	03.05	04.34	06.08	07.34	08.08	09.42
	14.43	16.15	17.44	20.17	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.10	08.55	07.23	06.34	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.20	21.52	23.28	23.44	22.18	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.40	08.15	09.47
	14.47	16.21	17.50	20.23	21.55	23.30	23.43	22.15	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16	06.27	04.42	03.11	03.12	04.43	06.17	07.43	08.18	09.49
	14.49	16.25	17.53	20.26	21.58	23.33	23.41	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.46	08.21	09.52
	14.52	16.28	17.57	20.29	22.02	23.35	23.39	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.23	07.49	08.24	09.54
	14.54	16.31	18.00	20.32	22.05	23.38	23.36	22.04	20.16	18.30	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51	08.27	09.56
	14.57	16.35	18.03	20.35	22.08	23.40	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.37	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.31	09.58
	15.00	16.38	18.06	20.38	22.11	23.42	23.32	21.58	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.01	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.09	20.41	22.15	23.44	23.30	21.54	20.06	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.12	20.44	22.18	23.46	23.27	21.51	20.02	18.17	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.15	20.47	22.21	23.47	23.25	21.47	19.59	18.13	15.32	14.28
14	09.52	08.24	06.48	05.58	04.16	02.56	03.32	05.08	06.40	08.06	08.44	10.06
	15.11	16.51	18.18	20.50	22.24	23.49	23.22	21.44	19.55	18.10	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.43	08.09	08.47	10.07
	15.14	16.54	18.20	20.53	22.28	23.50	23.19	21.41	19.51	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.09
	15.17	16.57	18.23	20.56	22.31	23.51	23.17	21.37	19.48	18.03	15.23	14.26
17	09.45	08.14	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.01	18.26	20.59	22.34	23.52	23.14	21.34	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.18	14.26
19	09.41	08.07	06.30	05.41	04.00	02.53	03.47	05.23	06.54	08.21	09.00	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.27	19.37	17.52	15.15	14.26
20	09.38	08.04	06.27	05.37	03.57	02.53	03.50	05.26	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.44	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.36	08.00	06.23	05.34	03.54	02.53	03.53	05.30	07.00	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.47	23.55	23.02	21.20	19.30	17.46	15.09	14.26
22	09.33	07.57	06.20	05.30	03.51	02.54	03.56	05.33	07.02	08.30	09.09	10.15
	15.35	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.27	17.42	15.07	14.27
23	09.30	07.54	06.16	05.27	03.48	02.54	03.59	05.36	07.05	08.34	09.12	10.15
	15.39	17.20	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.28	07.50	06.13	05.23	03.45	02.55	04.02	05.39	07.08	08.37	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.55	22.53	21.09	19.20	17.36	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.55	04.05	05.42	07.11	07.40	09.18	10.16
	15.45	17.26	18.50	21.23	22.59	23.55	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.05	05.16	03.39	02.56	04.08	05.45	07.14	07.43	09.21	10.16
	15.48	17.29	18.53	21.27	23.02	23.54	22.47	21.02	19.13	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.57	04.11	05.47	07.17	07.46	09.24	10.16
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.26	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.20	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.41	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.52	19.02	16.19	14.50	14.33
30	09.11		06.51	05.03	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.08		06.48		03.25		04.24	05.59		07.59		10.14
	16.05		20.08		23.17		22.31	20.45		16.12		14.36
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	138
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 23 - VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (5)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.05	07.33	06.44	04.59	03.22	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.11	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.46
2	10.12	09.02	07.30	06.41	04.56	03.20	03.03	04.30	06.05	07.31	08.05	09.39
	14.41	16.11	17.41	20.14	21.46	23.23	23.48	22.24	20.38	18.51	16.06	14.44
3	10.11	08.58	07.26	06.37	04.52	03.18	03.05	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.17	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.10	08.55	07.23	06.34	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.20	21.52	23.28	23.44	22.18	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.40	08.14	09.47
	14.47	16.21	17.50	20.23	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16	06.26	04.42	03.11	03.12	04.43	06.17	07.43	08.18	09.49
	14.49	16.25	17.53	20.25	21.58	23.33	23.41	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.46	08.21	09.52
	14.52	16.28	17.56	20.28	22.02	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	18.00	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51	08.27	09.56
	14.57	16.35	18.03	20.34	22.08	23.40	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.37	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.31	09.58
	15.00	16.38	18.06	20.37	22.11	23.42	23.32	21.58	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.01	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.09	20.40	22.15	23.44	23.29	21.54	20.06	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.12	20.43	22.18	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.14	20.47	22.21	23.47	23.24	21.47	19.59	18.13	15.32	14.28
14	09.52	08.24	06.48	05.58	04.16	02.56	03.32	05.08	06.40	08.06	08.44	10.06
	15.11	16.51	18.17	20.50	22.24	23.49	23.22	21.44	19.55	18.10	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.43	08.09	08.47	10.07
	15.14	16.54	18.20	20.53	22.27	23.50	23.19	21.41	19.51	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.09
	15.17	16.57	18.23	20.56	22.31	23.51	23.17	21.37	19.48	18.03	15.23	14.26
17	09.45	08.14	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.01	18.26	20.59	22.34	23.52	23.14	21.34	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.53	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.18	14.26
19	09.41	08.07	06.30	05.41	04.00	02.53	03.47	05.23	06.54	08.21	09.00	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.27	19.37	17.52	15.15	14.26
20	09.38	08.04	06.27	05.37	03.57	02.53	03.50	05.26	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.36	08.00	06.23	05.34	03.54	02.53	03.53	05.29	07.00	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.47	23.55	23.02	21.20	19.30	17.46	15.09	14.26
22	09.33	07.57	06.20	05.30	03.50	02.54	03.56	05.33	07.02	08.30	09.09	10.15
	15.35	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.27	17.42	15.07	14.26
23	09.30	07.53	06.16	05.27	03.47	02.54	03.59	05.36	07.05	08.33	09.12	10.15
	15.39	17.20	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.28	07.50	06.13	05.23	03.45	02.55	04.02	05.39	07.08	08.37	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.55	22.53	21.09	19.20	17.36	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.55	04.05	05.42	07.11	07.40	09.18	10.16
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.05	05.16	03.39	02.56	04.08	05.44	07.14	07.43	09.21	10.16
	15.48	17.29	18.53	21.27	23.02	23.54	22.47	21.02	19.12	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.57	04.11	05.47	07.17	07.46	09.24	10.16
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.26	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.20	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.41	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.52	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.08		06.48		03.25		04.24	05.59		07.59		10.14
	16.05		20.08		23.17		22.31	20.45		16.12		14.36
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	138
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 24 - VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (6)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.04	07.33	06.44	04.59	03.22	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.11	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.46
2	10.12	09.01	07.29	06.41	04.56	03.20	03.04	04.30	06.05	07.31	08.05	09.39
	14.41	16.11	17.41	20.14	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.11	08.58	07.26	06.37	04.52	03.18	03.05	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.23	06.34	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.28	23.44	22.18	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.40	08.14	09.47
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16	06.26	04.42	03.11	03.12	04.43	06.17	07.43	08.18	09.49
	14.49	16.25	17.53	20.25	21.58	23.33	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.46	08.21	09.51
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	17.59	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51	08.27	09.56
	14.57	16.35	18.02	20.34	22.08	23.39	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.31	09.58
	15.00	16.38	18.05	20.37	22.11	23.42	23.32	21.58	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.01	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.06	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.18	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.16	02.56	03.32	05.08	06.40	08.06	08.43	10.06
	15.11	16.51	18.17	20.49	22.24	23.48	23.22	21.44	19.55	18.10	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.42	08.09	08.47	10.07
	15.14	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.09
	15.17	16.57	18.23	20.56	22.31	23.51	23.16	21.37	19.48	18.03	15.23	14.26
17	09.45	08.14	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.01	18.26	20.59	22.34	23.52	23.14	21.34	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.18	14.26
19	09.40	08.07	06.30	05.41	04.00	02.53	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.27	19.37	17.52	15.15	14.26
20	09.38	08.04	06.27	05.37	03.57	02.53	03.50	05.26	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54	02.53	03.53	05.29	07.00	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.47	23.55	23.02	21.20	19.30	17.46	15.09	14.26
22	09.33	07.57	06.20	05.30	03.50	02.54	03.56	05.32	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.27	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.47	02.54	03.59	05.35	07.05	08.33	09.12	10.15
	15.39	17.20	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.45	02.55	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.55	22.53	21.09	19.19	17.36	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.55	04.05	05.41	07.11	07.40	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.05	05.16	03.39	02.56	04.08	05.44	07.14	07.43	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.54	22.47	21.02	19.12	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.11	05.47	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.26	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.20	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.52	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.14
	16.05		20.08		23.17		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 25 - VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (7)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.11	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.46
2	10.12	09.01	07.29	06.41	04.56	03.20	03.04	04.30	06.05	07.31	08.05	09.39
	14.41	16.12	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18	03.06	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.23	06.34	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.28	23.44	22.18	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.10	04.40	06.14	07.40	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16	06.26	04.42	03.11	03.12	04.43	06.17	07.43	08.18	09.49
	14.49	16.25	17.53	20.25	21.58	23.33	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.45	08.21	09.51
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.03	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	17.59	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51	08.27	09.56
	14.57	16.35	18.02	20.34	22.08	23.39	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.30	09.58
	15.00	16.38	18.05	20.37	22.11	23.41	23.32	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.06	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.18	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.58	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.16	02.56	03.32	05.08	06.40	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.22	21.44	19.55	18.10	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.56	03.35	05.11	06.42	08.09	08.47	10.07
	15.14	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.08
	15.17	16.57	18.23	20.55	22.30	23.51	23.16	21.37	19.48	18.03	15.23	14.26
17	09.45	08.13	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.01	18.26	20.59	22.34	23.52	23.13	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.18	14.26
19	09.40	08.07	06.30	05.41	04.00	02.53	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.53	23.08	21.27	19.37	17.52	15.15	14.26
20	09.38	08.03	06.27	05.37	03.57	02.53	03.50	05.26	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54	02.53	03.53	05.29	07.00	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.20	19.30	17.46	15.09	14.26
22	09.33	07.57	06.20	05.30	03.51	02.54	03.56	05.32	07.02	08.30	09.09	10.14
	15.36	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.27	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48	02.54	03.59	05.36	07.05	08.33	09.12	10.15
	15.39	17.20	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.45	02.55	04.02	05.39	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.54	22.53	21.09	19.19	17.36	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.56	04.05	05.41	07.11	07.40	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.05	05.16	03.39	02.57	04.08	05.44	07.14	07.43	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.54	22.47	21.02	19.12	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.12	05.47	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.26	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.52	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.08		23.17		22.31	20.44		16.12		14.37
Potential sun hours	172	238	363	451	568	621	607	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 26 - VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (8)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.05	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.11	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.46
2	10.12	09.02	07.30	06.41	04.56	03.20	03.04	04.31	06.05	07.31	08.05	09.39
	14.41	16.12	17.41	20.14	21.46	23.23	23.47	22.24	20.38	18.51	16.06	14.44
3	10.11	08.58	07.26	06.37	04.52	03.18	03.05	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.17	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.10	08.55	07.23	06.34	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.20	21.52	23.28	23.44	22.18	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.46	03.13	03.10	04.40	06.14	07.40	08.15	09.47
	14.47	16.22	17.50	20.23	21.55	23.30	23.42	22.15	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16	06.27	04.42	03.11	03.12	04.43	06.17	07.43	08.18	09.49
	14.50	16.25	17.54	20.26	21.58	23.33	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.46	08.21	09.52
	14.52	16.28	17.57	20.29	22.02	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43	07.09	06.20	04.35	03.07	03.16	04.49	06.23	07.49	08.24	09.54
	14.54	16.31	18.00	20.32	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51	08.27	09.56
	14.57	16.35	18.03	20.35	22.08	23.40	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.37	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.31	09.58
	15.00	16.38	18.06	20.38	22.11	23.42	23.32	21.58	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.09	20.41	22.15	23.44	23.29	21.54	20.06	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.12	20.44	22.18	23.45	23.27	21.51	20.02	18.17	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.58	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.15	20.47	22.21	23.47	23.24	21.47	19.59	18.13	15.32	14.28
14	09.52	08.24	06.48	05.58	04.16	02.56	03.32	05.08	06.40	08.06	08.44	10.06
	15.11	16.51	18.18	20.50	22.24	23.49	23.22	21.44	19.55	18.10	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.43	08.09	08.47	10.07
	15.14	16.54	18.21	20.53	22.27	23.50	23.19	21.41	19.51	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.09
	15.17	16.57	18.23	20.56	22.31	23.51	23.16	21.37	19.48	18.03	15.23	14.26
17	09.45	08.14	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.01	18.26	20.59	22.34	23.52	23.14	21.34	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.18	14.26
19	09.41	08.07	06.30	05.41	04.00	02.53	03.47	05.24	06.54	08.21	09.00	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.27	19.37	17.53	15.15	14.26
20	09.38	08.04	06.27	05.37	03.57	02.53	03.50	05.27	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.36	08.00	06.23	05.34	03.54	02.53	03.53	05.30	07.00	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.47	23.55	23.02	21.20	19.30	17.46	15.09	14.26
22	09.33	07.57	06.20	05.30	03.51	02.54	03.56	05.33	07.03	08.30	09.09	10.15
	15.36	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.27	17.42	15.07	14.27
23	09.30	07.54	06.16	05.27	03.48	02.54	03.59	05.36	07.05	08.34	09.12	10.15
	15.39	17.20	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.28	07.50	06.13	05.23	03.45	02.55	04.02	05.39	07.08	08.37	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.55	22.53	21.09	19.20	17.36	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.56	04.05	05.42	07.11	07.40	09.18	10.16
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.06	05.16	03.39	02.57	04.08	05.45	07.14	07.43	09.21	10.16
	15.49	17.29	18.53	21.27	23.02	23.54	22.47	21.02	19.13	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.12	05.48	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.26	14.55	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.51	07.20	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.41	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.23	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.52	19.02	16.19	14.50	14.33
30	09.11		06.51	05.03	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.08		06.48		03.25		04.24	05.59		07.59		10.14
	16.05		20.08		23.17		22.31	20.45		16.13		14.37
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest) WTG: 27 - VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (9)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.01	09.36
	14.39	16.08	17.38	20.11	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.41	04.56	03.20	03.04	04.31	06.05	07.31	08.05	09.38
	14.41	16.12	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18	03.06	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.49	23.25	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.23	06.34	04.49	03.15	03.08	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.27	23.44	22.18	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.10	04.40	06.14	07.40	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16	06.26	04.42	03.11	03.12	04.43	06.17	07.43	08.17	09.49
	14.50	16.25	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.45	08.21	09.51
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.03	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	17.59	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51	08.27	09.56
	14.57	16.35	18.02	20.34	22.08	23.39	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.30	09.58
	15.00	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.17	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.58	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.16	02.57	03.32	05.08	06.40	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.21	21.44	19.55	18.10	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.56	03.35	05.11	06.42	08.09	08.47	10.07
	15.14	16.54	18.20	20.52	22.27	23.49	23.19	21.40	19.51	18.06	15.26	14.27
16	09.47	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.08
	15.17	16.57	18.23	20.55	22.30	23.51	23.16	21.37	19.48	18.03	15.23	14.26
17	09.45	08.13	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.01	18.26	20.59	22.34	23.52	23.13	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.18	14.26
19	09.40	08.07	06.30	05.41	04.00	02.54	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.53	23.08	21.26	19.37	17.52	15.15	14.26
20	09.38	08.03	06.27	05.37	03.57	02.53	03.50	05.26	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54	02.54	03.53	05.29	07.00	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.20	19.30	17.46	15.09	14.26
22	09.33	07.57	06.19	05.30	03.51	02.54	03.56	05.32	07.02	08.30	09.09	10.14
	15.36	17.16	18.41	21.14	22.49	23.54	22.59	21.16	19.27	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48	02.54	03.59	05.36	07.05	08.33	09.12	10.15
	15.39	17.20	18.44	21.17	22.53	23.54	22.56	21.13	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.45	02.55	04.02	05.39	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.54	22.53	21.09	19.19	17.36	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.56	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.05	05.16	03.39	02.57	04.08	05.44	07.14	07.43	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.53	22.47	21.02	19.12	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.12	05.47	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.05	23.53	22.43	20.58	19.09	16.26	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.08		23.17		22.31	20.44		16.12		14.37
Potential sun hours	172	238	363	451	568	621	607	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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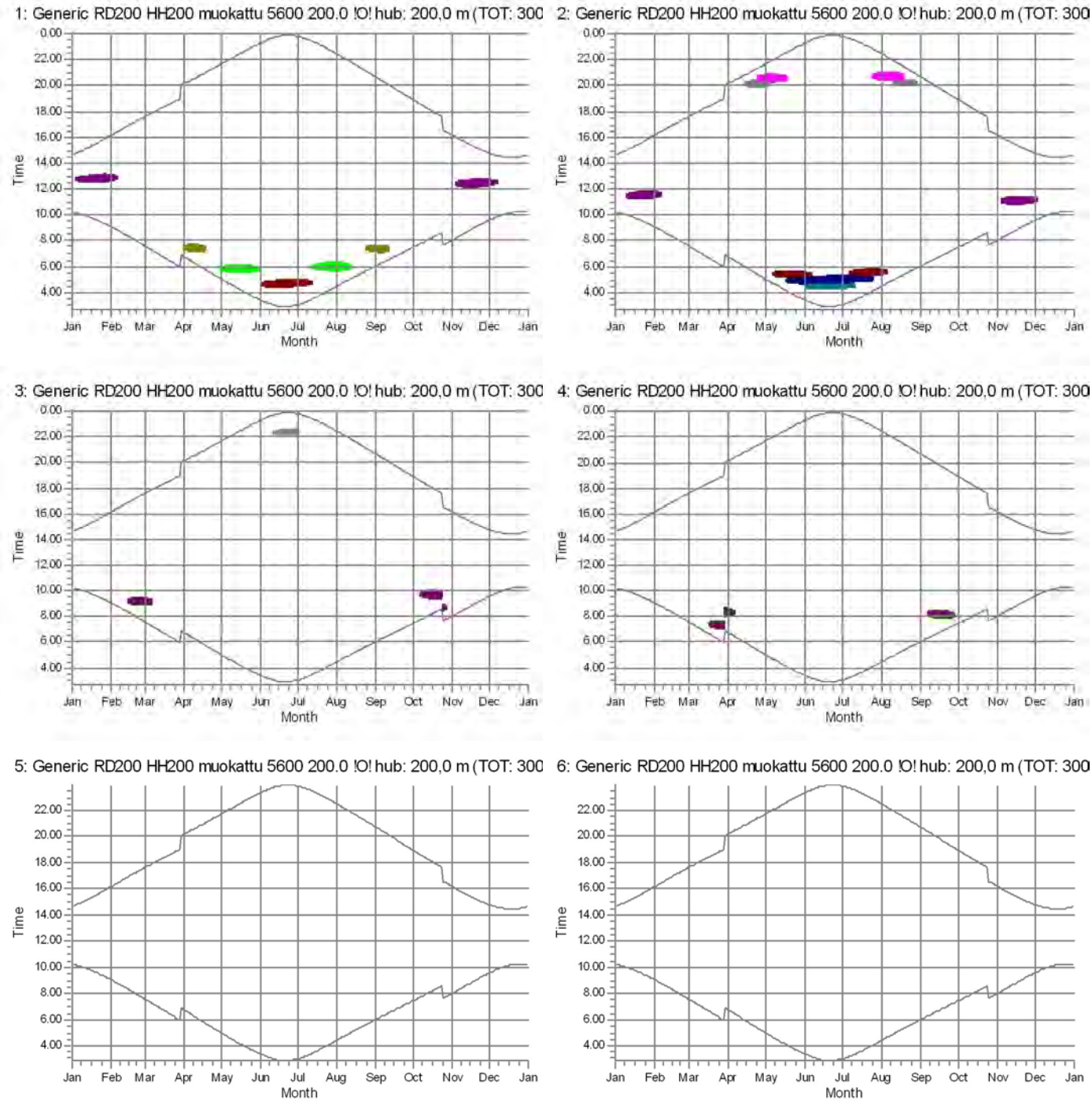
Henna-Riikka Rintamäki / henna-riikka.rintamaki@fcg.fi
Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar per WTG, graphical

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)



Shadow receptors

- D: Asuinrakennus D (Noppala)
- E: Muu rakennus E (Noppala)
- F: Asuinrakennus F (Maijannevantie)
- G: Asuinrakennus G (Maijannevantie)
- H: Asuinrakennus H (Hietasaari)
- I: Asuinrakennus I (Lahdenperä)
- J: Lomarakennus J (Junno)
- K: Lomarakennus K (Isomännikkö)

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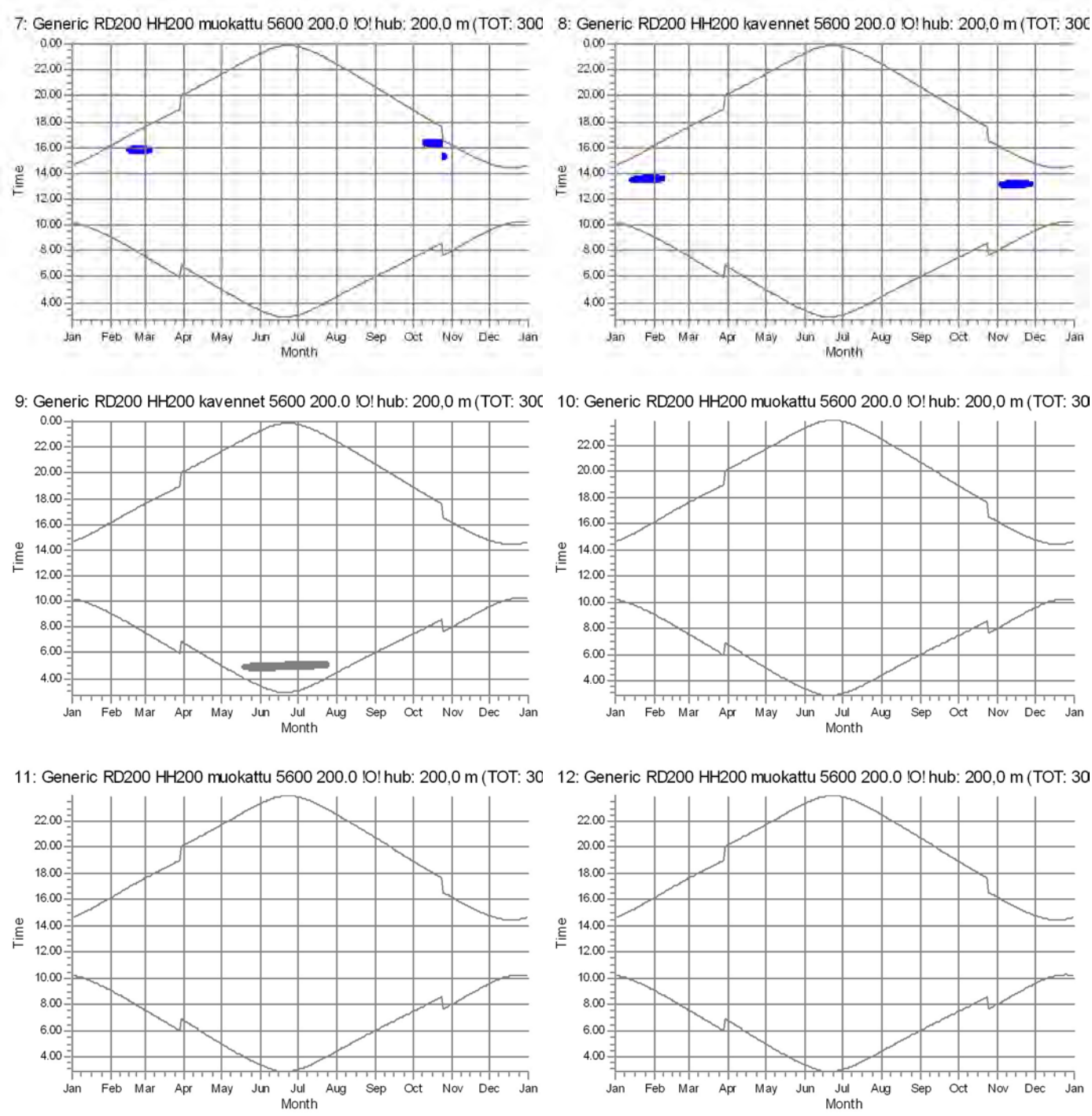
Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Calendar per WTG, graphical

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)



Shadow receptors

C: Lomarakennus C (Latvalampi)

D: Asuinrakennus D (Noppala)

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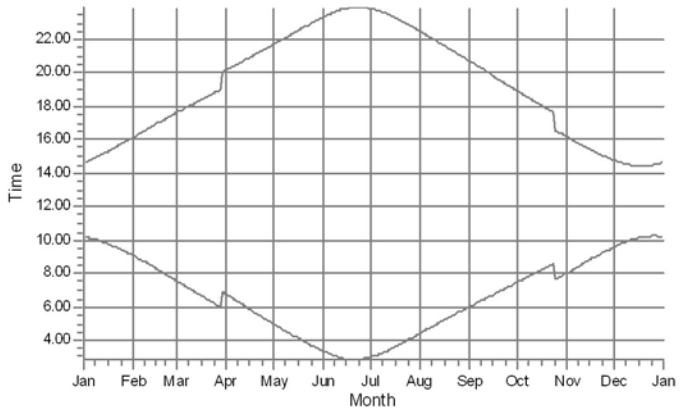
Calculated:
22.11.2023 17.03/3.6.377

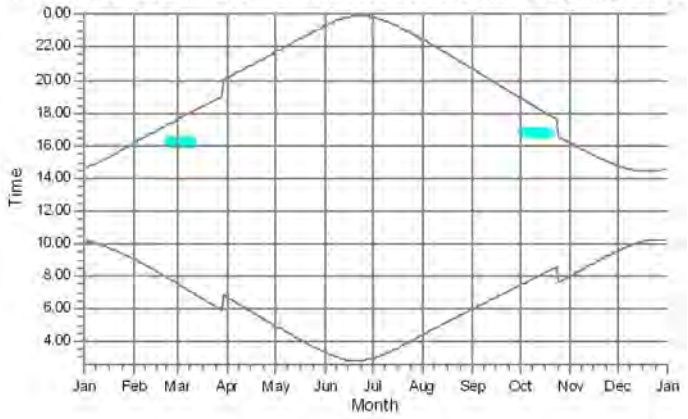
SHADOW - Calendar per WTG, graphical

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

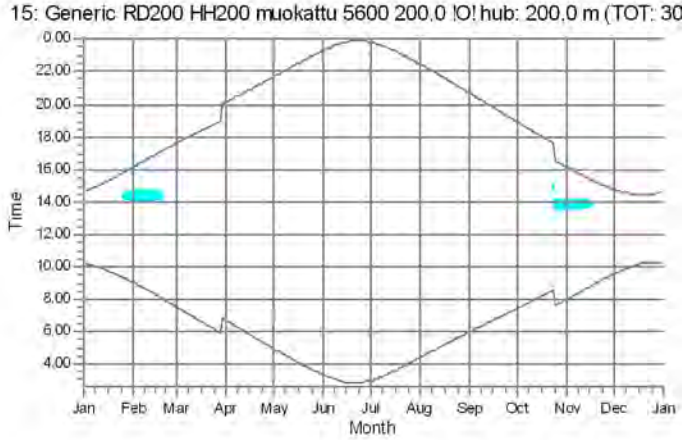
13: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 30



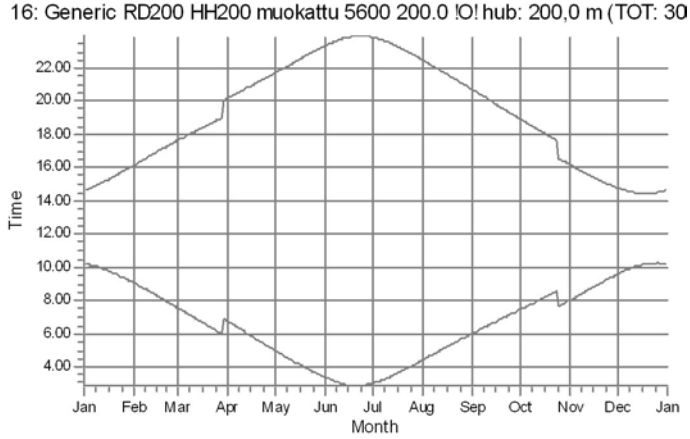
14: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 30



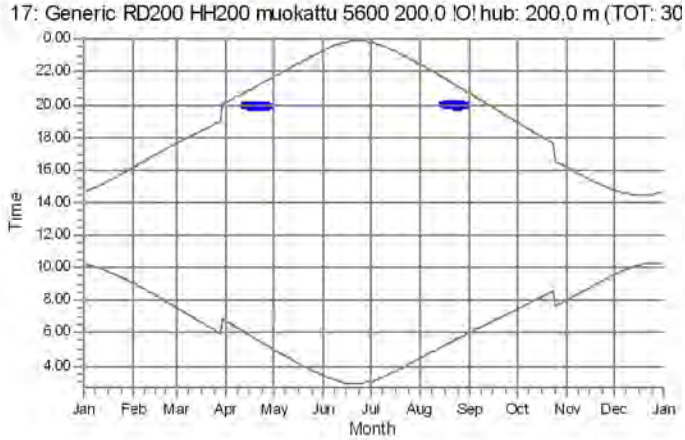
15: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 30



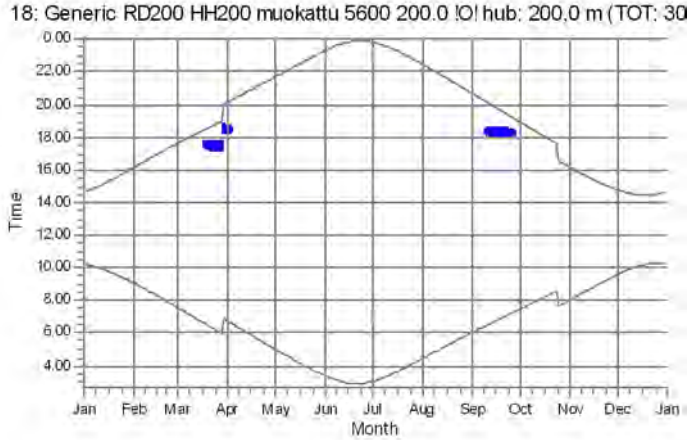
16: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 30



17: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 30



18: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 30



Shadow receptors

C: Lomarakennus C (Latvalampi)

M: Asuinrakennus M (Latvala)

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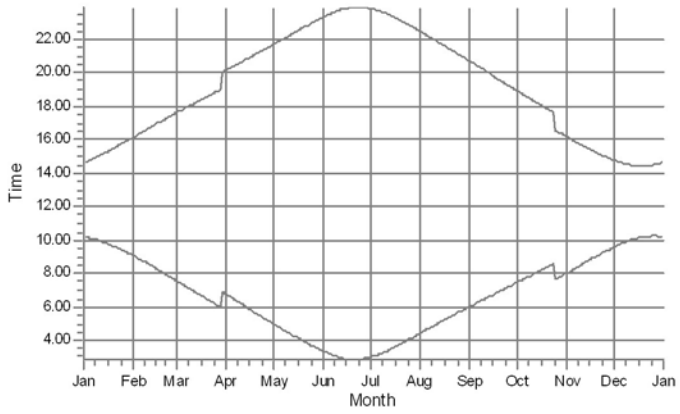
Calculated:
22.11.2023 17.03/3.6.377

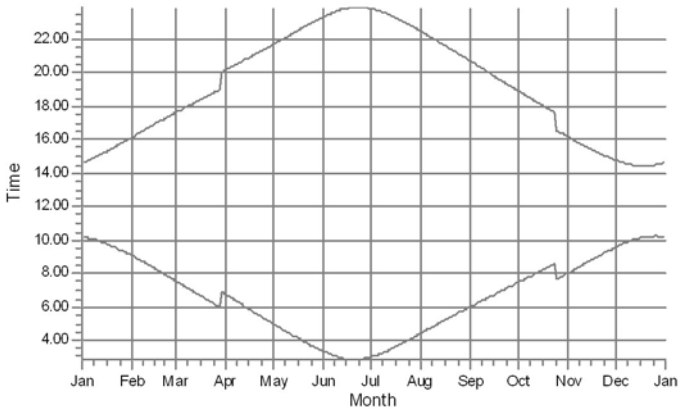
SHADOW - Calendar per WTG, graphical

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

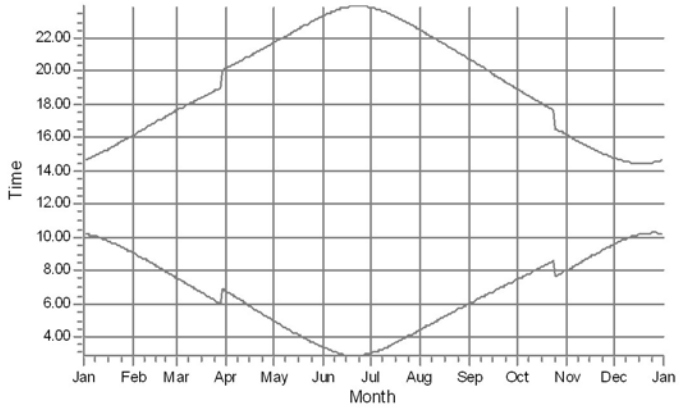
19: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



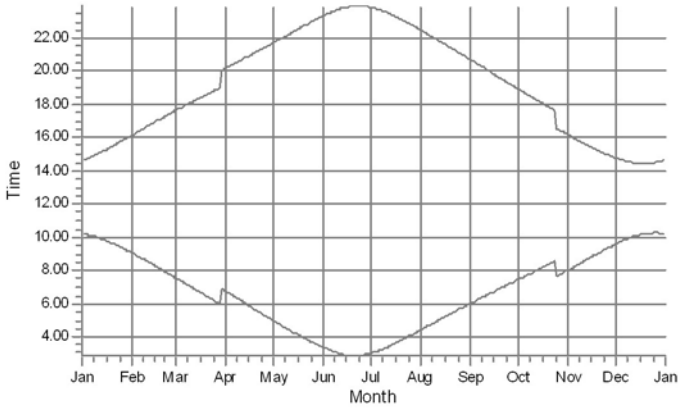
20: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



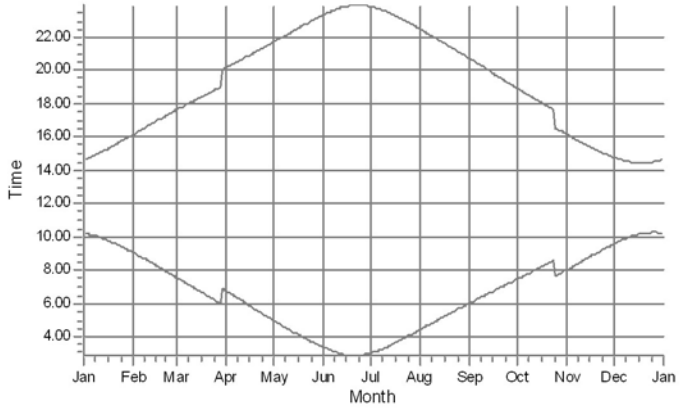
21: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



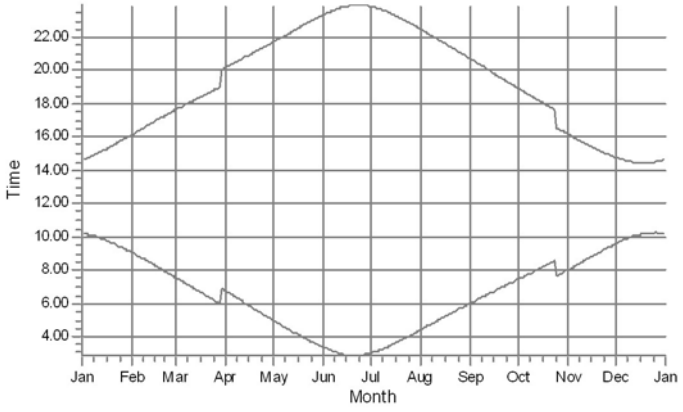
22: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



23: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



24: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



Shadow receptors

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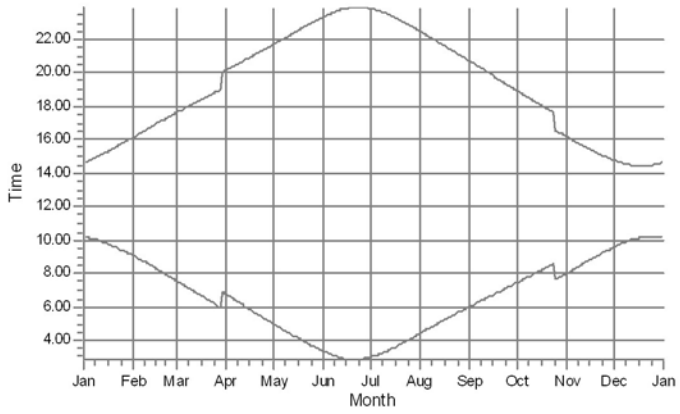
Calculated:
22.11.2023 17.03/3.6.377

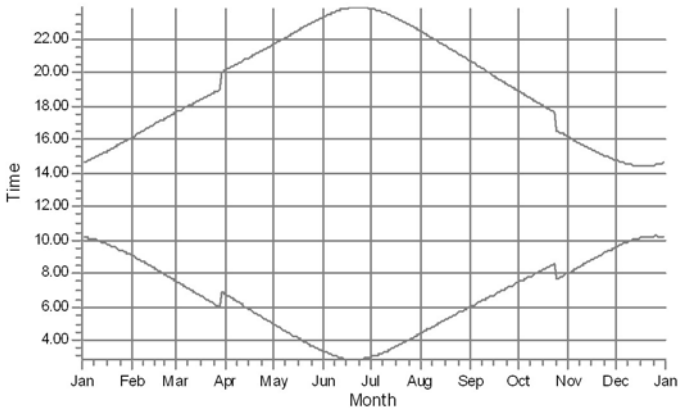
SHADOW - Calendar per WTG, graphical

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

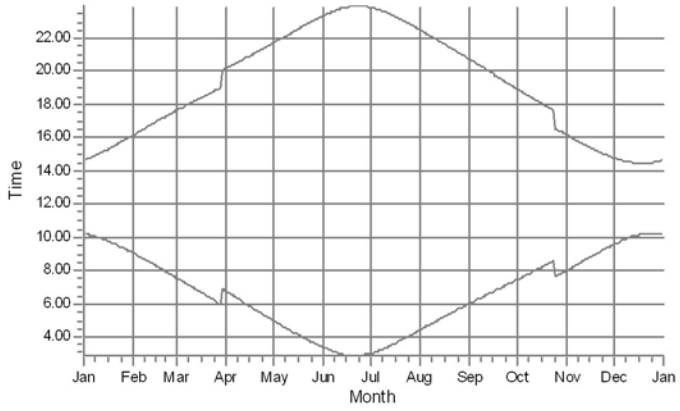
25: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



26: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



27: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



Shadow receptors

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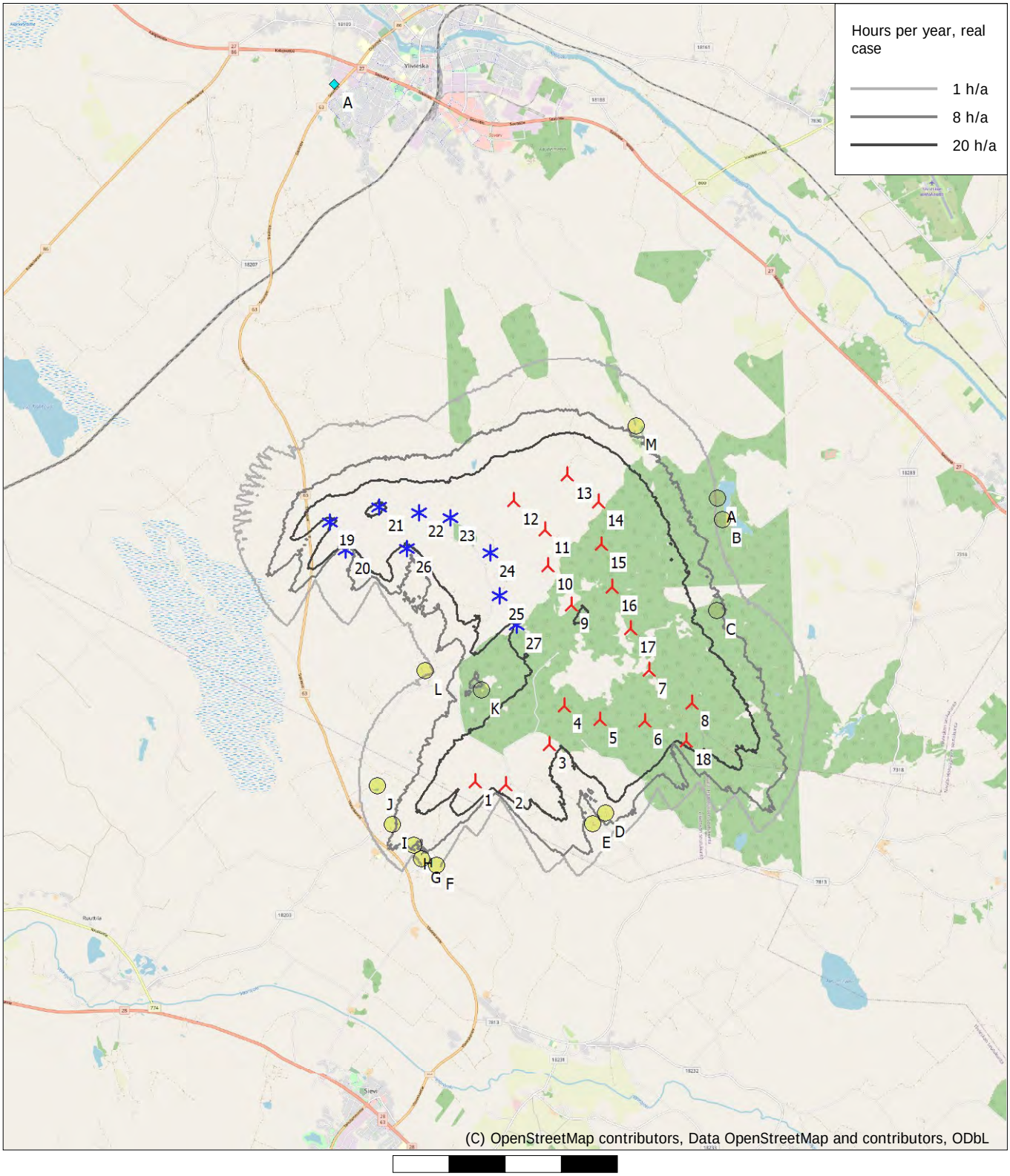
Calculated:
22.11.2023 17.03/3.6.377

SHADOW - Map

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)



0 1 2 3 4 km

Map: EMD OpenStreetMap , Print scale 1:100 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 381 270 North: 7 098 650

New WTG Existing WTG Obstacle Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_Pajukoski tv-hanke_0.wpo (5)

Time step: 4 minutes, Day step: 14 days, Map resolution: 30 m, Visibility resolution: 15 m, Eye height: 1,5 m

Liite 11: Pajukoski II tuulivoimahanke – varjostusmallinnuksen tulokset ”real case, no forest” (VE2).

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SHADOW - Main Result

Calculation: Shadow_Pajukoski II VE2_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

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

Sunshine probability S (Average daily sunshine hours) [LULEA]

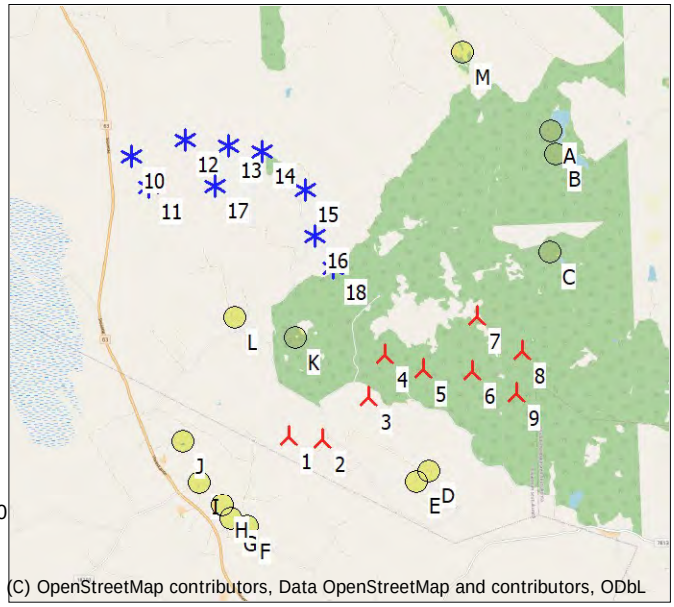
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: CONTOURLINE_Pajukoski tv-hanke_0
Obstacles used in calculation
Receptor grid resolution: 1,0 m

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



Scale 1:125 000

New WTG | Existing WTG | Shadow receptor

WTGs

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	380 209	7 094 637	107,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
2	380 766	7 094 564	106,8	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
3	381 556	7 095 242	112,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
4	381 855	7 095 926	117,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
5	382 487	7 095 665	119,8	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
6	383 284	7 095 590	122,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
7	383 404	7 096 507	124,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
8	384 145	7 095 898	110,0	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
9	384 021	7 095 208	112,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
10	377 791	7 099 387	87,5	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
11	378 057	7 098 862	90,0	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
12	378 683	7 099 618	85,9	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
13	379 394	7 099 490	94,6	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
14	379 949	7 099 376	100,0	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
15	380 638	7 098 723	105,0	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
16	380 775	7 097 932	105,0	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
17	379 139	7 098 839	92,5	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
18	381 062	7 097 401	107,5	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8

Shadow receptor-Input

No.	Name	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]
A	Lomarakennus A (Lampinjärvi)	384 750	7 099 539	90,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
B	Lomarakennus B (Lampinkallio)	384 818	7 099 152	93,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
C	Lomarakennus C (Latvalampi)	384 650	7 097 533	96,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
D	Asuinrakennus D (Noppala)	382 520	7 093 979	105,2	5,0	5,0	1,0	90,0	"Green house mode"	6,0
E	Muu rakennus E (Noppala)	382 290	7 093 807	109,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
F	Asuinrakennus F (Maijannevantie)	379 455	7 093 166	96,2	5,0	5,0	1,0	90,0	"Green house mode"	6,0
G	Asuinrakennus G (Maijannevantie)	379 203	7 093 300	92,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0
H	Asuinrakennus H (Hietasaari)	379 076	7 093 530	92,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
I	Asuinrakennus I (Lahdenperä)	378 699	7 093 923	88,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
J	Lomarakennus J (Junno)	378 456	7 094 615	89,4	5,0	5,0	1,0	90,0	"Green house mode"	6,0
K	Lomarakennus K (Isomännikkö)	380 394	7 096 271	106,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0

To be continued on next page...

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Calculated:
22.11.2023 16.57/3.6.377

SHADOW - Main Result

Calculation: Shadow_Pajukoski II VE2_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

...continued from previous page

No.	Name	East	North	Z [m]	Width [m]	Height [m]	Elevation a.g.l. [m]	Slope of window [°]	Direction mode	Eye height (ZVI) a.g.l. [m]
L	Asuinrakennus L (Malkasaari)	379 392	7 096 642	100,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0
M	Asuinrakennus M (Latvala)	383 344	7 100 875	82,6	5,0	5,0	1,0	90,0	"Green house mode"	6,0

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values Shadow hours per year [h/year]
A	Lomarakennus A (Lampinjärvi)	0:00
B	Lomarakennus B (Lampinkallio)	0:00
C	Lomarakennus C (Latvalampi)	4:47
D	Asuinrakennus D (Noppala)	12:14
E	Muu rakennus E (Noppala)	5:01
F	Asuinrakennus F (Maijannevantie)	3:19
G	Asuinrakennus G (Maijannevantie)	7:30
H	Asuinrakennus H (Hietasaari)	9:21
I	Asuinrakennus I (Lahdenperä)	6:22
J	Lomarakennus J (Junno)	2:55
K	Lomarakennus K (Isomännikkö)	10:40
L	Asuinrakennus L (Malkasaari)	0:00
M	Asuinrakennus M (Latvala)	0:00

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

No.	Name	Expected [h/year]
1	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (190)	15:32
2	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (191)	26:38
3	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (192)	4:06
4	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (193)	3:13
5	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (194)	0:00
6	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (195)	0:00
7	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (196)	2:37
8	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (197)	2:08
9	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (198)	7:47
10	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1)	0:00
11	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (2)	0:00
12	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (3)	0:00
13	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (4)	0:00
14	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (5)	0:00
15	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (6)	0:00
16	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (7)	0:00
17	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (8)	0:00
18	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (9)	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.

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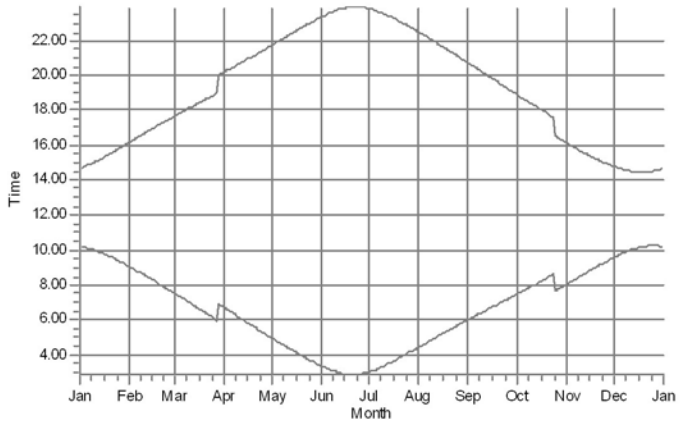
22.11.2023 16.57/3.6.377

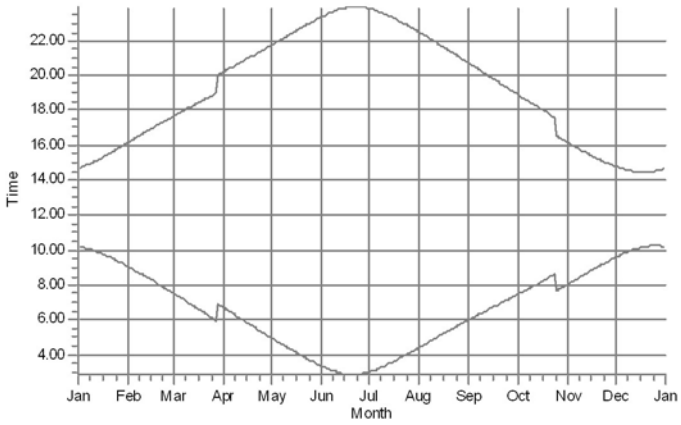
SHADOW - Calendar, graphical

Calculation: Shadow_Pajukoski II VE2_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

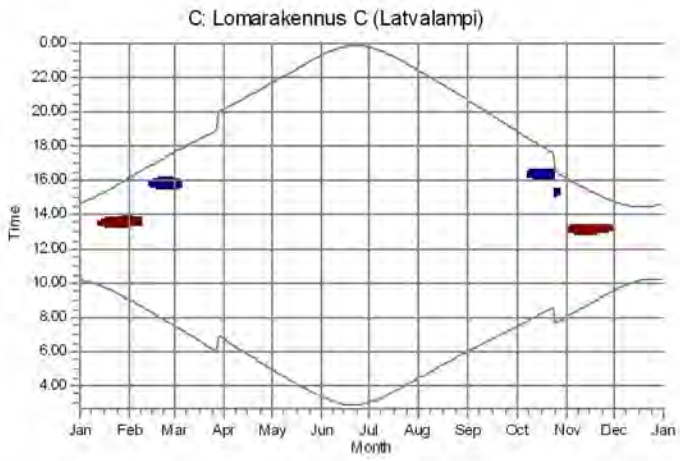
A: Lomarakennus A (Lampinjärvi)



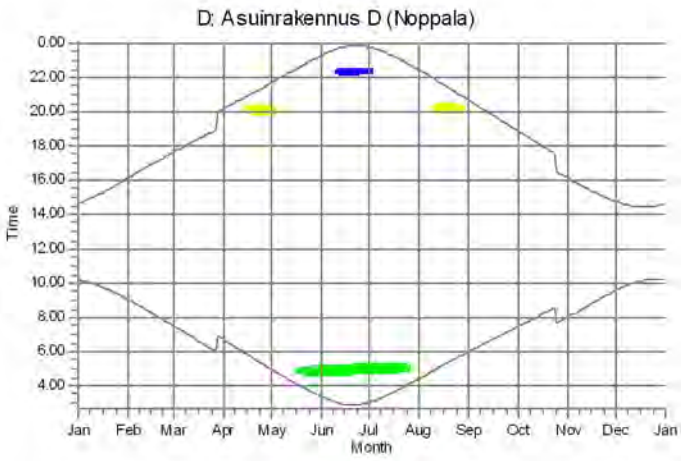
B: Lomarakennus B (Lampinkallio)



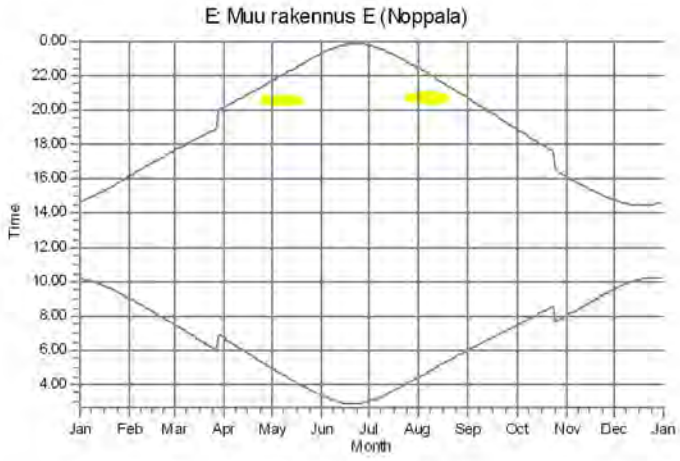
C: Lomarakennus C (Latvalampi)



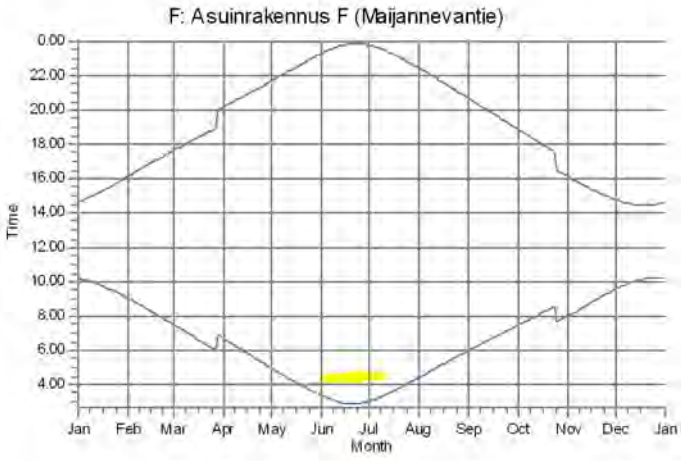
D: Asuinrakennus D (Noppala)



E: Muu rakennus E (Noppala)



F: Asuinrakennus F (Maijannevantie)



WTGs

- 2: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (191)
- 3: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (192)
- 7: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (196)
- 8: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (197)
- 9: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (198)

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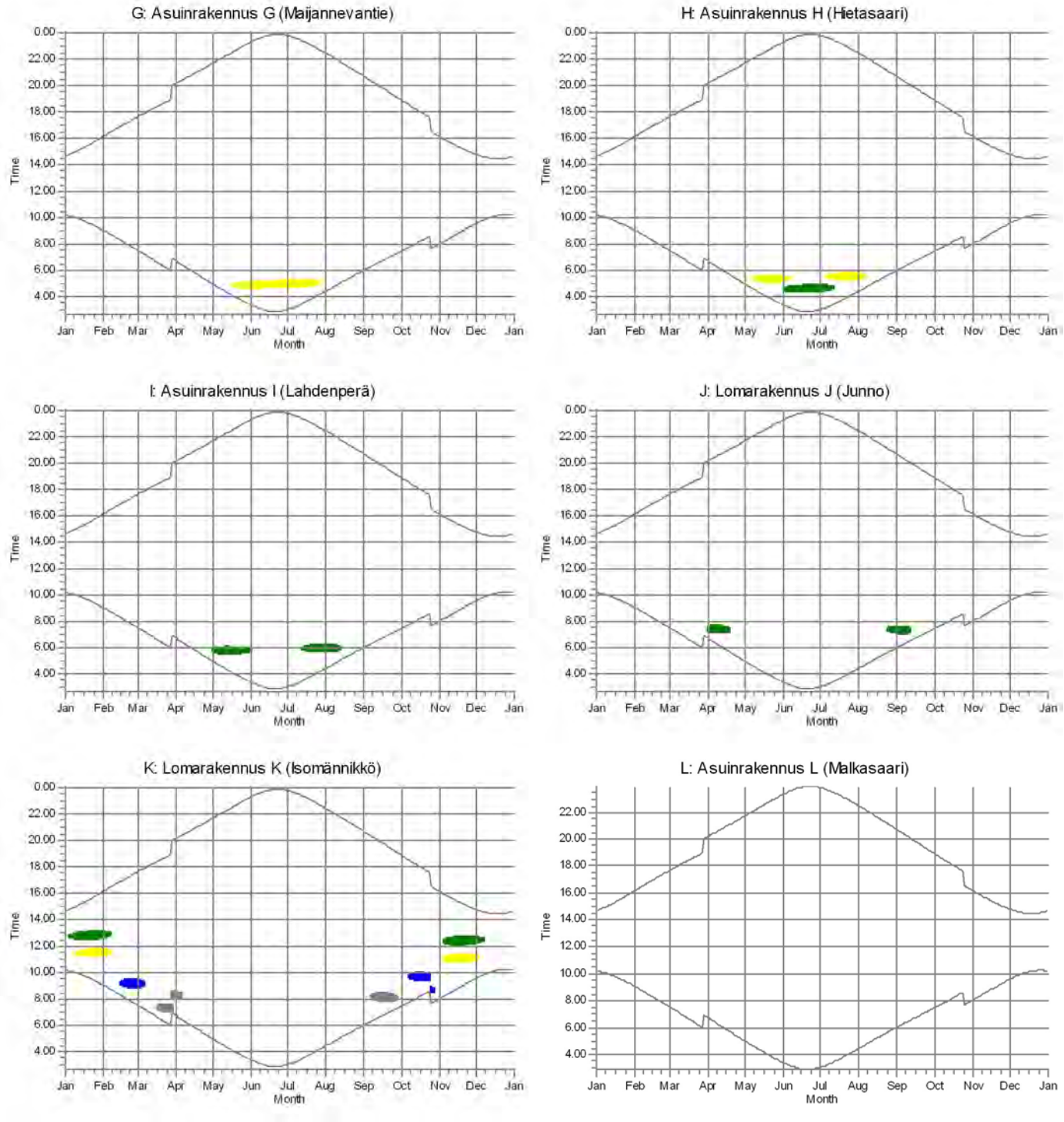
SHADOW - Calendar, graphical

Calculation: Shadow_Pajukoski II VE2_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)



WTGs

1: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (190)
2: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (191)
3: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (192)
4: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (193)

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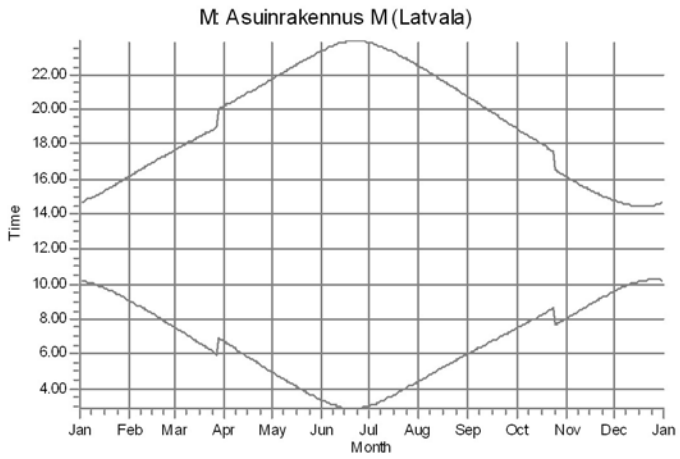
SHADOW - Calendar, graphical

Calculation: Shadow_Pajukoski II VE2_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)



WTGs

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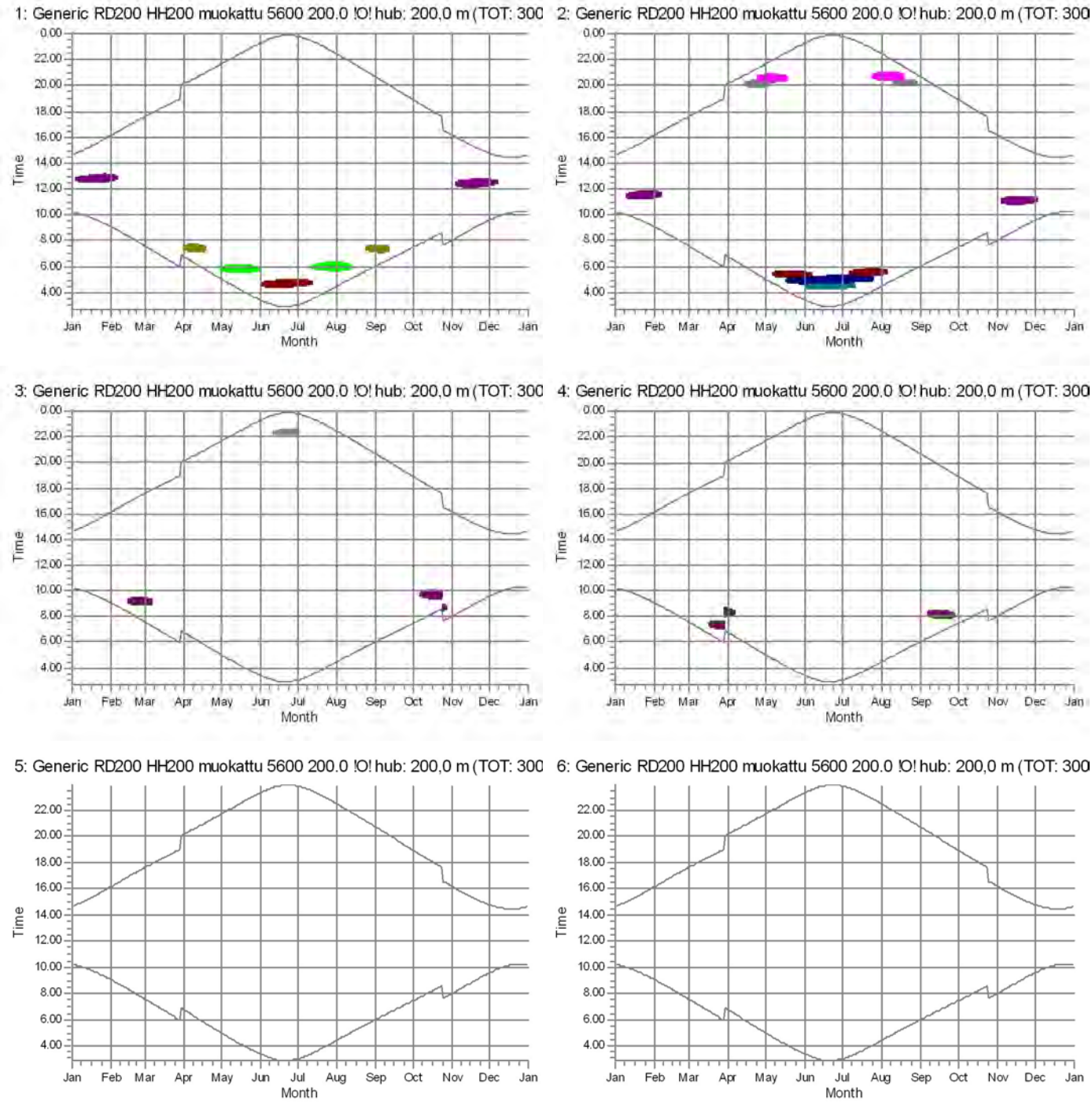
SHADOW - Calendar per WTG, graphical

Calculation: Shadow_Pajukoski II VE2_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)



Shadow receptors

- D: Asuinrakennus D (Noppala)
- E: Muu rakennus E (Noppala)
- F: Asuinrakennus F (Maijannevantie)
- G: Asuinrakennus G (Maijannevantie)
- H: Asuinrakennus H (Hietasaari)
- I: Asuinrakennus I (Lahdenperä)
- J: Lomarakennus J (Junno)
- K: Lomarakennus K (Isomännikkö)

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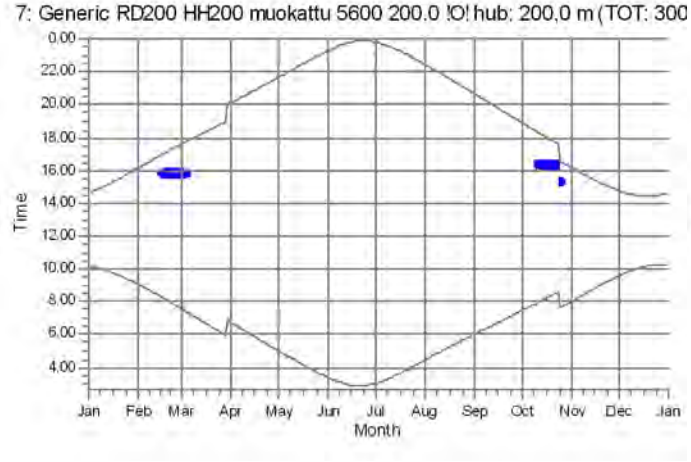
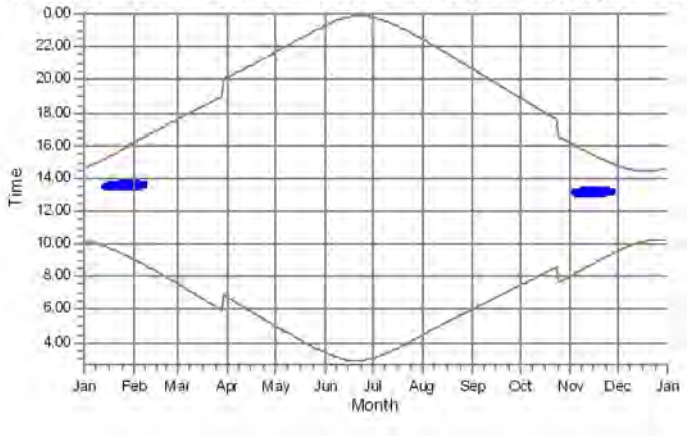
SHADOW - Calendar per WTG, graphical

Calculation: Shadow_Pajukoski II VE2_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

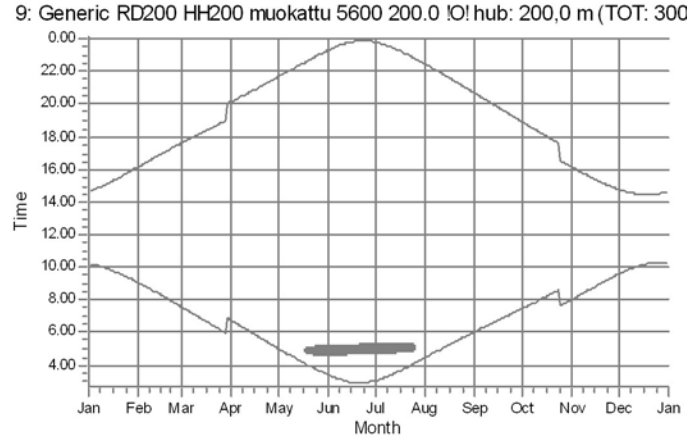
7: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300



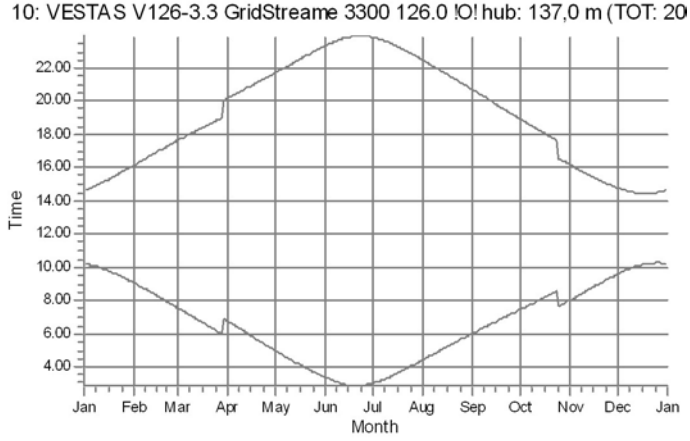
8: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300



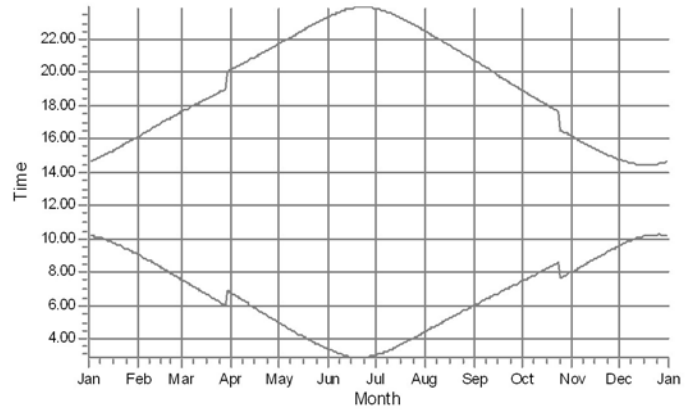
9: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300



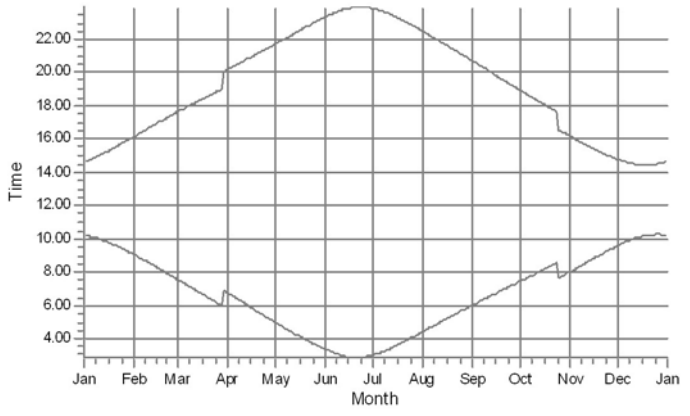
10: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



11: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



12: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



Shadow receptors

C: Lomarakennus C (Latvalampi)

D: Asuinrakennus D (Noppala)

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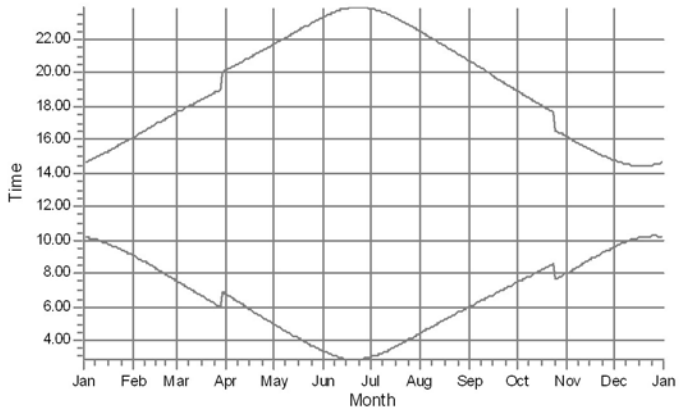
Calculated:
22.11.2023 16.57/3.6.377

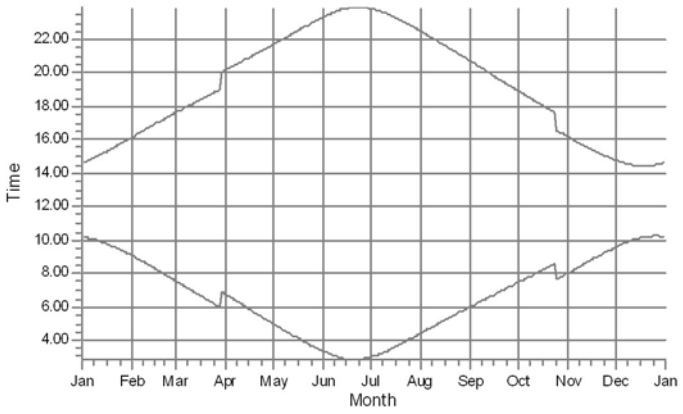
SHADOW - Calendar per WTG, graphical

Calculation: Shadow_Pajukoski II VE2_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

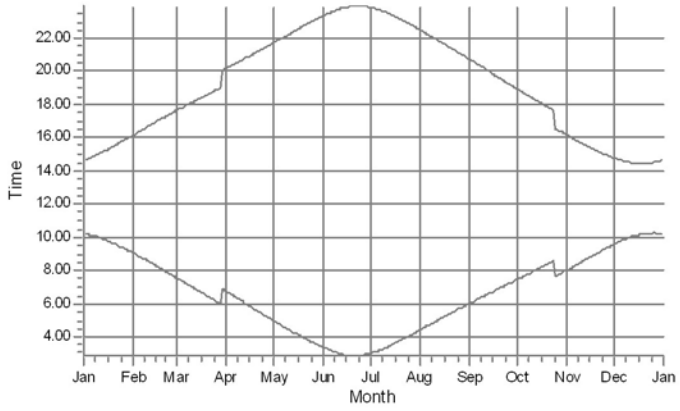
13: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



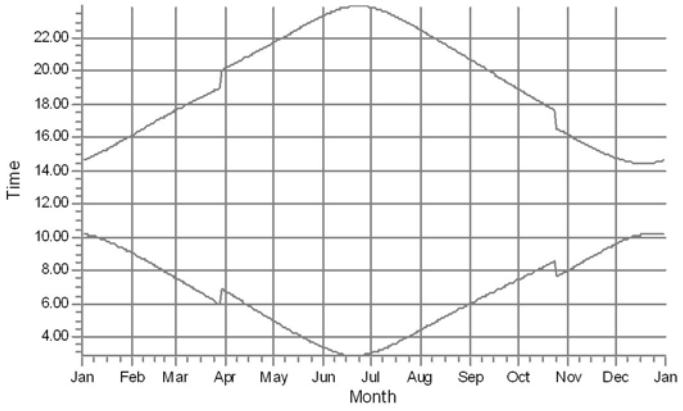
14: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



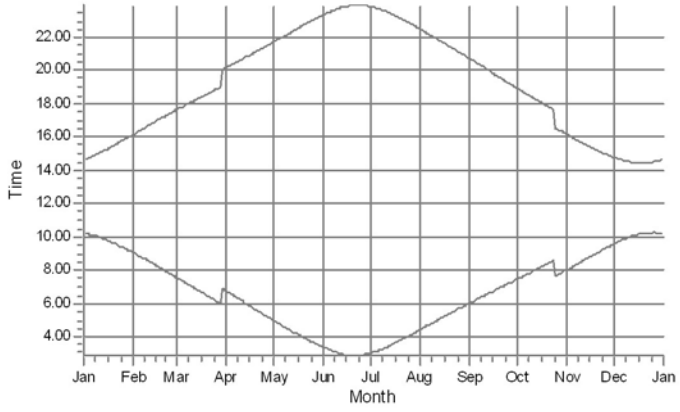
15: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



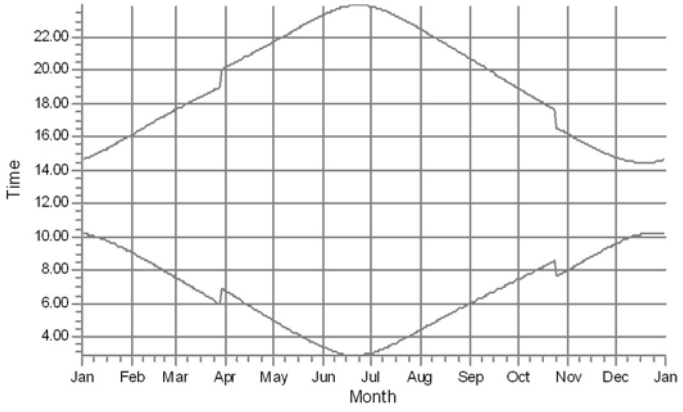
16: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



17: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



18: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



Shadow receptors

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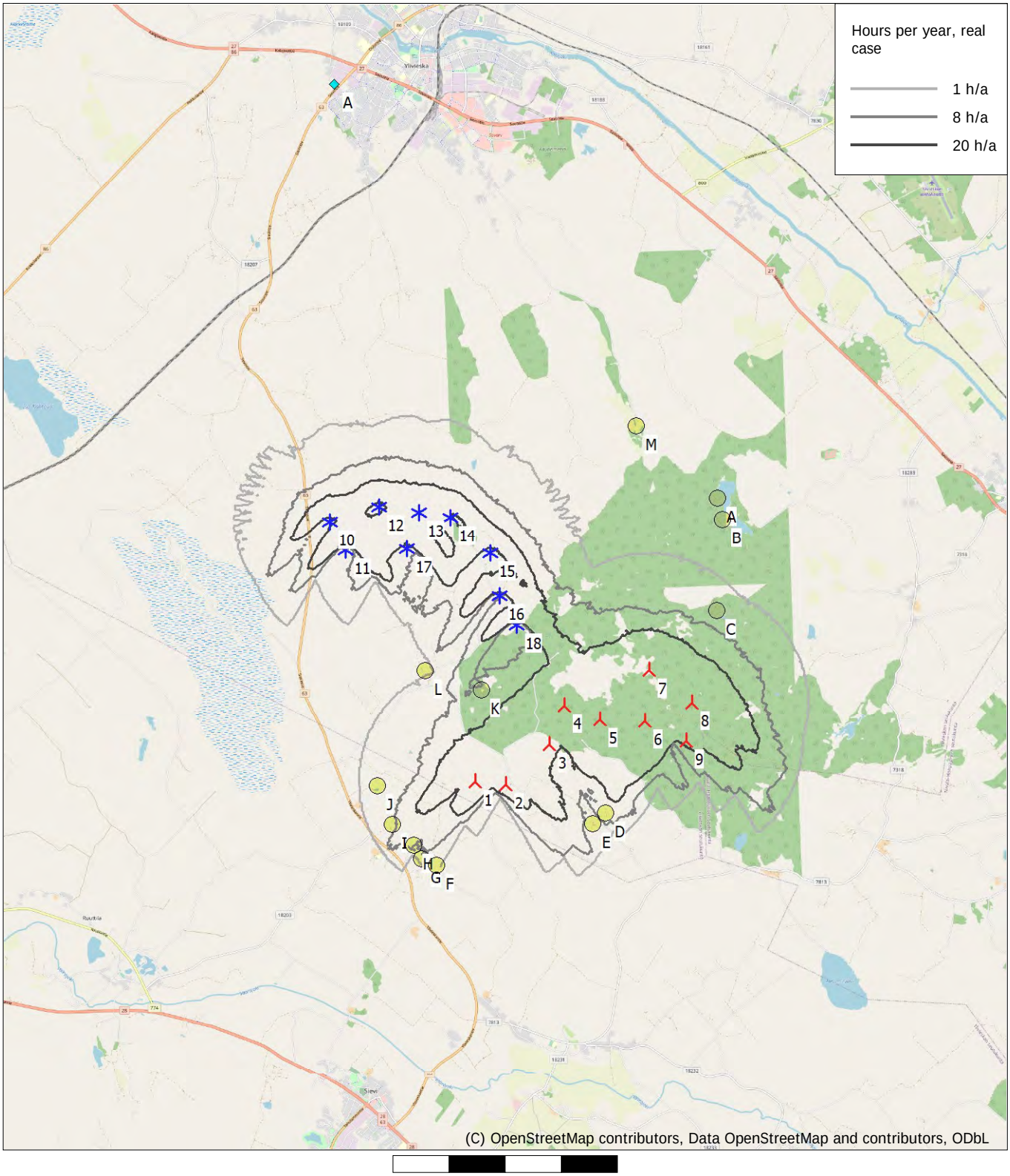
Calculated:
22.11.2023 16.57/3.6.377

SHADOW - Map

Calculation: Shadow_Pajukoski II VE2_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)



0 1 2 3 4 km

Map: EMD OpenStreetMap , Print scale 1:100 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 381 270 North: 7 098 650

New WTG Existing WTG Obstacle Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_Pajukoski tv-hanke_0.wpo (5)

Time step: 4 minutes, Day step: 14 days, Map resolution: 30 m, Visibility resolution: 15 m, Eye height: 1,5 m

Liite 12: Pajukoski II tuulivoimahanke – varjostusmallinnuksen tulokset ”real case, no forest” (VE3).

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Calculated:
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SHADOW - Main Result

Calculation: Shadow_Pajukoski II VE3_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

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

Sunshine probability S (Average daily sunshine hours) [LULEA]

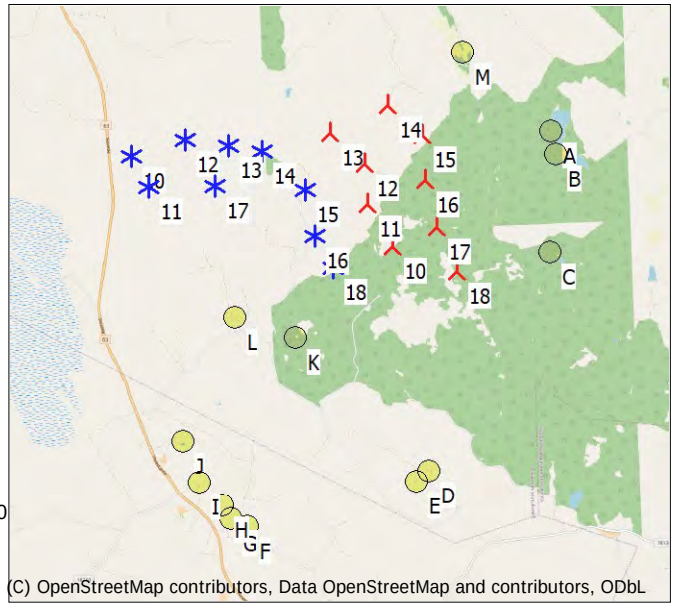
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: CONTOURLINE_Pajukoski tv-hanke_0
Obstacles used in calculation
Receptor grid resolution: 1,0 m

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



Scale 1:125 000

New WTG | Existing WTG | Shadow receptor

WTGs

	East	North	Z [m]	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	382 059	7 097 720	120,0	Generic RD200 HH20...	No	Generic	RD200 HH200 kavennet-5 600	5 600	200,0	200,0	2 086	10,4
10	377 791	7 099 387	87,5	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
11	378 057	7 098 862	90,0	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
11	381 666	7 098 437	107,7	Generic RD200 HH20...	No	Generic	RD200 HH200 kavennet-5 600	5 600	200,0	200,0	2 086	10,4
12	378 683	7 099 618	85,9	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
12	381 641	7 099 097	110,0	Generic RD200 HH20...	No	Generic	RD200 HH200 kavennet-5 600	5 600	200,0	200,0	2 086	10,4
13	379 394	7 099 490	94,6	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
13	381 097	7 099 635	104,3	Generic RD200 HH20...	No	Generic	RD200 HH200 kavennet-5 600	5 600	200,0	200,0	2 086	10,4
14	379 949	7 099 376	100,0	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
14	382 064	7 100 051	105,0	Generic RD200 HH20...	No	Generic	RD200 HH200 kavennet-5 600	5 600	200,0	200,0	2 086	10,4
15	382 623	7 099 549	108,6	Generic RD200 HH20...	No	Generic	RD200 HH200 kavennet-5 600	5 600	200,0	200,0	2 086	10,4
15	380 638	7 098 723	105,0	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
16	382 638	7 098 790	111,8	Generic RD200 HH20...	No	Generic	RD200 HH200 kavennet-5 600	5 600	200,0	200,0	2 086	10,4
16	380 775	7 097 932	105,0	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
17	379 139	7 098 839	92,5	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
17	382 790	7 098 020	125,0	Generic RD200 HH20...	No	Generic	RD200 HH200 kavennet-5 600	5 600	200,0	200,0	2 086	10,4
18	381 062	7 097 401	107,5	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
18	383 095	7 097 262	120,7	Generic RD200 HH20...	No	Generic	RD200 HH200 kavennet-5 600	5 600	200,0	200,0	2 086	10,4

Shadow receptor-Input

No.	Name	East	North	Z [m]	Width [m]	Height [m]	Elevation a.g.l. [m]	Slope of window [°]	Direction mode	Eye height (ZVI) a.g.l. [m]
A	Lomarakennus A (Lampinjärvi)	384 750	7 099 539	90,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
B	Lomarakennus B (Lampinkallio)	384 818	7 099 152	93,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
C	Lomarakennus C (Latvalampi)	384 650	7 097 533	96,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
D	Asuinrakennus D (Noppala)	382 520	7 093 979	105,2	5,0	5,0	1,0	90,0	"Green house mode"	6,0
E	Muu rakennus E (Noppala)	382 290	7 093 807	109,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
F	Asuinrakennus F (Maijannevantie)	379 455	7 093 166	96,2	5,0	5,0	1,0	90,0	"Green house mode"	6,0
G	Asuinrakennus G (Maijannevantie)	379 203	7 093 300	92,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0
H	Asuinrakennus H (Hietasaari)	379 076	7 093 530	92,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
I	Asuinrakennus I (Lahdenperä)	378 699	7 093 923	88,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
J	Lomarakennus J (Junno)	378 456	7 094 615	89,4	5,0	5,0	1,0	90,0	"Green house mode"	6,0
K	Lomarakennus K (Isomännikkö)	380 394	7 096 271	106,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0

To be continued on next page...

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Calculated:
22.11.2023 16.38/3.6.377

SHADOW - Main Result

Calculation: Shadow_Pajukoski II VE3_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

...continued from previous page

No.	Name	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]
L	Asuinrakennus L (Malkasaari)	379 392	7 096 642	100,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0
M	Asuinrakennus M (Latvala)	383 344	7 100 875	82,6	5,0	5,0	1,0	90,0	"Green house mode"	6,0

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values Shadow hours per year [h/year]
A	Lomarakennus A (Lampinjärvi)	0:00
B	Lomarakennus B (Lampinkallio)	0:00
C	Lomarakennus C (Latvalampi)	5:42
D	Asuinrakennus D (Noppala)	0:00
E	Muu rakennus E (Noppala)	0:00
F	Asuinrakennus F (Maijannevantie)	0:00
G	Asuinrakennus G (Maijannevantie)	0:00
H	Asuinrakennus H (Hietasaari)	0:00
I	Asuinrakennus I (Lahdenperä)	0:00
J	Lomarakennus J (Junno)	0:00
K	Lomarakennus K (Isomännikkö)	0:00
L	Asuinrakennus L (Malkasaari)	0:00
M	Asuinrakennus M (Latvala)	6:05

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

No.	Name	Expected [h/year]
10	Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (199)	0:00
10	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1)	0:00
11	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (2)	0:00
11	Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (200)	0:00
12	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (3)	0:00
12	Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (201)	0:00
13	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (4)	0:00
13	Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (202)	0:00
14	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (5)	0:00
14	Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (203)	2:58
15	Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (204)	3:06
15	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (6)	0:00
16	Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (205)	0:00
16	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (7)	0:00
17	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (8)	0:00
17	Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (206)	2:50
18	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (9)	0:00
18	Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (207)	2:52

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.

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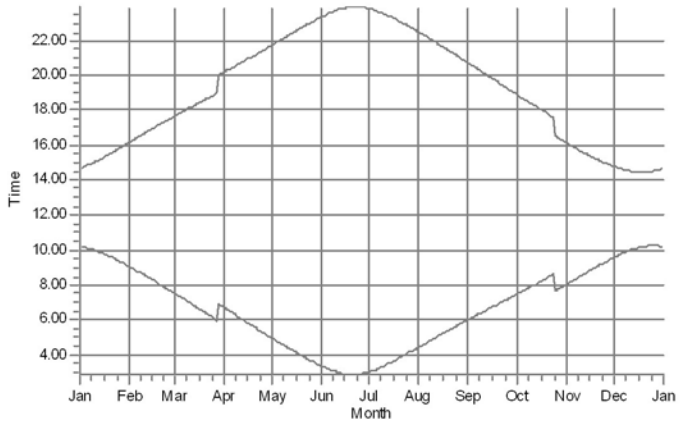
Calculated:
22.11.2023 16.38/3.6.377

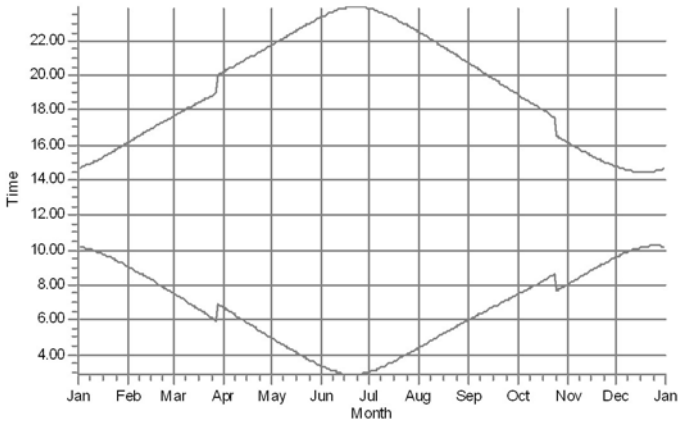
SHADOW - Calendar, graphical

Calculation: Shadow_Pajukoski II VE3_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

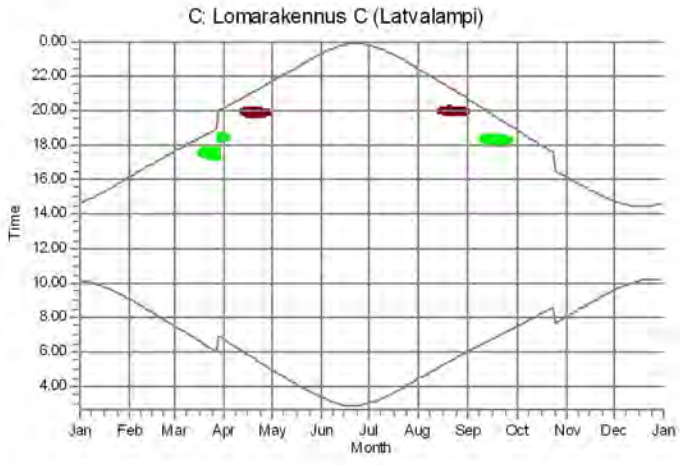
A: Lomarakennus A (Lampinjärvi)



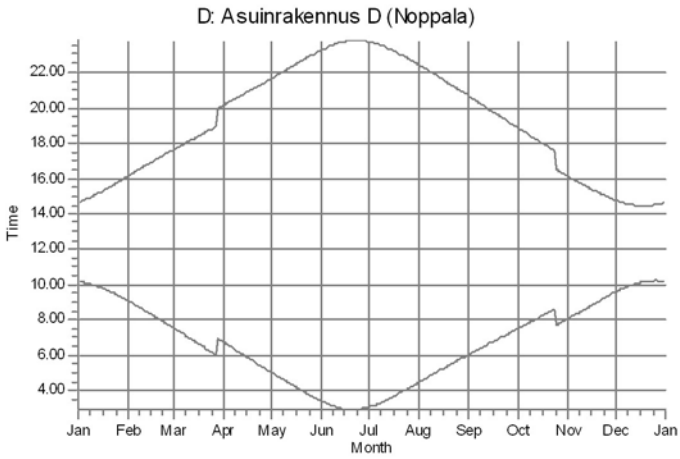
B: Lomarakennus B (Lampinkallio)



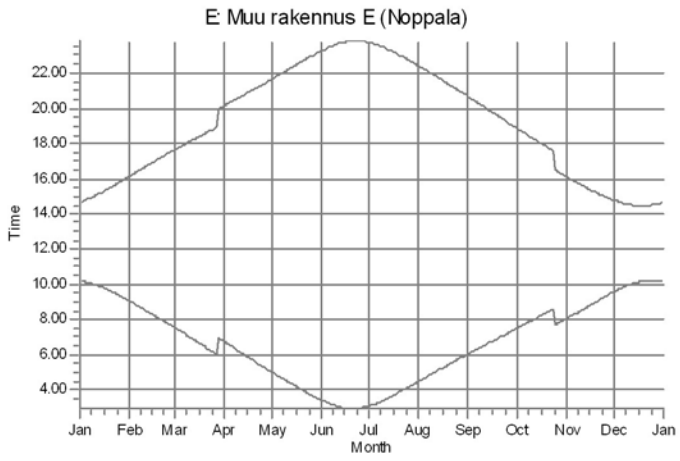
C: Lomarakennus C (Latvalampi)



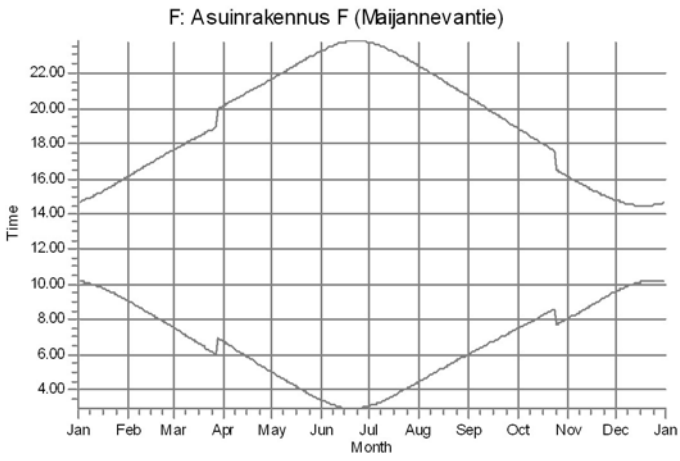
D: Asuinrakennus D (Noppala)



E: Muu rakennus E (Noppala)



F: Asuinrakennus F (Maijannevantie)



WTGs

17: Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (206)

18: Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (207)

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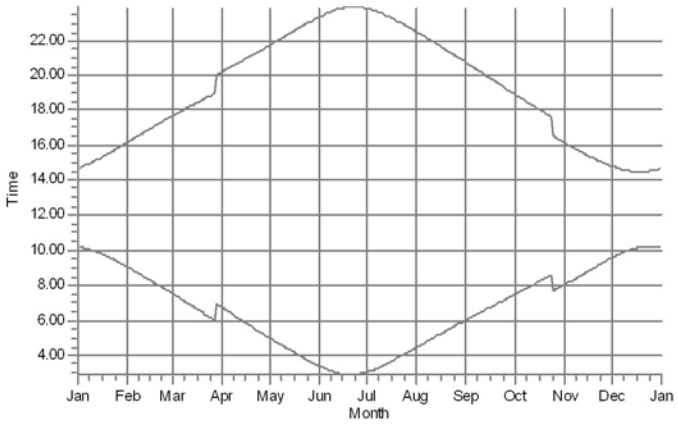
Calculated:
22.11.2023 16.38/3.6.377

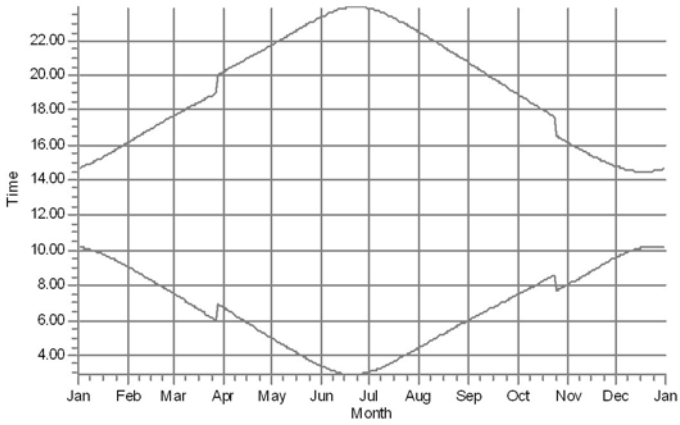
SHADOW - Calendar, graphical

Calculation: Shadow_Pajukoski II VE3_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)

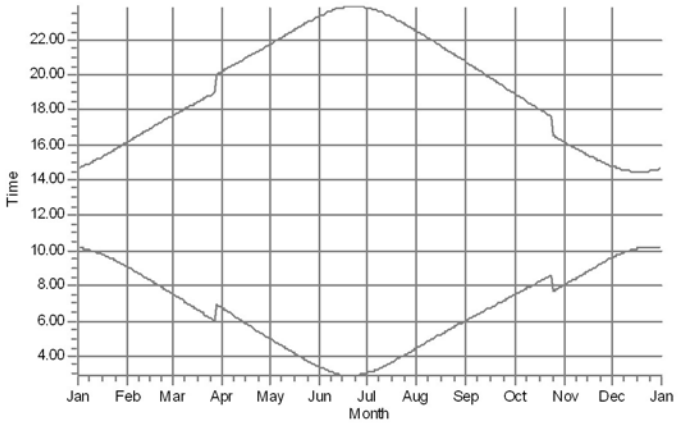
G: Asuinrakennus G (Maijannevantie)



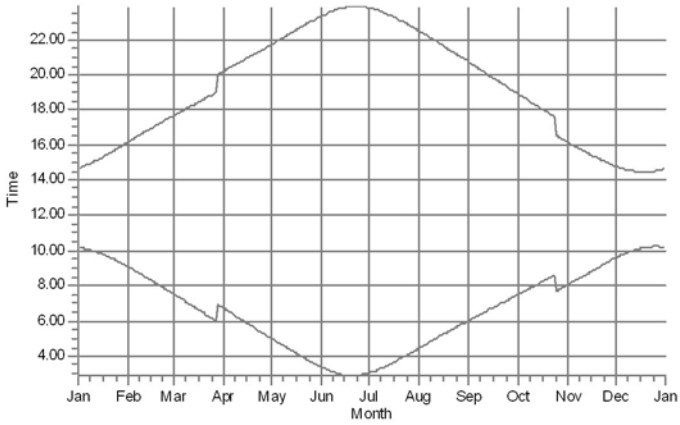
H: Asuinrakennus H (Hietasaari)



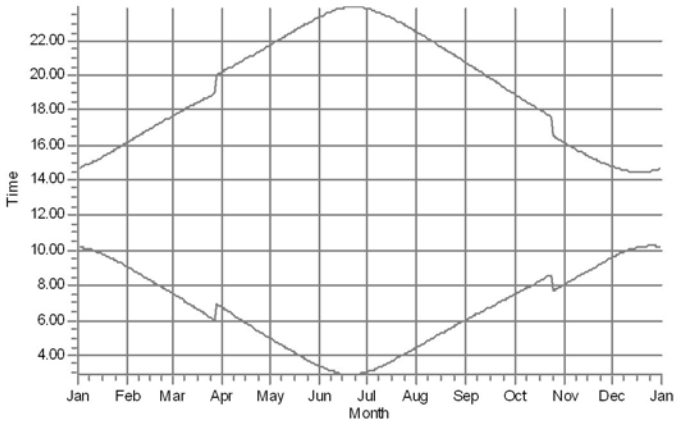
I: Asuinrakennus I (Lahdenperä)



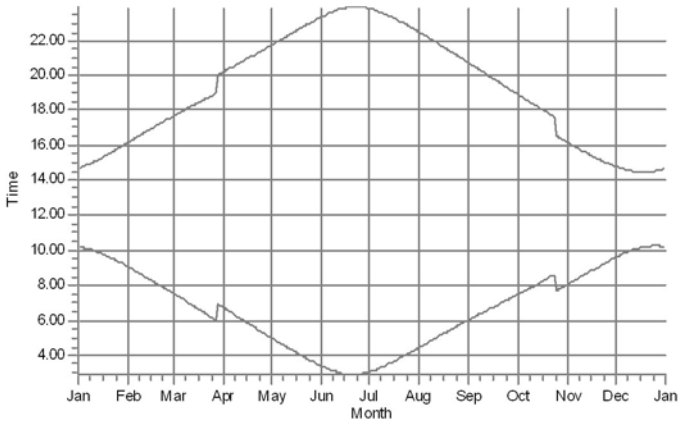
J: Lomarakennus J (Junno)



K: Lomarakennus K (Isomännikkö)



L: Asuinrakennus L (Malkasaari)



WTGs

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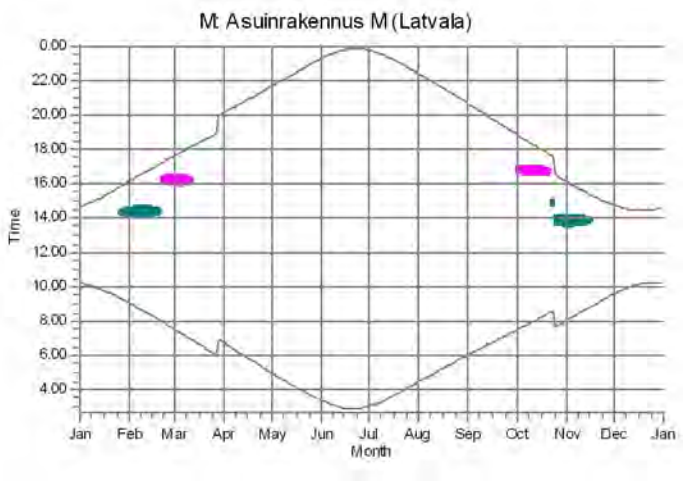
SHADOW - Calendar, graphical

Calculation: Shadow_Pajukoski II VE3_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)



WTGs

14: Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (203)

15: Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (204)

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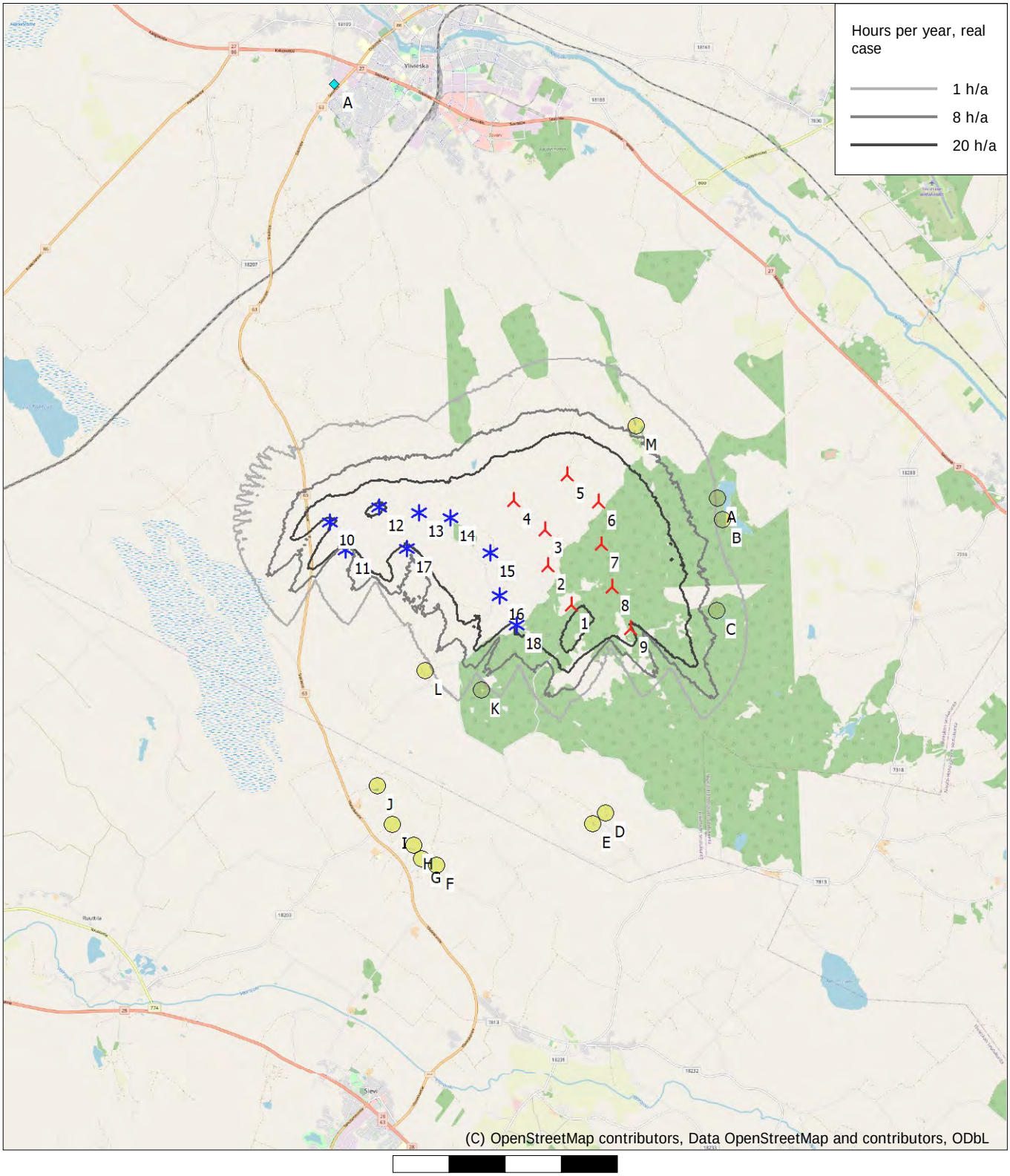
Calculated:
22.11.2023 16.38/3.6.377

SHADOW - Map

Calculation: Shadow_Pajukoski II VE3_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, no forest)



0 1 2 3 4 km

Map: EMD OpenStreetMap , Print scale 1:100 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 381 270 North: 7 098 650

New WTG Existing WTG Obstacle Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_Pajukoski tv-hanke_0.wpo (5)

Time step: 4 minutes, Day step: 14 days, Map resolution: 30 m, Visibility resolution: 15 m, Eye height: 1,5 m

Liite 13: Pajukoski II tuulivoimahanke – varjostusmallinnuksen tulokset ”real case, Luke forest” (VE1).

Project:

Pajukoski tv-hanke

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Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Main Result

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)

Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

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

Sunshine probability S (Average daily sunshine hours) [LULEA]

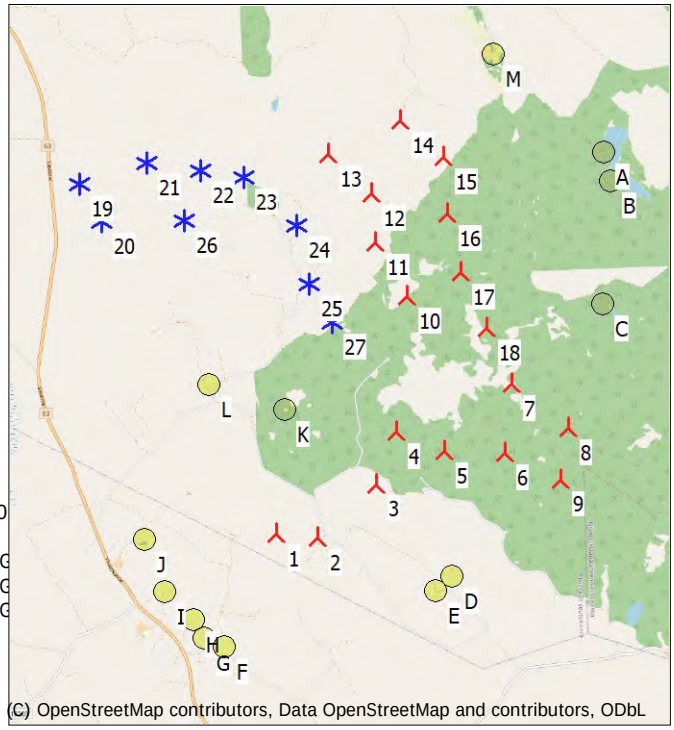
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: CONTOURLINE_Pajukoski tv-hanke_0
Area object(s) used in calculation:
Area object (Heights a.g.l. for e.g. Forest (ORA tool) or ZVI obstructions): REC
Area object (Heights a.g.l. for e.g. Forest (ORA tool) or ZVI obstructions): REC
Area object (Heights a.g.l. for e.g. Forest (ORA tool) or ZVI obstructions): REC
Area object (SE): (7)
Obstacles used in calculation
Receptor grid resolution: 1,0 m

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



Scale 1:100 000

New WTG Existing WTG Shadow receptor

WTGs

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	380 209	7 094 637	107,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
2	380 766	7 094 564	106,8	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
3	381 556	7 095 242	112,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
4	381 855	7 095 926	117,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
5	382 487	7 095 665	119,8	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
6	383 284	7 095 590	122,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
7	383 404	7 096 507	124,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
8	384 145	7 095 898	110,0	Generic RD200 HH20...	No	Generic	RD200 HH200 kavennet-5 600	5 600	200,0	200,0	2 086	10,4
9	384 021	7 095 208	112,5	Generic RD200 HH20...	No	Generic	RD200 HH200 kavennet-5 600	5 600	200,0	200,0	2 086	10,4
10	382 059	7 097 720	120,0	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
11	381 666	7 098 437	107,7	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
12	381 641	7 099 097	110,0	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
13	381 097	7 099 635	104,3	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
14	382 064	7 100 051	105,0	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
15	382 623	7 099 549	108,6	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
16	382 638	7 098 790	111,8	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
17	382 790	7 098 020	125,0	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
18	383 095	7 097 262	120,7	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
19	377 791	7 099 387	87,5	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
20	378 057	7 098 862	90,0	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
21	378 683	7 099 618	85,9	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
22	379 394	7 099 490	94,6	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
23	379 949	7 099 376	100,0	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
24	380 638	7 098 723	105,0	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
25	380 775	7 097 932	105,0	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
26	379 139	7 098 839	92,5	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
27	381 062	7 097 401	107,5	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8

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Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Main Result

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)

Shadow receptor-Input

No.	Name	East	North	Z [m]	Width [m]	Height [m]	Elevation a.g.l. [m]	Slope of window [°]	Direction mode	Eye height (ZVI) a.g.l. [m]
A	Lomarakennus A (Lampinjärvi)	384 750	7 099 539	90,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
B	Lomarakennus B (Lampinkallio)	384 818	7 099 152	93,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
C	Lomarakennus C (Latvalampi)	384 650	7 097 533	96,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
D	Asuinrakennus D (Noppala)	382 520	7 093 979	105,2	5,0	5,0	1,0	90,0	"Green house mode"	6,0
E	Muu rakennus E (Noppala)	382 290	7 093 807	109,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
F	Asuinrakennus F (Maijannevantie)	379 455	7 093 166	96,2	5,0	5,0	1,0	90,0	"Green house mode"	6,0
G	Asuinrakennus G (Maijannevantie)	379 203	7 093 300	92,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0
H	Asuinrakennus H (Hietasaari)	379 076	7 093 530	92,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
I	Asuinrakennus I (Lahdenperä)	378 699	7 093 923	88,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
J	Lomarakennus J (Junno)	378 456	7 094 615	89,4	5,0	5,0	1,0	90,0	"Green house mode"	6,0
K	Lomarakennus K (Isomännikkö)	380 394	7 096 271	106,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
L	Asuinrakennus L (Malkasaari)	379 392	7 096 642	100,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0
M	Asuinrakennus M (Latvala)	383 344	7 100 875	82,6	5,0	5,0	1,0	90,0	"Green house mode"	6,0

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values Shadow hours per year [h/year]
A	Lomarakennus A (Lampinjärvi)	0:00
B	Lomarakennus B (Lampinkallio)	0:00
C	Lomarakennus C (Latvalampi)	0:00
D	Asuinrakennus D (Noppala)	7:47
E	Muu rakennus E (Noppala)	5:01
F	Asuinrakennus F (Maijannevantie)	3:19
G	Asuinrakennus G (Maijannevantie)	0:00
H	Asuinrakennus H (Hietasaari)	9:21
I	Asuinrakennus I (Lahdenperä)	0:00
J	Lomarakennus J (Junno)	2:55
K	Lomarakennus K (Isomännikkö)	2:55
L	Asuinrakennus L (Malkasaari)	0:00
M	Asuinrakennus M (Latvala)	6:05

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

No.	Name	Expected [h/year]
1	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (172)	6:48
2	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (173)	13:48
3	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (174)	2:55
4	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (175)	0:00
5	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (176)	0:00
6	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (177)	0:00
7	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (178)	0:00
8	Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (179)	0:00
9	Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (210)	7:47
10	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (181)	0:00
11	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (182)	0:00
12	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (183)	0:00
13	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (184)	0:00
14	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (185)	2:58
15	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (186)	3:06
16	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (187)	0:00
17	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (188)	0:00
18	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (189)	0:00
19	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1)	0:00
20	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (2)	0:00
21	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (3)	0:00
22	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (4)	0:00
23	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (5)	0:00
24	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (6)	0:00
25	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (7)	0:00

To be continued on next page...

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Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Main Result

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)

...continued from previous page

No.	Name	Expected [h/year]
26	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (8)	0:00
27	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (9)	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.

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Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) Shadow receptor: A - Lomarakennus A (Lampinjärvi)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.22	03.01	04.27	06.02	07.28	08.01	09.36
	14.38	16.08	17.38	20.10	21.42	23.19	23.49	22.27	20.41	18.54	16.09	14.45
2	10.11	09.01	07.29	06.40	04.55	03.20	03.03	04.30	06.05	07.31	08.05	09.38
	14.40	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.43
3	10.10	08.58	07.26	06.37	04.52	03.17	03.05	04.33	06.08	07.34	08.08	09.41
	14.42	16.14	17.44	20.16	21.48	23.25	23.46	22.21	20.34	18.47	16.02	14.41
4	10.09	08.55	07.22	06.33	04.48	03.15	03.07	04.36	06.11	07.36	08.11	09.44
	14.44	16.18	17.47	20.19	21.52	23.28	23.44	22.17	20.30	18.44	15.59	14.39
5	10.08	08.52	07.19	06.30	04.45	03.12	03.09	04.40	06.13	07.39	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.40	15.56	14.38
6	10.07	08.49	07.15	06.26	04.42	03.10	03.11	04.43	06.16	07.42	08.17	09.49
	14.49	16.24	17.53	20.25	21.58	23.33	23.40	22.11	20.23	18.37	15.53	14.36
7	10.05	08.46	07.12	06.23	04.38	03.08	03.13	04.46	06.19	07.45	08.21	09.51
	14.51	16.28	17.56	20.28	22.01	23.35	23.38	22.07	20.19	18.33	15.50	14.35
8	10.03	08.43	07.08	06.19	04.35	03.06	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	17.59	20.31	22.04	23.37	23.36	22.04	20.16	18.30	15.47	14.33
9	10.02	08.39	07.05	06.15	04.32	03.04	03.18	04.52	06.25	07.51	08.27	09.56
	14.56	16.34	18.02	20.34	22.08	23.39	23.34	22.01	20.12	18.26	15.44	14.32
10	10.00	08.36	07.01	06.12	04.28	03.03	03.21	04.55	06.28	07.54	08.30	09.58
	14.59	16.37	18.05	20.37	22.11	23.41	23.32	21.57	20.09	18.23	15.40	14.31
11	09.58	08.33	06.58	06.08	04.25	03.01	03.23	04.58	06.31	07.57	08.33	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.37	14.29
12	09.56	08.30	06.54	06.05	04.22	02.58	03.26	05.01	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.17	23.45	23.27	21.50	20.02	18.16	15.34	14.28
13	09.54	08.26	06.51	06.01	04.18	02.57	03.29	05.05	06.36	08.03	08.40	10.04
	15.07	16.47	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.31	14.28
14	09.52	08.23	06.47	05.58	04.15	02.56	03.32	05.08	06.39	08.06	08.43	10.05
	15.10	16.50	18.17	20.49	22.24	23.48	23.22	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20	06.44	05.54	04.12	02.55	03.34	05.11	06.42	08.09	08.46	10.07
	15.13	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.26
16	09.47	08.17	06.40	05.51	04.09	02.54	03.37	05.14	06.45	08.12	08.50	10.08
	15.16	16.57	18.23	20.55	22.30	23.51	23.16	21.37	19.47	18.02	15.23	14.26
17	09.45	08.13	06.37	05.47	04.06	02.53	03.40	05.17	06.48	08.15	08.53	10.10
	15.19	17.00	18.26	20.58	22.34	23.52	23.13	21.33	19.44	17.59	15.20	14.25
18	09.43	08.10	06.33	05.44	04.02	02.53	03.43	05.20	06.51	08.18	08.56	10.11
	15.22	17.03	18.29	21.01	22.37	23.53	23.11	21.30	19.40	17.55	15.17	14.25
19	09.40	08.07	06.30	05.40	03.59	02.53	03.46	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.04	22.40	23.54	23.08	21.26	19.37	17.52	15.14	14.25
20	09.38	08.03	06.26	05.37	03.56	02.53	03.49	05.26	06.56	08.24	09.02	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.33	17.49	15.12	14.25
21	09.35	08.00	06.23	05.33	03.53	02.53	03.52	05.29	06.59	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.45	15.09	14.26
22	09.33	07.56	06.19	05.30	03.50	02.53	03.55	05.32	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.49	23.55	22.59	21.16	19.26	17.42	15.06	14.26
23	09.30	07.53	06.16	05.26	03.47	02.53	03.58	05.35	07.05	08.33	09.12	10.15
	15.38	17.19	18.44	21.17	22.53	23.55	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.44	02.54	04.02	05.38	07.08	08.36	09.15	10.15
	15.41	17.22	18.47	21.20	22.56	23.54	22.53	21.09	19.19	17.35	15.01	14.27
25	09.24	07.46	06.09	05.19	03.41	02.55	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.25	18.50	21.23	22.59	23.54	22.50	21.05	19.16	16.32	14.59	14.28
26	09.22	07.43	06.05	05.16	03.38	02.56	04.08	05.44	07.13	07.42	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.54	22.47	21.02	19.12	16.28	14.56	14.29
27	09.19	07.39	06.02	05.12	03.35	02.57	04.11	05.47	07.16	07.46	09.24	10.15
	15.51	17.32	18.55	21.29	23.05	23.53	22.43	20.58	19.09	16.25	14.54	14.30
28	09.16	07.36	05.58	05.09	03.33	02.58	04.14	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.58	21.32	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.31
29	09.13		06.54	05.05	03.30	03.00	04.17	05.53	07.22	07.52	09.30	10.15
	15.58		20.01	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.49	14.33
30	09.10		06.51	05.02	03.27	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.01		20.04	21.39	23.14	23.50	22.34	20.48	18.58	16.15	14.47	14.34
31	09.07		06.47		03.25		04.24	05.59		07.58		10.13
	16.04		20.07		23.17		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	138
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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Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) Shadow receptor: B - Lomarakennus B (Lampinkallio)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.22	03.01	04.27	06.02	07.28	08.01	09.36
	14.38	16.08	17.38	20.10	21.42	23.19	23.49	22.27	20.41	18.54	16.09	14.45
2	10.11	09.01	07.29	06.40	04.55	03.20	03.03	04.30	06.05	07.31	08.04	09.38
	14.40	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.43
3	10.10	08.58	07.26	06.37	04.52	03.17	03.05	04.33	06.08	07.34	08.08	09.41
	14.42	16.14	17.44	20.16	21.48	23.25	23.46	22.21	20.34	18.47	16.02	14.41
4	10.09	08.55	07.22	06.33	04.48	03.15	03.07	04.36	06.11	07.36	08.11	09.44
	14.44	16.18	17.47	20.19	21.52	23.27	23.44	22.17	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.13	07.39	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.26	18.40	15.56	14.38
6	10.06	08.49	07.15	06.26	04.42	03.10	03.11	04.43	06.16	07.42	08.17	09.49
	14.49	16.24	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.36
7	10.05	08.46	07.12	06.23	04.38	03.08	03.13	04.46	06.19	07.45	08.21	09.51
	14.51	16.28	17.56	20.28	22.01	23.35	23.38	22.07	20.19	18.33	15.50	14.35
8	10.03	08.42	07.08	06.19	04.35	03.06	03.16	04.49	06.22	07.48	08.24	09.53
	14.54	16.31	17.59	20.31	22.04	23.37	23.36	22.04	20.16	18.30	15.47	14.33
9	10.02	08.39	07.05	06.15	04.32	03.04	03.18	04.52	06.25	07.51	08.27	09.56
	14.56	16.34	18.02	20.34	22.08	23.39	23.34	22.01	20.12	18.26	15.44	14.32
10	10.00	08.36	07.01	06.12	04.28	03.03	03.21	04.55	06.28	07.54	08.30	09.58
	14.59	16.37	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.40	14.31
11	09.58	08.33	06.58	06.08	04.25	03.01	03.23	04.58	06.31	07.57	08.33	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.37	14.29
12	09.56	08.30	06.54	06.05	04.22	03.00	03.26	05.01	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.17	23.45	23.27	21.50	20.02	18.16	15.34	14.29
13	09.54	08.26	06.51	06.01	04.18	02.57	03.29	05.05	06.36	08.03	08.40	10.04
	15.07	16.47	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.31	14.28
14	09.52	08.23	06.47	05.58	04.15	02.56	03.32	05.08	06.39	08.06	08.43	10.05
	15.10	16.50	18.17	20.49	22.24	23.48	23.21	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20	06.44	05.54	04.12	02.55	03.35	05.11	06.42	08.09	08.46	10.07
	15.13	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.26
16	09.47	08.17	06.40	05.51	04.09	02.54	03.37	05.14	06.45	08.12	08.50	10.08
	15.16	16.57	18.23	20.55	22.30	23.51	23.16	21.37	19.47	18.02	15.23	14.26
17	09.45	08.13	06.37	05.47	04.06	02.54	03.40	05.17	06.48	08.15	08.53	10.10
	15.19	17.00	18.26	20.58	22.33	23.52	23.13	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10	06.33	05.44	04.02	02.53	03.43	05.20	06.51	08.18	08.56	10.11
	15.22	17.03	18.29	21.01	22.37	23.53	23.11	21.30	19.40	17.55	15.17	14.25
19	09.40	08.07	06.30	05.40	03.59	02.53	03.46	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.04	22.40	23.53	23.08	21.26	19.37	17.52	15.14	14.25
20	09.38	08.03	06.26	05.37	03.56	02.53	03.49	05.26	06.56	08.24	09.02	10.13
	15.29	17.10	18.35	21.07	22.43	23.54	23.05	21.23	19.33	17.49	15.12	14.25
21	09.35	08.00	06.23	05.33	03.53	02.53	03.52	05.29	06.59	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.45	15.09	14.26
22	09.32	07.56	06.19	05.30	03.50	02.53	03.55	05.32	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.49	23.55	22.59	21.16	19.26	17.42	15.06	14.26
23	09.30	07.53	06.16	05.26	03.47	02.54	03.59	05.35	07.05	08.33	09.12	10.15
	15.38	17.19	18.44	21.17	22.53	23.55	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.44	02.54	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.22	18.47	21.20	22.56	23.54	22.53	21.09	19.19	17.35	15.01	14.27
25	09.24	07.46	06.09	05.19	03.41	02.55	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.25	18.50	21.23	22.59	23.54	22.50	21.05	19.16	16.32	14.59	14.28
26	09.22	07.43	06.05	05.16	03.38	02.56	04.08	05.44	07.13	07.42	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.54	22.47	21.02	19.12	16.28	14.56	14.29
27	09.19	07.39	06.02	05.12	03.35	02.57	04.11	05.47	07.16	07.46	09.24	10.15
	15.51	17.32	18.55	21.29	23.05	23.53	22.43	20.58	19.09	16.25	14.54	14.30
28	09.16	07.36	05.58	05.09	03.33	02.58	04.14	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.58	21.32	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.54	05.06	03.30	03.00	04.17	05.53	07.22	07.52	09.30	10.14
	15.58		20.01	21.36	23.11	23.51	22.37	20.51	19.01	16.19	14.49	14.33
30	09.10		06.51	05.02	03.27	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.01		20.04	21.39	23.14	23.50	22.34	20.48	18.58	16.15	14.47	14.34
31	09.07		06.47		03.25		04.24	05.59		07.58		10.13
	16.04		20.07		23.17		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	138
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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Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) Shadow receptor: C - Lomarakennus C (Latvalampi)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.22	03.02	04.27	06.02	07.28	08.01	09.35
	14.39	16.08	17.38	20.10	21.42	23.19	23.48	22.27	20.41	18.54	16.09	14.45
2	10.11	09.01	07.29	06.40	04.55	03.20	03.03	04.30	06.05	07.31	08.04	09.38
	14.41	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.43
3	10.10	08.58	07.26	06.37	04.52	03.17	03.05	04.33	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.25	23.45	22.21	20.34	18.47	16.02	14.42
4	10.09	08.55	07.22	06.33	04.49	03.15	03.07	04.37	06.11	07.36	08.11	09.44
	14.45	16.18	17.47	20.19	21.51	23.27	23.44	22.17	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.13	07.39	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.26	18.40	15.56	14.38
6	10.06	08.49	07.15	06.26	04.42	03.11	03.11	04.43	06.16	07.42	08.17	09.49
	14.49	16.24	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.36
7	10.05	08.46	07.12	06.23	04.38	03.09	03.14	04.46	06.19	07.45	08.20	09.51
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.07	20.19	18.33	15.50	14.35
8	10.03	08.42	07.08	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.53
	14.54	16.31	17.59	20.31	22.04	23.37	23.36	22.04	20.16	18.30	15.47	14.33
9	10.01	08.39	07.05	06.16	04.32	03.05	03.19	04.52	06.25	07.51	08.27	09.56
	14.57	16.34	18.02	20.34	22.08	23.39	23.33	22.01	20.12	18.27	15.44	14.32
10	10.00	08.36	07.01	06.12	04.28	03.03	03.21	04.55	06.28	07.54	08.30	09.58
	14.59	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.08	04.25	03.01	03.24	04.58	06.31	07.57	08.33	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.54	06.05	04.22	03.00	03.26	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.17	23.45	23.26	21.50	20.02	18.16	15.35	14.29
13	09.54	08.26	06.51	06.01	04.19	02.57	03.29	05.05	06.36	08.03	08.40	10.03
	15.08	16.47	18.14	20.46	22.20	23.46	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.47	05.58	04.15	02.56	03.32	05.08	06.39	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.21	21.43	19.55	18.09	15.29	14.27
15	09.49	08.20	06.44	05.54	04.12	02.55	03.35	05.11	06.42	08.09	08.46	10.07
	15.14	16.54	18.20	20.52	22.27	23.49	23.19	21.40	19.51	18.06	15.26	14.27
16	09.47	08.16	06.40	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.49	10.08
	15.17	16.57	18.23	20.55	22.30	23.50	23.16	21.37	19.47	18.02	15.23	14.26
17	09.45	08.13	06.37	05.47	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.09
	15.20	17.00	18.26	20.58	22.33	23.52	23.13	21.33	19.44	17.59	15.20	14.26
18	09.42	08.10	06.33	05.44	04.03	02.53	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.03	18.29	21.01	22.37	23.52	23.10	21.30	19.40	17.56	15.17	14.26
19	09.40	08.07	06.30	05.40	03.59	02.53	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.04	22.40	23.53	23.07	21.26	19.37	17.52	15.15	14.26
20	09.38	08.03	06.26	05.37	03.56	02.53	03.50	05.26	06.56	08.24	09.02	10.13
	15.29	17.10	18.35	21.07	22.43	23.54	23.05	21.23	19.33	17.49	15.12	14.26
21	09.35	08.00	06.23	05.33	03.53	02.53	03.53	05.29	06.59	08.27	09.05	10.13
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.45	15.09	14.26
22	09.32	07.56	06.19	05.30	03.50	02.53	03.56	05.32	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.49	23.54	22.59	21.16	19.26	17.42	15.06	14.26
23	09.30	07.53	06.16	05.26	03.47	02.54	03.59	05.35	07.05	08.33	09.12	10.14
	15.38	17.19	18.44	21.17	22.52	23.54	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.44	02.55	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.22	18.47	21.20	22.55	23.54	22.53	21.09	19.19	17.35	15.01	14.28
25	09.24	07.46	06.09	05.19	03.41	02.55	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.25	18.50	21.23	22.59	23.54	22.49	21.05	19.16	16.32	14.59	14.28
26	09.21	07.43	06.05	05.16	03.39	02.56	04.08	05.44	07.13	07.42	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.53	22.46	21.02	19.12	16.29	14.57	14.29
27	09.19	07.39	06.02	05.13	03.36	02.57	04.11	05.47	07.16	07.45	09.24	10.15
	15.51	17.32	18.55	21.29	23.05	23.53	22.43	20.58	19.09	16.25	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.14	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.58	21.32	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.54	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.14
	15.58		20.01	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.27	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.01		20.04	21.39	23.13	23.50	22.34	20.48	18.58	16.15	14.48	14.35
31	09.07		06.47		03.25		04.24	05.59		07.58		10.13
	16.05		20.07		23.16		22.30	20.44		16.12		14.36
Potential sun hours	172	238	363	451	568	621	607	508	393	305	199	139
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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Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) Shadow receptor: D - Asuinrakennus D (Noppala)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	04.41 (9) 03.03	04.46 (9) 04.28	06.02	07.28	08.01	09.35
	14.39	16.08	17.38	20.10	21.42	23.19 26	05.07 (9) 23.48 26	05.12 (9) 22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.41	04.56	03.21	04.41 (9) 03.04	04.47 (9) 04.31	06.05	07.31	08.04	09.38
	14.41	16.12	17.41	20.13	21.45	23.21 26	05.07 (9) 23.46 26	05.13 (9) 22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18	04.41 (9) 03.06	04.47 (9) 04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.24 26	05.07 (9) 23.45 26	05.13 (9) 22.20	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	03.16	04.41 (9) 03.08	04.47 (9) 04.37	06.11	07.37	08.11	09.43
	14.45	16.18	17.47	20.19	21.51	23.27 26	05.07 (9) 23.43 26	05.13 (9) 22.17	20.30	18.44	16.00	14.40
5	10.07	08.52	07.19	06.30	04.46	03.14	04.41 (9) 03.10	04.48 (9) 04.40	06.14	07.39	08.14	09.46
	14.48	16.22	17.50	20.22	21.55	23.29 27	05.08 (9) 23.41 26	05.14 (9) 22.14	20.27	18.41	15.56	14.39
6	10.06	08.49	07.15	06.26	04.42	03.11	04.42 (9) 03.12	04.47 (9) 04.43	06.17	07.42	08.17	09.48
	14.50	16.25	17.53	20.25	21.58	23.32 26	05.08 (9) 23.39 27	05.14 (9) 22.11	20.23	18.37	15.53	14.37
7	10.04	08.46	07.12	06.23	04.39	03.09	04.41 (9) 03.15	04.48 (9) 04.46	06.20	07.45	08.20	09.51
	14.52	16.28	17.56	20.28	22.01	23.34 26	05.07 (9) 23.37 26	05.14 (9) 22.07	20.19	18.34	15.50	14.35
8	10.03	08.42	07.08	06.19	04.36	03.07	04.42 (9) 03.17	04.47 (9) 04.50	06.22	07.48	08.24	09.53
	14.55	16.31	17.59	20.31	22.04	23.36 26	05.08 (9) 23.35 27	05.14 (9) 22.04	20.16	18.30	15.47	14.34
9	10.01	08.39	07.05	06.16	04.32	03.06	04.42 (9) 03.19	04.48 (9) 04.53	06.25	07.51	08.27	09.55
	14.57	16.35	18.02	20.34	22.07	23.38 26	05.08 (9) 23.33 26	05.14 (9) 22.00	20.12	18.27	15.44	14.33
10	09.59	08.36	07.01	06.12	04.29	03.04	04.42 (9) 03.22	04.48 (9) 04.56	06.28	07.54	08.30	09.57
	15.00	16.38	18.05	20.37	22.11	23.40 26	05.08 (9) 23.31 26	05.14 (9) 21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.26	03.02	04.42 (9) 03.24	04.49 (9) 04.59	06.31	07.57	08.33	09.59
	15.03	16.41	18.08	20.40	22.14	23.42 26	05.08 (9) 23.28 26	05.15 (9) 21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.01	04.43 (9) 03.27	04.49 (9) 05.02	06.34	08.00	08.36	10.01
	15.05	16.44	18.11	20.43	22.17	23.44 26	05.09 (9) 23.26 26	05.15 (9) 21.50	20.02	18.16	15.35	14.29
13	09.54	08.26	06.51	06.02	04.19	02.58	04.43 (9) 03.30	04.49 (9) 05.05	06.37	08.03	08.40	10.03
	15.08	16.48	18.14	20.46	22.20	23.46 26	05.09 (9) 23.23 26	05.15 (9) 21.47	19.58	18.13	15.32	14.29
14	09.51	08.23	06.48	05.58	04.16	02.57	04.44 (9) 03.33	04.50 (9) 05.08	06.40	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.23	23.47 25	05.09 (9) 23.21 25	05.15 (9) 21.43	19.55	18.09	15.29	14.28
15	09.49	08.20	06.44	05.55	04.13	02.56	04.43 (9) 03.35	04.50 (9) 05.11	06.42	08.09	08.46	10.06
	15.14	16.54	18.20	20.52	22.27	23.49 26	05.09 (9) 23.18 25	05.15 (9) 21.40	19.51	18.06	15.26	14.27
16	09.47	08.16	06.40	05.51	04.09	02.55	04.44 (9) 03.38	04.50 (9) 05.14	06.45	08.12	08.49	10.08
	15.17	16.57	18.23	20.55	22.30	23.50 25	05.09 (9) 23.16 24	05.14 (9) 21.37	19.48	18.03	15.23	14.27
17	09.45	08.13	06.37	05.48	04.06	02.55	04.45 (9) 03.41	04.50 (9) 05.17	06.48	08.15	08.53	10.09
	15.20	17.01	18.26	20.58	22.33	23.51 25	05.10 (9) 23.13 24	05.14 (9) 21.33	19.44	17.59	15.21	14.26
18	09.42	08.10	06.33	05.44	04.03 04.50 (9)	02.54	04.44 (9) 03.44	04.51 (9) 05.20	06.51	08.18	08.56	10.10
	15.23	17.04	18.29	21.01	22.36 5 04.55 (9)	23.52 25	05.09 (9) 23.10 22	05.13 (9) 21.30	19.41	17.56	15.18	14.26
19	09.40	08.07	06.30	05.41	04.00 04.47 (9)	02.54	04.44 (9) 03.47	04.52 (9) 05.23	06.54	08.21	08.59	10.11
	15.26	17.07	18.32	21.04	22.39 11 04.58 (9)	23.52 25	05.09 (9) 23.07 22	05.14 (9) 21.26	19.37	17.52	15.15	14.26
20	09.37	08.03	06.26	05.37	03.57 04.46 (9)	02.54	04.44 (9) 03.50	04.52 (9) 05.27	06.57	08.24	09.02	10.12
	15.29	17.10	18.35	21.07	22.43 14 05.00 (9)	23.53 26	05.10 (9) 23.04 21	05.13 (9) 21.23	19.33	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54 04.45 (9)	02.54	04.46 (9) 03.53	04.53 (9) 05.30	06.59	08.27	09.05	10.13
	15.33	17.13	18.38	21.10	22.46 16 05.01 (9)	23.53 25	05.11 (9) 23.01 19	05.12 (9) 21.19	19.30	17.46	15.10	14.27
22	09.32	07.56	06.19	05.30	03.51 04.43 (9)	02.54	04.46 (9) 03.56	04.54 (9) 05.33	07.02	08.30	09.08	10.14
	15.36	17.16	18.41	21.14	22.49 18 05.01 (9)	23.54 25	05.11 (9) 22.58 18	05.12 (9) 21.16	19.26	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48 04.43 (9)	02.55	04.45 (9) 03.59	04.55 (9) 05.36	07.05	08.33	09.11	10.14
	15.39	17.19	18.44	21.17	22.52 19 05.02 (9)	23.54 25	05.10 (9) 22.55 16	05.11 (9) 21.12	19.23	17.39	15.04	14.28
24	09.27	07.50	06.12	05.23	03.45 04.42 (9)	02.55	04.46 (9) 04.02	04.56 (9) 05.39	07.08	08.36	09.15	10.14
	15.42	17.23	18.47	21.20	22.55 21 05.03 (9)	23.53 25	05.11 (9) 22.52 13	05.09 (9) 21.09	19.19	17.36	15.02	14.28
25	09.24	07.46	06.09	05.20	03.42 04.42 (9)	02.56	04.46 (9) 04.06	04.59 (9) 05.42	07.11	08.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.58 22 05.04 (9)	23.53 25	05.11 (9) 22.49 8	05.07 (9) 21.05	19.16	16.32	14.59	14.29
26	09.21	07.43	06.05	05.16	03.39 04.42 (9)	02.57	04.46 (9) 04.09	05.44	07.14	07.42	09.21	10.15
	15.49	17.29	18.53	21.26	23.01 23 05.05 (9)	23.53 26	05.12 (9) 22.46	21.02	19.12	16.29	14.57	14.30
27	09.19	07.39	06.02	05.13	03.36 04.41 (9)	02.58	04.46 (9) 04.12	05.47	07.16	07.45	09.24	10.15
	15.52	17.32	18.56	21.29	23.04 24 05.05 (9)	23.52 25	05.11 (9) 22.43	20.58	19.09	16.26	14.55	14.31
28	09.16	07.36	05.58	05.09	03.34 04.41 (9)	03.00	04.46 (9) 04.15	05.50	07.19	07.49	09.27	10.14
	15.55	17.35	18.59	21.32	23.07 24 05.05 (9)	23.51 25	05.11 (9) 22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.31 04.41 (9)	03.00	04.46 (9) 04.18	05.53	07.22	07.52	09.30	10.14
	15.58		20.01	21.35	23.10 25 05.06 (9)	23.50 26	05.12 (9) 22.37	20.51	19.02	16.19	14.50	14.34
30	09.10		06.51	05.03	03.28 04.41 (9)	03.01	04.46 (9) 04.21	05.56	07.25	07.55	09.32	10.13
	16.02		20.04	21.39	23.13 25 05.06 (9)	23.49 26	05.12 (9) 22.33	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.26 04.40 (9)		04.24	05.59		07.58		10.13
	16.05		20.07		23.16 26 05.06 (9)		22.30	20.44		16.12		14.37
Potential sun hours	173	239	363	450	568	621	606	507	393	305	199	139
Total, worst case					273	769	577					
Sun reduction					0,48	0,51	0,49					
Oper. time red.					0,94	0,94	0,94					
Wind dir. red.					0,62	0,62	0,62					
Total reduction					0,28	0,30	0,28					
Total, real					76	229	163					

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

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

Project:
Pajukoski tv-hanke

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Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) Shadow receptor: E - Muu rakennus E (Noppala)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	20.22 (2)	03.23	03.03	04.28	20.33 (2)	06.02	07.28	08.01	09.35
	14.39	16.08	17.38	20.10	21.42 27	20.49 (2)	23.19	23.48	22.27 25	20.58 (2)	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.41	04.56	20.21 (2)	03.21	03.04	04.31	20.31 (2)	06.05	07.31	08.04	09.38
	14.41	16.12	17.41	20.13	21.45 28	20.49 (2)	23.21	23.46	22.24 26	20.57 (2)	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	20.21 (2)	03.18	03.06	04.34	20.31 (2)	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48 28	20.49 (2)	23.24	23.45	22.20 27	20.58 (2)	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	20.21 (2)	03.16	03.08	04.37	20.31 (2)	06.11	07.37	08.11	09.43
	14.45	16.18	17.47	20.19	21.51 28	20.49 (2)	23.27	23.43	22.17 28	20.59 (2)	20.30	18.44	16.00	14.40
5	10.07	08.52	07.19	06.30	04.46	20.20 (2)	03.14	03.10	04.40	20.30 (2)	06.14	07.39	08.14	09.46
	14.48	16.22	17.50	20.22	21.55 29	20.49 (2)	23.29	23.41	22.14 28	20.58 (2)	20.27	18.41	15.57	14.39
6	10.06	08.49	07.15	06.26	04.42	20.20 (2)	03.11	03.12	04.43	20.30 (2)	06.17	07.42	08.17	09.48
	14.50	16.25	17.53	20.25	21.58 29	20.49 (2)	23.32	23.39	22.11 29	20.59 (2)	20.23	18.37	15.53	14.37
7	10.04	08.46	07.12	06.23	04.39	20.20 (2)	03.09	03.15	04.46	20.30 (2)	06.20	07.45	08.20	09.51
	14.52	16.28	17.56	20.28	22.01 29	20.49 (2)	23.34	23.37	22.07 29	20.59 (2)	20.19	18.34	15.50	14.35
8	10.03	08.42	07.08	06.19	04.36	20.20 (2)	03.07	03.17	04.50	20.30 (2)	06.22	07.48	08.24	09.53
	14.55	16.31	17.59	20.31	22.04 28	20.48 (2)	23.36	23.35	22.04 28	20.58 (2)	20.16	18.30	15.47	14.34
9	10.01	08.39	07.05	06.16	04.32	20.21 (2)	03.06	03.19	04.53	20.30 (2)	06.25	07.51	08.27	09.55
	14.57	16.35	18.02	20.34	22.07 28	20.49 (2)	23.38	23.33	22.00 28	20.58 (2)	20.12	18.27	15.44	14.33
10	09.59	08.36	07.02	06.12	04.29	20.21 (2)	03.04	03.22	04.56	20.30 (2)	06.28	07.54	08.30	09.57
	15.00	16.38	18.05	20.37	22.11 27	20.48 (2)	23.40	23.31	21.57 28	20.58 (2)	20.09	18.23	15.41	14.32
11	09.58	08.33	06.58	06.09	04.26	20.22 (2)	03.02	03.25	04.59	20.30 (2)	06.31	07.57	08.33	09.59
	15.03	16.41	18.08	20.40	22.14 25	20.47 (2)	23.42	23.28	21.54 27	20.57 (2)	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	20.22 (2)	03.01	03.27	05.02	20.30 (2)	06.34	08.00	08.36	10.01
	15.05	16.44	18.11	20.43	22.17 24	20.46 (2)	23.44	23.26	21.50 27	20.57 (2)	20.02	18.16	15.35	14.29
13	09.54	08.26	06.51	06.02	04.19	20.23 (2)	02.58	03.30	05.05	20.31 (2)	06.37	08.03	08.40	10.03
	15.08	16.48	18.14	20.46	22.20 23	20.46 (2)	23.46	23.23	21.47 25	20.56 (2)	19.58	18.13	15.32	14.29
14	09.51	08.23	06.48	05.58	04.16	20.24 (2)	02.57	03.33	05.08	20.32 (2)	06.40	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.23 21	20.45 (2)	23.47	23.21	21.43 24	20.56 (2)	19.55	18.09	15.29	14.28
15	09.49	08.20	06.44	05.55	04.13	20.25 (2)	02.56	03.35	05.11	20.32 (2)	06.42	08.09	08.46	10.06
	15.14	16.54	18.20	20.52	22.27 19	20.44 (2)	23.49	23.18	21.40 22	20.54 (2)	19.51	18.06	15.26	14.27
16	09.47	08.16	06.41	05.51	04.09	20.26 (2)	02.55	03.38	05.14	20.33 (2)	06.45	08.12	08.49	10.08
	15.17	16.57	18.23	20.55	22.30 17	20.43 (2)	23.50	23.16	21.37 20	20.53 (2)	19.48	18.03	15.23	14.27
17	09.45	08.13	06.37	05.48	04.06	20.28 (2)	02.55	03.41	05.17	20.35 (2)	06.48	08.15	08.53	10.09
	15.20	17.01	18.26	20.58	22.33 13	20.41 (2)	23.51	23.13	21.33 16	20.51 (2)	19.44	17.59	15.21	14.27
18	09.42	08.10	06.33	05.44	04.03	20.30 (2)	02.54	03.44	05.20	20.37 (2)	06.51	08.18	08.56	10.10
	15.23	17.04	18.29	21.01	22.36 10	20.40 (2)	23.52	23.10	21.30 10	20.47 (2)	19.41	17.56	15.18	14.26
19	09.40	08.07	06.30	05.41	04.00		02.54	03.47	05.24		06.54	08.21	08.59	10.11
	15.26	17.07	18.32	21.04	22.39		23.52	23.07	21.26		19.37	17.52	15.15	14.26
20	09.37	08.03	06.26	05.37	03.57		02.54	03.50	05.27		06.57	08.24	09.02	10.12
	15.29	17.10	18.35	21.07	22.43		23.53	23.04	21.23		19.33	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54		02.54	03.53	05.30		06.59	08.27	09.05	10.13
	15.33	17.13	18.38	21.11	22.46		23.53	23.01	21.19		19.30	17.46	15.10	14.27
22	09.32	07.56	06.19	05.30	03.51		02.54	03.56	05.33		07.02	08.30	09.08	10.14
	15.36	17.16	18.41	21.14	22.49		23.54	22.58	21.16		19.26	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48		02.55	03.59	05.36		07.05	08.33	09.11	10.14
	15.39	17.20	18.44	21.17	22.52		23.54	22.55	21.12		19.23	17.39	15.04	14.28
24	09.27	07.50	06.12	05.23	03.45		02.56	04.02	05.39		07.08	08.36	09.15	10.14
	15.42	17.23	18.47	21.20	22.55		23.53	22.52	21.09		19.19	17.36	15.02	14.28
25	09.24	07.46	06.09	05.20 20.30 (2)	03.42		02.56	04.06 20.43 (2)	05.42		07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23 12 20.42 (2)	22.58		23.53	22.49 5 20.48 (2)	21.05		19.16	16.32	14.59	14.29
26	09.21	07.43	06.05	05.16 20.27 (2)	03.39		02.57	04.09 20.39 (2)	05.45		07.14	07.42	09.21	10.15
	15.49	17.29	18.53	21.26 17 20.44 (2)	23.01		23.53	22.46 12 20.51 (2)	21.02		19.12	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13 20.26 (2)	03.36		02.58	04.12 20.38 (2)	05.47		07.16	07.45	09.24	10.14
	15.52	17.32	18.56	21.29 20 20.46 (2)	23.04		23.52	22.43 15 20.53 (2)	20.58		19.09	16.26	14.55	14.31
28	09.16	07.36	05.58	05.09 20.25 (2)	03.34		03.00	04.15 20.36 (2)	05.50		07.19	07.49	09.27	10.14
	15.55	17.35	18.59	21.32 22 20.47 (2)	23.07		23.51	22.40 18 20.54 (2)	20.55		19.05	16.22	14.52	14.32
29	09.13		06.55	05.06 20.24 (2)	03.31		03.00	04.18 20.35 (2)	05.53		07.22	07.52	09.30	10.14
	15.58		20.01	21.35 24 20.48 (2)	23.10		23.50	22.37 20 20.55 (2)	20.51		19.02	16.19	14.50	14.34
30	09.10		06.51	05.03 20.23 (2)	03.28		03.01	04.21 20.34 (2)	05.56		07.25	07.55	09.32	10.13
	16.02		20.04	21.39 25 20.48 (2)	23.13		23.49	22.33 22 20.56 (2)	20.48		18.58	16.16	14.48	14.35
31	09.07		06.48		03.26			04.24 20.33 (2)	05.59			07.58		10.13
	16.05		20.07		23.16			22.30 24 20.57 (2)	20.44			16.13		14.37
Potential sun hours	173	239	363	450	568	621	606		507		393	305	199	139
Total, worst case				120	433			116		447				
Sun reduction				0,43	0,48			0,49		0,42				
Oper. time red.				0,94	0,94			0,94		0,94				
Wind dir. red.				0,64	0,64			0,64		0,64				
Total reduction				0,26	0,29			0,29		0,25				
Total, real				31	124			34		112				

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

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

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Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) Shadow receptor: F - Asuinrakennus F (Maijannevantie)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June		July		August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23		03.03	04.20 (2)	04.28	06.02	07.28	08.01	09.35
	14.40	16.09	17.38	20.11	21.42	23.19		23.48	19 04.39 (2)	22.27	20.41	18.55	16.10	14.46
2	10.11	09.01	07.29	06.41	04.56	03.21	04.22 (2)	03.05	04.20 (2)	04.31	06.05	07.31	08.05	09.38
	14.42	16.12	17.41	20.14	21.45	23.22	2 04.24 (2)	23.46	19 04.39 (2)	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.53	03.19	04.20 (2)	03.07	04.20 (2)	04.34	06.08	07.34	08.08	09.41
	14.44	16.15	17.44	20.16	21.48	23.24	8 04.28 (2)	23.45	18 04.38 (2)	22.21	20.34	18.48	16.03	14.43
4	10.09	08.55	07.23	06.34	04.49	03.16	04.19 (2)	03.08	04.22 (2)	04.37	06.11	07.37	08.11	09.43
	14.46	16.19	17.48	20.19	21.52	23.27	11 04.30 (2)	23.43	17 04.39 (2)	22.17	20.30	18.44	16.00	14.41
5	10.07	08.52	07.19	06.30	04.46	03.14	04.17 (2)	03.11	04.22 (2)	04.40	06.14	07.40	08.14	09.46
	14.48	16.22	17.51	20.22	21.55	23.29	13 04.30 (2)	23.41	16 04.38 (2)	22.14	20.27	18.41	15.57	14.39
6	10.06	08.49	07.16	06.27	04.43	03.12	04.17 (2)	03.13	04.22 (2)	04.44	06.17	07.43	08.17	09.48
	14.50	16.25	17.54	20.25	21.58	23.32	14 04.31 (2)	23.39	15 04.37 (2)	22.11	20.23	18.37	15.54	14.37
7	10.05	08.46	07.12	06.23	04.39	03.10	04.17 (2)	03.15	04.23 (2)	04.47	06.20	07.46	08.21	09.51
	14.53	16.28	17.57	20.28	22.01	23.34	15 04.32 (2)	23.37	14 04.37 (2)	22.07	20.20	18.34	15.51	14.36
8	10.03	08.43	07.09	06.20	04.36	03.08	04.16 (2)	03.17	04.25 (2)	04.50	06.23	07.48	08.24	09.53
	14.55	16.32	18.00	20.31	22.04	23.36	17 04.33 (2)	23.35	12 04.37 (2)	22.04	20.16	18.30	15.47	14.34
9	10.01	08.39	07.05	06.16	04.33	03.06	04.16 (2)	03.20	04.26 (2)	04.53	06.26	07.51	08.27	09.55
	14.58	16.35	18.03	20.34	22.08	23.39	18 04.34 (2)	23.33	9 04.35 (2)	22.01	20.13	18.27	15.44	14.33
10	10.00	08.36	07.02	06.13	04.29	03.04	04.16 (2)	03.22	04.28 (2)	04.56	06.28	07.54	08.30	09.57
	15.00	16.38	18.06	20.37	22.11	23.41	18 04.34 (2)	23.31	6 04.34 (2)	21.57	20.09	18.24	15.41	14.32
11	09.58	08.33	06.58	06.09	04.26	03.03	04.15 (2)	03.25		04.59	06.31	07.57	08.33	09.59
	15.03	16.41	18.09	20.40	22.14	23.42	20 04.35 (2)	23.29		21.54	20.06	18.20	15.38	14.31
12	09.56	08.30	06.55	06.06	04.23	03.01	04.15 (2)	03.28		05.02	06.34	08.00	08.37	10.01
	15.06	16.45	18.12	20.43	22.17	23.44	20 04.35 (2)	23.26		21.50	20.02	18.17	15.35	14.30
13	09.54	08.27	06.51	06.02	04.19	03.00	04.15 (2)	03.30		05.05	06.37	08.03	08.40	10.03
	15.09	16.48	18.15	20.46	22.20	23.46	20 04.35 (2)	23.24		21.47	19.58	18.13	15.32	14.29
14	09.52	08.23	06.48	05.58	04.16	02.58	04.15 (2)	03.33		05.08	06.40	08.06	08.43	10.05
	15.11	16.51	18.18	20.49	22.24	23.47	21 04.36 (2)	23.21		21.44	19.55	18.10	15.29	14.28
15	09.49	08.20	06.44	05.55	04.13	02.57	04.15 (2)	03.36		05.12	06.43	08.09	08.46	10.06
	15.14	16.54	18.20	20.52	22.27	23.49	21 04.36 (2)	23.18		21.40	19.51	18.06	15.27	14.28
16	09.47	08.17	06.41	05.51	04.10	02.56	04.15 (2)	03.39		05.15	06.45	08.12	08.50	10.08
	15.17	16.58	18.23	20.55	22.30	23.50	21 04.36 (2)	23.16		21.37	19.48	18.03	15.24	14.27
17	09.45	08.13	06.37	05.48	04.07	02.55	04.16 (2)	03.42		05.18	06.48	08.15	08.53	10.09
	15.20	17.01	18.26	20.58	22.33	23.51	21 04.37 (2)	23.13		21.33	19.44	17.59	15.21	14.27
18	09.42	08.10	06.34	05.44	04.03	02.55	04.16 (2)	03.45		05.21	06.51	08.18	08.56	10.10
	15.23	17.04	18.29	21.01	22.36	23.52	21 04.37 (2)	23.10		21.30	19.41	17.56	15.18	14.27
19	09.40	08.07	06.30	05.41	04.00	02.55	04.16 (2)	03.48		05.24	06.54	08.21	08.59	10.11
	15.27	17.07	18.32	21.05	22.40	23.53	22 04.38 (2)	23.07		21.26	19.37	17.53	15.15	14.27
20	09.37	08.03	06.27	05.37	03.57	02.55	04.16 (2)	03.51		05.27	06.57	08.24	09.02	10.12
	15.30	17.10	18.35	21.08	22.43	23.53	22 04.38 (2)	23.04		21.23	19.34	17.49	15.13	14.27
21	09.35	08.00	06.23	05.34	03.54	02.55	04.16 (2)	03.54		05.30	07.00	08.27	09.05	10.13
	15.33	17.13	18.38	21.11	22.46	23.53	22 04.38 (2)	23.01		21.19	19.30	17.46	15.10	14.27
22	09.32	07.57	06.20	05.30	03.51	02.55	04.16 (2)	03.57		05.33	07.02	08.30	09.09	10.14
	15.36	17.17	18.41	21.14	22.49	23.54	22 04.38 (2)	22.58		21.16	19.27	17.43	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48	02.55	04.16 (2)	04.00		05.36	07.05	08.33	09.12	10.14
	15.39	17.20	18.44	21.17	22.52	23.54	22 04.38 (2)	22.55		21.12	19.23	17.39	15.05	14.28
24	09.27	07.50	06.13	05.24	03.45	02.56	04.17 (2)	04.03		05.39	07.08	08.36	09.15	10.14
	15.42	17.23	18.47	21.20	22.55	23.53	22 04.39 (2)	22.52		21.09	19.20	17.36	15.02	14.29
25	09.24	07.47	06.09	05.20	03.42	02.57	04.17 (2)	04.06		05.42	07.11	07.39	09.18	10.15
	15.46	17.26	18.50	21.23	22.58	23.53	21 04.38 (2)	22.49		21.05	19.16	16.32	15.00	14.29
26	09.22	07.43	06.06	05.17	03.40	02.58	04.17 (2)	04.09		05.45	07.14	07.43	09.21	10.15
	15.49	17.29	18.53	21.26	23.01	23.53	22 04.39 (2)	22.46		21.02	19.13	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.37	02.59	04.18 (2)	04.12		05.48	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.04	23.52	21 04.39 (2)	22.43		20.58	19.09	16.26	14.55	14.32
28	09.16	07.36	05.58	05.10	03.34	03.00	04.18 (2)	04.15		05.51	07.20	07.49	09.27	10.14
	15.55	17.35	18.59	21.33	23.07	23.51	21 04.39 (2)	22.40		20.55	19.05	16.23	14.53	14.33
29	09.13		06.55	05.06	03.31	03.00	04.19 (2)	04.18		05.54	07.22	07.52	09.30	10.14
	15.59		20.02	21.36	23.10	23.50	20 04.39 (2)	22.37		20.51	19.02	16.19	14.51	14.34
30	09.10		06.51	05.03	03.29	03.01	04.19 (2)	04.22		05.57	07.25	07.55	09.33	10.13
	16.02		20.05	21.39	23.13	23.49	20 04.39 (2)	22.34		20.48	18.58	16.16	14.48	14.36
31	09.07		06.48		03.26			04.25		05.59		07.58		10.13
	16.05		20.08		23.16			22.30		20.44		16.13		14.37
Potential sun hours	173	239	363	450	568	621		606		507	393	305	199	139
Total, worst case							538		145					
Sun reduction							0,51		0,49					
Oper. time red.							0,94		0,94					
Wind dir. red.							0,61		0,61					
Total reduction							0,30		0,28					
Total, real							159		41					

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: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) Shadow receptor: G - Asuinrakennus G (Maijannevantie)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	03.03	04.28	06.02	07.28	08.01	09.35
	14.40	16.09	17.38	20.11	21.42	23.19	23.48	22.27	20.41	18.55	16.10	14.46
2	10.11	09.01	07.29	06.41	04.56	03.21	03.05	04.31	06.05	07.31	08.05	09.38
	14.42	16.12	17.41	20.14	21.45	23.22	23.46	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.53	03.19	03.07	04.34	06.08	07.34	08.08	09.41
	14.44	16.15	17.44	20.16	21.48	23.24	23.45	22.21	20.34	18.48	16.03	14.43
4	10.09	08.55	07.23	06.34	04.49	03.16	03.08	04.37	06.11	07.37	08.11	09.43
	14.46	16.19	17.48	20.19	21.52	23.27	23.43	22.17	20.30	18.44	16.00	14.41
5	10.08	08.52	07.19	06.30	04.46	03.14	03.11	04.40	06.14	07.40	08.14	09.46
	14.48	16.22	17.51	20.22	21.55	23.29	23.41	22.14	20.27	18.41	15.57	14.39
6	10.06	08.49	07.16	06.27	04.43	03.12	03.13	04.44	06.17	07.43	08.17	09.48
	14.50	16.25	17.54	20.25	21.58	23.32	23.39	22.11	20.23	18.37	15.54	14.37
7	10.05	08.46	07.12	06.23	04.39	03.10	03.15	04.47	06.20	07.46	08.21	09.51
	14.53	16.28	17.57	20.28	22.01	23.34	23.37	22.07	20.20	18.34	15.51	14.36
8	10.03	08.43	07.09	06.20	04.36	03.08	03.17	04.50	06.23	07.48	08.24	09.53
	14.55	16.32	18.00	20.31	22.04	23.36	23.35	22.04	20.16	18.31	15.47	14.34
9	10.01	08.39	07.05	06.16	04.33	03.06	03.20	04.53	06.26	07.51	08.27	09.55
	14.58	16.35	18.03	20.34	22.08	23.39	23.33	22.01	20.13	18.27	15.44	14.33
10	10.00	08.36	07.02	06.13	04.29	03.04	03.22	04.56	06.28	07.54	08.30	09.57
	15.00	16.38	18.06	20.37	22.11	23.41	23.31	21.57	20.09	18.24	15.41	14.32
11	09.58	08.33	06.58	06.09	04.26	03.03	03.25	04.59	06.31	07.57	08.33	09.59
	15.03	16.41	18.09	20.40	22.14	23.42	23.29	21.54	20.06	18.20	15.38	14.31
12	09.56	08.30	06.55	06.06	04.23	03.01	03.28	05.02	06.34	08.00	08.37	10.01
	15.06	16.45	18.12	20.43	22.17	23.44	23.26	21.50	20.02	18.17	15.35	14.30
13	09.54	08.27	06.51	06.02	04.19	03.00	03.30	05.05	06.37	08.03	08.40	10.03
	15.09	16.48	18.15	20.46	22.20	23.46	23.24	21.47	19.58	18.13	15.32	14.29
14	09.52	08.23	06.48	05.58	04.16	02.58	03.33	05.09	06.40	08.06	08.43	10.05
	15.11	16.51	18.18	20.49	22.24	23.47	23.21	21.44	19.55	18.10	15.29	14.28
15	09.49	08.20	06.44	05.55	04.13	02.57	03.36	05.12	06.43	08.09	08.46	10.06
	15.14	16.54	18.21	20.52	22.27	23.49	23.18	21.40	19.51	18.06	15.27	14.28
16	09.47	08.17	06.41	05.51	04.10	02.56	03.39	05.15	06.45	08.12	08.50	10.08
	15.17	16.58	18.23	20.55	22.30	23.50	23.16	21.37	19.48	18.03	15.24	14.27
17	09.45	08.13	06.37	05.48	04.07	02.55	03.42	05.18	06.48	08.15	08.53	10.09
	15.20	17.01	18.26	20.58	22.33	23.51	23.13	21.33	19.44	17.59	15.21	14.27
18	09.42	08.10	06.34	05.44	04.03	02.55	03.45	05.21	06.51	08.18	08.56	10.10
	15.23	17.04	18.29	21.02	22.36	23.52	23.10	21.30	19.41	17.56	15.18	14.27
19	09.40	08.07	06.30	05.41	04.00	02.55	03.48	05.24	06.54	08.21	08.59	10.11
	15.27	17.07	18.32	21.05	22.40	23.53	23.07	21.26	19.37	17.53	15.15	14.27
20	09.38	08.03	06.27	05.37	03.57	02.55	03.51	05.27	06.57	08.24	09.02	10.12
	15.30	17.10	18.35	21.08	22.43	23.53	23.04	21.23	19.34	17.49	15.13	14.27
21	09.35	08.00	06.23	05.34	03.54	02.55	03.54	05.30	07.00	08.27	09.05	10.13
	15.33	17.14	18.38	21.11	22.46	23.53	23.02	21.19	19.30	17.46	15.10	14.27
22	09.32	07.57	06.20	05.30	03.51	02.55	03.57	05.33	07.03	08.30	09.09	10.14
	15.36	17.17	18.41	21.14	22.49	23.54	22.59	21.16	19.27	17.43	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48	02.55	04.00	05.36	07.05	08.33	09.12	10.14
	15.39	17.20	18.44	21.17	22.52	23.54	22.56	21.12	19.23	17.39	15.05	14.28
24	09.27	07.50	06.13	05.24	03.45	02.56	04.03	05.39	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.55	23.54	22.52	21.09	19.20	17.36	15.02	14.29
25	09.24	07.47	06.09	05.20	03.42	02.57	04.06	05.42	07.11	07.39	09.18	10.15
	15.46	17.26	18.50	21.23	22.58	23.53	22.49	21.05	19.16	16.33	15.00	14.29
26	09.22	07.43	06.06	05.17	03.40	02.58	04.09	05.45	07.14	07.43	09.21	10.15
	15.49	17.29	18.53	21.26	23.01	23.53	22.46	21.02	19.13	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.37	02.59	04.12	05.48	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.04	23.52	22.43	20.58	19.09	16.26	14.55	14.32
28	09.16	07.36	05.58	05.10	03.34	03.00	04.15	05.51	07.20	07.49	09.27	10.14
	15.55	17.35	18.59	21.33	23.07	23.51	22.40	20.55	19.05	16.23	14.53	14.33
29	09.13		06.55	05.06	03.31	03.00	04.18	05.54	07.22	07.52	09.30	10.14
	15.59		20.02	21.36	23.10	23.50	22.37	20.51	19.02	16.19	14.51	14.34
30	09.10		06.51	05.03	03.29	03.01	04.22	05.57	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.13	23.49	22.34	20.48	18.58	16.16	14.48	14.36
31	09.07		06.48		03.26		04.25	06.00		07.58		10.13
	16.05		20.08		23.16		22.30	20.44		16.13		14.37
Potential sun hours	173	239	363	450	568	621	606	507	393	305	199	139
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)

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) Shadow receptor: H - Asuinrakennus H (Hietasaari)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	05.17 (2)	03.03	04.31 (1)	04.28	05.24 (2)	06.02	07.28	08.01	09.35
	14.40	16.09	17.38	20.11	21.42	23.19 15	05.32 (2)	23.48 22	04.53 (1)	22.27 20	05.44 (2)	20.41	18.55	16.10	14.46
2	10.11	09.01	07.29	06.41	04.56	03.21	04.32 (1)	03.05	04.31 (1)	04.31	05.25 (2)	06.05	07.31	08.05	09.38
	14.42	16.12	17.41	20.14	21.45	23.22 20	05.31 (2)	23.46 22	04.53 (1)	22.24 19	05.44 (2)	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.53	03.19	04.31 (1)	03.07	04.31 (1)	04.34	05.25 (2)	06.08	07.34	08.08	09.41
	14.44	16.15	17.44	20.16	21.48	23.24 23	05.31 (2)	23.45 21	04.52 (1)	22.21 17	05.42 (2)	20.34	18.48	16.03	14.42
4	10.09	08.55	07.23	06.34	04.49	03.16	04.30 (1)	03.08	04.33 (1)	04.37	05.27 (2)	06.11	07.37	08.11	09.43
	14.46	16.19	17.48	20.19	21.52	23.27 22	05.30 (2)	23.43 20	04.53 (1)	22.17 14	05.41 (2)	20.30	18.44	16.00	14.41
5	10.08	08.52	07.19	06.30	04.46	03.14	04.28 (1)	03.11	04.33 (1)	04.40	05.29 (2)	06.14	07.40	08.14	09.46
	14.48	16.22	17.51	20.22	21.55	23.29 22	05.28 (2)	23.41 19	04.52 (1)	22.14 10	05.39 (2)	20.27	18.41	15.57	14.39
6	10.06	08.49	07.16	06.27	04.43	03.12	04.28 (1)	03.13	04.33 (1)	04.44		06.17	07.43	08.17	09.48
	14.50	16.25	17.54	20.25	21.58	23.32 17	04.45 (1)	23.40 18	04.51 (1)	22.11		20.23	18.37	15.54	14.37
7	10.05	08.46	07.12	06.23	04.39 05.21 (2)	03.10	04.28 (1)	03.15	04.35 (1)	04.47		06.20	07.46	08.21	09.51
	14.53	16.28	17.57	20.28	22.01 5	05.26 (2)	23.34 18	04.46 (1)	23.38 21	05.34 (2)	22.07	20.20	18.34	15.51	14.36
8	10.03	08.43	07.09	06.20	04.36	05.18 (2)	03.08	04.27 (1)	03.17	04.36 (1)	04.50	06.23	07.48	08.24	09.53
	14.55	16.32	18.00	20.31	22.04 12	05.30 (2)	23.36 20	04.47 (1)	23.35 23	05.36 (2)	22.04	20.16	18.31	15.47	14.34
9	10.01	08.39	07.05	06.16	04.33	05.16 (2)	03.06	04.27 (1)	03.20	04.37 (1)	04.53	06.26	07.51	08.27	09.55
	14.58	16.35	18.03	20.34	22.08 16	05.32 (2)	23.39 21	04.48 (1)	23.33 23	05.37 (2)	22.01	20.13	18.27	15.44	14.33
10	10.00	08.36	07.02	06.13	04.29	05.15 (2)	03.04	04.27 (1)	03.22	04.39 (1)	04.56	06.28	07.54	08.30	09.58
	15.00	16.38	18.06	20.37	22.11 18	05.33 (2)	23.41 21	04.48 (1)	23.31 22	05.39 (2)	21.57	20.09	18.24	15.41	14.32
11	09.58	08.33	06.58	06.09	04.26	05.13 (2)	03.03	04.26 (1)	03.25	04.42 (1)	04.59	06.31	07.57	08.33	10.00
	15.03	16.41	18.09	20.40	22.14 20	05.33 (2)	23.43 23	04.49 (1)	23.29 18	05.40 (2)	21.54	20.06	18.20	15.38	14.31
12	09.56	08.30	06.55	06.06	04.23	05.13 (2)	03.01	04.26 (1)	03.28	05.25 (2)	05.02	06.34	08.00	08.37	10.01
	15.06	16.45	18.12	20.43	22.17 22	05.35 (2)	23.44 23	04.49 (1)	23.26 16	05.41 (2)	21.50	20.02	18.17	15.35	14.30
13	09.54	08.27	06.51	06.02	04.19	05.12 (2)	03.00	04.26 (1)	03.30	05.24 (2)	05.05	06.37	08.03	08.40	10.03
	15.09	16.48	18.15	20.46	22.21 23	05.35 (2)	23.46 23	04.49 (1)	23.24 18	05.42 (2)	21.47	19.58	18.13	15.32	14.29
14	09.52	08.23	06.48	05.58	04.16	05.12 (2)	02.58	04.26 (1)	03.33	05.24 (2)	05.09	06.40	08.06	08.43	10.05
	15.11	16.51	18.18	20.49	22.24 23	05.35 (2)	23.47 24	04.50 (1)	23.21 18	05.42 (2)	21.44	19.55	18.10	15.29	14.28
15	09.49	08.20	06.44	05.55	04.13	05.12 (2)	02.57	04.26 (1)	03.36	05.23 (2)	05.12	06.43	08.09	08.46	10.06
	15.14	16.54	18.21	20.52	22.27 24	05.36 (2)	23.49 24	04.50 (1)	23.18 20	05.43 (2)	21.40	19.51	18.06	15.27	14.28
16	09.47	08.17	06.41	05.51	04.10	05.11 (2)	02.56	04.26 (1)	03.39	05.23 (2)	05.15	06.45	08.12	08.50	10.08
	15.17	16.58	18.23	20.55	22.30 25	05.36 (2)	23.50 25	04.51 (1)	23.16 21	05.44 (2)	21.37	19.48	18.03	15.24	14.27
17	09.45	08.13	06.37	05.48	04.07	05.11 (2)	02.55	04.26 (1)	03.42	05.22 (2)	05.18	06.48	08.15	08.53	10.09
	15.20	17.01	18.26	20.58	22.33 25	05.36 (2)	23.51 25	04.51 (1)	23.13 22	05.44 (2)	21.33	19.44	17.59	15.21	14.27
18	09.42	08.10	06.34	05.44	04.03	05.11 (2)	02.55	04.27 (1)	03.45	05.23 (2)	05.21	06.51	08.18	08.56	10.10
	15.23	17.04	18.29	21.02	22.37 25	05.36 (2)	23.52 25	04.52 (1)	23.10 22	05.45 (2)	21.30	19.41	17.56	15.18	14.27
19	09.40	08.07	06.30	05.41	04.00	05.11 (2)	02.55	04.27 (1)	03.48	05.22 (2)	05.24	06.54	08.21	08.59	10.11
	15.27	17.07	18.32	21.05	22.40 26	05.37 (2)	23.53 25	04.52 (1)	23.07 23	05.45 (2)	21.26	19.37	17.53	15.15	14.27
20	09.38	08.03	06.27	05.37	03.57	05.11 (2)	02.54	04.27 (1)	03.51	05.22 (2)	05.27	06.57	08.24	09.02	10.12
	15.30	17.10	18.35	21.08	22.43 25	05.36 (2)	23.53 25	04.52 (1)	23.04 24	05.46 (2)	21.23	19.34	17.49	15.13	14.27
21	09.35	08.00	06.23	05.34	03.54	05.11 (2)	02.55	04.27 (1)	03.54	05.21 (2)	05.30	07.00	08.27	09.05	10.13
	15.33	17.14	18.38	21.11	22.46 25	05.36 (2)	23.54 25	04.52 (1)	23.02 25	05.46 (2)	21.19	19.30	17.46	15.10	14.27
22	09.32	07.57	06.20	05.31	03.51	05.12 (2)	02.55	04.27 (1)	03.57	05.22 (2)	05.33	07.03	08.30	09.09	10.14
	15.36	17.17	18.41	21.14	22.49 24	05.36 (2)	23.54 25	04.52 (1)	22.59 24	05.46 (2)	21.16	19.27	17.43	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48	05.11 (2)	02.55	04.27 (1)	04.00	05.21 (2)	05.36	07.05	08.33	09.12	10.14
	15.39	17.20	18.44	21.17	22.52 24	05.35 (2)	23.54 25	04.52 (1)	22.56 25	05.46 (2)	21.12	19.23	17.39	15.05	14.28
24	09.27	07.50	06.13	05.24	03.45	05.12 (2)	02.56	04.28 (1)	04.03	05.22 (2)	05.39	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.55 23	05.35 (2)	23.54 25	04.53 (1)	22.53 25	05.47 (2)	21.09	19.20	17.36	15.02	14.29
25	09.24	07.47	06.09	05.20	03.42	05.12 (2)	02.57	04.27 (1)	04.06	05.21 (2)	05.42	07.11	08.39	09.18	10.15
	15.46	17.26	18.50	21.23	22.58 23	05.35 (2)	23.53 25	04.52 (1)	22.49 25	05.46 (2)	21.05	19.16	16.33	15.00	14.29
26	09.22	07.43	06.06	05.17	03.40	05.13 (2)	02.58	04.28 (1)	04.09	05.22 (2)	05.45	07.14	08.43	09.21	10.15
	15.49	17.29	18.53	21.26	23.01 22	05.35 (2)	23.53 25	04.53 (1)	22.46 25	05.47 (2)	21.02	19.13	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.37	05.13 (2)	02.59	04.29 (1)	04.12	05.21 (2)	05.48	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.05 22	05.35 (2)	23.52 24	04.53 (1)	22.43 25	05.46 (2)	20.58	19.09	16.26	14.55	14.32
28	09.16	07.36	05.58	05.10	03.34	05.14 (2)	03.00	04.29 (1)	04.15	05.22 (2)	05.51	07.20	07.49	09.27	10.14
	15.55	17.35	18.59	21.33	23.07 20	05.34 (2)	23.51 24	04.53 (1)	22.40 25	05.47 (2)	20.55	19.05	16.23	14.53	14.33
29	09.13		06.55	05.06	03.31	05.14 (2)	03.00	04.30 (1)	04.18	05.22 (2)	05.54	07.22	07.52	09.30	10.14
	15.59		20.02	21.36	23.10 20	05.34 (2)	23.50 23	04.53 (1)	22.37 24	05.46 (2)	20.51	19.02	16.19	14.51	14.34
30	09.10		06.51	05.03	03.29	05.15 (2)	03.01	04.30 (1)	04.22	05.23 (2)	05.57	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.13 18	05.33 (2)	23.49 23	04.53 (1)	22.34 23	05.46 (2)	20.48	18.58	16.16	14.48	14.36
31	09.07		06.48		03.26	05.16 (2)			04.25	05.23 (2)	06.00		07.58		10.13
	16.05		20.08		23.16 17	05.33 (2)			22.30 22	05.45 (2)	20.44		16.13		14.37
Potential sun hours	173	239	363	450	568	621	606	507	393	305	199	139
Total, worst case					527	685	681	80				
Sun reduction					0,48	0,51	0,49	0,42				
Oper. time red.					0,94	0,94	0,94	0,94				
Wind dir. red.					0,62	0,61	0,62	0,62				
Total reduction					0,28	0,29	0,28	0,25				
Total, real					148	201	192	20				

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

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

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Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) Shadow receptor: I - Asuinrakennus I (Lahdenperä)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	03.03	04.28	06.02	07.28	08.01	09.35
	14.40	16.09	17.38	20.11	21.42	23.19	23.48	22.27	20.41	18.55	16.10	14.46
2	10.11	09.01	07.30	06.41	04.56	03.21	03.05	04.31	06.05	07.31	08.05	09.38
	14.42	16.12	17.41	20.14	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.53	03.18	03.06	04.34	06.08	07.34	08.08	09.41
	14.44	16.15	17.45	20.17	21.48	23.24	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.23	06.34	04.49	03.16	03.08	04.37	06.11	07.37	08.11	09.44
	14.46	16.19	17.48	20.20	21.52	23.27	23.43	22.17	20.30	18.44	16.00	14.41
5	10.08	08.52	07.19	06.30	04.46	03.14	03.10	04.40	06.14	07.40	08.14	09.46
	14.48	16.22	17.51	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.57	14.39
6	10.06	08.49	07.16	06.27	04.43	03.12	03.13	04.44	06.17	07.43	08.17	09.49
	14.50	16.25	17.54	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.54	14.37
7	10.05	08.46	07.12	06.23	04.39	03.10	03.15	04.47	06.20	07.46	08.21	09.51
	14.53	16.28	17.57	20.28	22.01	23.34	23.38	22.07	20.20	18.34	15.51	14.36
8	10.03	08.43	07.09	06.20	04.36	03.08	03.17	04.50	06.23	07.48	08.24	09.53
	14.55	16.32	18.00	20.31	22.04	23.37	23.36	22.04	20.16	18.31	15.47	14.34
9	10.01	08.39	07.05	06.16	04.33	03.06	03.20	04.53	06.26	07.51	08.27	09.55
	14.58	16.35	18.03	20.34	22.08	23.39	23.33	22.01	20.13	18.27	15.44	14.33
10	10.00	08.36	07.02	06.13	04.29	03.04	03.22	04.56	06.28	07.54	08.30	09.58
	15.00	16.38	18.06	20.37	22.11	23.41	23.31	21.57	20.09	18.24	15.41	14.32
11	09.58	08.33	06.58	06.09	04.26	03.03	03.25	04.59	06.31	07.57	08.34	10.00
	15.03	16.42	18.09	20.40	22.14	23.43	23.29	21.54	20.06	18.20	15.38	14.31
12	09.56	08.30	06.55	06.06	04.23	03.01	03.27	05.02	06.34	08.00	08.37	10.02
	15.06	16.45	18.12	20.43	22.17	23.44	23.26	21.51	20.02	18.17	15.35	14.30
13	09.54	08.27	06.51	06.02	04.19	03.00	03.30	05.05	06.37	08.03	08.40	10.03
	15.09	16.48	18.15	20.46	22.21	23.46	23.24	21.47	19.59	18.13	15.32	14.29
14	09.52	08.23	06.48	05.59	04.16	02.57	03.33	05.09	06.40	08.06	08.43	10.05
	15.11	16.51	18.18	20.49	22.24	23.48	23.21	21.44	19.55	18.10	15.29	14.28
15	09.50	08.20	06.44	05.55	04.13	02.57	03.36	05.12	06.43	08.09	08.46	10.07
	15.14	16.54	18.21	20.52	22.27	23.49	23.19	21.40	19.51	18.06	15.27	14.28
16	09.47	08.17	06.41	05.51	04.10	02.56	03.39	05.15	06.46	08.12	08.50	10.08
	15.17	16.58	18.24	20.55	22.30	23.50	23.16	21.37	19.48	18.03	15.24	14.27
17	09.45	08.13	06.37	05.48	04.07	02.55	03.42	05.18	06.48	08.15	08.53	10.09
	15.20	17.01	18.26	20.59	22.33	23.51	23.13	21.33	19.44	18.00	15.21	14.27
18	09.43	08.10	06.34	05.44	04.03	02.55	03.45	05.21	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.52	23.10	21.30	19.41	17.56	15.18	14.27
19	09.40	08.07	06.30	05.41	04.00	02.55	03.47	05.24	06.54	08.21	08.59	10.12
	15.27	17.07	18.32	21.05	22.40	23.53	23.07	21.26	19.37	17.53	15.15	14.27
20	09.38	08.03	06.27	05.37	03.57	02.54	03.50	05.27	06.57	08.24	09.02	10.12
	15.30	17.10	18.35	21.08	22.43	23.53	23.05	21.23	19.34	17.49	15.13	14.27
21	09.35	08.00	06.23	05.34	03.54	02.55	03.54	05.30	07.00	08.27	09.06	10.13
	15.33	17.14	18.38	21.11	22.46	23.54	23.02	21.20	19.30	17.46	15.10	14.27
22	09.32	07.57	06.20	05.31	03.51	02.55	03.57	05.33	07.03	08.30	09.09	10.14
	15.36	17.17	18.41	21.14	22.49	23.54	22.59	21.16	19.27	17.43	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48	02.55	04.00	05.36	07.05	08.33	09.12	10.14
	15.39	17.20	18.44	21.17	22.52	23.54	22.56	21.13	19.23	17.39	15.05	14.28
24	09.27	07.50	06.13	05.24	03.45	02.56	04.03	05.39	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.55	23.54	22.53	21.09	19.20	17.36	15.02	14.29
25	09.24	07.47	06.09	05.20	03.42	02.57	04.06	05.42	07.11	07.40	09.18	10.15
	15.46	17.26	18.50	21.23	22.59	23.53	22.50	21.06	19.16	16.33	15.00	14.29
26	09.22	07.43	06.06	05.17	03.39	02.58	04.09	05.45	07.14	07.43	09.21	10.15
	15.49	17.29	18.53	21.26	23.02	23.53	22.46	21.02	19.13	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.37	02.59	04.12	05.48	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.05	23.52	22.43	20.59	19.09	16.26	14.55	14.32
28	09.16	07.36	05.59	05.10	03.34	03.00	04.15	05.51	07.20	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.51	22.40	20.55	19.06	16.23	14.53	14.33
29	09.13		06.55	05.06	03.31	03.00	04.18	05.54	07.23	07.52	09.30	10.14
	15.59		20.02	21.36	23.11	23.50	22.37	20.52	19.02	16.19	14.51	14.34
30	09.10		06.51	05.03	03.29	03.01	04.22	05.57	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.13	23.49	22.34	20.48	18.58	16.16	14.48	14.36
31	09.07		06.48		03.26		04.25	06.00		07.58		10.13
	16.05		20.08		23.16		22.31	20.44		16.13		14.37
Potential sun hours	173	239	363	450	568	621	606	507	393	305	199	139
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: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) Shadow receptor: J - Lomarakennus J (Junno)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April		May	June	July	August		September		October	November	December
1	10.12	09.04	07.33	06.44		07.22 (1)	04.59	03.23	03.03	04.28		06.02	07.11 (1)	07.28	08.02	09.36
	14.40	16.09	17.38	20.11	11	07.33 (1)	21.42	23.19	23.48	22.27		20.41	26 07.37 (1)	18.55	16.10	14.46
2	10.11	09.01	07.30	06.41		07.19 (1)	04.56	03.21	03.05	04.31		06.05	07.10 (1)	07.31	08.05	09.38
	14.41	16.12	17.41	20.14	17	07.36 (1)	21.45	23.22	23.47	22.24		20.37	27 07.37 (1)	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37		07.17 (1)	04.53	03.18	03.06	04.34		06.08	07.09 (1)	07.34	08.08	09.41
	14.43	16.15	17.45	20.17	20	07.37 (1)	21.49	23.25	23.45	22.21		20.34	27 07.36 (1)	18.48	16.03	14.42
4	10.09	08.55	07.23	06.34		07.16 (1)	04.49	03.16	03.08	04.37		06.11	07.09 (1)	07.37	08.11	09.44
	14.46	16.19	17.48	20.20	22	07.38 (1)	21.52	23.27	23.43	22.18		20.30	27 07.36 (1)	18.44	16.00	14.41
5	10.08	08.52	07.19	06.30		07.14 (1)	04.46	03.14	03.10	04.40		06.14	07.09 (1)	07.40	08.14	09.46
	14.48	16.22	17.51	20.23	24	07.38 (1)	21.55	23.30	23.42	22.14		20.27	27 07.36 (1)	18.41	15.57	14.39
6	10.06	08.49	07.16	06.27		07.13 (1)	04.43	03.12	03.13	04.44		06.17	07.10 (1)	07.43	08.18	09.49
	14.50	16.25	17.54	20.25	26	07.39 (1)	21.58	23.32	23.40	22.11		20.23	25 07.35 (1)	18.38	15.54	14.37
7	10.05	08.46	07.12	06.23		07.12 (1)	04.39	03.10	03.15	04.47		06.20	07.09 (1)	07.46	08.21	09.51
	14.53	16.28	17.57	20.28	27	07.39 (1)	22.01	23.34	23.38	22.08		20.20	24 07.33 (1)	18.34	15.51	14.36
8	10.03	08.43	07.09	06.20		07.12 (1)	04.36	03.08	03.17	04.50		06.23	07.10 (1)	07.49	08.24	09.53
	14.55	16.32	18.00	20.31	27	07.39 (1)	22.05	23.37	23.36	22.04		20.16	22 07.32 (1)	18.31	15.47	14.34
9	10.02	08.40	07.05	06.16		07.12 (1)	04.32	03.06	03.20	04.53		06.26	07.11 (1)	07.51	08.27	09.56
	14.58	16.35	18.03	20.34	27	07.39 (1)	22.08	23.39	23.33	22.01		20.13	20 07.31 (1)	18.27	15.44	14.33
10	10.00	08.36	07.02	06.13		07.11 (1)	04.29	03.04	03.22	04.56		06.28	07.12 (1)	07.54	08.30	09.58
	15.00	16.38	18.06	20.37	27	07.38 (1)	22.11	23.41	23.31	21.57		20.09	16 07.28 (1)	18.24	15.41	14.32
11	09.58	08.33	06.58	06.09		07.12 (1)	04.26	03.02	03.25	04.59		06.31	07.14 (1)	07.57	08.34	10.00
	15.03	16.41	18.09	20.40	26	07.38 (1)	22.14	23.43	23.29	21.54		20.06	12 07.26 (1)	18.20	15.38	14.31
12	09.56	08.30	06.55	06.06		07.11 (1)	04.23	03.01	03.27	05.02		06.34		08.00	08.37	10.02
	15.06	16.45	18.12	20.43	26	07.37 (1)	22.17	23.45	23.26	21.51		20.02		18.17	15.35	14.30
13	09.54	08.27	06.51	06.02		07.12 (1)	04.19	03.00	03.30	05.05		06.37		08.03	08.40	10.03
	15.09	16.48	18.15	20.46	24	07.36 (1)	22.21	23.46	23.24	21.47		19.59		18.13	15.32	14.29
14	09.52	08.23	06.48	05.59		07.13 (1)	04.16	02.57	03.33	05.08		06.40		08.06	08.43	10.05
	15.11	16.51	18.18	20.49	22	07.35 (1)	22.24	23.48	23.21	21.44		19.55		18.10	15.29	14.28
15	09.50	08.20	06.44	05.55		07.13 (1)	04.13	02.56	03.36	05.12		06.43		08.09	08.47	10.07
	15.14	16.54	18.21	20.53	20	07.33 (1)	22.27	23.49	23.19	21.40		19.51		18.06	15.26	14.28
16	09.47	08.17	06.41	05.51		07.14 (1)	04.10	02.56	03.39	05.15		06.46		08.12	08.50	10.08
	15.17	16.58	18.24	20.56	18	07.32 (1)	22.30	23.50	23.16	21.37		19.48		18.03	15.24	14.27
17	09.45	08.14	06.37	05.48		07.17 (1)	04.07	02.55	03.41	05.18		06.48		08.15	08.53	10.09
	15.20	17.01	18.26	20.59	12	07.29 (1)	22.34	23.51	23.13	21.33		19.44		18.00	15.21	14.27
18	09.43	08.10	06.34	05.44		07.19 (1)	04.03	02.55	03.44	05.21		06.51		08.18	08.56	10.11
	15.23	17.04	18.29	21.02	5	07.24 (1)	22.37	23.52	23.10	21.30		19.41		17.56	15.18	14.27
19	09.40	08.07	06.30	05.41			04.00	02.54	03.47	05.24		06.54		08.21	08.59	10.12
	15.27	17.07	18.32	21.05			22.40	23.53	23.08	21.27		19.37		17.53	15.15	14.27
20	09.38	08.04	06.27	05.37			03.57	02.54	03.50	05.27		06.57		08.24	09.02	10.13
	15.30	17.10	18.35	21.08			22.43	23.53	23.05	21.23		19.34		17.49	15.13	14.27
21	09.35	08.00	06.23	05.34			03.54	02.54	03.53	05.30		07.00		08.27	09.06	10.13
	15.33	17.14	18.38	21.11			22.46	23.54	23.02	21.20		19.30		17.46	15.10	14.27
22	09.33	07.57	06.20	05.31			03.51	02.55	03.57	05.33		07.03		08.30	09.09	10.14
	15.36	17.17	18.41	21.14			22.49	23.54	22.59	21.16		19.27		17.43	15.07	14.27
23	09.30	07.53	06.16	05.27			03.48	02.55	04.00	05.36		07.05		08.33	09.12	10.14
	15.39	17.20	18.44	21.17			22.52	23.54	22.56	21.13		19.23		17.39	15.05	14.28
24	09.27	07.50	06.13	05.24			03.45	02.56	04.03	05.39		07.08		08.36	09.15	10.15
	15.42	17.23	18.47	21.20			22.56	23.54	22.53	21.09		19.20		17.36	15.02	14.29
25	09.24	07.47	06.09	05.20			03.42	02.57	04.06	05.42	07.22 (1)	07.11		07.40	09.18	10.15
	15.46	17.26	18.50	21.23			22.59	23.54	22.50	21.06	7 07.29 (1)	19.16		16.33	15.00	14.29
26	09.22	07.43	06.06	05.17			03.39	02.57	04.09	05.45	07.19 (1)	07.14		07.43	09.21	10.15
	15.49	17.29	18.53	21.26			23.02	23.53	22.47	21.02	13 07.32 (1)	19.13		16.29	14.57	14.30
27	09.19	07.40	06.02	05.13			03.37	02.59	04.12	05.48	07.16 (1)	07.17		07.46	09.24	10.15
	15.52	17.32	18.56	21.30			23.05	23.52	22.43	20.59	18 07.34 (1)	19.09		16.26	14.55	14.31
28	09.16	07.36	05.59	05.10			03.34	03.00	04.15	05.51	07.15 (1)	07.20		07.49	09.27	10.15
	15.55	17.35	18.59	21.33			23.08	23.52	22.40	20.55	20 07.35 (1)	19.06		16.23	14.53	14.33
29	09.13		06.55	05.06			03.31	03.00	04.18	05.54	07.14 (1)	07.23		07.52	09.30	10.14
	15.59		20.02	21.36			23.11	23.51	22.37	20.52	22 07.36 (1)	19.02		16.19	14.51	14.34
30	09.10		06.51	05.03			03.28	03.01	04.22	05.57	07.12 (1)	07.25		07.55	09.33	10.14
	16.02		20.05	21.39			23.14	23.49	22.34	20.48	24 07.36 (1)	18.59		16.16	14.48	14.36
31	09.07		06.48				03.26		04.25	06.00	07.11 (1)			07.58		10.13
	16.05		20.08				23.16		22.31	20.45	26 07.37 (1)			16.13		14.37
Potential sun hours	173	239	363	450			568	621	606	508		393		305	199	139
Total, worst case					381						130		253			
Sun reduction					0,43						0,42		0,32			
Oper. time red.					0,94						0,94		0,94			
Wind dir. red.					0,62						0,62		0,62			
Total reduction					0,25						0,25		0,19			
Total, real					96						32		48			

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

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

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Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) Shadow receptor: K - Lomarakennus K (Isomännikkö)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February		March		April	May	June	July	August	September	October		November	December
1	10.12	09.04		07.33	08.57 (3)	06.44	04.59	03.23	03.02	04.28	06.02	07.28		08.01	09.36
	14.39	16.08		17.38	27 09.24 (3)	20.11	21.42	23.19	23.48	22.27	20.41	18.55		16.09	14.46
2	10.11	09.01		07.29	08.57 (3)	06.41	04.56	03.20	03.04	04.31	06.05	07.31		08.05	09.38
	14.41	16.12		17.41	26 09.23 (3)	20.13	21.45	23.22	23.47	22.24	20.37	18.51		16.06	14.44
3	10.10	08.58		07.26	08.58 (3)	06.37	04.52	03.18	03.06	04.34	06.08	07.34		08.08	09.41
	14.43	16.15		17.44	24 09.22 (3)	20.16	21.48	23.25	23.45	22.21	20.34	18.48		16.03	14.42
4	10.09	08.55		07.23	08.59 (3)	06.34	04.49	03.16	03.08	04.37	06.11	07.37		08.11	09.44
	14.45	16.18		17.47	21 09.20 (3)	20.19	21.52	23.27	23.44	22.18	20.30	18.44		16.00	14.40
5	10.08	08.52		07.19	09.01 (3)	06.30	04.46	03.13	03.10	04.40	06.14	07.40		08.14	09.46
	14.47	16.22		17.50	16 09.17 (3)	20.22	21.55	23.30	23.42	22.14	20.27	18.41		15.57	14.39
6	10.06	08.49		07.16	09.04 (3)	06.27	04.42	03.11	03.12	04.43	06.17	07.43		08.17	09.49
	14.50	16.25		17.53	10 09.14 (3)	20.25	21.58	23.32	23.40	22.11	20.23	18.37		15.53	14.37
7	10.05	08.46		07.12		06.23	04.39	03.09	03.14	04.46	06.20	07.45	09.43 (3)	08.21	09.51
	14.52	16.28		17.56		20.28	22.01	23.35	23.38	22.08	20.20	18.34	4 09.47 (3)	15.50	14.35
8	10.03	08.43		07.09		06.19	04.36	03.07	03.17	04.50	06.23	07.48	09.38 (3)	08.24	09.53
	14.55	16.31		18.00		20.31	22.05	23.37	23.36	22.04	20.16	18.30	14 09.52 (3)	15.47	14.34
9	10.02	08.39		07.05		06.16	04.32	03.05	03.19	04.53	06.25	07.51	09.35 (3)	08.27	09.56
	14.57	16.35		18.03		20.34	22.08	23.39	23.34	22.01	20.13	18.27	19 09.54 (3)	15.44	14.33
10	10.00	08.36		07.02		06.12	04.29	03.04	03.22	04.56	06.28	07.54	09.33 (3)	08.30	09.58
	15.00	16.38		18.06		20.37	22.11	23.41	23.31	21.57	20.09	18.23	22 09.55 (3)	15.41	14.31
11	09.58	08.33		06.58		06.09	04.26	03.02	03.24	04.59	06.31	07.57	09.31 (3)	08.34	10.00
	15.03	16.41		18.09		20.40	22.14	23.43	23.29	21.54	20.06	18.20	25 09.56 (3)	15.38	14.30
12	09.56	08.30		06.55		06.05	04.22	03.00	03.27	05.02	06.34	08.00	09.30 (3)	08.37	10.02
	15.05	16.44		18.11		20.43	22.17	23.45	23.26	21.51	20.02	18.16	27 09.57 (3)	15.35	14.29
13	09.54	08.27		06.51		06.02	04.19	02.58	03.30	05.05	06.37	08.03	09.30 (3)	08.40	10.04
	15.08	16.48		18.14		20.46	22.21	23.46	23.24	21.47	19.58	18.13	28 09.58 (3)	15.32	14.28
14	09.52	08.23		06.48		05.58	04.16	02.57	03.32	05.08	06.40	08.06	09.29 (3)	08.43	10.05
	15.11	16.51		18.17		20.49	22.24	23.48	23.21	21.44	19.55	18.10	29 09.58 (3)	15.29	14.28
15	09.50	08.20	09.06 (3)	06.44		05.55	04.13	02.56	03.35	05.11	06.43	08.09	09.28 (3)	08.46	10.07
	15.14	16.54	11 09.17 (3)	18.20		20.52	22.27	23.49	23.19	21.40	19.51	18.06	30 09.58 (3)	15.26	14.27
16	09.47	08.17	09.04 (3)	06.41		05.51	04.09	02.55	03.38	05.14	06.45	08.12	09.27 (3)	08.50	10.08
	15.17	16.57	16 09.20 (3)	18.23		20.55	22.30	23.51	23.16	21.37	19.48	18.03	31 09.58 (3)	15.23	14.27
17	09.45	08.13	09.02 (3)	06.37		05.48	04.06	02.55	03.41	05.17	06.48	08.15	09.27 (3)	08.53	10.10
	15.20	17.01	20 09.22 (3)	18.26		20.59	22.34	23.52	23.13	21.33	19.44	17.59	30 09.57 (3)	15.21	14.26
18	09.43	08.10	09.00 (3)	06.34		05.44	04.03	02.54	03.44	05.20	06.51	08.18	09.27 (3)	08.56	10.11
	15.23	17.04	23 09.23 (3)	18.29		21.02	22.37	23.52	23.10	21.30	19.41	17.56	31 09.58 (3)	15.18	14.26
19	09.40	08.07	08.58 (3)	06.30		05.41	04.00	02.54	03.47	05.24	06.54	08.21	09.27 (3)	08.59	10.12
	15.26	17.07	26 09.24 (3)	18.32		21.05	22.40	23.53	23.08	21.26	19.37	17.52	30 09.57 (3)	15.15	14.26
20	09.38	08.03	08.58 (3)	06.27		05.37	03.57	02.54	03.50	05.27	06.57	08.24	09.27 (3)	09.02	10.13
	15.29	17.10	27 09.25 (3)	18.35		21.08	22.43	23.54	23.05	21.23	19.34	17.49	29 09.56 (3)	15.12	14.26
21	09.35	08.00	08.57 (3)	06.23		05.34	03.54	02.54	03.53	05.30	07.00	08.27	09.28 (3)	09.06	10.13
	15.32	17.13	28 09.25 (3)	18.38		21.11	22.46	23.54	23.02	21.19	19.30	17.46	28 09.56 (3)	15.10	14.26
22	09.33	07.57	08.56 (3)	06.20		05.30	03.51	02.54	03.56	05.33	07.02	08.30	09.28 (3)	09.09	10.14
	15.36	17.16	29 09.25 (3)	18.41		21.14	22.49	23.54	22.59	21.16	19.27	17.42	27 09.55 (3)	15.07	14.27
23	09.30	07.53	08.56 (3)	06.16		05.27	03.48	02.55	03.59	05.36	07.05	08.33	09.30 (3)	09.12	10.15
	15.39	17.20	30 09.26 (3)	18.44		21.17	22.53	23.54	22.56	21.13	19.23	17.39	24 09.54 (3)	15.04	14.27
24	09.27	07.50	08.56 (3)	06.12		05.23	03.45	02.55	04.02	05.39	07.08	08.36	09.30 (3)	09.15	10.15
	15.42	17.23	30 09.26 (3)	18.47		21.20	22.56	23.54	22.53	21.09	19.19	17.36	23 09.53 (3)	15.02	14.28
25	09.24	07.47	08.55 (3)	06.09		05.20	03.42	02.56	04.05	05.42	07.11	07.39	08.32 (3)	09.18	10.15
	15.45	17.26	31 09.26 (3)	18.50		21.23	22.59	23.54	22.50	21.06	19.16	16.32	20 08.52 (3)	14.59	14.29
26	09.22	07.43	08.56 (3)	06.05		05.16	03.39	02.57	04.09	05.45	07.14	07.43	08.34 (3)	09.21	10.15
	15.49	17.29	30 09.26 (3)	18.53		21.26	23.02	23.53	22.47	21.02	19.12	16.29	15 08.49 (3)	14.57	14.30
27	09.19	07.40	08.56 (3)	06.02		05.13	03.36	02.58	04.12	05.48	07.17	07.46	08.37 (3)	09.24	10.15
	15.52	17.32	29 09.25 (3)	18.56		21.29	23.05	23.53	22.43	20.58	19.09	16.26	9 08.46 (3)	14.55	14.31
28	09.16	07.36	08.57 (3)	05.58		05.09	03.33	02.59	04.15	05.50	07.20	07.49		09.27	10.15
	15.55	17.35	28 09.25 (3)	18.59		21.33	23.08	23.52	22.40	20.55	19.05	16.22		14.52	14.32
29	09.13			06.55		05.06	03.31	03.01	04.18	05.53	07.22	07.52		09.30	10.14
	15.58			20.02		21.36	23.11	23.51	22.37	20.51	19.02	16.19		14.50	14.34
30	09.10			06.51		05.03	03.28	03.01	04.21	05.56	07.25	07.55		09.33	10.14
	16.02			20.05		21.39	23.14	23.50	22.34	20.48	18.58	16.16		14.48	14.35
31	09.07			06.48			03.25		04.24	05.59		07.58			10.13
	16.05			20.08			23.16		22.31	20.44		16.13			14.37
Potential sun hours	173	239		363		451	568	621	606	508	393	305		199	139
Total, worst case			358		124								495		
Sun reduction			0,31		0,36								0,28		
Oper. time red.			0,94		0,94								0,94		
Wind dir. red.			0,64		0,64								0,64		
Total reduction			0,18		0,21								0,17		
Total, real			66		26								83		

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

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

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Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) Shadow receptor: L - Asuinrakennus L (Malkasaari)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	03.02	04.28	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.11	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.30	06.41	04.56	03.20	03.04	04.31	06.05	07.31	08.05	09.38
	14.41	16.12	17.41	20.14	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18	03.06	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.17	21.49	23.25	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.23	06.34	04.49	03.16	03.08	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.20	21.52	23.27	23.44	22.18	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.46	03.13	03.10	04.40	06.14	07.40	08.14	09.46
	14.47	16.22	17.51	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.57	14.39
6	10.07	08.49	07.16	06.27	04.42	03.11	03.12	04.43	06.17	07.43	08.18	09.49
	14.50	16.25	17.54	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.46	08.21	09.51
	14.52	16.28	17.57	20.28	22.01	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.03	08.43	07.09	06.20	04.36	03.07	03.17	04.50	06.23	07.48	08.24	09.54
	14.55	16.32	18.00	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51	08.27	09.56
	14.57	16.35	18.03	20.34	22.08	23.39	23.34	22.01	20.13	18.27	15.44	14.33
10	10.00	08.36	07.02	06.12	04.29	03.04	03.22	04.56	06.28	07.54	08.30	09.58
	15.00	16.38	18.06	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.26	03.02	03.24	04.59	06.31	07.57	08.34	10.00
	15.03	16.41	18.09	20.40	22.14	23.43	23.29	21.54	20.06	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.01	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.45	18.12	20.43	22.18	23.45	23.27	21.51	20.02	18.17	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.58	03.30	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.15	20.46	22.21	23.47	23.24	21.47	19.59	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.16	02.57	03.33	05.08	06.40	08.06	08.43	10.05
	15.11	16.51	18.18	20.49	22.24	23.48	23.22	21.44	19.55	18.10	15.29	14.28
15	09.50	08.20	06.44	05.55	04.13	02.56	03.35	05.11	06.43	08.09	08.47	10.07
	15.14	16.54	18.20	20.53	22.27	23.49	23.19	21.40	19.51	18.06	15.26	14.27
16	09.47	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.08
	15.17	16.57	18.23	20.56	22.30	23.51	23.16	21.37	19.48	18.03	15.23	14.27
17	09.45	08.14	06.37	05.48	04.06	02.55	03.41	05.18	06.48	08.15	08.53	10.10
	15.20	17.01	18.26	20.59	22.34	23.52	23.13	21.33	19.44	17.59	15.21	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.21	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.18	14.26
19	09.40	08.07	06.30	05.41	04.00	02.54	03.47	05.24	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.53	23.08	21.27	19.37	17.53	15.15	14.26
20	09.38	08.04	06.27	05.37	03.57	02.54	03.50	05.27	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54	02.54	03.53	05.30	07.00	08.27	09.06	10.14
	15.33	17.13	18.38	21.11	22.46	23.54	23.02	21.20	19.30	17.46	15.10	14.27
22	09.33	07.57	06.20	05.30	03.51	02.54	03.56	05.33	07.02	08.30	09.09	10.14
	15.36	17.17	18.41	21.14	22.50	23.54	22.59	21.16	19.27	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48	02.55	03.59	05.36	07.05	08.33	09.12	10.15
	15.39	17.20	18.44	21.17	22.53	23.54	22.56	21.13	19.23	17.39	15.04	14.27
24	09.27	07.50	06.13	05.23	03.45	02.55	04.02	05.39	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.54	22.53	21.09	19.20	17.36	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.56	04.06	05.42	07.11	07.40	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.06	05.16	03.39	02.57	04.09	05.45	07.14	07.43	09.21	10.15
	15.49	17.29	18.53	21.26	23.02	23.53	22.47	21.02	19.13	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.12	05.48	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.26	14.55	14.31
28	09.16	07.36	05.58	05.10	03.33	02.59	04.15	05.51	07.20	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.31	03.01	04.18	05.54	07.22	07.52	09.30	10.15
	15.59		20.02	21.36	23.11	23.51	22.37	20.52	19.02	16.19	14.50	14.34
30	09.10		06.51	05.03	03.28	03.01	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.08		23.17		22.31	20.45		16.13		14.37
Potential sun hours	173	238	363	451	568	621	607	508	393	305	199	139
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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Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) Shadow receptor: M - Asuinrakennus M (Latvala)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January		February		March		April	May	June
1	10.13		09.04		14.09 (15)	07.33	15.58 (14)	06.44	04.59	03.22
	14.38		16.08	27	14.36 (15)	17.38	31 16.29 (14)	20.10	21.42	23.20
2	10.12		09.01		14.09 (15)	07.29	15.58 (14)	06.40	04.55	03.19
	14.40		16.11	28	14.37 (15)	17.41	30 16.28 (14)	20.13	21.45	23.23
3	10.11		08.58		14.08 (15)	07.26	15.58 (14)	06.37	04.52	03.17
	14.42		16.14	29	14.37 (15)	17.44	31 16.29 (14)	20.16	21.49	23.25
4	10.10		08.55		14.07 (15)	07.22	15.58 (14)	06.33	04.48	03.15
	14.44		16.18	31	14.38 (15)	17.47	30 16.28 (14)	20.19	21.52	23.28
5	10.08		08.52		14.08 (15)	07.19	15.57 (14)	06.30	04.45	03.12
	14.47		16.21	31	14.39 (15)	17.50	30 16.27 (14)	20.22	21.55	23.30
6	10.07		08.49		14.08 (15)	07.15	15.58 (14)	06.26	04.42	03.10
	14.49		16.24	31	14.39 (15)	17.53	29 16.27 (14)	20.25	21.58	23.33
7	10.05		08.46		14.07 (15)	07.12	15.58 (14)	06.23	04.38	03.08
	14.51		16.28	32	14.39 (15)	17.56	28 16.26 (14)	20.28	22.01	23.35
8	10.04		08.43		14.07 (15)	07.09	15.59 (14)	06.19	04.35	03.06
	14.54		16.31	32	14.39 (15)	17.59	26 16.25 (14)	20.31	22.05	23.38
9	10.02		08.40		14.08 (15)	07.05	16.00 (14)	06.16	04.32	03.04
	14.56		16.34	32	14.40 (15)	18.02	24 16.24 (14)	20.34	22.08	23.40
10	10.00		08.36		14.08 (15)	07.02	16.01 (14)	06.12	04.28	03.02
	14.59		16.38	31	14.39 (15)	18.05	21 16.22 (14)	20.37	22.11	23.42
11	09.58		08.33		14.08 (15)	06.58	16.03 (14)	06.08	04.25	03.01
	15.02		16.41	31	14.39 (15)	18.08	16 16.19 (14)	20.40	22.14	23.44
12	09.56		08.30		14.08 (15)	06.55	16.07 (14)	06.05	04.22	02.58
	15.05		16.44	30	14.38 (15)	18.11	9 16.16 (14)	20.43	22.18	23.45
13	09.54		08.27		14.09 (15)	06.51		06.01	04.18	02.57
	15.07		16.47	29	14.38 (15)	18.14		20.46	22.21	23.47
14	09.52		08.23		14.10 (15)	06.48		05.58	04.15	02.56
	15.10		16.51	28	14.38 (15)	18.17		20.49	22.24	23.49
15	09.50		08.20		14.10 (15)	06.44		05.54	04.12	02.55
	15.13		16.54	26	14.36 (15)	18.20		20.52	22.27	23.50
16	09.48		08.17		14.12 (15)	06.40		05.51	04.09	02.54
	15.16		16.57	24	14.36 (15)	18.23		20.55	22.31	23.51
17	09.45		08.13		14.13 (15)	06.37		05.47	04.06	02.53
	15.19		17.00	21	14.34 (15)	18.26		20.58	22.34	23.52
18	09.43		08.10		14.15 (15)	06.33		05.44	04.02	02.53
	15.22		17.03	17	14.32 (15)	18.29		21.02	22.37	23.53
19	09.40		08.07		14.19 (15)	06.30		05.40	03.59	02.53
	15.26		17.07	10	14.29 (15)	18.32		21.05	22.40	23.54
20	09.38		08.03			06.26		05.37	03.56	02.53
	15.29		17.10			18.35		21.08	22.43	23.55
21	09.35		08.00		16.09 (14)	06.23		05.33	03.53	02.53
	15.32		17.13	10	16.19 (14)	18.38		21.11	22.47	23.55
22	09.33		07.57		16.06 (14)	06.19		05.30	03.50	02.53
	15.35		17.16	16	16.22 (14)	18.41		21.14	22.50	23.55
23	09.30		07.53		16.04 (14)	06.16		05.26	03.47	02.53
	15.38		17.19	20	16.24 (14)	18.44		21.17	22.53	23.55
24	09.27		07.50		16.02 (14)	06.12		05.23	03.44	02.54
	15.41		17.22	24	16.26 (14)	18.47		21.20	22.56	23.55
25	09.25		07.46		16.01 (14)	06.09		05.19	03.41	02.55
	15.45		17.25	25	16.26 (14)	18.50		21.23	22.59	23.55
26	09.22	14.19 (15)	07.43		16.00 (14)	06.05		05.16	03.38	02.56
	15.48	4 14.23 (15)	17.29	28	16.28 (14)	18.53		21.26	23.02	23.54
27	09.19	14.15 (15)	07.40		15.59 (14)	06.02		05.12	03.35	02.57
	15.51	13 14.28 (15)	17.32	29	16.28 (14)	18.56		21.30	23.05	23.53
28	09.16	14.13 (15)	07.36		15.58 (14)	05.58		05.09	03.33	02.58
	15.55	17 14.30 (15)	17.35	30	16.28 (14)	18.59		21.33	23.08	23.52
29	09.13	14.12 (15)				06.55		05.06	03.30	03.00
	15.58	20 14.32 (15)				20.02		21.36	23.11	23.51
30	09.10	14.10 (15)				06.51		05.02	03.27	03.00
	16.01	23 14.33 (15)				20.04		21.39	23.14	23.50
31	09.07	14.10 (15)				06.47			03.24	
	16.04	25 14.35 (15)				20.07			23.17	
Potential sun hours	172		238		363		451	569	622	
Total, worst case	102		702		305					
Sun reduction	0,11		0,31		0,36					
Oper. time red.	0,94		0,94		0,94					
Wind dir. red.	0,65		0,64		0,62					
Total reduction	0,07		0,18		0,21					
Total, real	7		130		64					

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

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

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Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Calendar

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) Shadow receptor: M - Asuinrakennus M (Latvala)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	July	August	September	October		November		December
1	03.01	04.27	06.02	07.28		16.49 (14)	08.01	13.37 (15)	09.36
	23.49	22.28	20.41	18.55	4	16.53 (14)	16.09	32	14.09 (15)	14.45
2	03.03	04.30	06.05	07.31		16.43 (14)	08.05	13.37 (15)	09.39
	23.48	22.24	20.37	18.51	15	16.58 (14)	16.06	32	14.09 (15)	14.43
3	03.05	04.33	06.08	07.34		16.40 (14)	08.08	13.37 (15)	09.41
	23.46	22.21	20.34	18.48	20	17.00 (14)	16.02	32	14.09 (15)	14.41
4	03.07	04.36	06.11	07.37		16.38 (14)	08.11	13.37 (15)	09.44
	23.44	22.18	20.30	18.44	23	17.01 (14)	15.59	32	14.09 (15)	14.39
5	03.09	04.40	06.14	07.40		16.37 (14)	08.14	13.37 (15)	09.47
	23.42	22.14	20.27	18.41	25	17.02 (14)	15.56	32	14.09 (15)	14.38
6	03.11	04.43	06.16	07.42		16.35 (14)	08.18	13.38 (15)	09.49
	23.41	22.11	20.23	18.37	27	17.02 (14)	15.53	30	14.08 (15)	14.36
7	03.13	04.46	06.19	07.45		16.34 (14)	08.21	13.38 (15)	09.52
	23.39	22.08	20.20	18.34	29	17.03 (14)	15.50	30	14.08 (15)	14.35
8	03.16	04.49	06.22	07.48		16.33 (14)	08.24	13.39 (15)	09.54
	23.36	22.04	20.16	18.30	30	17.03 (14)	15.47	29	14.08 (15)	14.33
9	03.18	04.52	06.25	07.51		16.32 (14)	08.27	13.39 (15)	09.56
	23.34	22.01	20.12	18.27	31	17.03 (14)	15.44	28	14.07 (15)	14.32
10	03.21	04.55	06.28	07.54		16.32 (14)	08.30	13.40 (15)	09.58
	23.32	21.57	20.09	18.23	31	17.03 (14)	15.40	27	14.07 (15)	14.30
11	03.23	04.58	06.31	07.57		16.31 (14)	08.34	13.41 (15)	10.00
	23.29	21.54	20.05	18.20	31	17.02 (14)	15.37	25	14.06 (15)	14.29
12	03.26	05.02	06.34	08.00		16.31 (14)	08.37	13.42 (15)	10.02
	23.27	21.51	20.02	18.16	31	17.02 (14)	15.34	23	14.05 (15)	14.28
13	03.29	05.05	06.37	08.03		16.31 (14)	08.40	13.43 (15)	10.04
	23.24	21.47	19.58	18.13	30	17.01 (14)	15.31	20	14.03 (15)	14.28
14	03.32	05.08	06.39	08.06		16.32 (14)	08.43	13.46 (15)	10.06
	23.22	21.44	19.55	18.09	29	17.01 (14)	15.29	17	14.03 (15)	14.27
15	03.34	05.11	06.42	08.09		16.32 (14)	08.47	13.48 (15)	10.07
	23.19	21.40	19.51	18.06	28	17.00 (14)	15.26	12	14.00 (15)	14.26
16	03.37	05.14	06.45	08.12		16.32 (14)	08.50	13.52 (15)	10.09
	23.16	21.37	19.48	18.02	27	16.59 (14)	15.23	4	13.56 (15)	14.26
17	03.40	05.17	06.48	08.15		16.33 (14)	08.53		10.10
	23.14	21.33	19.44	17.59	25	16.58 (14)	15.20		14.25
18	03.43	05.20	06.51	08.18		16.35 (14)	08.56		10.11
	23.11	21.30	19.41	17.56	22	16.57 (14)	15.17		14.25
19	03.46	05.23	06.54	08.21		16.36 (14)	08.59		10.12
	23.08	21.26	19.37	17.52	19	16.55 (14)	15.14		14.25
20	03.49	05.26	06.56	08.24		16.37 (14)	09.03		10.13
	23.05	21.23	19.33	17.49	15	16.52 (14)	15.12		14.25
21	03.52	05.29	06.59	08.27		16.42 (14)	09.06		10.14
	23.02	21.20	19.30	17.45	6	16.48 (14)	15.09		14.26
22	03.55	05.32	07.02	08.30			09.09		10.15
	22.59	21.16	19.26	17.42			15.06		14.26
23	03.58	05.35	07.05	08.33		14.48 (15)	09.12		10.15
	22.56	21.13	19.23	17.39	12	15.00 (15)	15.04		14.27
24	04.02	05.38	07.08	08.36		14.45 (15)	09.15		10.15
	22.53	21.09	19.19	17.35	17	15.02 (15)	15.01		14.27
25	04.05	05.41	07.11	07.39		13.43 (15)	09.18		10.16
	22.50	21.05	19.16	16.32	22	14.05 (15)	14.59		14.28
26	04.08	05.44	07.14	07.43		13.41 (15)	09.21		10.16
	22.47	21.02	19.12	16.29	24	14.05 (15)	14.56		14.29
27	04.11	05.47	07.16	07.46		13.40 (15)	09.24		10.15
	22.44	20.58	19.09	16.25	27	14.07 (15)	14.54		14.30
28	04.14	05.50	07.19	07.49		13.39 (15)	09.27		10.15
	22.41	20.55	19.05	16.22	28	14.07 (15)	14.52		14.31
29	04.17	05.53	07.22	07.52		13.38 (15)	09.30		10.15
	22.37	20.51	19.02	16.19	30	14.08 (15)	14.49		14.33
30	04.21	05.56	07.25	07.55		13.38 (15)	09.33		10.14
	22.34	20.48	18.58	16.15	31	14.09 (15)	14.47		14.34
31	04.24	05.59		07.58		13.37 (15)			10.14
	22.31	20.44		16.12	31	14.08 (15)			14.36
Potential sun hours	607	508	393	305			199		138
Total, worst case					720			405	
Sun reduction					0,28			0,18	
Oper. time red.					0,94			0,94	
Wind dir. red.					0,63			0,65	
Total reduction					0,17			0,11	
Total, real					120			45	

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

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

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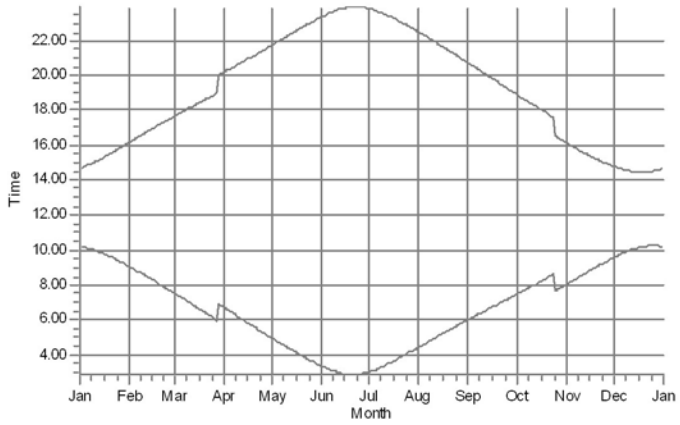
Calculated:
22.11.2023 17.01/3.6.377

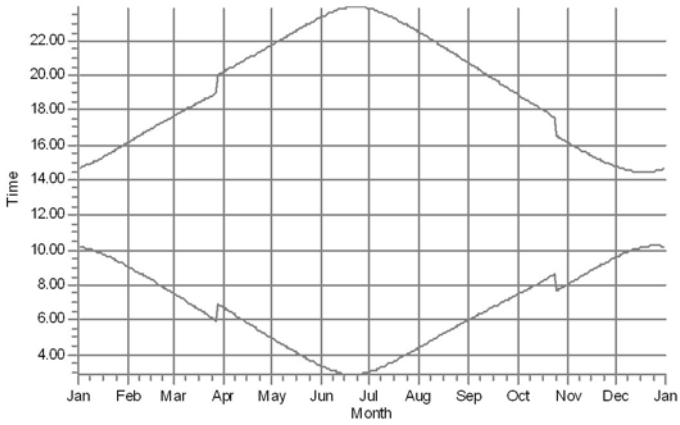
SHADOW - Calendar, graphical

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)

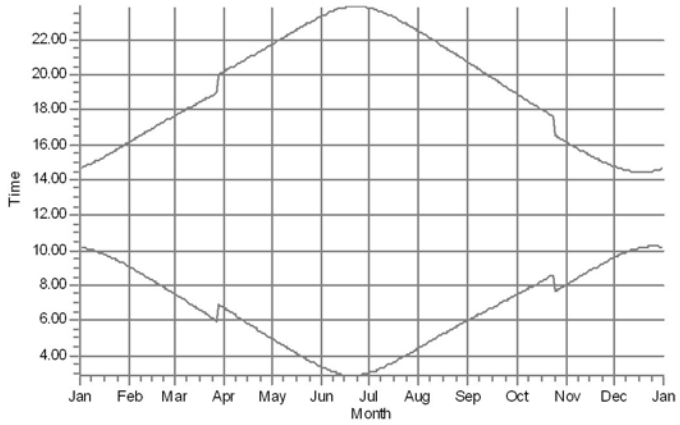
A: Lomarakennus A (Lampinjärvi)



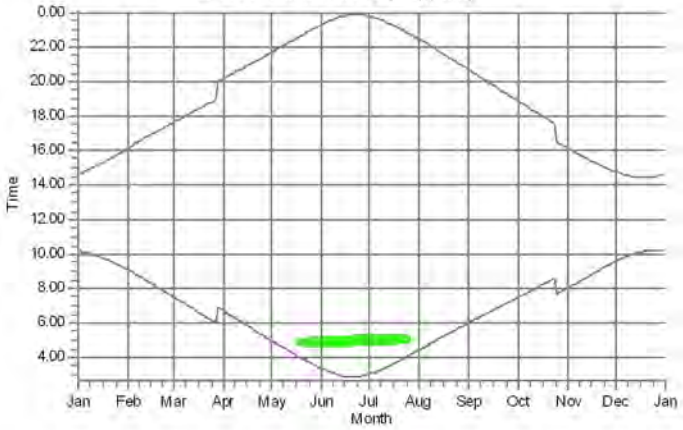
B: Lomarakennus B (Lampinkallio)



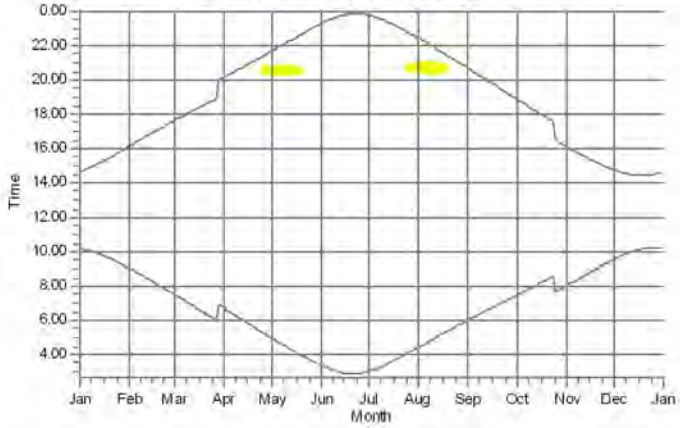
C: Lomarakennus C (Latvalampi)



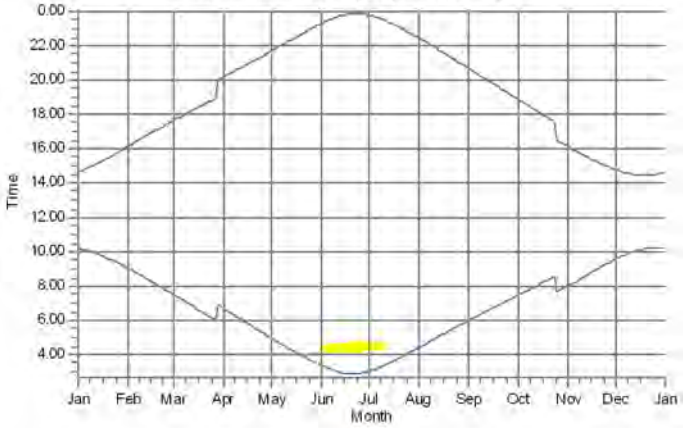
D: Asuinrakennus D (Noppala)



E: Muu rakennus E (Noppala)



F: Asuinrakennus F (Maijannevantie)



WTGs

2: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (173)

9: Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (210)

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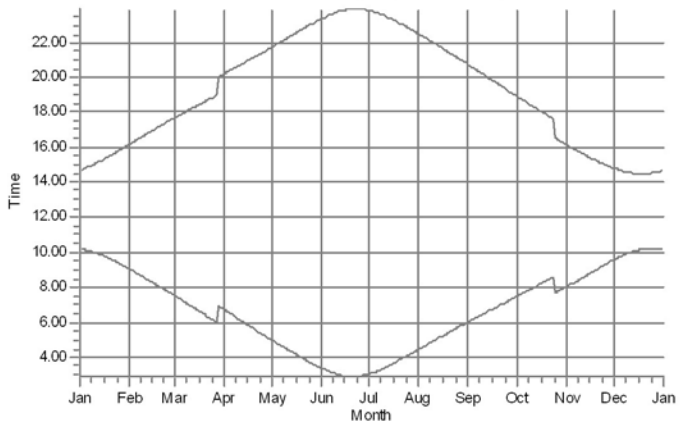
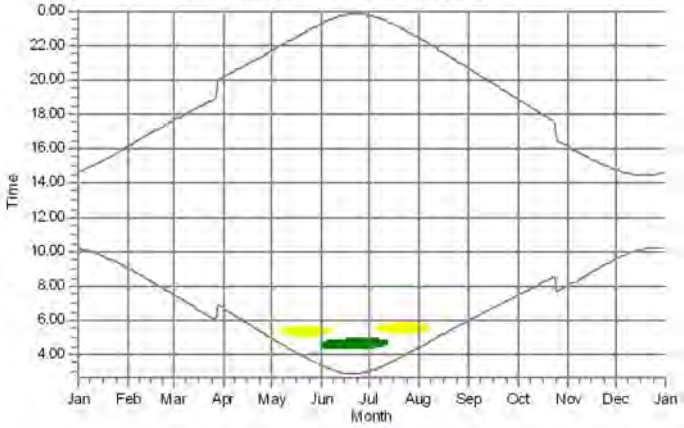
SHADOW - Calendar, graphical

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)

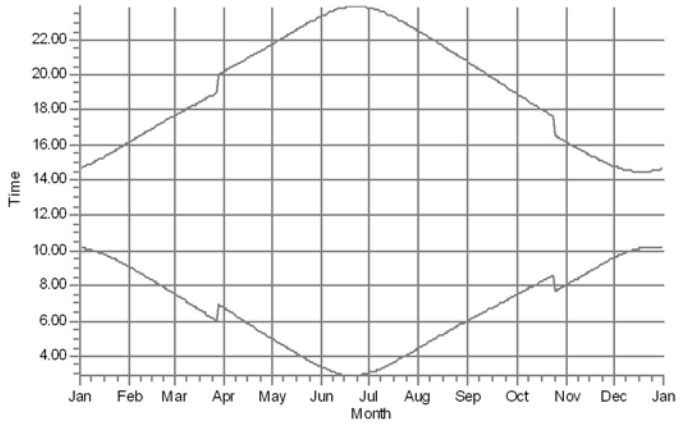
G: Asuinrakennus G (Maijannevantie)



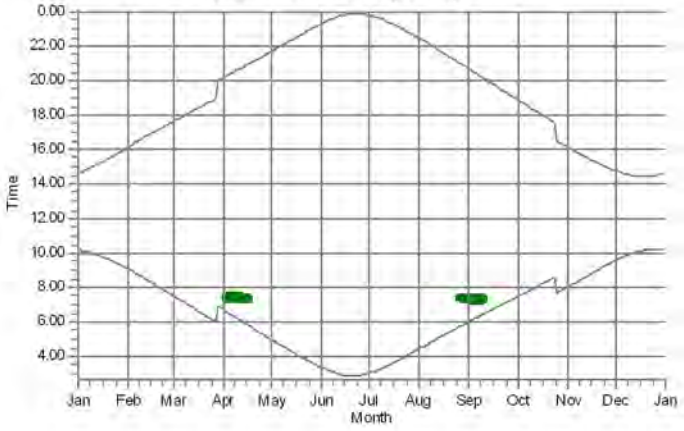
H: Asuinrakennus H (Hietasaari)



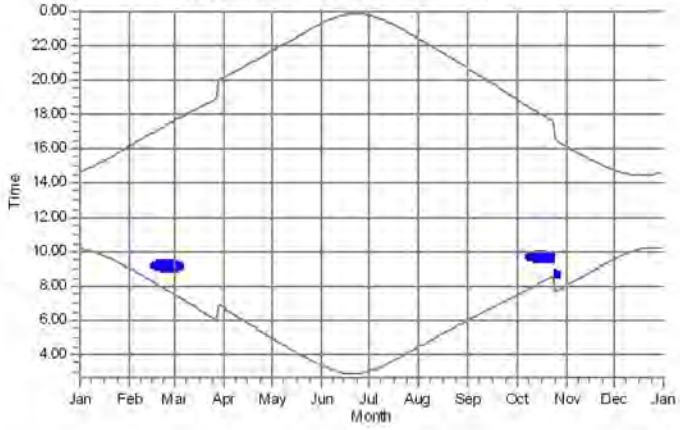
I: Asuinrakennus I (Lahdenperä)



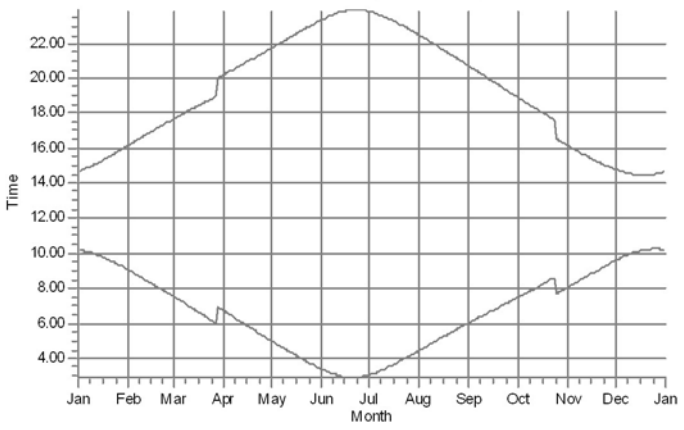
J: Lomarakennus J (Junno)



K: Lomarakennus K (Isomännikkö)



L: Asuinrakennus L (Malkasaari)



WTGs

1: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (172)
2: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (173)
3: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (174)

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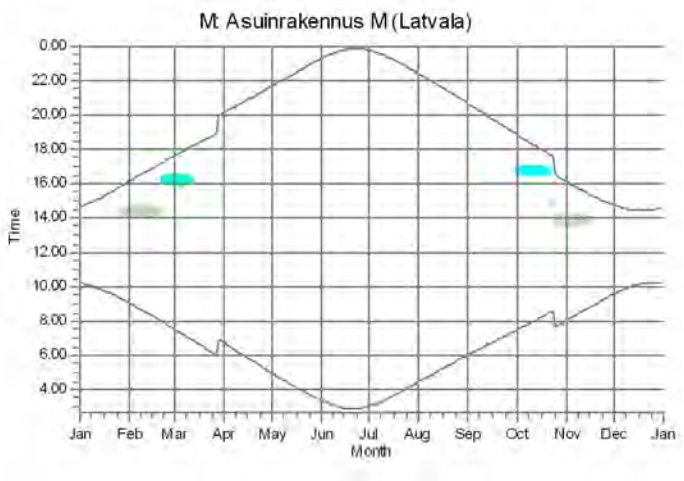
Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Calendar, graphical

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)



WTGs

14: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (185)

15: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (186)

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 1 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (172)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44 07.22-07.33/11	04.59	03.23	03.03 04.31-04.53/22	04.28	06.02 07.11-07.37/26	07.28	08.01	09.35
	14.39	16.08	17.38	20.11	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.41 07.19-07.36/17	04.56	03.21 04.32-04.39/7	03.04 04.31-04.53/22	04.31	06.05 07.10-07.37/27	07.31	08.05	09.38
	14.41	16.12	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37 07.17-07.37/20	04.52	03.18 04.31-04.42/11	03.06 04.31-04.52/21	04.34	06.08 07.09-07.36/27	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.24	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.23	06.34 07.16-07.38/22	04.49	03.16 04.30-04.43/13	03.08 04.33-04.53/20	04.37	06.11 07.09-07.36/27	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.27	23.43	22.17	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30 07.14-07.38/24	04.46	03.14 04.28-04.44/16	03.10 04.33-04.52/19	04.40	06.14 07.09-07.36/27	07.40	08.14	09.46
	14.48	16.22	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.57	14.39
6	10.06	08.49	07.16	06.27 07.13-07.39/26	04.42	03.12 04.28-04.45/17	03.12 04.33-04.51/18	04.43	06.17 07.10-07.35/25	07.43	08.17	09.49
	14.50	16.25	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23 07.12-07.39/27	04.39	03.09 04.28-04.46/18	03.15 04.35-04.51/16	04.47	06.20 07.09-07.33/24	07.45	08.21	09.51
	14.52	16.28	17.57	20.28	22.01	23.34	23.38	22.07	20.20	18.34	15.50	14.36
8	10.03	08.43	07.09	06.20 07.12-07.39/27	04.36	03.08 04.27-04.47/20	03.17 04.36-04.51/15	04.50	06.23 07.10-07.32/22	07.48	08.24	09.53
	14.55	16.32	18.00	20.31	22.04	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.01	08.39	07.05	06.16 07.12-07.39/27	04.32	03.06 04.27-04.48/21	03.19 04.37-04.49/12	04.53	06.25 07.11-07.31/20	07.51	08.27	09.55
	14.57	16.35	18.03	20.34	22.08	23.39	23.33	22.01	20.13	18.27	15.44	14.33
10	10.00	08.36	07.02	06.12 07.11-07.38/27	04.29	03.04 04.27-04.48/21	03.22 04.39-04.48/9	04.56	06.28 07.12-07.28/16	07.54	08.30	09.58
	15.00	16.38	18.06	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.32
11	09.58	08.33	06.58	06.09 07.12-07.38/26	04.26	03.02 04.26-04.49/23	03.25 04.42-04.45/3	04.59	06.31 07.14-07.26/12	07.57	08.33	10.00
	15.03	16.41	18.09	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.31
12	09.56	08.30	06.55	06.05 07.11-07.37/26	04.22	03.01 04.26-04.49/23	03.27	05.02	06.34	08.00	08.37	10.02
	15.06	16.45	18.12	20.43	22.17	23.44	23.26	21.50	20.02	18.17	15.35	14.30
13	09.54	08.27	06.51	06.02 07.12-07.36/24	04.19	02.58 04.26-04.49/23	03.30	05.05	06.37	08.03	08.40	10.03
	15.08	16.48	18.14	20.46	22.21	23.46	23.24	21.47	19.58	18.13	15.32	14.29
14	09.52	08.23	06.48	05.58 07.13-07.35/22	04.16	02.57 04.26-04.50/24	03.33	05.08	06.40	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.21	21.44	19.55	18.10	15.29	14.28
15	09.49	08.20	06.44	05.55 07.13-07.33/20	04.13	02.56 04.26-04.50/24	03.36	05.11	06.43	08.09	08.46	10.07
	15.14	16.54	18.20	20.52	22.27	23.49	23.19	21.40	19.51	18.06	15.26	14.27
16	09.47	08.17	06.41	05.51 07.14-07.32/18	04.10	02.56 04.26-04.51/25	03.38	05.14	06.45	08.12	08.50	10.08
	15.17	16.57	18.23	20.55	22.30	23.50	23.16	21.37	19.48	18.03	15.23	14.27
17	09.45	08.13	06.37	05.48 07.17-07.29/12	04.06	02.55 04.26-04.51/25	03.41	05.18	06.48	08.15	08.53	10.09
	15.20	17.01	18.26	20.58	22.33	23.51	23.13	21.33	19.44	17.59	15.21	14.27
18	09.43	08.10	06.34	05.44 07.19-07.24/5	04.03	02.54 04.27-04.52/25	03.44	05.21	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.52	23.10	21.30	19.41	17.56	15.18	14.26
19	09.40	08.07	06.30	05.41	04.00	02.54 04.27-04.52/25	03.47	05.24	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.53	23.07	21.26	19.37	17.53	15.15	14.26
20	09.38	08.03	06.27	05.37	03.57	02.54 04.27-04.52/25	03.50	05.27	06.57	08.24	09.02	10.12
	15.30	17.10	18.35	21.08	22.43	23.53	23.05	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54	02.54 04.27-04.52/25	03.53	05.30	07.00	08.27	09.05	10.13
	15.33	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.46	15.10	14.27
22	09.32	07.57	06.20	05.30	03.51	02.55 04.27-04.52/25	03.56	05.33	07.02	08.30	09.09	10.14
	15.36	17.17	18.41	21.14	22.49	23.54	22.59	21.16	19.27	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48	02.55 04.27-04.52/25	03.59	05.36	07.05	08.33	09.12	10.14
	15.39	17.20	18.44	21.17	22.52	23.54	22.56	21.12	19.23	17.39	15.05	14.28
24	09.27	07.50	06.13	05.23	03.45	02.56 04.28-04.53/25	04.03	05.39	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.55	23.54	22.53	21.09	19.19	17.36	15.02	14.28
25	09.24	07.47	06.09	05.20	03.42	02.56 04.27-04.52/25	04.06	05.42 07.22-07.29/7	07.11	07.39	09.18	10.15
	15.46	17.26	18.50	21.23	22.59	23.53	22.49	21.05	19.16	16.32	15.00	14.29
26	09.22	07.43	06.05	05.16	03.39	02.57 04.28-04.53/25	04.09	05.45 07.19-07.32/13	07.14	07.43	09.21	10.15
	15.49	17.29	18.53	21.26	23.02	23.53	22.46	21.02	19.12	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58 04.29-04.53/24	04.12	05.48 07.16-07.34/18	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.05	23.52	22.43	20.58	19.09	16.26	14.55	14.31
28	09.16	07.36	05.58	05.10	03.34	03.00 04.29-04.53/24	04.15	05.51 07.15-07.35/20	07.20	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.51	22.40	20.55	19.05	16.22	14.53	14.33
29	09.13		06.55	05.06	03.31	03.00 04.30-04.53/23	04.18	05.54 07.14-07.36/22	07.22	07.52	09.30	10.14
	15.59		20.02	21.36	23.10	23.50	22.37	20.51	19.02	16.19	14.50	14.34
30	09.10		06.51	05.03	03.28	03.01 04.30-04.53/23	04.21	05.56 07.12-07.36/24	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.13	23.49	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.26		04.25	05.59 07.11-07.37/26		07.58		10.13
	16.05		20.08		23.16		22.30	20.44		16.13		14.37
Potential sun hours	173	239	363	450	568	621	606	508	393	305	199	139
Sum of minutes with flicker	0	0	0	381	0	630	177	130	253	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 2 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (173)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59 20.22-20.49/27	03.23 05.17-05.32/15	03.03 04.20-04.39/19	04.28 05.24-05.44/20	06.02	07.28	08.01	09.35
	14.39	16.08	17.38	20.10	21.42	23.19	23.48	22.27 20.33-20.58/25	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.41	04.56 20.21-20.49/28	03.21 05.18-05.31/13	03.04 04.20-04.39/19	04.31 05.25-05.44/19	06.05	07.31	08.05	09.38
	14.41	16.12	17.41	20.13	21.45	23.22 04.22-04.24/2	23.47	22.24 20.31-20.57/26	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52 20.21-20.49/28	03.18 05.19-05.31/12	03.06 04.20-04.38/18	04.34 05.25-05.42/17	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.24 04.20-04.28/8	23.45	22.21 20.31-20.58/27	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.34	04.49 20.21-20.49/28	03.16 05.21-05.30/9	03.08 04.22-04.39/17	04.37 05.27-05.41/14	06.11	07.37	08.11	09.43
	14.45	16.18	17.47	20.19	21.52	23.27 04.19-04.30/11	23.43	22.17 20.31-20.59/28	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.46 20.20-20.49/29	03.14 05.22-05.28/6	03.10 04.22-04.38/16	04.40 05.29-05.39/10	06.14	07.40	08.14	09.46
	14.48	16.22	17.50	20.22	21.55	23.29 04.17-04.30/13	23.41	22.14 20.30-20.58/28	20.27	18.41	15.57	14.39
6	10.06	08.49	07.16	06.27	04.42 20.20-20.49/29	03.11 04.17-04.31/14	03.12 04.22-04.37/15	04.43 20.30-20.59/29	06.17	07.43	08.17	09.48
	14.50	16.25	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39 05.21-05.26/5	03.09 04.17-04.32/15	03.15 05.29-05.34/5	04.47 20.30-20.59/29	06.20	07.45	08.21	09.51
	14.52	16.28	17.56	20.28	22.01 20.20-20.49/29	23.34	23.38 04.23-04.37/14	22.07	20.20	18.34	15.50	14.36
8	10.03	08.43	07.09	06.19	04.36 05.18-05.30/12	03.07 04.16-04.33/17	03.17 05.28-05.36/8	04.50 20.30-20.58/28	06.23	07.48	08.24	09.53
	14.55	16.31	17.59	20.31	22.04 20.20-20.48/28	23.37	23.35 04.25-04.37/12	22.04	20.16	18.30	15.47	14.34
9	10.01	08.39	07.05	06.16	04.32 05.16-05.32/16	03.06 04.16-04.34/18	03.19 05.26-05.37/11	04.53 20.30-20.58/28	06.25	07.51	08.27	09.55
	14.57	16.35	18.02	20.34	22.08 20.21-20.49/28	23.39	23.33 04.26-04.35/9	22.01	20.13	18.27	15.44	14.33
10	10.00	08.36	07.02	06.12	04.29 05.15-05.33/18	03.04 04.16-04.34/18	03.22 05.26-05.39/13	04.56 20.30-20.58/28	06.28	07.54	08.30	09.58
	15.00	16.38	18.05	20.37	22.11 20.21-20.48/27	23.41	23.31 04.28-04.34/6	21.57	20.09	18.23	15.41	14.32
11	09.58	08.33	06.58	06.09	04.26 05.13-05.33/20	03.02 04.15-04.35/20	03.25 05.25-05.40/15	04.59 20.30-20.57/27	06.31	07.57	08.33	10.00
	15.03	16.41	18.08	20.40	22.14 20.22-20.47/25	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22 05.13-05.35/22	03.01 04.15-04.35/20	03.27 05.25-05.41/16	05.02 20.30-20.57/27	06.34	08.00	08.37	10.01
	15.06	16.45	18.11	20.43	22.17 20.22-20.46/24	23.44	23.26	21.50	20.02	18.16	15.35	14.29
13	09.54	08.26	06.51	06.02	04.19 05.12-05.35/23	02.58 04.15-04.35/20	03.30 05.24-05.42/18	05.05 20.31-20.56/25	06.37	08.03	08.40	10.03
	15.08	16.48	18.14	20.46	22.20 20.23-20.46/23	23.46	23.24	21.47	19.58	18.13	15.32	14.29
14	09.52	08.23	06.48	05.58	04.16 05.12-05.35/23	02.57 04.15-04.36/21	03.33 05.24-05.42/18	05.08 20.32-20.56/24	06.40	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24 20.24-20.45/21	23.48	23.21	21.44	19.55	18.10	15.29	14.28
15	09.49	08.20	06.44	05.55	04.13 05.12-05.36/24	02.56 04.15-04.36/21	03.36 05.23-05.43/20	05.11 20.32-20.54/22	06.43	08.09	08.46	10.07
	15.14	16.54	18.20	20.52	22.27 20.25-20.44/19	23.49	23.18	21.40	19.51	18.06	15.26	14.27
16	09.47	08.17	06.41	05.51	04.10 05.11-05.36/25	02.55 04.15-04.36/21	03.38 05.23-05.44/21	05.14 20.33-20.53/20	06.45	08.12	08.50	10.08
	15.17	16.57	18.23	20.55	22.30 20.26-20.43/17	23.50	23.16	21.37	19.48	18.03	15.23	14.27
17	09.45	08.13	06.37	05.48	04.06 05.11-05.36/25	02.55 04.16-04.37/21	03.41 05.22-05.44/22	05.18 20.35-20.51/16	06.48	08.15	08.53	10.09
	15.20	17.01	18.26	20.58	22.33 20.28-20.41/13	23.51	23.13	21.33	19.44	17.59	15.21	14.27
18	09.42	08.10	06.34	05.44	04.03 05.11-05.36/25	02.54 04.16-04.37/21	03.44 05.23-05.45/22	05.21 20.37-20.47/10	06.51	08.18	08.56	10.10
	15.23	17.04	18.29	21.01	22.37 20.30-20.40/10	23.52	23.10	21.30	19.41	17.56	15.18	14.26
19	09.40	08.07	06.30	05.41	04.00 05.11-05.37/26	02.54 04.16-04.38/22	03.47 05.22-05.45/23	05.24	06.54	08.21	08.59	10.11
	15.26	17.07	18.32	21.05	22.40	23.53	23.07	21.26	19.37	17.53	15.15	14.26
20	09.38	08.03	06.27	05.37	03.57 05.11-05.36/25	02.54 04.16-04.38/22	03.50 05.22-05.46/24	05.27	06.57	08.24	09.02	10.12
	15.29	17.10	18.35	21.08	22.43	23.53	23.04	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54 05.11-05.36/25	02.54 04.16-04.38/22	03.53 05.21-05.46/25	05.30	07.00	08.27	09.05	10.13
	15.33	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.46	15.10	14.27
22	09.32	07.57	06.20	05.30	03.51 05.12-05.36/24	02.54 04.16-04.38/22	03.56 05.22-05.46/24	05.33	07.02	08.30	09.09	10.14
	15.36	17.16	18.41	21.14	22.49	23.54	22.59	21.16	19.27	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48 05.11-05.35/24	02.55 04.16-04.38/22	03.59 05.21-05.46/25	05.36	07.05	08.33	09.12	10.14
	15.39	17.20	18.44	21.17	22.52	23.54	22.56	21.12	19.23	17.39	15.05	14.28
24	09.27	07.50	06.12	05.23	03.45 05.12-05.35/23	02.56 04.17-04.39/22	04.03 05.22-05.47/25	05.39	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.55	23.54	22.53	21.09	19.19	17.36	15.02	14.28
25	09.24	07.46	06.09	05.20 20.30-20.42/12	03.42 05.12-05.35/23	02.56 04.17-04.38/21	04.06 05.21-05.46/25	05.42	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.58	23.53	22.49 20.43-20.48/5	21.05	19.16	16.32	15.00	14.29
26	09.22	07.43	06.05	05.16 20.27-20.44/17	03.39 05.13-05.35/22	02.57 04.17-04.39/22	04.09 05.22-05.47/25	05.45	07.14	07.42	09.21	10.15
	15.49	17.29	18.53	21.26	23.02	23.53	22.46 20.39-20.51/12	21.02	19.12	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13 20.26-20.46/20	03.36 05.13-05.35/22	02.58 04.18-04.39/21	04.12 05.21-05.46/25	05.48	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.05	23.52	22.43 20.38-20.53/15	20.58	19.09	16.26	14.55	14.31
28	09.16	07.36	05.58	05.10 20.25-20.47/22	03.34 05.14-05.34/20	03.00 04.18-04.39/21	04.15 05.22-05.47/25	05.51	07.19	07.49	09.27	10.14
	15.55	17.35	18.59	21.32	23.07	23.51	22.40 20.36-20.54/18	20.55	19.05	16.22	14.53	14.33
29	09.13		06.55	05.06 20.24-20.48/24	03.31 05.14-05.34/20	03.00 04.19-04.39/20	04.18 05.22-05.46/24	05.53	07.22	07.52	09.30	10.14
	15.59		20.02	21.36	23.10	23.50	22.37 20.35-20.55/20	20.51	19.02	16.19	14.50	14.34
30	09.10		06.51	05.03 20.23-20.48/25	03.28 05.15-05.33/18	03.01 04.19-04.39/20	04.21 05.23-05.46/23	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.13	23.49	22.34 20.34-20.56/22	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.26 05.16-05.33/17		04.24 05.23-05.45/22	05.59		07.58		10.13
	16.05		20.08		23.16		22.30 20.33-20.57/24	20.44		16.13		14.37
Potential sun hours	173	239	363	450	568	621	606	508	393	305	199	139
Sum of minutes with flicker	0	0	0	120	960	593	765	527	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 3 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (174)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33 08.57-09.24/27	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.01	09.35
	14.39	16.08	17.38	20.10	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29 08.57-09.23/26	06.41	04.56	03.20	03.04	04.31	06.05	07.31	08.05	09.38
	14.41	16.12	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26 08.58-09.22/24	06.37	04.52	03.18	03.06	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.24	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22 08.59-09.20/21	06.34	04.49	03.16	03.08	04.37	06.11	07.37	08.11	09.43
	14.45	16.18	17.47	20.19	21.52	23.27	23.43	22.17	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19 09.01-09.17/16	06.30	04.46	03.13	03.10	04.40	06.14	07.40	08.14	09.46
	14.47	16.22	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.39
6	10.06	08.49	07.16 09.04-09.14/10	06.26	04.42	03.11	03.12	04.43	06.17	07.42	08.17	09.49
	14.50	16.25	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.45 09.43-09.47/4	08.21	09.51
	14.52	16.28	17.56	20.28	22.01	23.34	23.38	22.07	20.20	18.34	15.50	14.35
8	10.03	08.43	07.09	06.19	04.36	03.07	03.17	04.50	06.22	07.48 09.38-09.52/14	08.24	09.53
	14.55	16.31	17.59	20.31	22.04	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.01	08.39	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51 09.35-09.54/19	08.27	09.55
	14.57	16.35	18.02	20.34	22.08	23.39	23.33	22.01	20.12	18.27	15.44	14.33
10	10.00	08.36	07.02	06.12	04.29	03.04	03.22	04.56	06.28	07.54 09.33-09.55/22	08.30	09.58
	15.00	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.26	03.02	03.24	04.59	06.31	07.57 09.31-09.56/25	08.33	10.00
	15.03	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.01	03.27	05.02	06.34	08.00 09.30-09.57/27	08.37	10.02
	15.05	16.44	18.11	20.43	22.17	23.44	23.26	21.50	20.02	18.16	15.35	14.29
13	09.54	08.26	06.51	06.02	04.19	02.58	03.30	05.05	06.37	08.03 09.30-09.58/28	08.40	10.03
	15.08	16.48	18.14	20.46	22.20	23.46	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.16	02.57	03.33	05.08	06.40	08.06 09.29-09.58/29	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.21	21.44	19.55	18.10	15.29	14.28
15	09.49	08.20 09.06-09.17/11	06.44	05.55	04.13	02.56	03.35	05.11	06.42	08.09 09.28-09.58/30	08.46	10.07
	15.14	16.54	18.20	20.52	22.27	23.49	23.18	21.40	19.51	18.06	15.26	14.27
16	09.47	08.17 09.04-09.20/16	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12 09.27-09.58/31	08.50	10.08
	15.17	16.57	18.23	20.55	22.30	23.50	23.16	21.37	19.48	18.03	15.23	14.27
17	09.45	08.13 09.02-09.22/20	06.37	05.48	04.06	02.55	03.41	05.17	06.48	08.15 09.27-09.57/30	08.53	10.09
	15.20	17.01	18.26	20.58	22.33	23.51	23.13	21.33	19.44	17.59	15.20	14.26
18	09.42	08.10 09.00-09.23/23	06.34	05.44	04.03	02.54	03.44	05.20	06.51	08.18 09.27-09.58/31	08.56	10.10
	15.23	17.04	18.29	21.01	22.37	23.52	23.10	21.30	19.41	17.56	15.18	14.26
19	09.40	08.07 08.58-09.24/26	06.30	05.41	04.00	02.54	03.47	05.23	06.54	08.21 09.27-09.57/30	08.59	10.12
	15.26	17.07	18.32	21.04	22.40	23.53	23.07	21.26	19.37	17.52	15.15	14.26
20	09.38	08.03 08.58-09.25/27	06.27	05.37	03.57	02.54	03.50	05.27	06.57	08.24 09.27-09.56/29	09.02	10.12
	15.29	17.10	18.35	21.08	22.43	23.53	23.04	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00 08.57-09.25/28	06.23	05.34	03.54	02.54	03.53	05.30	06.59	08.27 09.28-09.56/28	09.05	10.13
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.46	15.10	14.27
22	09.32	07.57 08.56-09.25/29	06.19	05.30	03.51	02.54	03.56	05.33	07.02	08.30 09.28-09.55/27	09.09	10.14
	15.36	17.16	18.41	21.14	22.49	23.54	22.59	21.16	19.26	17.42	15.07	14.27
23	09.30	07.53 08.56-09.26/30	06.16	05.27	03.48	02.55	03.59	05.36	07.05	08.33 09.30-09.54/24	09.12	10.14
	15.39	17.20	18.44	21.17	22.52	23.54	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50 08.56-09.26/30	06.12	05.23	03.45	02.55	04.02	05.39	07.08	08.36 09.30-09.53/23	09.15	10.15
	15.42	17.23	18.47	21.20	22.55	23.54	22.53	21.09	19.19	17.36	15.02	14.28
25	09.24	07.46 08.55-09.26/31	06.09	05.20	03.42	02.56	04.05	05.42	07.11	07.39 08.32-08.52/20	09.18	10.15
	15.45	17.26	18.50	21.23	22.58	23.53	22.49	21.05	19.16	16.32	14.59	14.29
26	09.22	07.43 08.56-09.26/30	06.05	05.16	03.39	02.57	04.09	05.45	07.14	07.42 08.34-08.49/15	09.21	10.15
	15.49	17.29	18.53	21.26	23.02	23.53	22.46	21.02	19.12	16.29	14.57	14.30
27	09.19	07.40 08.56-09.25/29	06.02	05.13	03.36	02.58	04.12	05.47	07.17	07.46 08.37-08.46/9	09.24	10.15
	15.52	17.32	18.56	21.29	23.05	23.52	22.43	20.58	19.09	16.26	14.55	14.31
28	09.16	07.36 08.57-09.25/28	05.58	05.09	03.33	02.59	04.15	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.32	23.08	23.51	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.31	03.01	04.18	05.53	07.22	07.52	09.30	10.14
	15.58		20.02	21.36	23.10	23.50	22.37	20.51	19.02	16.19	14.50	14.34
30	09.10		06.51	05.03	03.28	03.01	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.13	23.49	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.07		23.16		22.30	20.44		16.12		14.37
Potential sun hours	173	239	363	450	568	621	606	508	393	305	199	139
Sum of minutes with flicker	0	358	124	0	0	0	0	0	0	495	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 4 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (175)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.01	09.35
	14.39	16.08	17.38	20.10	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.41	04.56	03.20	03.04	04.31	06.05	07.31	08.05	09.38
	14.41	16.12	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18	03.06	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.25	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	03.16	03.08	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.27	23.43	22.17	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.10	04.40	06.14	07.40	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.06	08.49	07.15	06.26	04.42	03.11	03.12	04.43	06.17	07.42	08.17	09.49
	14.50	16.25	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.45	08.21	09.51
	14.52	16.28	17.56	20.28	22.01	23.34	23.38	22.07	20.20	18.34	15.50	14.35
8	10.03	08.43	07.09	06.19	04.35	03.07	03.17	04.49	06.22	07.48	08.24	09.53
	14.55	16.31	17.59	20.31	22.04	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.01	08.39	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51	08.27	09.56
	14.57	16.35	18.02	20.34	22.08	23.39	23.33	22.01	20.12	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.04	03.22	04.56	06.28	07.54	08.30	09.58
	15.00	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.26	03.02	03.24	04.59	06.31	07.57	08.33	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.17	23.45	23.26	21.50	20.02	18.16	15.35	14.29
13	09.54	08.26	06.51	06.02	04.19	02.58	03.30	05.05	06.37	08.03	08.40	10.03
	15.08	16.48	18.14	20.46	22.21	23.46	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.16	02.57	03.32	05.08	06.40	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.21	21.44	19.55	18.09	15.29	14.28
15	09.49	08.20	06.44	05.55	04.13	02.56	03.35	05.11	06.42	08.09	08.46	10.07
	15.14	16.54	18.20	20.52	22.27	23.49	23.19	21.40	19.51	18.06	15.26	14.27
16	09.47	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.08
	15.17	16.57	18.23	20.55	22.30	23.50	23.16	21.37	19.48	18.03	15.23	14.27
17	09.45	08.13	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.09
	15.20	17.01	18.26	20.58	22.33	23.51	23.13	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.01	22.37	23.52	23.10	21.30	19.41	17.56	15.18	14.26
19	09.40	08.07	06.30	05.41	04.00	02.54	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.04	22.40	23.53	23.07	21.26	19.37	17.52	15.15	14.26
20	09.38	08.03	06.26	05.37	03.57	02.54	03.50	05.26	06.57	08.24	09.02	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54	02.54	03.53	05.29	06.59	08.27	09.05	10.13
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.46	15.09	14.26
22	09.32	07.57	06.19	05.30	03.51	02.54	03.56	05.32	07.02	08.30	09.09	10.14
	15.36	17.16	18.41	21.14	22.49	23.54	22.59	21.16	19.26	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48	02.55	03.59	05.36	07.05	08.33	09.12	10.14
	15.39	17.19	18.44	21.17	22.52	23.54	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.45	02.55	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.55	23.54	22.53	21.09	19.19	17.36	15.02	14.28
25	09.24	07.46	06.09	05.20	03.42	02.56	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.05	19.16	16.32	14.59	14.29
26	09.22	07.43	06.05	05.16	03.39	02.57	04.09	05.44	07.14	07.42	09.21	10.15
	15.49	17.29	18.53	21.26	23.02	23.53	22.46	21.02	19.12	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.12	05.47	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.05	23.52	22.43	20.58	19.09	16.26	14.55	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.32	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.31	03.01	04.18	05.53	07.22	07.52	09.30	10.14
	15.58		20.02	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.34
30	09.10		06.51	05.03	03.28	03.01	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.13	23.49	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.07		23.16		22.30	20.44		16.12		14.37
Potential sun hours	173	239	363	451	568	621	606	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 5 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (176)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.01	09.35
	14.39	16.08	17.38	20.10	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.41	04.56	03.20	03.04	04.31	06.05	07.31	08.04	09.38
	14.41	16.12	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18	03.06	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.24	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	03.16	03.08	04.37	06.11	07.37	08.11	09.43
	14.45	16.18	17.47	20.19	21.51	23.27	23.43	22.17	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.10	04.40	06.14	07.39	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.06	08.49	07.15	06.26	04.42	03.11	03.12	04.43	06.17	07.42	08.17	09.48
	14.50	16.25	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.19	07.45	08.20	09.51
	14.52	16.28	17.56	20.28	22.01	23.34	23.38	22.07	20.19	18.34	15.50	14.35
8	10.03	08.42	07.08	06.19	04.35	03.07	03.17	04.49	06.22	07.48	08.24	09.53
	14.55	16.31	17.59	20.31	22.04	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.01	08.39	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51	08.27	09.55
	14.57	16.35	18.02	20.34	22.08	23.39	23.33	22.01	20.12	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.04	03.22	04.56	06.28	07.54	08.30	09.58
	15.00	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02	03.24	04.59	06.31	07.57	08.33	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.01
	15.05	16.44	18.11	20.43	22.17	23.44	23.26	21.50	20.02	18.16	15.35	14.29
13	09.54	08.26	06.51	06.02	04.19	02.58	03.30	05.05	06.37	08.03	08.40	10.03
	15.08	16.48	18.14	20.46	22.20	23.46	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.16	02.57	03.32	05.08	06.40	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.21	21.44	19.55	18.09	15.29	14.28
15	09.49	08.20	06.44	05.55	04.12	02.56	03.35	05.11	06.42	08.09	08.46	10.07
	15.14	16.54	18.20	20.52	22.27	23.49	23.18	21.40	19.51	18.06	15.26	14.27
16	09.47	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.49	10.08
	15.17	16.57	18.23	20.55	22.30	23.50	23.16	21.37	19.48	18.03	15.23	14.27
17	09.45	08.13	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.09
	15.20	17.00	18.26	20.58	22.33	23.51	23.13	21.33	19.44	17.59	15.20	14.26
18	09.42	08.10	06.33	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.10
	15.23	17.04	18.29	21.01	22.36	23.52	23.10	21.30	19.41	17.56	15.18	14.26
19	09.40	08.07	06.30	05.41	04.00	02.54	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.04	22.40	23.53	23.07	21.26	19.37	17.52	15.15	14.26
20	09.38	08.03	06.26	05.37	03.57	02.54	03.50	05.26	06.57	08.24	09.02	10.12
	15.29	17.10	18.35	21.08	22.43	23.53	23.04	21.23	19.33	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54	02.54	03.53	05.29	06.59	08.27	09.05	10.13
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.46	15.09	14.26
22	09.32	07.57	06.19	05.30	03.51	02.54	03.56	05.32	07.02	08.30	09.09	10.14
	15.36	17.16	18.41	21.14	22.49	23.54	22.59	21.16	19.26	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48	02.55	03.59	05.35	07.05	08.33	09.12	10.14
	15.39	17.19	18.44	21.17	22.52	23.54	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.45	02.55	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.55	23.54	22.53	21.09	19.19	17.35	15.02	14.28
25	09.24	07.46	06.09	05.20	03.42	02.56	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.58	23.53	22.49	21.05	19.16	16.32	14.59	14.29
26	09.21	07.43	06.05	05.16	03.39	02.57	04.08	05.44	07.14	07.42	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.53	22.46	21.02	19.12	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.12	05.47	07.16	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.05	23.52	22.43	20.58	19.09	16.26	14.55	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.32	23.08	23.51	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.31	03.01	04.18	05.53	07.22	07.52	09.30	10.14
	15.58		20.02	21.36	23.10	23.50	22.37	20.51	19.02	16.19	14.50	14.34
30	09.10		06.51	05.02	03.28	03.01	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.04	21.39	23.13	23.49	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.07		23.16		22.30	20.44		16.12		14.37
Potential sun hours	173	239	363	451	568	621	606	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 6 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (177)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.01	09.35
	14.39	16.08	17.38	20.10	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.40	04.56	03.20	03.04	04.30	06.05	07.31	08.04	09.38
	14.41	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18	03.06	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.24	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	03.16	03.08	04.37	06.11	07.37	08.11	09.43
	14.45	16.18	17.47	20.19	21.51	23.27	23.43	22.17	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.10	04.40	06.14	07.39	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.29	23.41	22.14	20.27	18.41	15.56	14.38
6	10.06	08.49	07.15	06.26	04.42	03.11	03.12	04.43	06.17	07.42	08.17	09.48
	14.50	16.25	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.19	07.45	08.20	09.51
	14.52	16.28	17.56	20.28	22.01	23.34	23.38	22.07	20.19	18.34	15.50	14.35
8	10.03	08.42	07.08	06.19	04.35	03.07	03.17	04.49	06.22	07.48	08.24	09.53
	14.54	16.31	17.59	20.31	22.04	23.37	23.35	22.04	20.16	18.30	15.47	14.34
9	10.01	08.39	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51	08.27	09.55
	14.57	16.35	18.02	20.34	22.07	23.39	23.33	22.01	20.12	18.27	15.44	14.32
10	10.00	08.36	07.01	06.12	04.29	03.03	03.22	04.56	06.28	07.54	08.30	09.57
	15.00	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02	03.24	04.59	06.31	07.57	08.33	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.54	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.01
	15.05	16.44	18.11	20.43	22.17	23.44	23.26	21.50	20.02	18.16	15.35	14.29
13	09.54	08.26	06.51	06.02	04.19	02.58	03.30	05.05	06.37	08.03	08.40	10.03
	15.08	16.48	18.14	20.46	22.20	23.46	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.47	05.58	04.16	02.57	03.32	05.08	06.39	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.21	21.43	19.55	18.09	15.29	14.28
15	09.49	08.20	06.44	05.55	04.12	02.56	03.35	05.11	06.42	08.09	08.46	10.06
	15.14	16.54	18.20	20.52	22.27	23.49	23.18	21.40	19.51	18.06	15.26	14.27
16	09.47	08.16	06.40	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.49	10.08
	15.17	16.57	18.23	20.55	22.30	23.50	23.16	21.37	19.48	18.03	15.23	14.27
17	09.45	08.13	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.09
	15.20	17.00	18.26	20.58	22.33	23.51	23.13	21.33	19.44	17.59	15.20	14.26
18	09.42	08.10	06.33	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.10
	15.23	17.04	18.29	21.01	22.36	23.52	23.10	21.30	19.40	17.56	15.18	14.26
19	09.40	08.07	06.30	05.41	04.00	02.54	03.47	05.23	06.54	08.21	08.59	10.11
	15.26	17.07	18.32	21.04	22.40	23.53	23.07	21.26	19.37	17.52	15.15	14.26
20	09.37	08.03	06.26	05.37	03.57	02.54	03.50	05.26	06.56	08.24	09.02	10.12
	15.29	17.10	18.35	21.07	22.43	23.53	23.04	21.23	19.33	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54	02.54	03.53	05.29	06.59	08.27	09.05	10.13
	15.32	17.13	18.38	21.11	22.46	23.54	23.01	21.19	19.30	17.46	15.09	14.26
22	09.32	07.56	06.19	05.30	03.51	02.54	03.56	05.32	07.02	08.30	09.08	10.14
	15.35	17.16	18.41	21.14	22.49	23.54	22.58	21.16	19.26	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48	02.54	03.59	05.35	07.05	08.33	09.12	10.14
	15.39	17.19	18.44	21.17	22.52	23.54	22.55	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.45	02.55	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.55	23.54	22.52	21.09	19.19	17.35	15.02	14.28
25	09.24	07.46	06.09	05.20	03.42	02.56	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.58	23.53	22.49	21.05	19.16	16.32	14.59	14.29
26	09.21	07.43	06.05	05.16	03.39	02.57	04.08	05.44	07.14	07.42	09.21	10.15
	15.48	17.29	18.53	21.26	23.01	23.53	22.46	21.02	19.12	16.29	14.57	14.30
27	09.19	07.39	06.02	05.13	03.36	02.58	04.12	05.47	07.16	07.45	09.24	10.15
	15.52	17.32	18.56	21.29	23.04	23.52	22.43	20.58	19.09	16.25	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.19	07.49	09.27	10.14
	15.55	17.35	18.58	21.32	23.07	23.51	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.31	03.01	04.18	05.53	07.22	07.52	09.30	10.14
	15.58		20.01	21.36	23.10	23.50	22.37	20.51	19.02	16.19	14.50	14.34
30	09.10		06.51	05.02	03.28	03.01	04.21	05.56	07.25	07.55	09.32	10.14
	16.02		20.04	21.39	23.13	23.49	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.07		23.16		22.30	20.44		16.12		14.37
Potential sun hours	173	239	363	451	568	621	606	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 7 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (178)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.01	09.35
	14.39	16.08	17.38	20.10	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.40	04.56	03.20	03.04	04.30	06.05	07.31	08.04	09.38
	14.41	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18	03.06	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.25	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	03.15	03.08	04.37	06.11	07.37	08.11	09.43
	14.45	16.18	17.47	20.19	21.51	23.27	23.43	22.17	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.10	04.40	06.14	07.39	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.06	08.49	07.15	06.26	04.42	03.11	03.12	04.43	06.17	07.42	08.17	09.49
	14.49	16.25	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.19	07.45	08.20	09.51
	14.52	16.28	17.56	20.28	22.01	23.34	23.38	22.07	20.19	18.34	15.50	14.35
8	10.03	08.42	07.08	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.53
	14.54	16.31	17.59	20.31	22.04	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.01	08.39	07.05	06.16	04.32	03.05	03.19	04.52	06.25	07.51	08.27	09.55
	14.57	16.34	18.02	20.34	22.08	23.39	23.33	22.01	20.12	18.27	15.44	14.32
10	10.00	08.36	07.01	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.30	09.58
	15.00	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02	03.24	04.59	06.31	07.57	08.33	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.54	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.17	23.45	23.26	21.50	20.02	18.16	15.35	14.29
13	09.54	08.26	06.51	06.02	04.19	02.58	03.29	05.05	06.37	08.03	08.40	10.03
	15.08	16.47	18.14	20.46	22.20	23.46	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.47	05.58	04.16	02.57	03.32	05.08	06.39	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.21	21.44	19.55	18.09	15.29	14.27
15	09.49	08.20	06.44	05.55	04.12	02.56	03.35	05.11	06.42	08.09	08.46	10.07
	15.14	16.54	18.20	20.52	22.27	23.49	23.19	21.40	19.51	18.06	15.26	14.27
16	09.47	08.17	06.40	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.49	10.08
	15.17	16.57	18.23	20.55	22.30	23.50	23.16	21.37	19.48	18.02	15.23	14.26
17	09.45	08.13	06.37	05.47	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.09
	15.20	17.00	18.26	20.58	22.33	23.51	23.13	21.33	19.44	17.59	15.20	14.26
18	09.42	08.10	06.33	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.01	22.37	23.52	23.10	21.30	19.40	17.56	15.17	14.26
19	09.40	08.07	06.30	05.40	04.00	02.54	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.04	22.40	23.53	23.07	21.26	19.37	17.52	15.15	14.26
20	09.38	08.03	06.26	05.37	03.57	02.53	03.50	05.26	06.56	08.24	09.02	10.12
	15.29	17.10	18.35	21.07	22.43	23.54	23.05	21.23	19.33	17.49	15.12	14.26
21	09.35	08.00	06.23	05.33	03.54	02.54	03.53	05.29	06.59	08.27	09.05	10.13
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.45	15.09	14.26
22	09.32	07.56	06.19	05.30	03.51	02.54	03.56	05.32	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.49	23.54	22.59	21.16	19.26	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48	02.54	03.59	05.35	07.05	08.33	09.12	10.14
	15.39	17.19	18.44	21.17	22.52	23.54	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.45	02.55	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.22	18.47	21.20	22.55	23.54	22.53	21.09	19.19	17.35	15.02	14.28
25	09.24	07.46	06.09	05.20	03.42	02.56	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.49	21.05	19.16	16.32	14.59	14.29
26	09.21	07.43	06.05	05.16	03.39	02.57	04.08	05.44	07.14	07.42	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.53	22.46	21.02	19.12	16.29	14.57	14.30
27	09.19	07.39	06.02	05.13	03.36	02.58	04.11	05.47	07.16	07.45	09.24	10.15
	15.52	17.32	18.56	21.29	23.05	23.52	22.43	20.58	19.09	16.25	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.58	21.32	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.14
	15.58		20.01	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.01		20.04	21.39	23.13	23.49	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.47		03.25		04.24	05.59		07.58		10.13
	16.05		20.07		23.16		22.30	20.44		16.12		14.37
Potential sun hours	173	238	363	451	568	621	607	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 8 - Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (179)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.01	09.35
	14.39	16.08	17.38	20.10	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.40	04.55	03.20	03.04	04.30	06.05	07.31	08.04	09.38
	14.41	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18	03.06	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.24	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	03.15	03.08	04.37	06.11	07.36	08.11	09.43
	14.45	16.18	17.47	20.19	21.51	23.27	23.43	22.17	20.30	18.44	15.59	14.40
5	10.07	08.52	07.19	06.30	04.45	03.13	03.10	04.40	06.14	07.39	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.29	23.41	22.14	20.26	18.41	15.56	14.38
6	10.06	08.49	07.15	06.26	04.42	03.11	03.12	04.43	06.16	07.42	08.17	09.48
	14.49	16.25	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.19	07.45	08.20	09.51
	14.52	16.28	17.56	20.28	22.01	23.34	23.38	22.07	20.19	18.34	15.50	14.35
8	10.03	08.42	07.08	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.53
	14.54	16.31	17.59	20.31	22.04	23.37	23.35	22.04	20.16	18.30	15.47	14.34
9	10.01	08.39	07.05	06.16	04.32	03.05	03.19	04.52	06.25	07.51	08.27	09.55
	14.57	16.34	18.02	20.34	22.07	23.39	23.33	22.00	20.12	18.27	15.44	14.32
10	09.59	08.36	07.01	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.30	09.57
	15.00	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02	03.24	04.59	06.31	07.57	08.33	09.59
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.54	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.36	10.01
	15.05	16.44	18.11	20.43	22.17	23.44	23.26	21.50	20.02	18.16	15.35	14.29
13	09.54	08.26	06.51	06.02	04.19	02.58	03.29	05.05	06.37	08.03	08.40	10.03
	15.08	16.47	18.14	20.46	22.20	23.46	23.24	21.47	19.58	18.13	15.32	14.28
14	09.51	08.23	06.47	05.58	04.16	02.57	03.32	05.08	06.39	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.21	21.43	19.55	18.09	15.29	14.27
15	09.49	08.20	06.44	05.54	04.12	02.56	03.35	05.11	06.42	08.09	08.46	10.06
	15.14	16.54	18.20	20.52	22.27	23.49	23.18	21.40	19.51	18.06	15.26	14.27
16	09.47	08.16	06.40	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.49	10.08
	15.17	16.57	18.23	20.55	22.30	23.50	23.16	21.37	19.47	18.02	15.23	14.26
17	09.45	08.13	06.37	05.47	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.09
	15.20	17.00	18.26	20.58	22.33	23.51	23.13	21.33	19.44	17.59	15.20	14.26
18	09.42	08.10	06.33	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.10
	15.23	17.04	18.29	21.01	22.36	23.52	23.10	21.30	19.40	17.56	15.17	14.26
19	09.40	08.06	06.30	05.40	04.00	02.54	03.47	05.23	06.54	08.21	08.59	10.11
	15.26	17.07	18.32	21.04	22.40	23.53	23.07	21.26	19.37	17.52	15.15	14.26
20	09.37	08.03	06.26	05.37	03.57	02.54	03.50	05.26	06.56	08.24	09.02	10.12
	15.29	17.10	18.35	21.07	22.43	23.53	23.04	21.23	19.33	17.49	15.12	14.26
21	09.35	08.00	06.23	05.33	03.54	02.54	03.53	05.29	06.59	08.27	09.05	10.13
	15.32	17.13	18.38	21.10	22.46	23.54	23.01	21.19	19.30	17.45	15.09	14.26
22	09.32	07.56	06.19	05.30	03.51	02.54	03.56	05.32	07.02	08.30	09.08	10.14
	15.35	17.16	18.41	21.14	22.49	23.54	22.58	21.16	19.26	17.42	15.07	14.27
23	09.30	07.53	06.16	05.26	03.48	02.54	03.59	05.35	07.05	08.33	09.12	10.14
	15.39	17.19	18.44	21.17	22.52	23.54	22.55	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.45	02.55	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.22	18.47	21.20	22.55	23.54	22.52	21.09	19.19	17.35	15.02	14.28
25	09.24	07.46	06.09	05.20	03.42	02.56	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.58	23.53	22.49	21.05	19.16	16.32	14.59	14.29
26	09.21	07.43	06.05	05.16	03.39	02.57	04.08	05.44	07.13	07.42	09.21	10.15
	15.48	17.29	18.53	21.26	23.01	23.53	22.46	21.02	19.12	16.29	14.57	14.30
27	09.19	07.39	06.02	05.13	03.36	02.58	04.11	05.47	07.16	07.45	09.24	10.15
	15.52	17.32	18.55	21.29	23.04	23.52	22.43	20.58	19.09	16.25	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.19	07.49	09.27	10.14
	15.55	17.35	18.58	21.32	23.07	23.51	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.14
	15.58		20.01	21.35	23.10	23.50	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.32	10.14
	16.01		20.04	21.39	23.13	23.49	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.47		03.25		04.24	05.59		07.58		10.13
	16.05		20.07		23.16		22.30	20.44		16.12		14.37
Potential sun hours	173	239	363	451	568	621	606	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 9 - Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (210)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23 04.41-05.07/26	03.02 04.46-05.12/26	04.27	06.02	07.28	08.01	09.35
	14.39	16.08	17.38	20.10	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.40	04.56	03.20 04.41-05.07/26	03.04 04.47-05.13/26	04.30	06.05	07.31	08.04	09.38
	14.41	16.11	17.41	20.13	21.45	23.22	23.46	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18 04.41-05.07/26	03.06 04.47-05.13/26	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.24	23.45	22.20	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	03.16 04.41-05.07/26	03.08 04.47-05.13/26	04.37	06.11	07.36	08.11	09.43
	14.45	16.18	17.47	20.19	21.51	23.27	23.43	22.17	20.30	18.44	15.59	14.40
5	10.07	08.52	07.19	06.30	04.45	03.13 04.41-05.08/27	03.10 04.48-05.14/26	04.40	06.14	07.39	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.29	23.41	22.14	20.26	18.41	15.56	14.38
6	10.06	08.49	07.15	06.26	04.42	03.11 04.42-05.08/26	03.12 04.47-05.14/27	04.43	06.16	07.42	08.17	09.48
	14.50	16.25	17.53	20.25	21.58	23.32	23.39	22.10	20.23	18.37	15.53	14.37
7	10.05	08.45	07.12	06.23	04.39	03.09 04.41-05.07/26	03.14 04.48-05.14/26	04.46	06.19	07.45	08.20	09.51
	14.52	16.28	17.56	20.28	22.01	23.34	23.37	22.07	20.19	18.34	15.50	14.35
8	10.03	08.42	07.08	06.19	04.35	03.07 04.42-05.08/26	03.17 04.47-05.14/27	04.49	06.22	07.48	08.24	09.53
	14.54	16.31	17.59	20.31	22.04	23.36	23.35	22.04	20.16	18.30	15.47	14.34
9	10.01	08.39	07.05	06.16	04.32	03.05 04.42-05.08/26	03.19 04.48-05.14/26	04.52	06.25	07.51	08.27	09.55
	14.57	16.34	18.02	20.34	22.07	23.39	23.33	22.00	20.12	18.27	15.44	14.32
10	09.59	08.36	07.01	06.12	04.29	03.03 04.42-05.08/26	03.22 04.48-05.14/26	04.56	06.28	07.54	08.30	09.57
	15.00	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02 04.42-05.08/26	03.24 04.49-05.15/26	04.59	06.31	07.57	08.33	09.59
	15.02	16.41	18.08	20.40	22.14	23.43	23.28	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.54	06.05	04.22	03.00 04.43-05.09/26	03.27 04.49-05.15/26	05.02	06.34	08.00	08.36	10.01
	15.05	16.44	18.11	20.43	22.17	23.44	23.26	21.50	20.02	18.16	15.35	14.29
13	09.54	08.26	06.51	06.02	04.19	02.58 04.43-05.09/26	03.30 04.49-05.15/26	05.05	06.37	08.03	08.40	10.03
	15.08	16.47	18.14	20.46	22.20	23.46	23.24	21.47	19.58	18.13	15.32	14.28
14	09.51	08.23	06.47	05.58	04.16	02.57 04.44-05.09/25	03.32 04.50-05.15/25	05.08	06.39	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.23	23.47	23.21	21.43	19.55	18.09	15.29	14.28
15	09.49	08.20	06.44	05.55	04.12	02.56 04.43-05.09/26	03.35 04.50-05.15/25	05.11	06.42	08.09	08.46	10.06
	15.14	16.54	18.20	20.52	22.27	23.49	23.18	21.40	19.51	18.06	15.26	14.27
16	09.47	08.16	06.40	05.51	04.09	02.55 04.44-05.09/25	03.38 04.50-05.14/24	05.14	06.45	08.12	08.49	10.08
	15.17	16.57	18.23	20.55	22.30	23.50	23.16	21.36	19.47	18.02	15.23	14.26
17	09.45	08.13	06.37	05.47	04.06	02.54 04.45-05.10/25	03.41 04.50-05.14/24	05.17	06.48	08.15	08.53	10.09
	15.20	17.00	18.26	20.58	22.33	23.51	23.13	21.33	19.44	17.59	15.20	14.26
18	09.42	08.10	06.33	05.44	04.03 04.50-04.55/5	02.54 04.44-05.09/25	03.44 04.51-05.13/22	05.20	06.51	08.18	08.56	10.10
	15.23	17.04	18.29	21.01	22.36	23.52	23.10	21.30	19.40	17.56	15.17	14.26
19	09.40	08.06	06.30	05.40	04.00 04.47-04.58/11	02.54 04.44-05.09/25	03.47 04.52-05.14/22	05.23	06.54	08.21	08.59	10.11
	15.26	17.07	18.32	21.04	22.40	23.53	23.07	21.26	19.37	17.52	15.15	14.26
20	09.37	08.03	06.26	05.37	03.57 04.46-05.00/14	02.54 04.44-05.10/26	03.50 04.52-05.13/21	05.26	06.56	08.24	09.02	10.12
	15.29	17.10	18.35	21.07	22.43	23.53	23.04	21.23	19.33	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54 04.45-05.01/16	02.54 04.46-05.11/25	03.53 04.53-05.12/19	05.29	06.59	08.27	09.05	10.13
	15.32	17.13	18.38	21.10	22.46	23.54	23.01	21.19	19.30	17.45	15.09	14.26
22	09.32	07.56	06.19	05.30	03.51 04.43-05.01/18	02.54 04.46-05.11/25	03.56 04.54-05.12/18	05.32	07.02	08.30	09.08	10.14
	15.35	17.16	18.41	21.14	22.49	23.54	22.58	21.16	19.26	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48 04.43-05.02/19	02.54 04.45-05.10/25	03.59 04.55-05.11/16	05.35	07.05	08.33	09.11	10.14
	15.39	17.19	18.44	21.17	22.52	23.54	22.55	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.45 04.42-05.03/21	02.55 04.46-05.11/25	04.02 04.56-05.09/13	05.38	07.08	08.36	09.15	10.14
	15.42	17.22	18.47	21.20	22.55	23.54	22.52	21.09	19.19	17.35	15.02	14.28
25	09.24	07.46	06.09	05.20	03.42 04.42-05.04/22	02.56 04.46-05.11/25	04.05 04.59-05.07/8	05.41	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.58	23.53	22.49	21.05	19.16	16.32	14.59	14.29
26	09.21	07.43	06.05	05.16	03.39 04.42-05.05/23	02.57 04.46-05.12/26	04.08	05.44	07.14	07.42	09.21	10.15
	15.48	17.29	18.53	21.26	23.01	23.53	22.46	21.02	19.12	16.29	14.57	14.30
27	09.19	07.39	06.02	05.13	03.36 04.41-05.05/24	02.58 04.46-05.11/25	04.12	05.47	07.16	07.45	09.24	10.15
	15.52	17.32	18.55	21.29	23.04	23.52	22.43	20.58	19.09	16.25	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33 04.41-05.05/24	02.59 04.46-05.11/25	04.15	05.50	07.19	07.49	09.27	10.14
	15.55	17.35	18.58	21.32	23.07	23.51	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.31 04.41-05.06/25	03.01 04.46-05.12/26	04.18	05.53	07.22	07.52	09.30	10.14
	15.58		20.01	21.35	23.10	23.50	22.37	20.51	19.02	16.19	14.50	14.34
30	09.10		06.51	05.02	03.28 04.41-05.06/25	03.01 04.46-05.12/26	04.21	05.56	07.25	07.55	09.32	10.13
	16.02		20.04	21.39	23.13	23.49	22.33	20.48	18.58	16.16	14.48	14.35
31	09.07		06.47		03.25 04.40-05.06/26		04.24	05.59		07.58		10.13
	16.05		20.07		23.16		22.30	20.44		16.12		14.37
Potential sun hours	173	239	363	450	568	621	606	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	273	769	577	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 10 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (181)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.01	09.36
	14.39	16.08	17.38	20.10	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.41	04.56	03.20	03.04	04.30	06.05	07.31	08.05	09.38
	14.41	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18	03.05	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.25	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.27	23.44	22.18	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.40	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.06	08.49	07.16	06.26	04.42	03.11	03.12	04.43	06.17	07.42	08.17	09.49
	14.49	16.25	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.19	07.45	08.21	09.51
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.03	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	17.59	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.02	08.39	07.05	06.16	04.32	03.05	03.19	04.52	06.25	07.51	08.27	09.56
	14.57	16.34	18.02	20.34	22.08	23.39	23.34	22.01	20.12	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.30	09.58
	15.00	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.17	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.16	02.56	03.32	05.08	06.40	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.21	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.42	08.09	08.46	10.07
	15.14	16.54	18.20	20.52	22.27	23.49	23.19	21.40	19.51	18.06	15.26	14.27
16	09.47	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.08
	15.17	16.57	18.23	20.55	22.30	23.51	23.16	21.37	19.48	18.03	15.23	14.26
17	09.45	08.13	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.00	18.26	20.58	22.34	23.52	23.13	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.01	22.37	23.53	23.11	21.30	19.41	17.56	15.17	14.26
19	09.40	08.07	06.30	05.41	04.00	02.53	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.53	23.08	21.26	19.37	17.52	15.15	14.26
20	09.38	08.03	06.26	05.37	03.57	02.53	03.50	05.26	06.57	08.24	09.02	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54	02.53	03.53	05.29	06.59	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.46	15.09	14.26
22	09.33	07.57	06.19	05.30	03.50	02.54	03.56	05.32	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.49	23.54	22.59	21.16	19.26	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.47	02.54	03.59	05.35	07.05	08.33	09.12	10.15
	15.39	17.19	18.44	21.17	22.53	23.54	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.45	02.55	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.54	22.53	21.09	19.19	17.35	15.02	14.28
25	09.24	07.46	06.09	05.20	03.42	02.56	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.05	19.16	16.32	14.59	14.29
26	09.22	07.43	06.05	05.16	03.39	02.56	04.08	05.44	07.14	07.43	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.53	22.47	21.02	19.12	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.11	05.47	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.05	23.53	22.43	20.58	19.09	16.25	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.14
	15.58		20.02	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.07		23.17		22.31	20.44		16.12		14.37
Potential sun hours	172	238	363	451	568	621	607	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 11 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (182)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.22	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.10	21.42	23.20	23.49	22.27	20.41	18.55	16.09	14.46
2	10.12	09.01	07.29	06.41	04.56	03.20	03.03	04.30	06.05	07.31	08.05	09.39
	14.41	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18	03.05	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.28	23.44	22.18	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.40	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16	06.26	04.42	03.11	03.12	04.43	06.17	07.43	08.18	09.49
	14.49	16.25	17.53	20.25	21.58	23.33	23.40	22.11	20.23	18.37	15.53	14.36
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.19	07.45	08.21	09.51
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.03	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	17.59	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.52	06.25	07.51	08.27	09.56
	14.57	16.34	18.02	20.34	22.08	23.39	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.30	09.58
	14.59	16.38	18.05	20.37	22.11	23.41	23.32	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.01	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.18	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.16	02.56	03.32	05.08	06.40	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.22	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.42	08.09	08.47	10.07
	15.14	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.08
	15.17	16.57	18.23	20.55	22.30	23.51	23.16	21.37	19.48	18.03	15.23	14.26
17	09.45	08.13	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.00	18.26	20.58	22.34	23.52	23.13	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.17	14.26
19	09.40	08.07	06.30	05.41	04.00	02.53	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.26	19.37	17.52	15.15	14.26
20	09.38	08.03	06.27	05.37	03.57	02.53	03.50	05.26	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.53	02.53	03.53	05.29	06.59	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.20	19.30	17.46	15.09	14.26
22	09.33	07.57	06.19	05.30	03.50	02.54	03.56	05.32	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.26	17.42	15.07	14.26
23	09.30	07.53	06.16	05.27	03.47	02.54	03.59	05.35	07.05	08.33	09.12	10.15
	15.39	17.19	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.44	02.55	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.54	22.53	21.09	19.19	17.35	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.55	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.05	05.16	03.39	02.56	04.08	05.44	07.14	07.43	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.54	22.47	21.02	19.12	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.57	04.11	05.47	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.58	19.09	16.25	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.01		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.08		23.17		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 12 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (183)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.04	07.33	06.44	04.59	03.22	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.10	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.46
2	10.12	09.01	07.29	06.41	04.55	03.20	03.03	04.30	06.05	07.31	08.05	09.39
	14.41	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.11	08.58	07.26	06.37	04.52	03.17	03.05	04.33	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.23	06.33	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.28	23.44	22.18	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.40	08.14	09.47
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16	06.26	04.42	03.11	03.11	04.43	06.17	07.43	08.18	09.49
	14.49	16.25	17.53	20.25	21.58	23.33	23.40	22.11	20.23	18.37	15.53	14.36
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.19	07.45	08.21	09.51
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	17.59	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.33
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.52	06.25	07.51	08.27	09.56
	14.57	16.34	18.02	20.34	22.08	23.39	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.30	09.58
	14.59	16.38	18.05	20.37	22.11	23.42	23.32	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.01	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.26	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.18	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.15	02.56	03.32	05.08	06.40	08.06	08.43	10.06
	15.11	16.51	18.17	20.49	22.24	23.48	23.22	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.42	08.09	08.47	10.07
	15.14	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.54	03.38	05.14	06.45	08.12	08.50	10.09
	15.17	16.57	18.23	20.55	22.31	23.51	23.16	21.37	19.48	18.03	15.23	14.26
17	09.45	08.13	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.00	18.26	20.59	22.34	23.52	23.14	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.53	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.17	14.26
19	09.40	08.07	06.30	05.41	04.00	02.53	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.27	19.37	17.52	15.15	14.26
20	09.38	08.03	06.27	05.37	03.56	02.53	03.50	05.26	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.53	02.53	03.53	05.29	06.59	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.46	23.55	23.02	21.20	19.30	17.46	15.09	14.26
22	09.33	07.57	06.19	05.30	03.50	02.53	03.56	05.32	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.26	17.42	15.07	14.26
23	09.30	07.53	06.16	05.27	03.47	02.54	03.59	05.35	07.05	08.33	09.12	10.15
	15.39	17.19	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.44	02.54	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.55	22.53	21.09	19.19	17.35	15.02	14.28
25	09.25	07.47	06.09	05.20	03.41	02.55	04.05	05.41	07.11	07.40	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.28
26	09.22	07.43	06.05	05.16	03.39	02.56	04.08	05.44	07.14	07.43	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.54	22.47	21.02	19.12	16.29	14.57	14.29
27	09.19	07.40	06.02	05.13	03.36	02.57	04.11	05.47	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.25	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.14	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.01		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.14
	16.05		20.08		23.17		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	138
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 13 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (184)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.04	07.33	06.44	04.59	03.22	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.11	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.46
2	10.12	09.01	07.29	06.41	04.56	03.20	03.03	04.30	06.05	07.31	08.05	09.39
	14.41	16.11	17.41	20.14	21.45	23.23	23.47	22.24	20.37	18.51	16.06	14.44
3	10.11	08.58	07.26	06.37	04.52	03.17	03.05	04.33	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.10	08.55	07.23	06.33	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.28	23.44	22.18	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.40	08.14	09.47
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16	06.26	04.42	03.11	03.11	04.43	06.17	07.43	08.18	09.49
	14.49	16.25	17.53	20.25	21.58	23.33	23.40	22.11	20.23	18.37	15.53	14.36
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.45	08.21	09.52
	14.52	16.28	17.56	20.28	22.02	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	17.59	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.33
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.52	06.25	07.51	08.27	09.56
	14.57	16.34	18.02	20.34	22.08	23.40	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.31	09.58
	14.59	16.38	18.05	20.37	22.11	23.42	23.32	21.58	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.01	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.08	20.40	22.14	23.44	23.29	21.54	20.06	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.26	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.18	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.15	02.56	03.32	05.08	06.40	08.06	08.43	10.06
	15.11	16.51	18.17	20.49	22.24	23.49	23.22	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.42	08.09	08.47	10.07
	15.14	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.54	03.38	05.14	06.45	08.12	08.50	10.09
	15.17	16.57	18.23	20.56	22.31	23.51	23.16	21.37	19.48	18.03	15.23	14.26
17	09.45	08.14	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.00	18.26	20.59	22.34	23.52	23.14	21.34	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.53	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.17	14.26
19	09.41	08.07	06.30	05.41	04.00	02.53	03.47	05.23	06.54	08.21	09.00	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.27	19.37	17.52	15.15	14.26
20	09.38	08.04	06.27	05.37	03.56	02.53	03.50	05.26	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.53	02.53	03.53	05.29	07.00	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.47	23.55	23.02	21.20	19.30	17.46	15.09	14.26
22	09.33	07.57	06.19	05.30	03.50	02.53	03.56	05.32	07.02	08.30	09.09	10.15
	15.35	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.27	17.42	15.07	14.26
23	09.30	07.53	06.16	05.27	03.47	02.54	03.59	05.35	07.05	08.33	09.12	10.15
	15.39	17.19	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.44	02.54	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.55	22.53	21.09	19.19	17.35	15.02	14.28
25	09.25	07.47	06.09	05.20	03.41	02.55	04.05	05.41	07.11	07.40	09.18	10.16
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.28
26	09.22	07.43	06.05	05.16	03.39	02.56	04.08	05.44	07.14	07.43	09.21	10.16
	15.48	17.29	18.53	21.26	23.02	23.54	22.47	21.02	19.12	16.29	14.57	14.29
27	09.19	07.40	06.02	05.13	03.36	02.57	04.11	05.47	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.25	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.14	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.41	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.52	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.01		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.14
	16.05		20.08		23.17		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	138
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 14 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (185)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.04	07.33 15.58-16.29/31	06.44	04.59	03.22	03.01	04.27	06.02	07.28 16.49-16.53/4	08.02	09.36
	14.38	16.08	17.38	20.10	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.45
2	10.12	09.01	07.29 15.58-16.28/30	06.40	04.55	03.20	03.03	04.30	06.05	07.31 16.43-16.58/15	08.05	09.39
	14.40	16.11	17.41	20.13	21.45	23.23	23.48	22.24	20.37	18.51	16.06	14.43
3	10.11	08.58	07.26 15.58-16.29/31	06.37	04.52	03.17	03.05	04.33	06.08	07.34 16.40-17.00/20	08.08	09.41
	14.42	16.15	17.44	20.16	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.41
4	10.09	08.55	07.22 15.58-16.28/30	06.33	04.49	03.15	03.07	04.37	06.11	07.37 16.38-17.01/23	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.28	23.44	22.18	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19 15.57-16.27/30	06.30	04.45	03.13	03.09	04.40	06.14	07.40 16.37-17.02/25	08.14	09.47
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16 15.58-16.27/29	06.26	04.42	03.10	03.11	04.43	06.17	07.43 16.35-17.02/27	08.18	09.49
	14.49	16.25	17.53	20.25	21.58	23.33	23.40	22.11	20.23	18.37	15.53	14.36
7	10.05	08.46	07.12 15.58-16.26/28	06.23	04.38	03.08	03.14	04.46	06.19	07.45 16.34-17.03/29	08.21	09.52
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43	07.09 15.59-16.25/26	06.19	04.35	03.06	03.16	04.49	06.22	07.48 16.33-17.03/30	08.24	09.54
	14.54	16.31	17.59	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.33
9	10.02	08.40	07.05 16.00-16.24/24	06.16	04.32	03.05	03.18	04.52	06.25	07.51 16.32-17.03/31	08.27	09.56
	14.57	16.34	18.02	20.34	22.08	23.40	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.36	07.02 16.01-16.22/21	06.12	04.28	03.03	03.21	04.55	06.28	07.54 16.32-17.03/31	08.30	09.58
	14.59	16.38	18.05	20.37	22.11	23.42	23.32	21.58	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58 16.03-16.19/16	06.09	04.25	03.01	03.24	04.59	06.31	07.57 16.31-17.02/31	08.34	10.00
	15.02	16.41	18.08	20.40	22.14	23.44	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55 16.07-16.16/9	06.05	04.22	03.00	03.26	05.02	06.34	08.00 16.31-17.02/31	08.37	10.02
	15.05	16.44	18.11	20.43	22.18	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03 16.31-17.01/30	08.40	10.04
	15.08	16.47	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.15	02.56	03.32	05.08	06.39	08.06 16.32-17.01/29	08.43	10.06
	15.11	16.51	18.17	20.49	22.24	23.49	23.22	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.42	08.09 16.32-17.00/28	08.47	10.07
	15.13	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.26
16	09.48	08.17	06.41	05.51	04.09	02.54	03.38	05.14	06.45	08.12 16.32-16.59/27	08.50	10.09
	15.16	16.57	18.23	20.55	22.31	23.51	23.16	21.37	19.48	18.03	15.23	14.26
17	09.45	08.13	06.37	05.47	04.06	02.54	03.40	05.17	06.48	08.15 16.33-16.58/25	08.53	10.10
	15.20	17.00	18.26	20.59	22.34	23.52	23.14	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.53	03.43	05.20	06.51	08.18 16.35-16.57/22	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.17	14.25
19	09.40	08.07	06.30	05.40	03.59	02.53	03.46	05.23	06.54	08.21 16.36-16.55/19	09.00	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.27	19.37	17.52	15.15	14.25
20	09.38	08.03	06.26	05.37	03.56	02.53	03.49	05.26	06.57	08.24 16.37-16.52/15	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00 16.09-16.19/10	06.23	05.33	03.53	02.53	03.52	05.29	06.59	08.27 16.42-16.48/6	09.06	10.14
	15.32	17.13	18.38	21.11	22.47	23.55	23.02	21.20	19.30	17.45	15.09	14.26
22	09.33	07.57 16.06-16.22/16	06.19	05.30	03.50	02.53	03.56	05.32	07.02	08.30	09.09	10.15
	15.35	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.26	17.42	15.06	14.26
23	09.30	07.53 16.04-16.24/20	06.16	05.26	03.47	02.54	03.59	05.35	07.05	08.33	09.12	10.15
	15.38	17.19	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.27	07.50 16.02-16.26/24	06.12	05.23	03.44	02.54	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.22	18.47	21.20	22.56	23.55	22.53	21.09	19.19	17.35	15.01	14.27
25	09.25	07.47 16.01-16.26/25	06.09	05.20	03.41	02.55	04.05	05.41	07.11	07.40	09.18	10.16
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.28
26	09.22	07.43 16.00-16.28/28	06.05	05.16	03.38	02.56	04.08	05.44	07.14	07.43	09.21	10.16
	15.48	17.29	18.53	21.26	23.02	23.54	22.47	21.02	19.12	16.29	14.56	14.29
27	09.19	07.40 15.59-16.28/29	06.02	05.13	03.36	02.57	04.11	05.47	07.17	07.46	09.24	10.15
	15.51	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.25	14.54	14.30
28	09.16	07.36 15.58-16.28/30	05.58	05.09	03.33	02.58	04.14	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.41	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.27	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.01		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.15	14.47	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.14
	16.05		20.08		23.17		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	569	622	607	508	393	305	199	138
Sum of minutes with flicker	0	182	305	0	0	0	0	0	0	498	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 15 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (186)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.04 14.09-14.36/27	07.33	06.44	04.59	03.22	03.01	04.27	06.02	07.28	08.01 13.37-14.09/32	09.36
	14.38	16.08	17.38	20.10	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.45
2	10.12	09.01 14.09-14.37/28	07.29	06.40	04.55	03.20	03.03	04.30	06.05	07.31	08.05 13.37-14.09/32	09.39
	14.40	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.43
3	10.11	08.58 14.08-14.37/29	07.26	06.37	04.52	03.17	03.05	04.33	06.08	07.34	08.08 13.37-14.09/32	09.41
	14.42	16.15	17.44	20.16	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.41
4	10.09	08.55 14.07-14.38/31	07.22	06.33	04.49	03.15	03.07	04.37	06.11	07.37	08.11 13.37-14.09/32	09.44
	14.45	16.18	17.47	20.19	21.52	23.28	23.44	22.18	20.30	18.44	15.59	14.40
5	10.08	08.52 14.08-14.39/31	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.40	08.14 13.37-14.09/32	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.07	08.49 14.08-14.39/31	07.16	06.26	04.42	03.10	03.11	04.43	06.17	07.42	08.17 13.38-14.08/30	09.49
	14.49	16.24	17.53	20.25	21.58	23.33	23.40	22.11	20.23	18.37	15.53	14.36
7	10.05	08.46 14.07-14.39/32	07.12	06.23	04.38	03.08	03.14	04.46	06.19	07.45	08.21 13.38-14.08/30	09.51
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43 14.07-14.39/32	07.09	06.19	04.35	03.06	03.16	04.49	06.22	07.48	08.24 13.39-14.08/29	09.54
	14.54	16.31	17.59	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.33
9	10.02	08.40 14.08-14.40/32	07.05	06.16	04.32	03.05	03.18	04.52	06.25	07.51	08.27 13.39-14.07/28	09.56
	14.57	16.34	18.02	20.34	22.08	23.39	23.34	22.01	20.12	18.27	15.44	14.32
10	10.00	08.36 14.08-14.39/31	07.02	06.12	04.28	03.03	03.21	04.55	06.28	07.54	08.30 13.40-14.07/27	09.58
	14.59	16.38	18.05	20.37	22.11	23.42	23.32	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33 14.08-14.39/31	06.58	06.09	04.25	03.01	03.24	04.59	06.31	07.57	08.34 13.41-14.06/25	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30 14.08-14.38/30	06.55	06.05	04.22	03.00	03.26	05.02	06.34	08.00	08.37 13.42-14.05/23	10.02
	15.05	16.44	18.11	20.43	22.18	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27 14.09-14.38/29	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40 13.43-14.03/20	10.04
	15.08	16.47	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23 14.10-14.38/28	06.48	05.58	04.15	02.56	03.32	05.08	06.39	08.06	08.43 13.46-14.03/17	10.06
	15.11	16.51	18.17	20.49	22.24	23.48	23.22	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20 14.10-14.36/26	06.44	05.54	04.12	02.55	03.35	05.11	06.42	08.09	08.47 13.48-14.00/12	10.07
	15.13	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.26
16	09.48	08.17 14.12-14.36/24	06.41	05.51	04.09	02.54	03.38	05.14	06.45	08.12	08.50 13.52-13.56/4	10.09
	15.16	16.57	18.23	20.55	22.30	23.51	23.16	21.37	19.48	18.02	15.23	14.26
17	09.45	08.13 14.13-14.34/21	06.37	05.47	04.06	02.54	03.40	05.17	06.48	08.15	08.53	10.10
	15.20	17.00	18.26	20.58	22.34	23.52	23.14	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10 14.15-14.32/17	06.33	05.44	04.03	02.53	03.43	05.20	06.51	08.18	08.56	10.11
	15.23	17.03	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.17	14.25
19	09.40	08.07 14.19-14.29/10	06.30	05.40	03.59	02.53	03.46	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.26	19.37	17.52	15.15	14.25
20	09.38	08.03	06.26	05.37	03.56	02.53	03.49	05.26	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.33	17.49	15.12	14.26
21	09.35	08.00	06.23	05.33	03.53	02.53	03.53	05.29	06.59	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.46	23.55	23.02	21.19	19.30	17.45	15.09	14.26
22	09.33	07.57	06.19	05.30	03.50	02.53	03.56	05.32	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.26	17.42	15.06	14.26
23	09.30	07.53	06.16	05.26	03.47	02.54	03.59	05.35	07.05	08.33 14.48-15.00/12	09.12	10.15
	15.38	17.19	18.44	21.17	22.53	23.55	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.44	02.54	04.02	05.38	07.08	08.36 14.45-15.02/17	09.15	10.15
	15.42	17.22	18.47	21.20	22.56	23.55	22.53	21.09	19.19	17.35	15.01	14.27
25	09.25	07.46	06.09	05.19	03.41	02.55	04.05	05.41	07.11	07.39 13.43-14.05/22	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.05	19.16	16.32	14.59	14.28
26	09.22 14.19-14.23/4	07.43	06.05	05.16	03.38	02.56	04.08	05.44	07.14	07.43 13.41-14.05/24	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.54	22.47	21.02	19.12	16.29	14.56	14.29
27	09.19 14.15-14.28/13	07.40	06.02	05.13	03.36	02.57	04.11	05.47	07.16	07.46 13.40-14.07/27	09.24	10.15
	15.51	17.32	18.56	21.29	23.05	23.53	22.44	20.58	19.09	16.25	14.54	14.30
28	09.16 14.13-14.30/17	07.36	05.58	05.09	03.33	02.58	04.14	05.50	07.19	07.49 13.39-14.07/28	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13 14.12-14.32/20		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52 13.38-14.08/30	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10 14.10-14.33/23		06.51	05.02	03.27	03.00	04.21	05.56	07.25	07.55 13.38-14.09/31	09.33	10.14
	16.01		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.15	14.47	14.35
31	09.07 14.10-14.35/25		06.48		03.25		04.24	05.59		07.58 13.37-14.08/31		10.14
	16.05		20.07		23.17		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	138
Sum of minutes with flicker	102	520	0	0	0	0	0	0	0	222	405	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 16 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (187)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.22	03.02	04.27	06.02	07.28	08.01	09.36
	14.39	16.08	17.38	20.10	21.42	23.20	23.49	22.27	20.41	18.55	16.09	14.45
2	10.12	09.01	07.29	06.40	04.55	03.20	03.03	04.30	06.05	07.31	08.05	09.38
	14.41	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.43
3	10.10	08.58	07.26	06.37	04.52	03.17	03.05	04.33	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.28	23.44	22.18	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.40	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.07	08.49	07.15	06.26	04.42	03.11	03.11	04.43	06.17	07.42	08.17	09.49
	14.49	16.25	17.53	20.25	21.58	23.33	23.40	22.11	20.23	18.37	15.53	14.36
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.19	07.45	08.21	09.51
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.03	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	17.59	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.33
9	10.02	08.39	07.05	06.16	04.32	03.05	03.19	04.52	06.25	07.51	08.27	09.56
	14.57	16.34	18.02	20.34	22.08	23.39	23.34	22.01	20.12	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.03	03.21	04.55	06.28	07.54	08.30	09.58
	14.59	16.38	18.05	20.37	22.11	23.41	23.32	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.01	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.26	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.17	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.47	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.15	02.56	03.32	05.08	06.39	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.22	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.42	08.09	08.47	10.07
	15.14	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.27
16	09.47	08.17	06.41	05.51	04.09	02.54	03.38	05.14	06.45	08.12	08.50	10.08
	15.17	16.57	18.23	20.55	22.30	23.51	23.16	21.37	19.48	18.02	15.23	14.26
17	09.45	08.13	06.37	05.47	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.00	18.26	20.58	22.34	23.52	23.13	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10	06.33	05.44	04.03	02.53	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.01	22.37	23.53	23.11	21.30	19.41	17.56	15.17	14.26
19	09.40	08.07	06.30	05.40	04.00	02.53	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.26	19.37	17.52	15.15	14.26
20	09.38	08.03	06.26	05.37	03.56	02.53	03.50	05.26	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.33	17.49	15.12	14.26
21	09.35	08.00	06.23	05.33	03.53	02.53	03.53	05.29	06.59	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.45	15.09	14.26
22	09.33	07.57	06.19	05.30	03.50	02.53	03.56	05.32	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.26	17.42	15.07	14.26
23	09.30	07.53	06.16	05.26	03.47	02.54	03.59	05.35	07.05	08.33	09.12	10.15
	15.38	17.19	18.44	21.17	22.53	23.55	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.44	02.54	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.22	18.47	21.20	22.56	23.54	22.53	21.09	19.19	17.35	15.01	14.28
25	09.25	07.46	06.09	05.20	03.41	02.55	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.05	19.16	16.32	14.59	14.28
26	09.22	07.43	06.05	05.16	03.39	02.56	04.08	05.44	07.14	07.43	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.54	22.47	21.02	19.12	16.29	14.57	14.29
27	09.19	07.40	06.02	05.13	03.36	02.57	04.11	05.47	07.16	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.05	23.53	22.44	20.58	19.09	16.25	14.54	14.30
28	09.16	07.36	05.58	05.09	03.33	02.59	04.14	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.27	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.01		20.04	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.07		23.17		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	138
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 17 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (188)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.22	03.02	04.27	06.02	07.28	08.01	09.36
	14.39	16.08	17.38	20.10	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.40	04.55	03.20	03.03	04.30	06.05	07.31	08.05	09.38
	14.41	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.17	03.05	04.33	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.25	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.27	23.44	22.17	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.40	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.06	08.49	07.15	06.26	04.42	03.11	03.12	04.43	06.17	07.42	08.17	09.49
	14.49	16.25	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.36
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.19	07.45	08.21	09.51
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.07	20.20	18.34	15.50	14.35
8	10.03	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	17.59	20.31	22.04	23.37	23.36	22.04	20.16	18.30	15.47	14.33
9	10.02	08.39	07.05	06.16	04.32	03.05	03.19	04.52	06.25	07.51	08.27	09.56
	14.57	16.34	18.02	20.34	22.08	23.39	23.34	22.01	20.12	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.30	09.58
	14.59	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.01	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.26	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.17	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.26	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.47	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.15	02.56	03.32	05.08	06.39	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.21	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.42	08.09	08.46	10.07
	15.14	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.27
16	09.47	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.08
	15.17	16.57	18.23	20.55	22.30	23.51	23.16	21.37	19.48	18.02	15.23	14.26
17	09.45	08.13	06.37	05.47	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.00	18.26	20.58	22.34	23.52	23.13	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10	06.33	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.01	22.37	23.53	23.11	21.30	19.41	17.56	15.17	14.26
19	09.40	08.07	06.30	05.40	04.00	02.53	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.53	23.08	21.26	19.37	17.52	15.15	14.26
20	09.38	08.03	06.26	05.37	03.56	02.53	03.50	05.26	06.57	08.24	09.02	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.33	17.49	15.12	14.26
21	09.35	08.00	06.23	05.33	03.53	02.53	03.53	05.29	06.59	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.45	15.09	14.26
22	09.33	07.57	06.19	05.30	03.50	02.54	03.56	05.32	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.49	23.54	22.59	21.16	19.26	17.42	15.07	14.26
23	09.30	07.53	06.16	05.27	03.47	02.54	03.59	05.35	07.05	08.33	09.12	10.15
	15.39	17.19	18.44	21.17	22.53	23.54	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.44	02.55	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.22	18.47	21.20	22.56	23.54	22.53	21.09	19.19	17.35	15.02	14.28
25	09.24	07.46	06.09	05.20	03.41	02.55	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.05	19.16	16.32	14.59	14.28
26	09.22	07.43	06.05	05.16	03.39	02.56	04.08	05.44	07.14	07.42	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.53	22.47	21.02	19.12	16.29	14.57	14.29
27	09.19	07.40	06.02	05.13	03.36	02.57	04.11	05.47	07.16	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.05	23.53	22.43	20.58	19.09	16.25	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.14	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.14
	15.58		20.02	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.01		20.04	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.07		23.17		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	568	621	607	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 18 - Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (189)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.22	03.02	04.27	06.02	07.28	08.01	09.36
	14.39	16.08	17.38	20.10	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.40	04.55	03.20	03.04	04.30	06.05	07.31	08.05	09.38
	14.41	16.11	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18	03.05	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.48	23.25	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.22	06.33	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.27	23.44	22.17	20.30	18.44	15.59	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.39	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.06	08.49	07.15	06.26	04.42	03.11	03.12	04.43	06.17	07.42	08.17	09.49
	14.49	16.25	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.19	07.45	08.21	09.51
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.07	20.19	18.34	15.50	14.35
8	10.03	08.43	07.08	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.53
	14.54	16.31	17.59	20.31	22.04	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.02	08.39	07.05	06.16	04.32	03.05	03.19	04.52	06.25	07.51	08.27	09.56
	14.57	16.34	18.02	20.34	22.08	23.39	23.34	22.01	20.12	18.27	15.44	14.32
10	10.00	08.36	07.01	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.30	09.58
	15.00	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02	03.24	04.59	06.31	07.57	08.33	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.17	23.45	23.26	21.50	20.02	18.16	15.35	14.29
13	09.54	08.26	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.03
	15.08	16.47	18.14	20.46	22.21	23.46	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.47	05.58	04.16	02.56	03.32	05.08	06.39	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.21	21.44	19.55	18.09	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.42	08.09	08.46	10.07
	15.14	16.54	18.20	20.52	22.27	23.49	23.19	21.40	19.51	18.06	15.26	14.27
16	09.47	08.17	06.40	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.08
	15.17	16.57	18.23	20.55	22.30	23.51	23.16	21.37	19.48	18.02	15.23	14.26
17	09.45	08.13	06.37	05.47	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.09
	15.20	17.00	18.26	20.58	22.33	23.52	23.13	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10	06.33	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.01	22.37	23.52	23.10	21.30	19.40	17.56	15.17	14.26
19	09.40	08.07	06.30	05.40	04.00	02.53	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.04	22.40	23.53	23.08	21.26	19.37	17.52	15.15	14.26
20	09.38	08.03	06.26	05.37	03.57	02.53	03.50	05.26	06.57	08.24	09.02	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.33	17.49	15.12	14.26
21	09.35	08.00	06.23	05.33	03.53	02.53	03.53	05.29	06.59	08.27	09.06	10.13
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.19	19.30	17.45	15.09	14.26
22	09.32	07.57	06.19	05.30	03.50	02.54	03.56	05.32	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.49	23.54	22.59	21.16	19.26	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.47	02.54	03.59	05.35	07.05	08.33	09.12	10.14
	15.39	17.19	18.44	21.17	22.52	23.54	22.56	21.12	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.44	02.55	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.22	18.47	21.20	22.56	23.54	22.53	21.09	19.19	17.35	15.02	14.28
25	09.24	07.46	06.09	05.20	03.42	02.56	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.05	19.16	16.32	14.59	14.29
26	09.22	07.43	06.05	05.16	03.39	02.56	04.08	05.44	07.14	07.42	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.53	22.46	21.02	19.12	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.11	05.47	07.16	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.05	23.53	22.43	20.58	19.09	16.25	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.32	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.14
	15.58		20.01	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.01		20.04	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.07		23.16		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	568	621	607	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 19 - VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.05	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.11	21.43	23.20	23.49	22.28	20.41	18.55	16.09	14.46
2	10.12	09.02	07.30	06.41	04.56	03.20	03.04	04.31	06.05	07.31	08.05	09.39
	14.41	16.12	17.41	20.14	21.46	23.23	23.48	22.25	20.38	18.52	16.06	14.44
3	10.11	08.59	07.26	06.37	04.52	03.18	03.05	04.34	06.08	07.34	08.08	09.42
	14.43	16.15	17.44	20.17	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.10	08.56	07.23	06.34	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.48	20.20	21.52	23.28	23.44	22.18	20.31	18.45	16.00	14.40
5	10.08	08.52	07.19	06.30	04.46	03.13	03.10	04.40	06.14	07.40	08.15	09.47
	14.47	16.22	17.51	20.23	21.55	23.31	23.43	22.15	20.27	18.41	15.57	14.38
6	10.07	08.49	07.16	06.27	04.42	03.11	03.12	04.43	06.17	07.43	08.18	09.49
	14.50	16.25	17.54	20.26	21.59	23.33	23.41	22.11	20.24	18.38	15.53	14.37
7	10.06	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.46	08.21	09.52
	14.52	16.28	17.57	20.29	22.02	23.35	23.39	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43	07.09	06.20	04.36	03.07	03.16	04.50	06.23	07.49	08.24	09.54
	14.54	16.31	18.00	20.32	22.05	23.38	23.37	22.05	20.16	18.31	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.53	06.26	07.52	08.28	09.56
	14.57	16.35	18.03	20.35	22.08	23.40	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.37	07.02	06.13	04.29	03.03	03.21	04.56	06.28	07.55	08.31	09.58
	15.00	16.38	18.06	20.38	22.11	23.42	23.32	21.58	20.09	18.24	15.41	14.31
11	09.59	08.33	06.58	06.09	04.26	03.02	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.09	20.41	22.15	23.44	23.30	21.54	20.06	18.20	15.38	14.30
12	09.57	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.45	18.12	20.44	22.18	23.46	23.27	21.51	20.02	18.17	15.35	14.29
13	09.55	08.27	06.51	06.02	04.19	02.58	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.15	20.47	22.21	23.47	23.25	21.48	19.59	18.13	15.32	14.28
14	09.52	08.24	06.48	05.58	04.16	02.56	03.32	05.08	06.40	08.06	08.44	10.06
	15.11	16.51	18.18	20.50	22.24	23.49	23.22	21.44	19.55	18.10	15.29	14.28
15	09.50	08.20	06.44	05.55	04.13	02.55	03.35	05.11	06.43	08.09	08.47	10.07
	15.14	16.54	18.21	20.53	22.28	23.50	23.19	21.41	19.52	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.46	08.12	08.50	10.09
	15.17	16.58	18.24	20.56	22.31	23.51	23.17	21.37	19.48	18.03	15.23	14.26
17	09.46	08.14	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.01	18.27	20.59	22.34	23.52	23.14	21.34	19.45	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.21	06.51	08.18	08.57	10.11
	15.23	17.04	18.30	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.18	14.26
19	09.41	08.07	06.30	05.41	04.00	02.53	03.47	05.24	06.54	08.21	09.00	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.27	19.37	17.53	15.15	14.26
20	09.38	08.04	06.27	05.37	03.57	02.53	03.50	05.27	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.44	23.55	23.05	21.23	19.34	17.49	15.12	14.26
21	09.36	08.00	06.23	05.34	03.54	02.53	03.53	05.30	07.00	08.28	09.06	10.14
	15.32	17.13	18.38	21.11	22.47	23.55	23.02	21.20	19.30	17.46	15.10	14.26
22	09.33	07.57	06.20	05.30	03.51	02.54	03.56	05.33	07.03	08.31	09.09	10.15
	15.36	17.17	18.41	21.14	22.50	23.55	22.59	21.16	19.27	17.42	15.07	14.27
23	09.30	07.54	06.16	05.27	03.48	02.54	03.59	05.36	07.05	08.34	09.12	10.15
	15.39	17.20	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.28	07.50	06.13	05.23	03.45	02.55	04.02	05.39	07.08	08.37	09.15	10.16
	15.42	17.23	18.47	21.20	22.56	23.55	22.53	21.09	19.20	17.36	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.56	04.05	05.42	07.11	07.40	09.19	10.16
	15.45	17.26	18.50	21.24	22.59	23.55	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.06	05.16	03.39	02.57	04.08	05.45	07.14	07.43	09.22	10.16
	15.49	17.29	18.53	21.27	23.02	23.54	22.47	21.02	19.13	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.12	05.48	07.17	07.46	09.25	10.16
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.26	14.55	14.31
28	09.16	07.37	05.59	05.10	03.33	02.59	04.15	05.51	07.20	07.49	09.28	10.15
	15.55	17.35	18.59	21.33	23.08	23.53	22.41	20.55	19.06	16.22	14.52	14.32
29	09.14		06.55	05.06	03.31	03.00	04.18	05.54	07.23	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.52	22.38	20.52	19.02	16.19	14.50	14.33
30	09.11		06.51	05.03	03.28	03.00	04.21	05.57	07.25	07.56	09.33	10.15
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.59	16.16	14.48	14.35
31	09.08		06.48		03.25		04.24	05.59		07.59		10.14
	16.05		20.08		23.17		22.31	20.45		16.13		14.37
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	138
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 20 - VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (2)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.05	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.11	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.46
2	10.12	09.02	07.30	06.41	04.56	03.20	03.04	04.31	06.05	07.31	08.05	09.39
	14.41	16.12	17.41	20.14	21.46	23.23	23.48	22.25	20.38	18.52	16.06	14.44
3	10.11	08.59	07.26	06.37	04.52	03.18	03.06	04.34	06.08	07.34	08.08	09.42
	14.43	16.15	17.44	20.17	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.10	08.56	07.23	06.34	04.49	03.15	03.08	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.48	20.20	21.52	23.28	23.44	22.18	20.31	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.46	03.13	03.10	04.40	06.14	07.40	08.15	09.47
	14.47	16.22	17.51	20.23	21.55	23.30	23.42	22.15	20.27	18.41	15.57	14.38
6	10.07	08.49	07.16	06.27	04.42	03.11	03.12	04.43	06.17	07.43	08.18	09.49
	14.50	16.25	17.54	20.26	21.58	23.33	23.41	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.46	08.21	09.52
	14.52	16.28	17.57	20.29	22.02	23.35	23.39	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43	07.09	06.20	04.36	03.07	03.16	04.50	06.23	07.49	08.24	09.54
	14.55	16.31	18.00	20.32	22.05	23.38	23.36	22.05	20.16	18.31	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.53	06.26	07.52	08.27	09.56
	14.57	16.35	18.03	20.35	22.08	23.40	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.37	07.02	06.13	04.29	03.03	03.21	04.56	06.28	07.55	08.31	09.58
	15.00	16.38	18.06	20.38	22.11	23.42	23.32	21.58	20.09	18.24	15.41	14.31
11	09.58	08.33	06.58	06.09	04.26	03.02	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.09	20.41	22.15	23.44	23.30	21.54	20.06	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.45	18.12	20.44	22.18	23.45	23.27	21.51	20.02	18.17	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.58	03.30	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.15	20.47	22.21	23.47	23.25	21.48	19.59	18.13	15.32	14.28
14	09.52	08.24	06.48	05.58	04.16	02.57	03.32	05.08	06.40	08.06	08.44	10.06
	15.11	16.51	18.18	20.50	22.24	23.49	23.22	21.44	19.55	18.10	15.29	14.28
15	09.50	08.20	06.44	05.55	04.13	02.56	03.35	05.11	06.43	08.09	08.47	10.07
	15.14	16.54	18.21	20.53	22.28	23.50	23.19	21.41	19.52	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.46	08.12	08.50	10.09
	15.17	16.58	18.24	20.56	22.31	23.51	23.17	21.37	19.48	18.03	15.23	14.26
17	09.46	08.14	06.37	05.48	04.06	02.54	03.41	05.18	06.48	08.15	08.53	10.10
	15.20	17.01	18.27	20.59	22.34	23.52	23.14	21.34	19.44	17.59	15.21	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.21	06.51	08.18	08.57	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.18	14.26
19	09.41	08.07	06.30	05.41	04.00	02.54	03.47	05.24	06.54	08.21	09.00	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.27	19.37	17.53	15.15	14.26
20	09.38	08.04	06.27	05.37	03.57	02.53	03.50	05.27	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.44	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.36	08.00	06.23	05.34	03.54	02.54	03.53	05.30	07.00	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.47	23.55	23.02	21.20	19.30	17.46	15.10	14.26
22	09.33	07.57	06.20	05.30	03.51	02.54	03.56	05.33	07.03	08.31	09.09	10.15
	15.36	17.17	18.41	21.14	22.50	23.55	22.59	21.16	19.27	17.42	15.07	14.27
23	09.30	07.54	06.16	05.27	03.48	02.54	03.59	05.36	07.05	08.34	09.12	10.15
	15.39	17.20	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.28	07.50	06.13	05.23	03.45	02.55	04.02	05.39	07.08	08.37	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.55	22.53	21.09	19.20	17.36	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.56	04.05	05.42	07.11	07.40	09.18	10.16
	15.45	17.26	18.50	21.24	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.06	05.16	03.39	02.57	04.09	05.45	07.14	07.43	09.22	10.16
	15.49	17.29	18.53	21.27	23.02	23.54	22.47	21.02	19.13	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.12	05.48	07.17	07.46	09.25	10.16
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.26	14.55	14.31
28	09.16	07.37	05.59	05.10	03.33	02.59	04.15	05.51	07.20	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.41	20.55	19.06	16.22	14.52	14.32
29	09.14		06.55	05.06	03.31	03.00	04.18	05.54	07.23	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.38	20.52	19.02	16.19	14.50	14.34
30	09.11		06.51	05.03	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.59	16.16	14.48	14.35
31	09.08		06.48		03.25		04.24	05.59		07.59		10.14
	16.05		20.08		23.17		22.31	20.45		16.13		14.37
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 21 - VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (3)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.05	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.11	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.46
2	10.12	09.02	07.30	06.41	04.56	03.20	03.04	04.31	06.05	07.31	08.05	09.39
	14.41	16.12	17.41	20.14	21.46	23.23	23.48	22.25	20.38	18.51	16.06	14.44
3	10.11	08.59	07.26	06.37	04.52	03.18	03.05	04.34	06.08	07.34	08.08	09.42
	14.43	16.15	17.44	20.17	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.10	08.56	07.23	06.34	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.20	21.52	23.28	23.44	22.18	20.31	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.46	03.13	03.09	04.40	06.14	07.40	08.15	09.47
	14.47	16.22	17.51	20.23	21.55	23.31	23.43	22.15	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16	06.27	04.42	03.11	03.12	04.43	06.17	07.43	08.18	09.49
	14.49	16.25	17.54	20.26	21.59	23.33	23.41	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.46	08.21	09.52
	14.52	16.28	17.57	20.29	22.02	23.35	23.39	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43	07.09	06.20	04.35	03.07	03.16	04.49	06.23	07.49	08.24	09.54
	14.54	16.31	18.00	20.32	22.05	23.38	23.37	22.05	20.16	18.30	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.52	08.27	09.56
	14.57	16.35	18.03	20.35	22.08	23.40	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.37	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.31	09.58
	15.00	16.38	18.06	20.38	22.11	23.42	23.32	21.58	20.09	18.24	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.09	20.41	22.15	23.44	23.30	21.54	20.06	18.20	15.38	14.30
12	09.57	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.12	20.44	22.18	23.46	23.27	21.51	20.02	18.17	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.15	20.47	22.21	23.47	23.25	21.48	19.59	18.13	15.32	14.28
14	09.52	08.24	06.48	05.58	04.16	02.56	03.32	05.08	06.40	08.06	08.44	10.06
	15.11	16.51	18.18	20.50	22.24	23.49	23.22	21.44	19.55	18.10	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.43	08.09	08.47	10.07
	15.14	16.54	18.21	20.53	22.28	23.50	23.19	21.41	19.52	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.09
	15.17	16.57	18.24	20.56	22.31	23.51	23.17	21.37	19.48	18.03	15.23	14.26
17	09.46	08.14	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.01	18.26	20.59	22.34	23.52	23.14	21.34	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.57	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.18	14.26
19	09.41	08.07	06.30	05.41	04.00	02.53	03.47	05.24	06.54	08.21	09.00	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.27	19.37	17.53	15.15	14.26
20	09.38	08.04	06.27	05.37	03.57	02.53	03.50	05.27	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.44	23.55	23.05	21.23	19.34	17.49	15.12	14.26
21	09.36	08.00	06.23	05.34	03.54	02.53	03.53	05.30	07.00	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.47	23.55	23.02	21.20	19.30	17.46	15.09	14.26
22	09.33	07.57	06.20	05.30	03.51	02.54	03.56	05.33	07.03	08.31	09.09	10.15
	15.36	17.17	18.41	21.14	22.50	23.55	22.59	21.16	19.27	17.42	15.07	14.27
23	09.30	07.54	06.16	05.27	03.48	02.54	03.59	05.36	07.05	08.34	09.12	10.15
	15.39	17.20	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.28	07.50	06.13	05.23	03.45	02.55	04.02	05.39	07.08	08.37	09.15	10.16
	15.42	17.23	18.47	21.20	22.56	23.55	22.53	21.09	19.20	17.36	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.55	04.05	05.42	07.11	07.40	09.19	10.16
	15.45	17.26	18.50	21.24	22.59	23.55	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.06	05.16	03.39	02.56	04.08	05.45	07.14	07.43	09.22	10.16
	15.49	17.29	18.53	21.27	23.02	23.54	22.47	21.02	19.13	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.12	05.48	07.17	07.46	09.25	10.16
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.26	14.54	14.31
28	09.16	07.37	05.58	05.09	03.33	02.59	04.15	05.51	07.20	07.49	09.28	10.15
	15.55	17.35	18.59	21.33	23.08	23.53	22.41	20.55	19.06	16.22	14.52	14.32
29	09.14		06.55	05.06	03.30	03.00	04.18	05.53	07.23	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.52	22.38	20.52	19.02	16.19	14.50	14.33
30	09.11		06.51	05.03	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.15
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.08		06.48		03.25		04.24	05.59		07.59		10.14
	16.05		20.08		23.17		22.31	20.45		16.13		14.37
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	138
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 22 - VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (4)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.05	07.33	06.44	04.59	03.22	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.11	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.46
2	10.12	09.02	07.30	06.41	04.56	03.20	03.03	04.30	06.05	07.31	08.05	09.39
	14.41	16.12	17.41	20.14	21.46	23.23	23.48	22.24	20.38	18.51	16.06	14.44
3	10.11	08.59	07.26	06.37	04.52	03.18	03.05	04.34	06.08	07.34	08.08	09.42
	14.43	16.15	17.44	20.17	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.10	08.55	07.23	06.34	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.20	21.52	23.28	23.44	22.18	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.40	08.15	09.47
	14.47	16.21	17.50	20.23	21.55	23.30	23.43	22.15	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16	06.27	04.42	03.11	03.12	04.43	06.17	07.43	08.18	09.49
	14.49	16.25	17.53	20.26	21.58	23.33	23.41	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.46	08.21	09.52
	14.52	16.28	17.57	20.29	22.02	23.35	23.39	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.23	07.49	08.24	09.54
	14.54	16.31	18.00	20.32	22.05	23.38	23.36	22.04	20.16	18.30	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51	08.27	09.56
	14.57	16.35	18.03	20.35	22.08	23.40	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.37	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.31	09.58
	15.00	16.38	18.06	20.38	22.11	23.42	23.32	21.58	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.01	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.09	20.41	22.15	23.44	23.30	21.54	20.06	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.12	20.44	22.18	23.46	23.27	21.51	20.02	18.17	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.15	20.47	22.21	23.47	23.25	21.47	19.59	18.13	15.32	14.28
14	09.52	08.24	06.48	05.58	04.16	02.56	03.32	05.08	06.40	08.06	08.44	10.06
	15.11	16.51	18.18	20.50	22.24	23.49	23.22	21.44	19.55	18.10	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.43	08.09	08.47	10.07
	15.14	16.54	18.20	20.53	22.28	23.50	23.19	21.41	19.51	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.09
	15.17	16.57	18.23	20.56	22.31	23.51	23.17	21.37	19.48	18.03	15.23	14.26
17	09.45	08.14	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.01	18.26	20.59	22.34	23.52	23.14	21.34	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.18	14.26
19	09.41	08.07	06.30	05.41	04.00	02.53	03.47	05.23	06.54	08.21	09.00	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.27	19.37	17.52	15.15	14.26
20	09.38	08.04	06.27	05.37	03.57	02.53	03.50	05.26	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.44	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.36	08.00	06.23	05.34	03.54	02.53	03.53	05.30	07.00	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.47	23.55	23.02	21.20	19.30	17.46	15.09	14.26
22	09.33	07.57	06.20	05.30	03.51	02.54	03.56	05.33	07.02	08.30	09.09	10.15
	15.35	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.27	17.42	15.07	14.27
23	09.30	07.54	06.16	05.27	03.48	02.54	03.59	05.36	07.05	08.34	09.12	10.15
	15.39	17.20	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.28	07.50	06.13	05.23	03.45	02.55	04.02	05.39	07.08	08.37	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.55	22.53	21.09	19.20	17.36	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.55	04.05	05.42	07.11	07.40	09.18	10.16
	15.45	17.26	18.50	21.23	22.59	23.55	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.05	05.16	03.39	02.56	04.08	05.45	07.14	07.43	09.21	10.16
	15.48	17.29	18.53	21.27	23.02	23.54	22.47	21.02	19.13	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.57	04.11	05.47	07.17	07.46	09.24	10.16
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.26	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.20	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.41	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.52	19.02	16.19	14.50	14.33
30	09.11		06.51	05.03	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.08		06.48		03.25		04.24	05.59		07.59		10.14
	16.05		20.08		23.17		22.31	20.45		16.12		14.36
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	138
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 23 - VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (5)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.05	07.33	06.44	04.59	03.22	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.11	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.46
2	10.12	09.02	07.30	06.41	04.56	03.20	03.03	04.30	06.05	07.31	08.05	09.39
	14.41	16.11	17.41	20.14	21.46	23.23	23.48	22.24	20.38	18.51	16.06	14.44
3	10.11	08.58	07.26	06.37	04.52	03.18	03.05	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.17	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.10	08.55	07.23	06.34	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.20	21.52	23.28	23.44	22.18	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.40	08.14	09.47
	14.47	16.21	17.50	20.23	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16	06.26	04.42	03.11	03.12	04.43	06.17	07.43	08.18	09.49
	14.49	16.25	17.53	20.25	21.58	23.33	23.41	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.46	08.21	09.52
	14.52	16.28	17.56	20.28	22.02	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	18.00	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51	08.27	09.56
	14.57	16.35	18.03	20.34	22.08	23.40	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.37	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.31	09.58
	15.00	16.38	18.06	20.37	22.11	23.42	23.32	21.58	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.01	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.09	20.40	22.15	23.44	23.29	21.54	20.06	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.12	20.43	22.18	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.14	20.47	22.21	23.47	23.24	21.47	19.59	18.13	15.32	14.28
14	09.52	08.24	06.48	05.58	04.16	02.56	03.32	05.08	06.40	08.06	08.44	10.06
	15.11	16.51	18.17	20.50	22.24	23.49	23.22	21.44	19.55	18.10	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.43	08.09	08.47	10.07
	15.14	16.54	18.20	20.53	22.27	23.50	23.19	21.41	19.51	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.09
	15.17	16.57	18.23	20.56	22.31	23.51	23.17	21.37	19.48	18.03	15.23	14.26
17	09.45	08.14	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.01	18.26	20.59	22.34	23.52	23.14	21.34	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.53	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.18	14.26
19	09.41	08.07	06.30	05.41	04.00	02.53	03.47	05.23	06.54	08.21	09.00	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.27	19.37	17.52	15.15	14.26
20	09.38	08.04	06.27	05.37	03.57	02.53	03.50	05.26	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.36	08.00	06.23	05.34	03.54	02.53	03.53	05.29	07.00	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.47	23.55	23.02	21.20	19.30	17.46	15.09	14.26
22	09.33	07.57	06.20	05.30	03.50	02.54	03.56	05.33	07.02	08.30	09.09	10.15
	15.35	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.27	17.42	15.07	14.26
23	09.30	07.53	06.16	05.27	03.47	02.54	03.59	05.36	07.05	08.33	09.12	10.15
	15.39	17.20	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.28	07.50	06.13	05.23	03.45	02.55	04.02	05.39	07.08	08.37	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.55	22.53	21.09	19.20	17.36	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.55	04.05	05.42	07.11	07.40	09.18	10.16
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.05	05.16	03.39	02.56	04.08	05.44	07.14	07.43	09.21	10.16
	15.48	17.29	18.53	21.27	23.02	23.54	22.47	21.02	19.12	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.57	04.11	05.47	07.17	07.46	09.24	10.16
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.26	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.20	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.41	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.52	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.08		06.48		03.25		04.24	05.59		07.59		10.14
	16.05		20.08		23.17		22.31	20.45		16.12		14.36
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	138
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 24 - VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (6)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.04	07.33	06.44	04.59	03.22	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.11	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.46
2	10.12	09.01	07.29	06.41	04.56	03.20	03.04	04.30	06.05	07.31	08.05	09.39
	14.41	16.11	17.41	20.14	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.11	08.58	07.26	06.37	04.52	03.18	03.05	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.23	06.34	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.28	23.44	22.18	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.09	04.40	06.14	07.40	08.14	09.47
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16	06.26	04.42	03.11	03.12	04.43	06.17	07.43	08.18	09.49
	14.49	16.25	17.53	20.25	21.58	23.33	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.46	08.21	09.51
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	17.59	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51	08.27	09.56
	14.57	16.35	18.02	20.34	22.08	23.39	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.31	09.58
	15.00	16.38	18.05	20.37	22.11	23.42	23.32	21.58	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.01	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.06	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.18	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.57	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.16	02.56	03.32	05.08	06.40	08.06	08.43	10.06
	15.11	16.51	18.17	20.49	22.24	23.48	23.22	21.44	19.55	18.10	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.42	08.09	08.47	10.07
	15.14	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.09
	15.17	16.57	18.23	20.56	22.31	23.51	23.16	21.37	19.48	18.03	15.23	14.26
17	09.45	08.14	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.01	18.26	20.59	22.34	23.52	23.14	21.34	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.18	14.26
19	09.40	08.07	06.30	05.41	04.00	02.53	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.27	19.37	17.52	15.15	14.26
20	09.38	08.04	06.27	05.37	03.57	02.53	03.50	05.26	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54	02.53	03.53	05.29	07.00	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.47	23.55	23.02	21.20	19.30	17.46	15.09	14.26
22	09.33	07.57	06.20	05.30	03.50	02.54	03.56	05.32	07.02	08.30	09.09	10.14
	15.35	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.27	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.47	02.54	03.59	05.35	07.05	08.33	09.12	10.15
	15.39	17.20	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.45	02.55	04.02	05.38	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.55	22.53	21.09	19.19	17.36	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.55	04.05	05.41	07.11	07.40	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.05	05.16	03.39	02.56	04.08	05.44	07.14	07.43	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.54	22.47	21.02	19.12	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.11	05.47	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.26	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.20	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.52	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.14
	16.05		20.08		23.17		22.31	20.44		16.12		14.36
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 25 - VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (7)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.11	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.46
2	10.12	09.01	07.29	06.41	04.56	03.20	03.04	04.30	06.05	07.31	08.05	09.39
	14.41	16.12	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18	03.06	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.23	06.34	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.28	23.44	22.18	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.10	04.40	06.14	07.40	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16	06.26	04.42	03.11	03.12	04.43	06.17	07.43	08.18	09.49
	14.49	16.25	17.53	20.25	21.58	23.33	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.45	08.21	09.51
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.03	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	17.59	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51	08.27	09.56
	14.57	16.35	18.02	20.34	22.08	23.39	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.30	09.58
	15.00	16.38	18.05	20.37	22.11	23.41	23.32	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.06	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.18	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.58	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.16	02.56	03.32	05.08	06.40	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.22	21.44	19.55	18.10	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.56	03.35	05.11	06.42	08.09	08.47	10.07
	15.14	16.54	18.20	20.52	22.27	23.50	23.19	21.40	19.51	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.08
	15.17	16.57	18.23	20.55	22.30	23.51	23.16	21.37	19.48	18.03	15.23	14.26
17	09.45	08.13	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.01	18.26	20.59	22.34	23.52	23.13	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.18	14.26
19	09.40	08.07	06.30	05.41	04.00	02.53	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.53	23.08	21.27	19.37	17.52	15.15	14.26
20	09.38	08.03	06.27	05.37	03.57	02.53	03.50	05.26	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54	02.53	03.53	05.29	07.00	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.20	19.30	17.46	15.09	14.26
22	09.33	07.57	06.20	05.30	03.51	02.54	03.56	05.32	07.02	08.30	09.09	10.14
	15.36	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.27	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48	02.54	03.59	05.36	07.05	08.33	09.12	10.15
	15.39	17.20	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.45	02.55	04.02	05.39	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.54	22.53	21.09	19.19	17.36	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.56	04.05	05.41	07.11	07.40	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.05	05.16	03.39	02.57	04.08	05.44	07.14	07.43	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.54	22.47	21.02	19.12	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.12	05.47	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.26	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.52	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.08		23.17		22.31	20.44		16.12		14.37
Potential sun hours	172	238	363	451	568	621	607	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 26 - VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (8)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.13	09.05	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.02	09.36
	14.39	16.08	17.38	20.11	21.42	23.20	23.49	22.28	20.41	18.55	16.09	14.46
2	10.12	09.02	07.30	06.41	04.56	03.20	03.04	04.31	06.05	07.31	08.05	09.39
	14.41	16.12	17.41	20.14	21.46	23.23	23.47	22.24	20.38	18.51	16.06	14.44
3	10.11	08.58	07.26	06.37	04.52	03.18	03.05	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.17	21.49	23.25	23.46	22.21	20.34	18.48	16.03	14.42
4	10.10	08.55	07.23	06.34	04.49	03.15	03.07	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.20	21.52	23.28	23.44	22.18	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.46	03.13	03.10	04.40	06.14	07.40	08.15	09.47
	14.47	16.22	17.50	20.23	21.55	23.30	23.42	22.15	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16	06.27	04.42	03.11	03.12	04.43	06.17	07.43	08.18	09.49
	14.50	16.25	17.54	20.26	21.58	23.33	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.46	08.21	09.52
	14.52	16.28	17.57	20.29	22.02	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.04	08.43	07.09	06.20	04.35	03.07	03.16	04.49	06.23	07.49	08.24	09.54
	14.54	16.31	18.00	20.32	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51	08.27	09.56
	14.57	16.35	18.03	20.35	22.08	23.40	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.37	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.31	09.58
	15.00	16.38	18.06	20.38	22.11	23.42	23.32	21.58	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.09	20.41	22.15	23.44	23.29	21.54	20.06	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.12	20.44	22.18	23.45	23.27	21.51	20.02	18.17	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.58	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.15	20.47	22.21	23.47	23.24	21.47	19.59	18.13	15.32	14.28
14	09.52	08.24	06.48	05.58	04.16	02.56	03.32	05.08	06.40	08.06	08.44	10.06
	15.11	16.51	18.18	20.50	22.24	23.49	23.22	21.44	19.55	18.10	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.55	03.35	05.11	06.43	08.09	08.47	10.07
	15.14	16.54	18.21	20.53	22.27	23.50	23.19	21.41	19.51	18.06	15.26	14.27
16	09.48	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.09
	15.17	16.57	18.23	20.56	22.31	23.51	23.16	21.37	19.48	18.03	15.23	14.26
17	09.45	08.14	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.01	18.26	20.59	22.34	23.52	23.14	21.34	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.18	14.26
19	09.41	08.07	06.30	05.41	04.00	02.53	03.47	05.24	06.54	08.21	09.00	10.12
	15.26	17.07	18.32	21.05	22.40	23.54	23.08	21.27	19.37	17.53	15.15	14.26
20	09.38	08.04	06.27	05.37	03.57	02.53	03.50	05.27	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.36	08.00	06.23	05.34	03.54	02.53	03.53	05.30	07.00	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.47	23.55	23.02	21.20	19.30	17.46	15.09	14.26
22	09.33	07.57	06.20	05.30	03.51	02.54	03.56	05.33	07.03	08.30	09.09	10.15
	15.36	17.16	18.41	21.14	22.50	23.55	22.59	21.16	19.27	17.42	15.07	14.27
23	09.30	07.54	06.16	05.27	03.48	02.54	03.59	05.36	07.05	08.34	09.12	10.15
	15.39	17.20	18.44	21.17	22.53	23.55	22.56	21.13	19.23	17.39	15.04	14.27
24	09.28	07.50	06.13	05.23	03.45	02.55	04.02	05.39	07.08	08.37	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.55	22.53	21.09	19.20	17.36	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.56	04.05	05.42	07.11	07.40	09.18	10.16
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.06	05.16	03.39	02.57	04.08	05.45	07.14	07.43	09.21	10.16
	15.49	17.29	18.53	21.27	23.02	23.54	22.47	21.02	19.13	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.12	05.48	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.30	23.05	23.53	22.44	20.59	19.09	16.26	14.55	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.51	07.20	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.41	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.23	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.52	19.02	16.19	14.50	14.33
30	09.11		06.51	05.03	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.08		06.48		03.25		04.24	05.59		07.59		10.14
	16.05		20.08		23.17		22.31	20.45		16.13		14.37
Potential sun hours	172	238	363	451	568	622	607	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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SHADOW - Calendar per WTG

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest) WTG: 27 - VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (9)

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

	January	February	March	April	May	June	July	August	September	October	November	December
1	10.12	09.04	07.33	06.44	04.59	03.23	03.02	04.27	06.02	07.28	08.01	09.36
	14.39	16.08	17.38	20.11	21.42	23.19	23.48	22.27	20.41	18.55	16.09	14.46
2	10.11	09.01	07.29	06.41	04.56	03.20	03.04	04.31	06.05	07.31	08.05	09.38
	14.41	16.12	17.41	20.13	21.45	23.22	23.47	22.24	20.37	18.51	16.06	14.44
3	10.10	08.58	07.26	06.37	04.52	03.18	03.06	04.34	06.08	07.34	08.08	09.41
	14.43	16.15	17.44	20.16	21.49	23.25	23.45	22.21	20.34	18.48	16.03	14.42
4	10.09	08.55	07.23	06.34	04.49	03.15	03.08	04.37	06.11	07.37	08.11	09.44
	14.45	16.18	17.47	20.19	21.52	23.27	23.44	22.18	20.30	18.44	16.00	14.40
5	10.08	08.52	07.19	06.30	04.45	03.13	03.10	04.40	06.14	07.40	08.14	09.46
	14.47	16.21	17.50	20.22	21.55	23.30	23.42	22.14	20.27	18.41	15.56	14.38
6	10.07	08.49	07.16	06.26	04.42	03.11	03.12	04.43	06.17	07.43	08.17	09.49
	14.50	16.25	17.53	20.25	21.58	23.32	23.40	22.11	20.23	18.37	15.53	14.37
7	10.05	08.46	07.12	06.23	04.39	03.09	03.14	04.46	06.20	07.45	08.21	09.51
	14.52	16.28	17.56	20.28	22.01	23.35	23.38	22.08	20.20	18.34	15.50	14.35
8	10.03	08.43	07.09	06.19	04.35	03.07	03.16	04.49	06.22	07.48	08.24	09.54
	14.54	16.31	17.59	20.31	22.05	23.37	23.36	22.04	20.16	18.30	15.47	14.34
9	10.02	08.40	07.05	06.16	04.32	03.05	03.19	04.53	06.25	07.51	08.27	09.56
	14.57	16.35	18.02	20.34	22.08	23.39	23.34	22.01	20.13	18.27	15.44	14.32
10	10.00	08.36	07.02	06.12	04.29	03.03	03.21	04.56	06.28	07.54	08.30	09.58
	15.00	16.38	18.05	20.37	22.11	23.41	23.31	21.57	20.09	18.23	15.41	14.31
11	09.58	08.33	06.58	06.09	04.25	03.02	03.24	04.59	06.31	07.57	08.34	10.00
	15.02	16.41	18.08	20.40	22.14	23.43	23.29	21.54	20.05	18.20	15.38	14.30
12	09.56	08.30	06.55	06.05	04.22	03.00	03.27	05.02	06.34	08.00	08.37	10.02
	15.05	16.44	18.11	20.43	22.17	23.45	23.27	21.51	20.02	18.16	15.35	14.29
13	09.54	08.27	06.51	06.02	04.19	02.58	03.29	05.05	06.37	08.03	08.40	10.04
	15.08	16.48	18.14	20.46	22.21	23.47	23.24	21.47	19.58	18.13	15.32	14.28
14	09.52	08.23	06.48	05.58	04.16	02.57	03.32	05.08	06.40	08.06	08.43	10.05
	15.11	16.51	18.17	20.49	22.24	23.48	23.21	21.44	19.55	18.10	15.29	14.27
15	09.50	08.20	06.44	05.55	04.12	02.56	03.35	05.11	06.42	08.09	08.47	10.07
	15.14	16.54	18.20	20.52	22.27	23.49	23.19	21.40	19.51	18.06	15.26	14.27
16	09.47	08.17	06.41	05.51	04.09	02.55	03.38	05.14	06.45	08.12	08.50	10.08
	15.17	16.57	18.23	20.55	22.30	23.51	23.16	21.37	19.48	18.03	15.23	14.26
17	09.45	08.13	06.37	05.48	04.06	02.54	03.41	05.17	06.48	08.15	08.53	10.10
	15.20	17.01	18.26	20.59	22.34	23.52	23.13	21.33	19.44	17.59	15.20	14.26
18	09.43	08.10	06.34	05.44	04.03	02.54	03.44	05.20	06.51	08.18	08.56	10.11
	15.23	17.04	18.29	21.02	22.37	23.53	23.11	21.30	19.41	17.56	15.18	14.26
19	09.40	08.07	06.30	05.41	04.00	02.54	03.47	05.23	06.54	08.21	08.59	10.12
	15.26	17.07	18.32	21.05	22.40	23.53	23.08	21.26	19.37	17.52	15.15	14.26
20	09.38	08.03	06.27	05.37	03.57	02.53	03.50	05.26	06.57	08.24	09.03	10.13
	15.29	17.10	18.35	21.08	22.43	23.54	23.05	21.23	19.34	17.49	15.12	14.26
21	09.35	08.00	06.23	05.34	03.54	02.54	03.53	05.29	07.00	08.27	09.06	10.14
	15.32	17.13	18.38	21.11	22.46	23.54	23.02	21.20	19.30	17.46	15.09	14.26
22	09.33	07.57	06.19	05.30	03.51	02.54	03.56	05.32	07.02	08.30	09.09	10.14
	15.36	17.16	18.41	21.14	22.49	23.54	22.59	21.16	19.27	17.42	15.07	14.27
23	09.30	07.53	06.16	05.27	03.48	02.54	03.59	05.36	07.05	08.33	09.12	10.15
	15.39	17.20	18.44	21.17	22.53	23.54	22.56	21.13	19.23	17.39	15.04	14.27
24	09.27	07.50	06.12	05.23	03.45	02.55	04.02	05.39	07.08	08.36	09.15	10.15
	15.42	17.23	18.47	21.20	22.56	23.54	22.53	21.09	19.19	17.36	15.02	14.28
25	09.25	07.47	06.09	05.20	03.42	02.56	04.05	05.41	07.11	07.39	09.18	10.15
	15.45	17.26	18.50	21.23	22.59	23.54	22.50	21.06	19.16	16.32	14.59	14.29
26	09.22	07.43	06.05	05.16	03.39	02.57	04.08	05.44	07.14	07.43	09.21	10.15
	15.48	17.29	18.53	21.26	23.02	23.53	22.47	21.02	19.12	16.29	14.57	14.30
27	09.19	07.40	06.02	05.13	03.36	02.58	04.12	05.47	07.17	07.46	09.24	10.15
	15.52	17.32	18.56	21.29	23.05	23.53	22.43	20.58	19.09	16.26	14.54	14.31
28	09.16	07.36	05.58	05.09	03.33	02.59	04.15	05.50	07.19	07.49	09.27	10.15
	15.55	17.35	18.59	21.33	23.08	23.52	22.40	20.55	19.05	16.22	14.52	14.32
29	09.13		06.55	05.06	03.30	03.00	04.18	05.53	07.22	07.52	09.30	10.15
	15.58		20.02	21.36	23.11	23.51	22.37	20.51	19.02	16.19	14.50	14.33
30	09.10		06.51	05.02	03.28	03.00	04.21	05.56	07.25	07.55	09.33	10.14
	16.02		20.05	21.39	23.14	23.50	22.34	20.48	18.58	16.16	14.48	14.35
31	09.07		06.48		03.25		04.24	05.59		07.58		10.13
	16.05		20.08		23.17		22.31	20.44		16.12		14.37
Potential sun hours	172	238	363	451	568	621	607	508	393	305	199	139
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

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

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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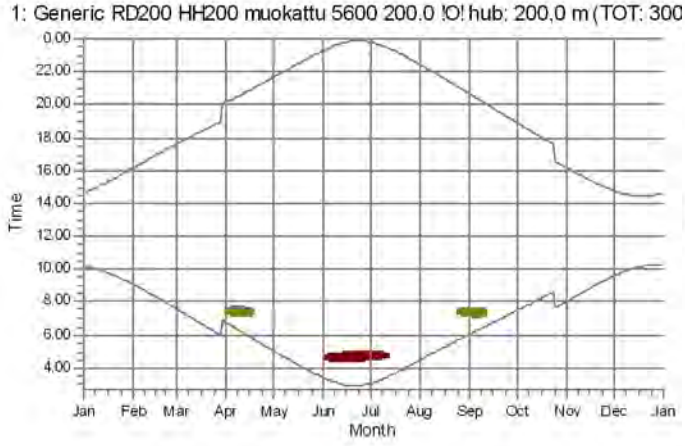
Calculated:
22.11.2023 17.01/3.6.377

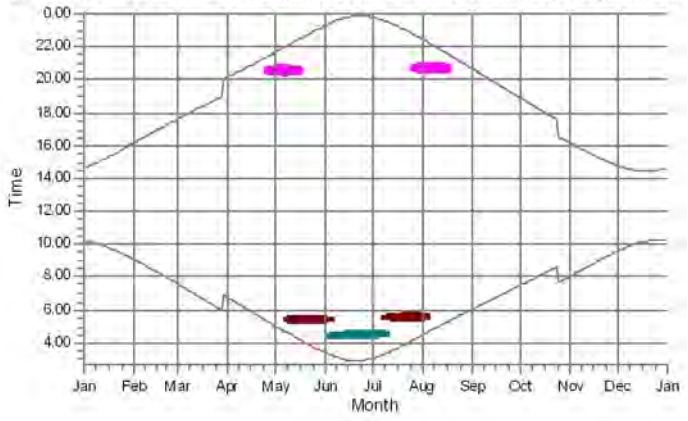
SHADOW - Calendar per WTG, graphical

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)

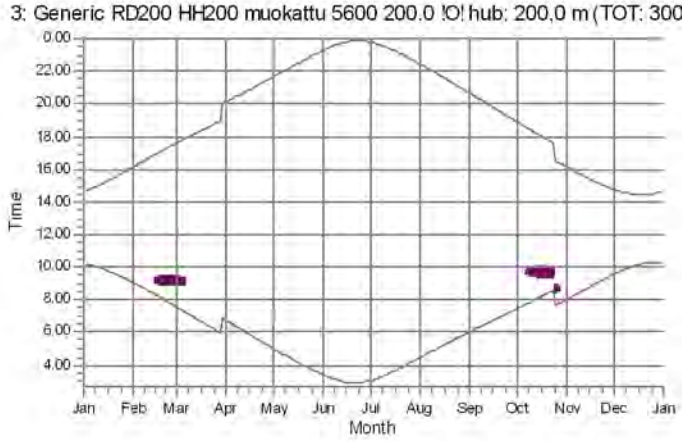
1: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300



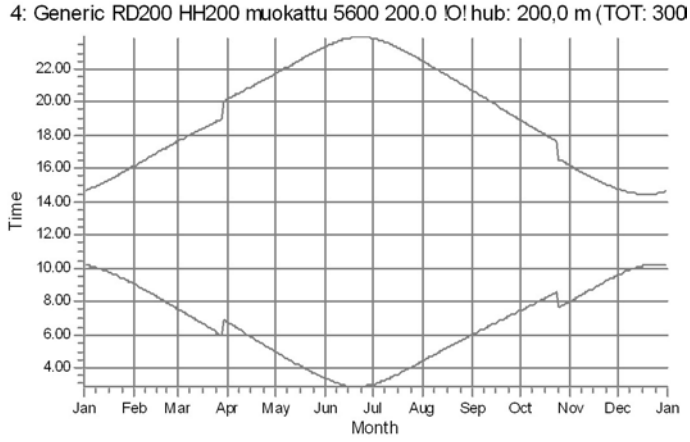
2: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300



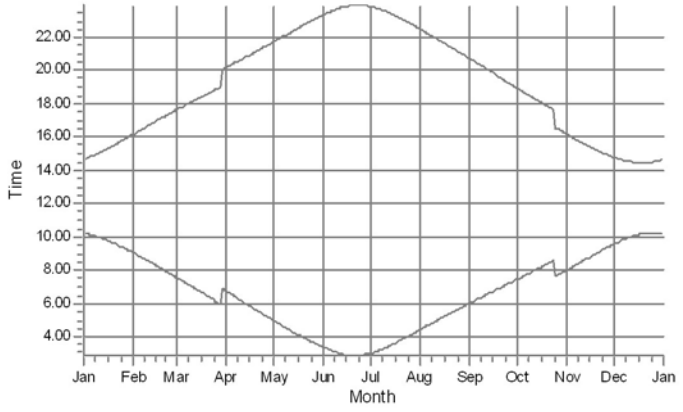
3: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300



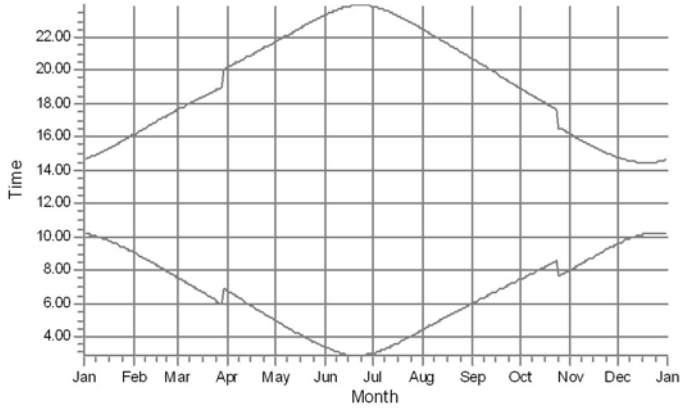
4: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300



5: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300



6: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300



Shadow receptors

- E: Muu rakennus E (Noppala)
- F: Asuinrakennus F (Maijannevantie)
- H: Asuinrakennus H (Hietasaari)
- J: Lomarakennus J (Junno)
- K: Lomarakennus K (Isomännikkö)

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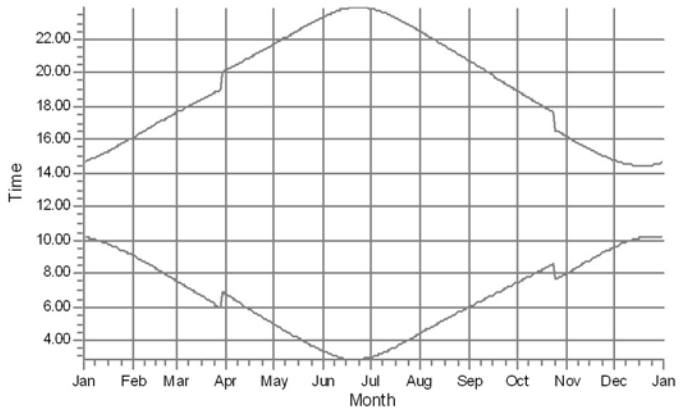
Calculated:
22.11.2023 17.01/3.6.377

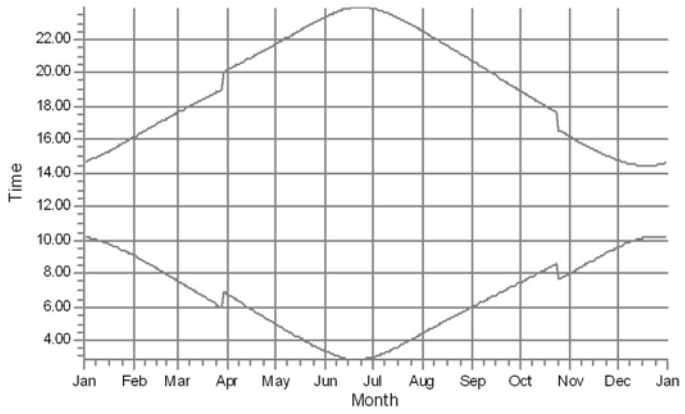
SHADOW - Calendar per WTG, graphical

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)

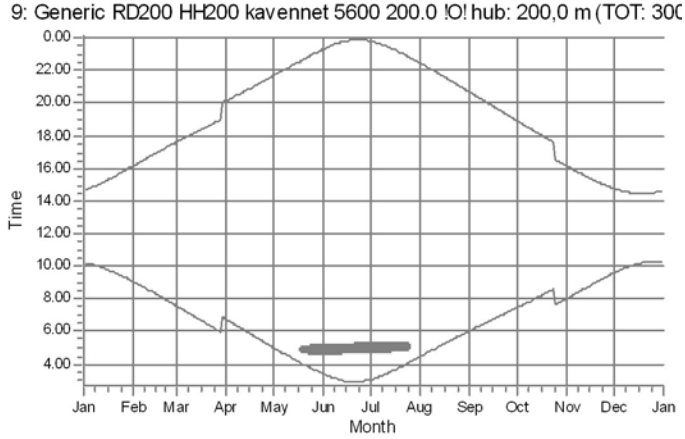
7: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300



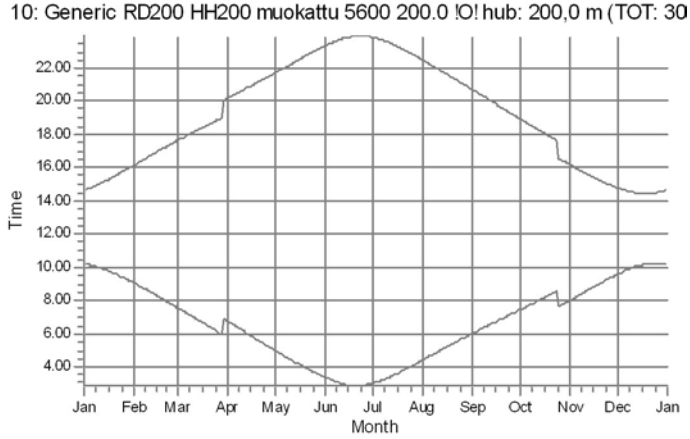
8: Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300



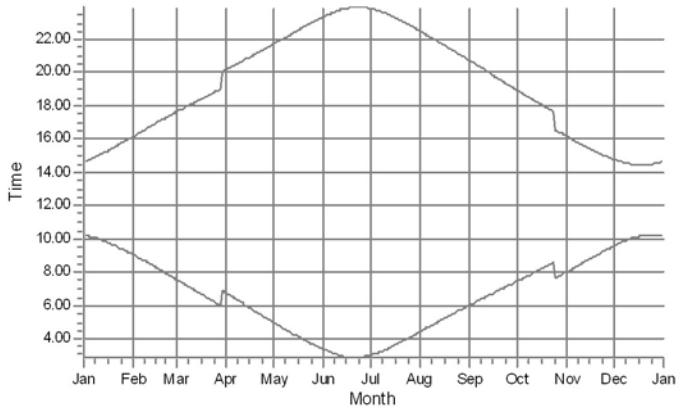
9: Generic RD200 HH200 kavennet 5600 200.0 !O! hub: 200,0 m (TOT: 300



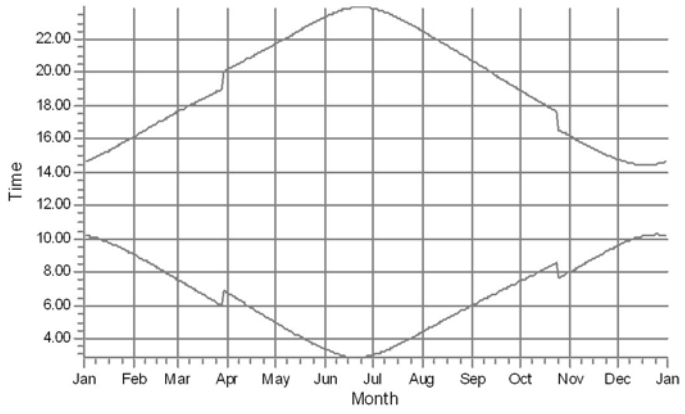
10: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 30



11: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 30



12: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 30



Shadow receptors

D: Asuinrakennus D (Noppala)

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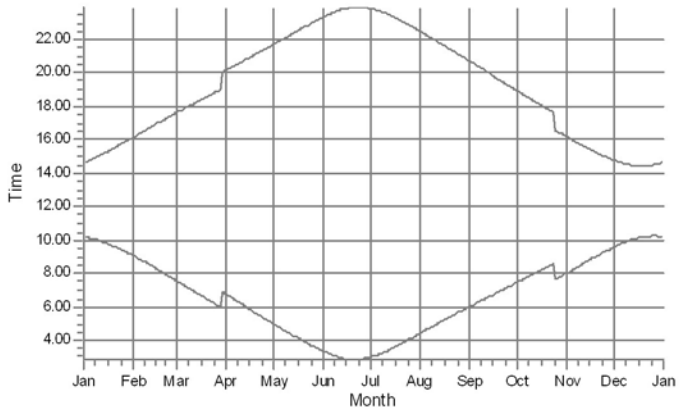
Calculated:
22.11.2023 17.01/3.6.377

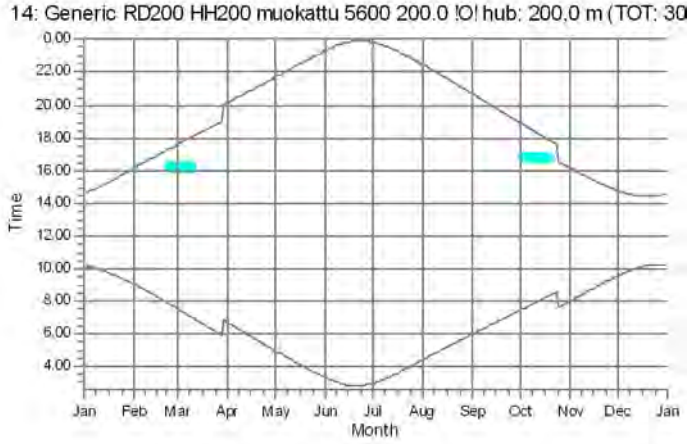
SHADOW - Calendar per WTG, graphical

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)

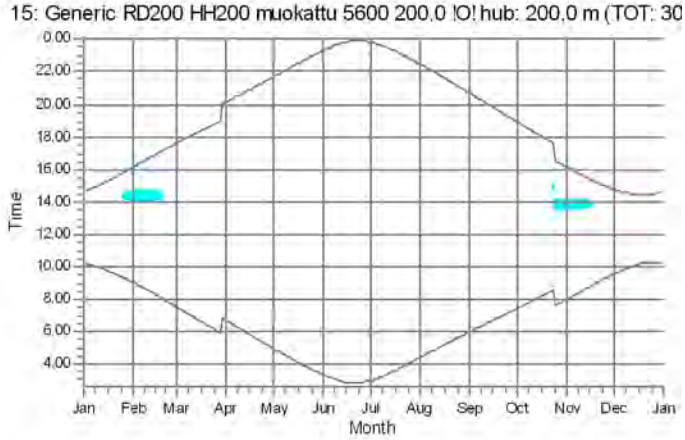
13: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 30



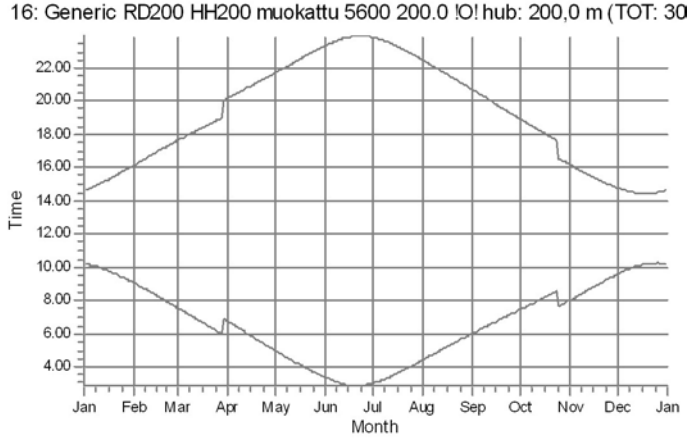
14: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 30



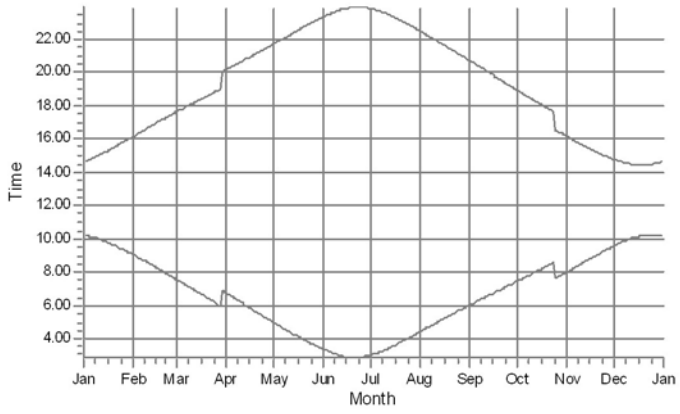
15: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 30



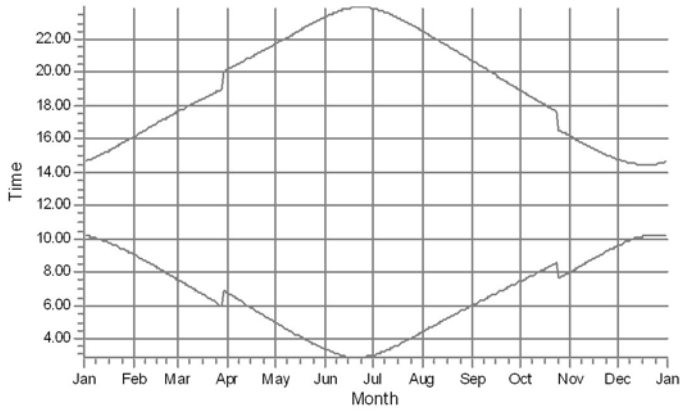
16: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 30



17: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 30



18: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 30



Shadow receptors

M: Asuinrakennus M (Latvala)

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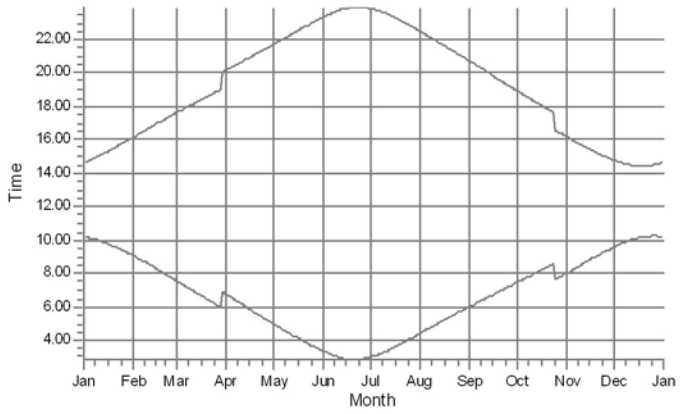
Calculated:
22.11.2023 17.01/3.6.377

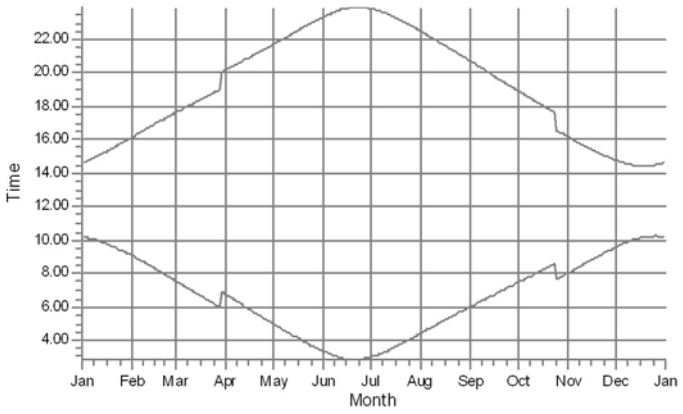
SHADOW - Calendar per WTG, graphical

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)

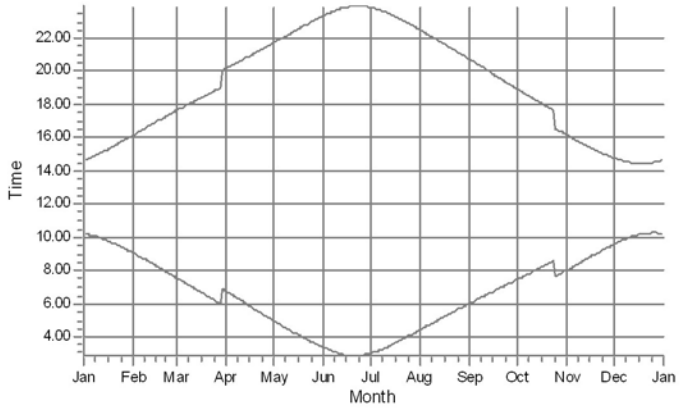
19: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



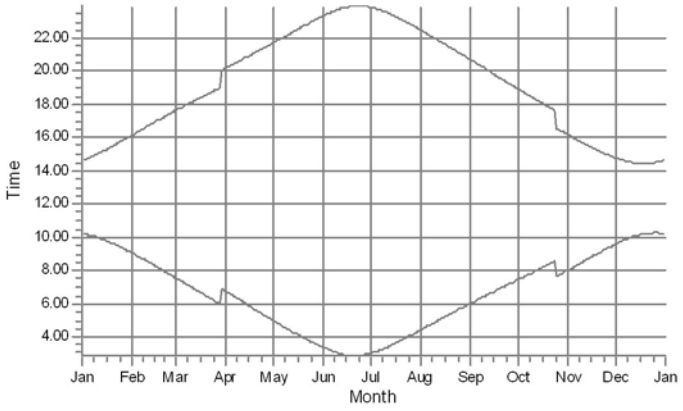
20: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



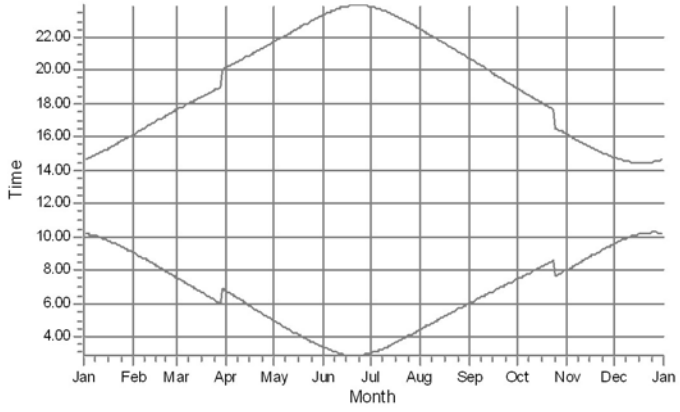
21: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



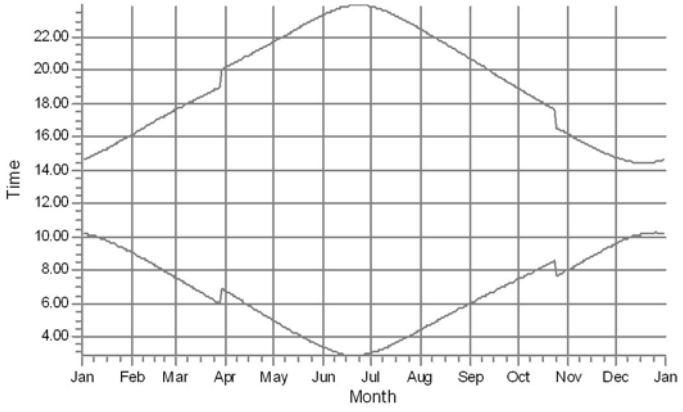
22: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



23: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



24: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



Shadow receptors

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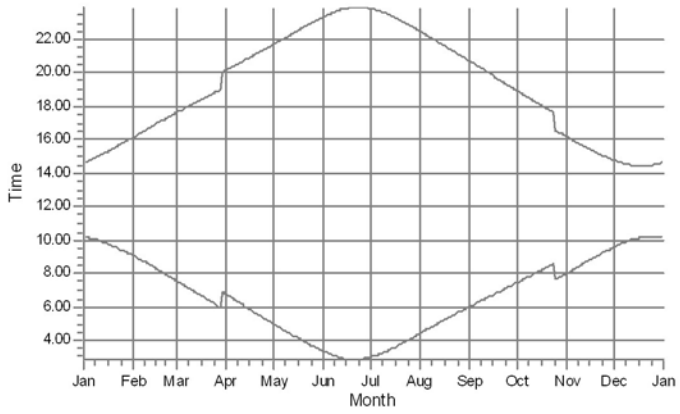
Calculated:
22.11.2023 17.01/3.6.377

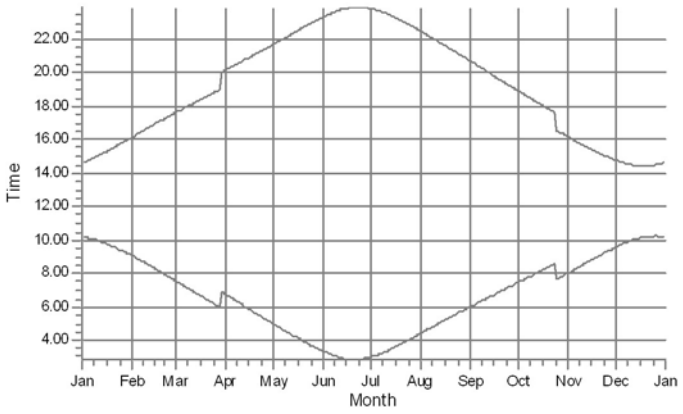
SHADOW - Calendar per WTG, graphical

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)

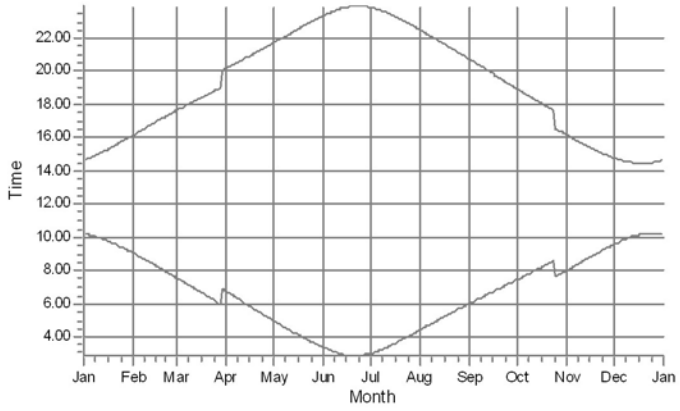
25: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



26: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



27: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



Shadow receptors

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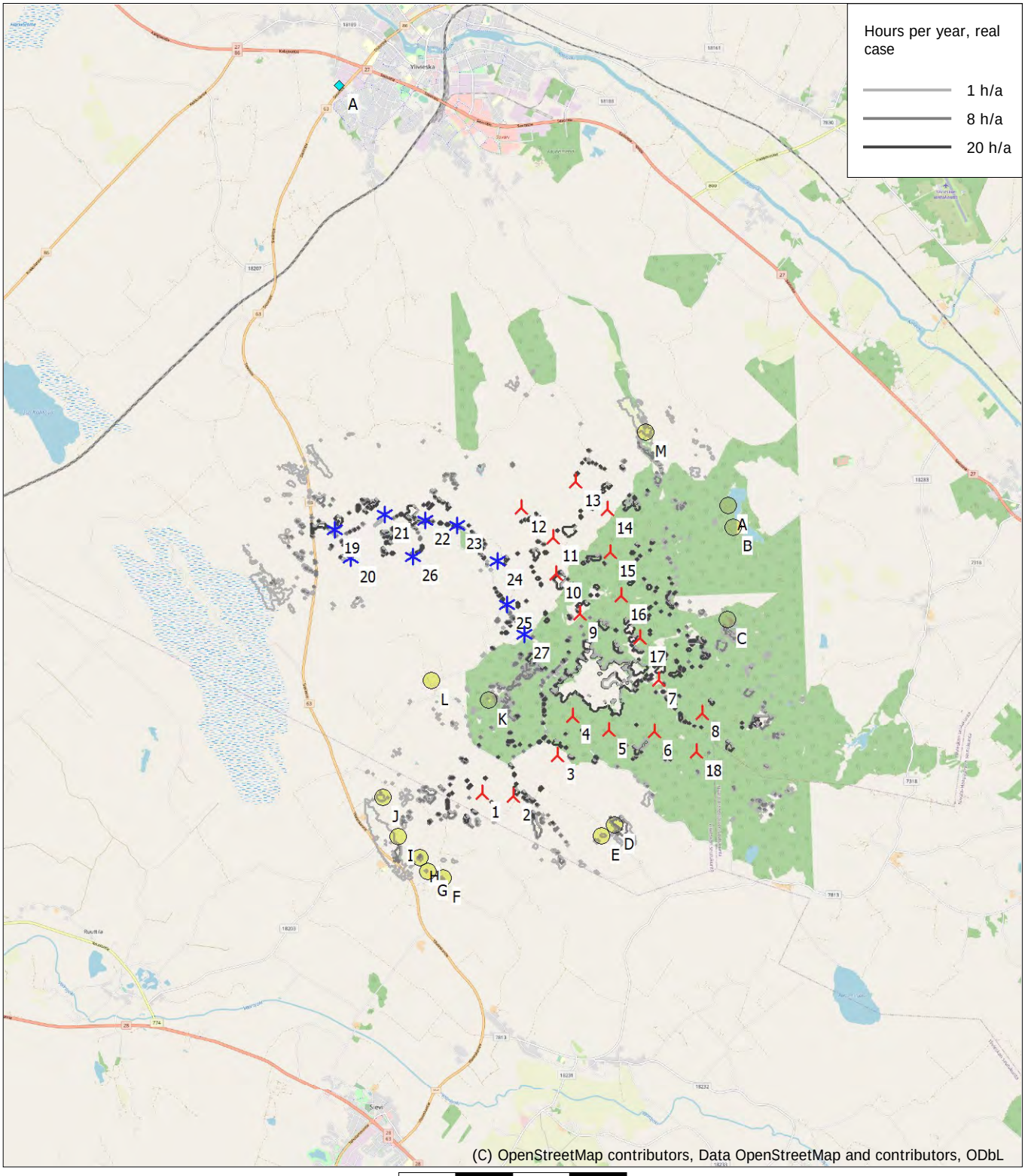
Calculated:
22.11.2023 17.01/3.6.377

SHADOW - Map

Calculation: Shadow_Pajukoski II VE1_RD200x18xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)



Map: EMD OpenStreetMap , Print scale 1:100 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 381 270 North: 7 098 650

New WTG Existing WTG Obstacle Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_Pajukoski tv-hanke_0.wpo (5)

Time step: 4 minutes, Day step: 14 days, Map resolution: 30 m, Visibility resolution: 15 m, Eye height: 1,5 m

Liite 15: Pajukoski II tuulivoimahanke – varjostusmallinnuksen tulokset ”real case, Luke forest” (VE2).

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Calculated:
22.11.2023 16.55/3.6.377

SHADOW - Main Result

Calculation: Shadow_Pajukoski II VE2_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)

Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

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

Sunshine probability S (Average daily sunshine hours) [LULEA]

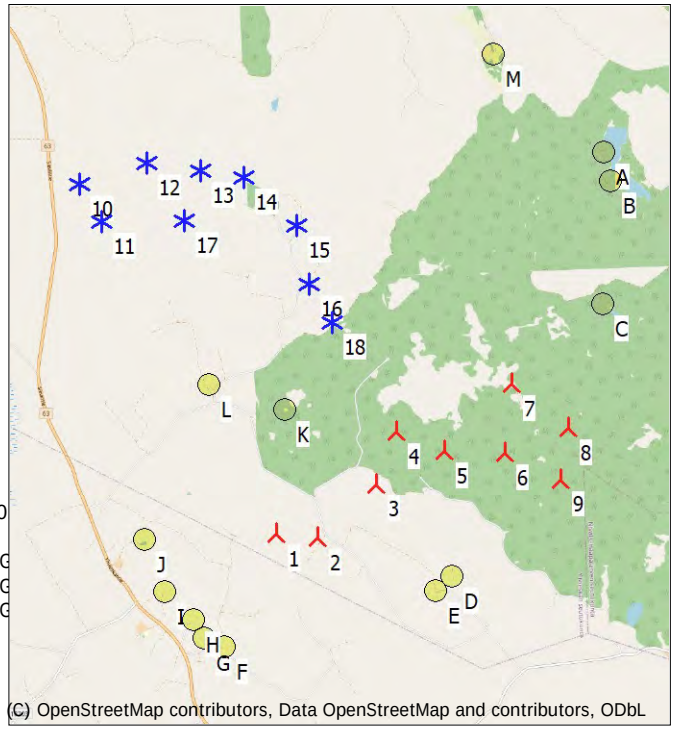
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
564	412	414	434	580	826	955	1 032	927	759	646	672	8 221

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: CONTOURLINE_Pajukoski tv-hanke_0
Area object(s) used in calculation:
Area object (Heights a.g.l. for e.g. Forest (ORA tool) or ZVI obstructions): REC
Area object (Heights a.g.l. for e.g. Forest (ORA tool) or ZVI obstructions): REC
Area object (Heights a.g.l. for e.g. Forest (ORA tool) or ZVI obstructions): REC
Area object (SE): (7)
Obstacles used in calculation
Receptor grid resolution: 1,0 m

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



(C) OpenStreetMap contributors, Data OpenStreetMap and contributors, ODbL

Scale 1:100 000

New WTG Existing WTG Shadow receptor

WTGs

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	380 209	7 094 637	107,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
2	380 766	7 094 564	106,8	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
3	381 556	7 095 242	112,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
4	381 855	7 095 926	117,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
5	382 487	7 095 665	119,8	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
6	383 284	7 095 590	122,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
7	383 404	7 096 507	124,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
8	384 145	7 095 898	110,0	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
9	384 021	7 095 208	112,5	Generic RD200 HH20...	No	Generic	RD200 HH200 muokattu-5 600	5 600	200,0	200,0	2 086	10,4
10	377 791	7 099 387	87,5	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
11	378 057	7 098 862	90,0	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
12	378 683	7 099 618	85,9	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
13	379 394	7 099 490	94,6	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
14	379 949	7 099 376	100,0	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
15	380 638	7 098 723	105,0	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
16	380 775	7 097 932	105,0	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
17	379 139	7 098 839	92,5	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8
18	381 062	7 097 401	107,5	VESTAS V126-3.3 Gri...	Yes	VESTAS	V126-3.3 GridStreame-3 300	3 300	126,0	137,0	1 718	12,8

Shadow receptor-Input

No.	Name	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]
A	Lomarakennus A (Lampinjärvi)	384 750	7 099 539	90,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
B	Lomarakennus B (Lampinkallio)	384 818	7 099 152	93,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
C	Lomarakennus C (Latvalampi)	384 650	7 097 533	96,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
D	Asuinrakennus D (Noppala)	382 520	7 093 979	105,2	5,0	5,0	1,0	90,0	"Green house mode"	6,0
E	Muu rakennus E (Noppala)	382 290	7 093 807	109,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
F	Asuinrakennus F (Maijannevantie)	379 455	7 093 166	96,2	5,0	5,0	1,0	90,0	"Green house mode"	6,0

To be continued on next page...

SHADOW - Main Result

Calculation: Shadow_Pajukoski II VE2_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)

...continued from previous page

No.	Name	East	North	Z [m]	Width [m]	Height [m]	Elevation a.g.l. [m]	Slope of window [°]	Direction mode	Eye height (ZVI) a.g.l. [m]
G	Asuinrakennus G (Maijannevantie)	379 203	7 093 300	92,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0
H	Asuinrakennus H (Hietasaari)	379 076	7 093 530	92,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
I	Asuinrakennus I (Lahdenperä)	378 699	7 093 923	88,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
J	Lomarakennus J (Junno)	378 456	7 094 615	89,4	5,0	5,0	1,0	90,0	"Green house mode"	6,0
K	Lomarakennus K (Isomännikkö)	380 394	7 096 271	106,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
L	Asuinrakennus L (Malkasaari)	379 392	7 096 642	100,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0
M	Asuinrakennus M (Latvala)	383 344	7 100 875	82,6	5,0	5,0	1,0	90,0	"Green house mode"	6,0

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values: Shadow hours per year [h/year]
A	Lomarakennus A (Lampinjärvi)	0:00
B	Lomarakennus B (Lampinkallio)	0:00
C	Lomarakennus C (Latvalampi)	0:00
D	Asuinrakennus D (Noppala)	7:47
E	Muu rakennus E (Noppala)	5:01
F	Asuinrakennus F (Maijannevantie)	3:19
G	Asuinrakennus G (Maijannevantie)	0:00
H	Asuinrakennus H (Hietasaari)	9:21
I	Asuinrakennus I (Lahdenperä)	0:00
J	Lomarakennus J (Junno)	2:55
K	Lomarakennus K (Isomännikkö)	2:55
L	Asuinrakennus L (Malkasaari)	0:00
M	Asuinrakennus M (Latvala)	0:00

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

No.	Name	Expected [h/year]
1	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (190)	6:48
2	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (191)	13:48
3	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (192)	2:55
4	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (193)	0:00
5	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (194)	0:00
6	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (195)	0:00
7	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (196)	0:00
8	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (197)	0:00
9	Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (198)	7:47
10	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (1)	0:00
11	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (2)	0:00
12	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (3)	0:00
13	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (4)	0:00
14	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (5)	0:00
15	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (6)	0:00
16	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (7)	0:00
17	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (8)	0:00
18	VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 200,0 m) (9)	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.

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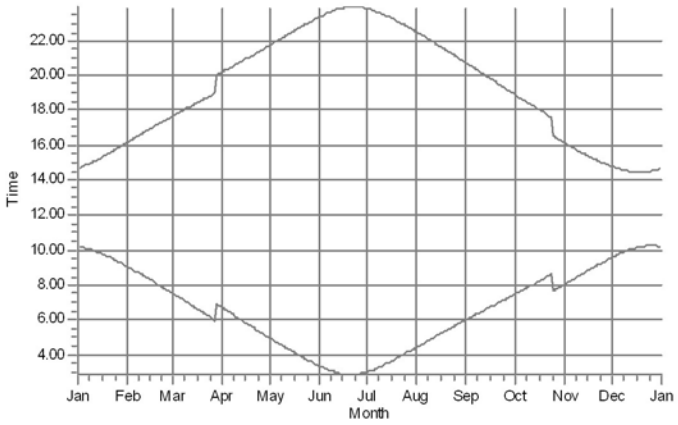
Calculated:
22.11.2023 16.55/3.6.377

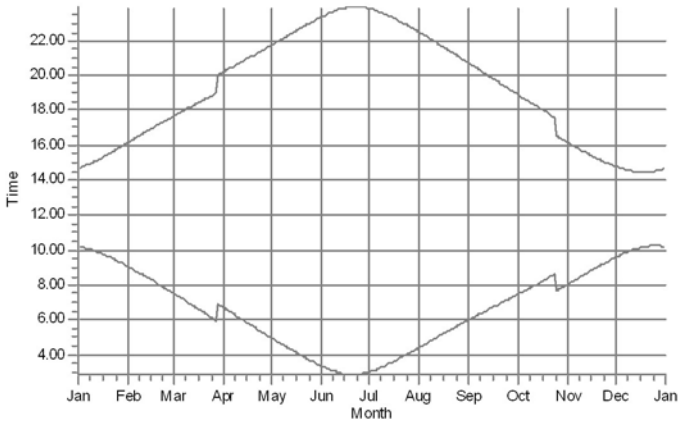
SHADOW - Calendar, graphical

Calculation: Shadow_Pajukoski II VE2_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)

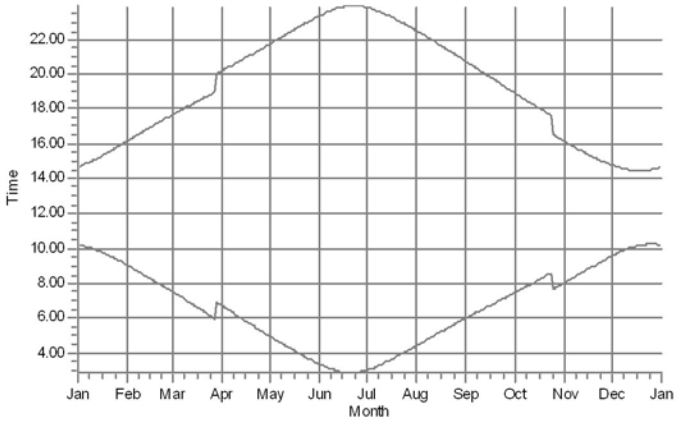
A: Lomarakennus A (Lampinjärvi)



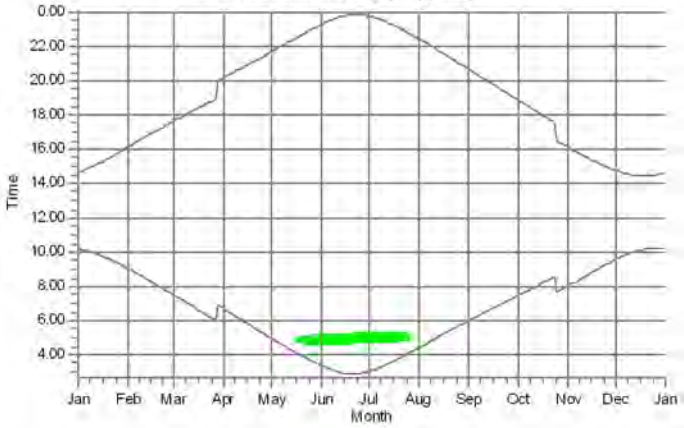
B: Lomarakennus B (Lampinkallio)



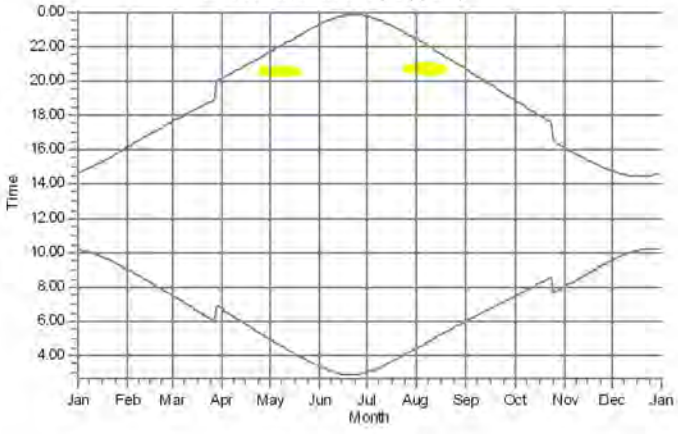
C: Lomarakennus C (Latvalampi)



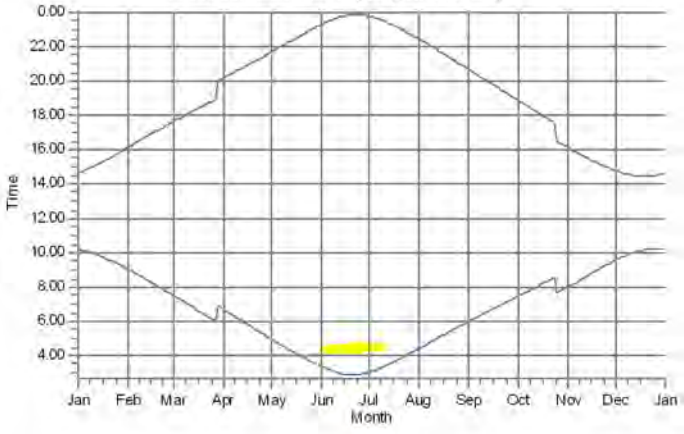
D: Asuinrakennus D (Noppala)



E: Muu rakennus E (Noppala)



F: Asuinrakennus F (Maijannevantie)



WTGs

2: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (191)

9: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (198)

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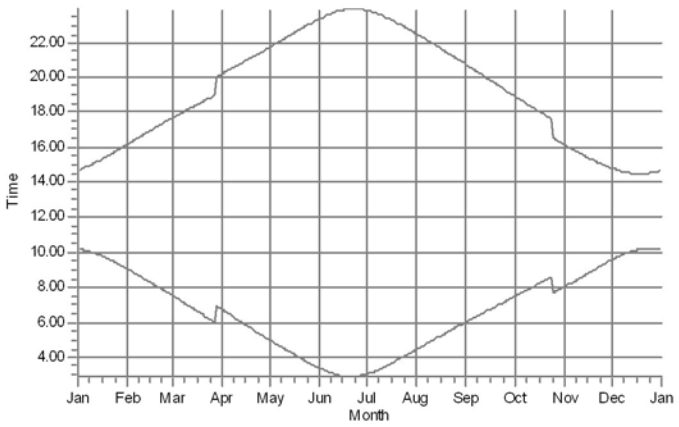
Calculated:
22.11.2023 16.55/3.6.377

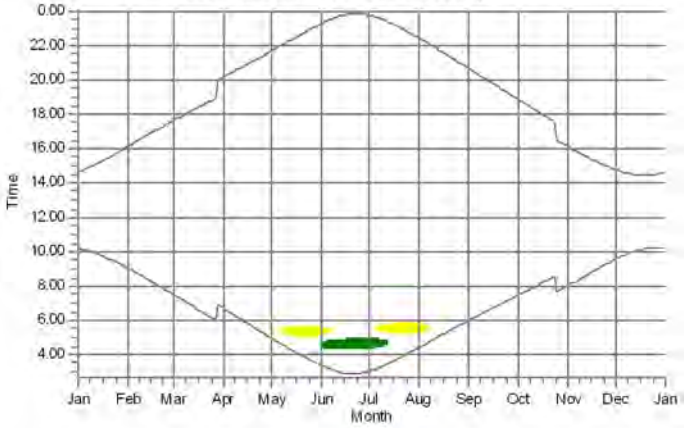
SHADOW - Calendar, graphical

Calculation: Shadow_Pajukoski II VE2_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)

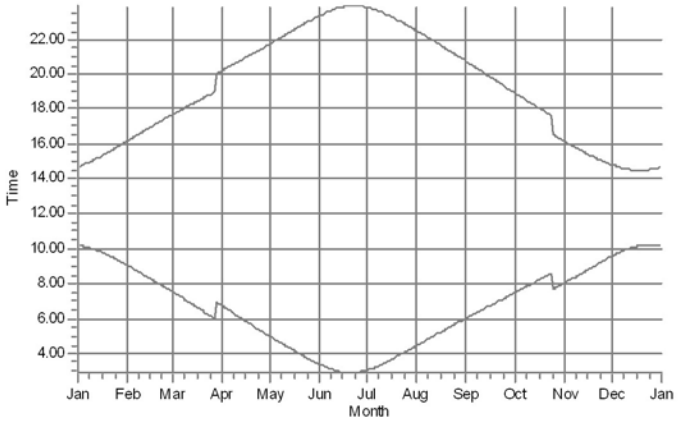
G: Asuinrakennus G (Maijannevantie)



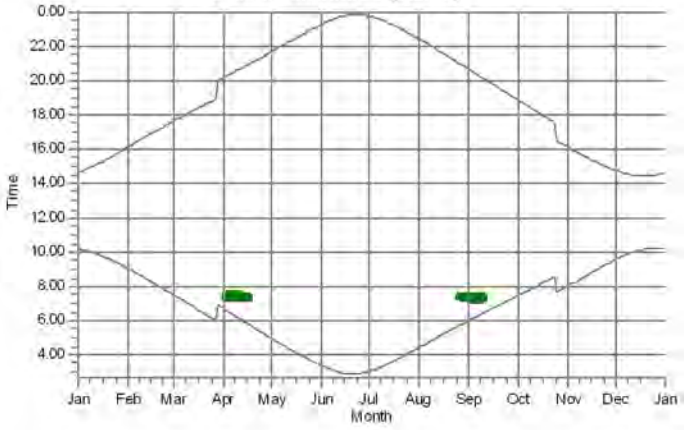
H: Asuinrakennus H (Hietasaari)



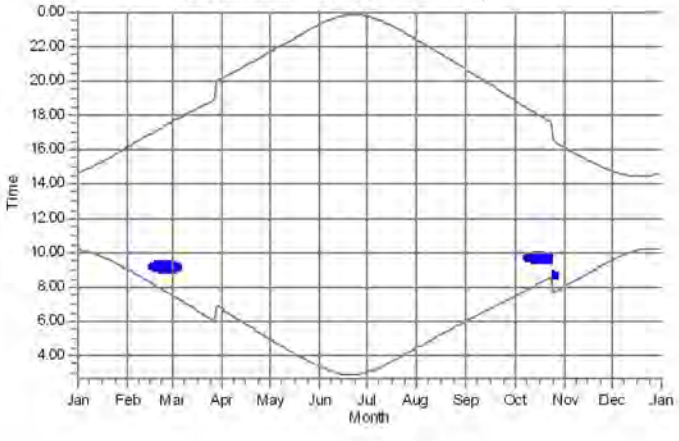
I: Asuinrakennus I (Lahdenperä)



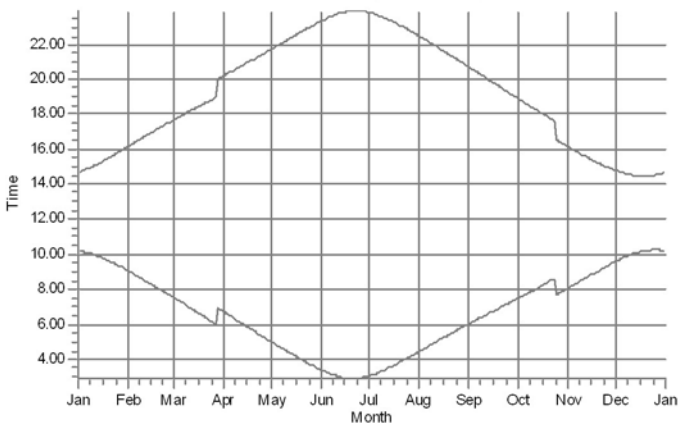
J: Lomarakennus J (Junno)



K: Lomarakennus K (Isomännikkö)



L: Asuinrakennus L (Malkasaari)



WTGs

1: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (190)

2: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (191)

3: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (192)

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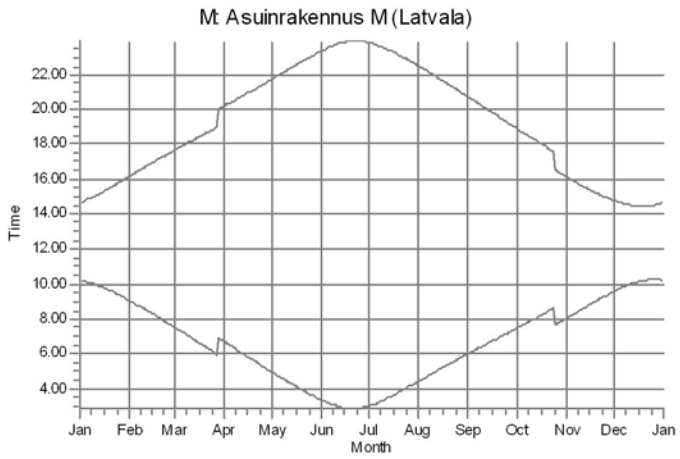
SHADOW - Calendar, graphical

Calculation: Shadow_Pajukoski II VE2_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)



WTGs

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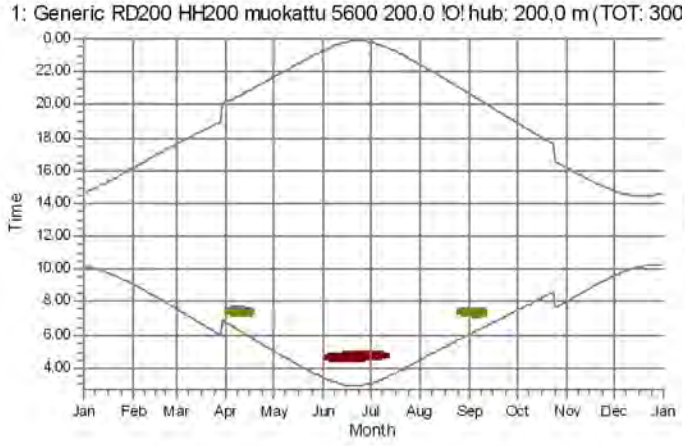
Calculated:
22.11.2023 16.55/3.6.377

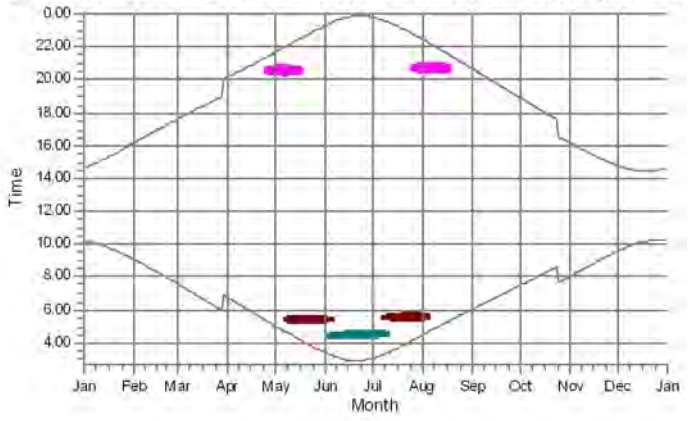
SHADOW - Calendar per WTG, graphical

Calculation: Shadow_Pajukoski II VE2_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)

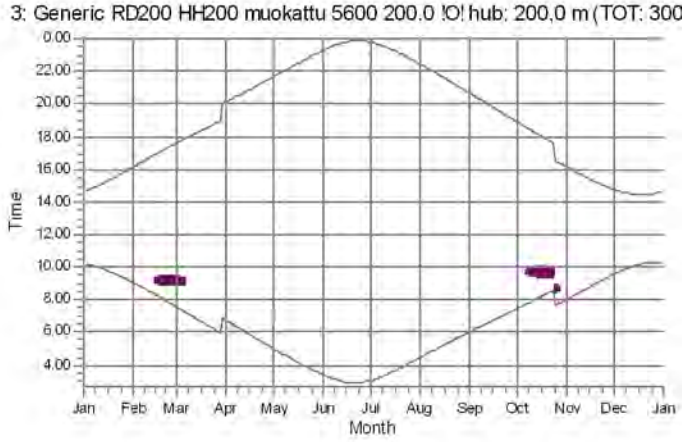
1: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300



2: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300



3: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300



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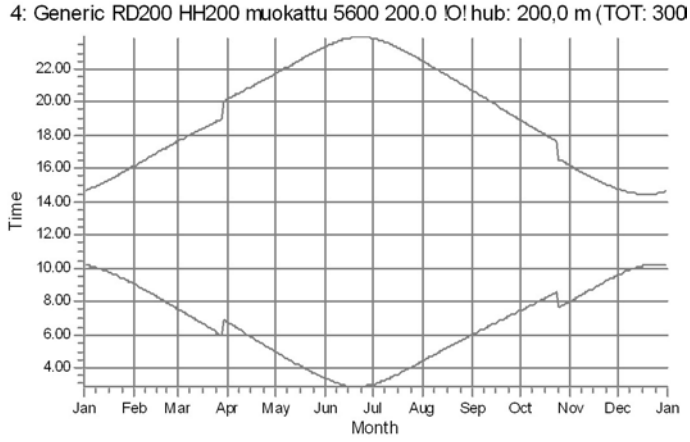
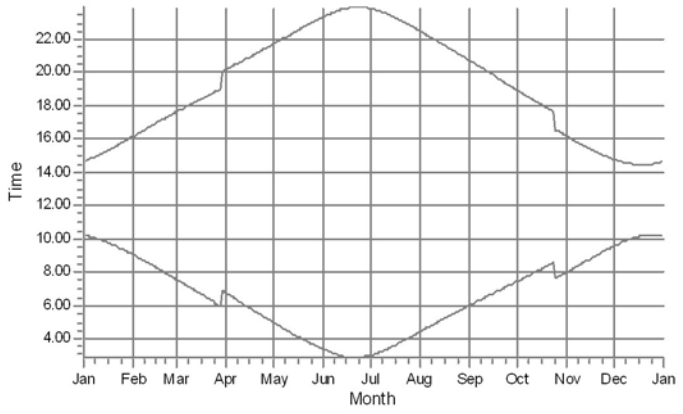
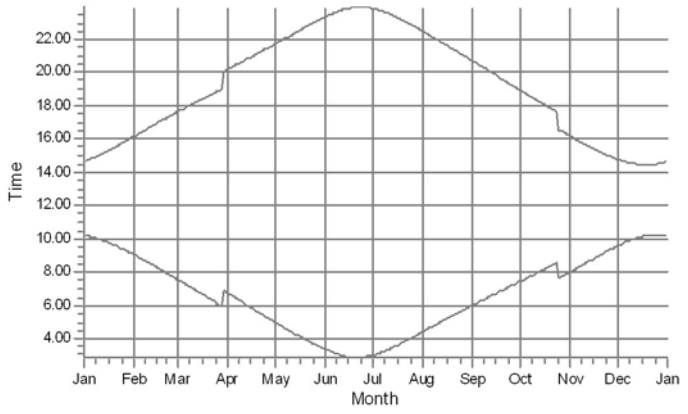


5: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300



6: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300



Shadow receptors

- E: Muu rakennus E (Noppala)
- F: Asuinrakennus F (Maijannevantie)
- H: Asuinrakennus H (Hietasaari)
- J: Lomarakennus J (Junno)
- K: Lomarakennus K (Isomännikkö)

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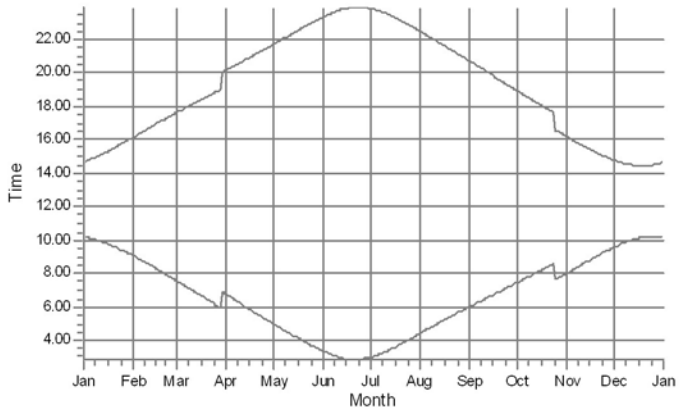
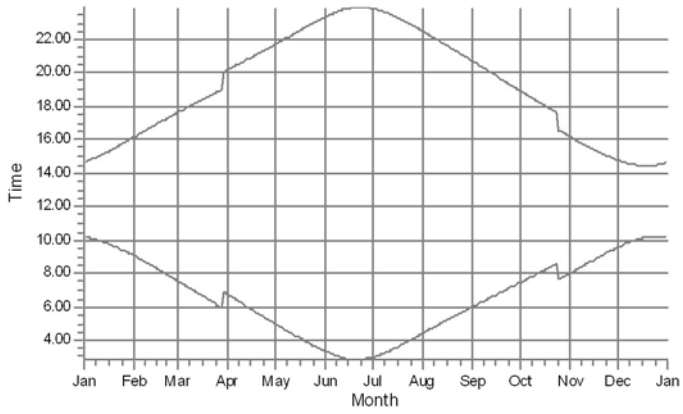
SHADOW - Calendar per WTG, graphical

Calculation: Shadow_Pajukoski II VE2_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)

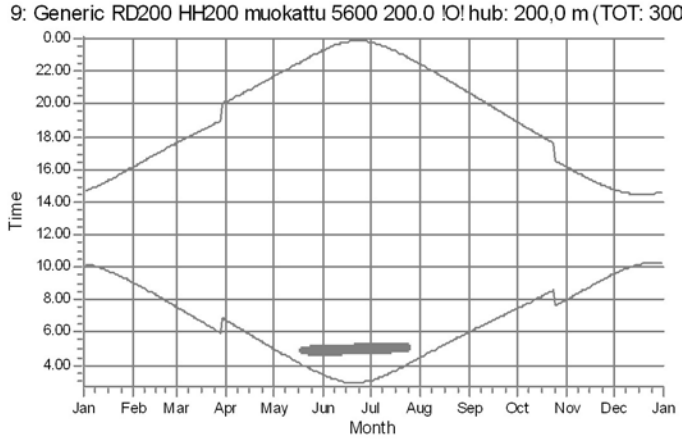
7: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300



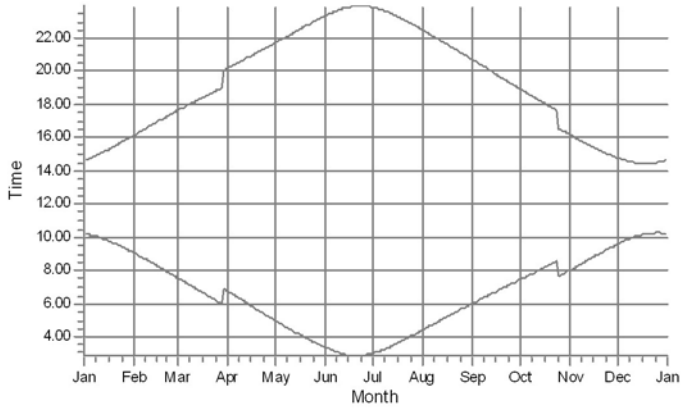
8: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300



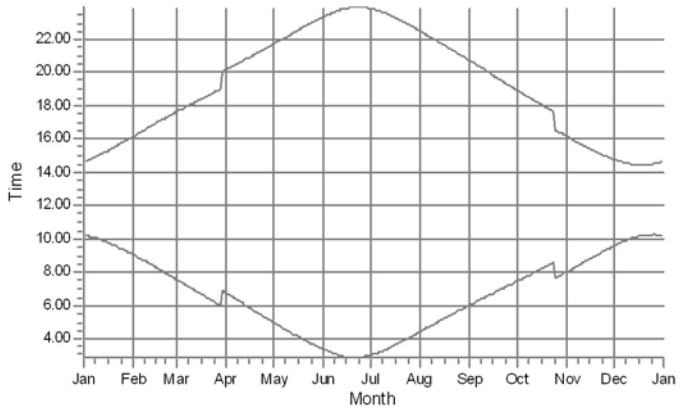
9: Generic RD200 HH200 muokattu 5600 200.0 !O! hub: 200,0 m (TOT: 300



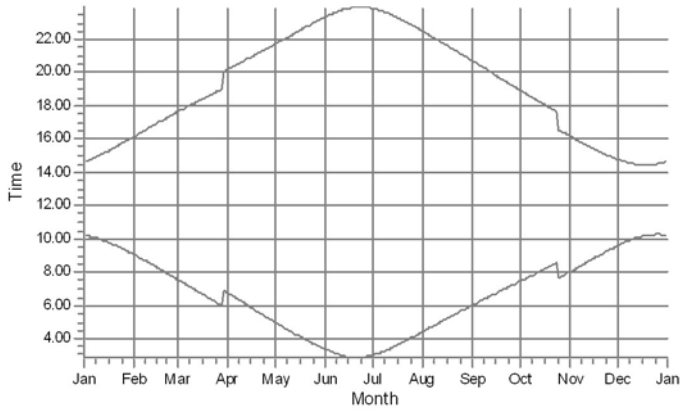
10: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



11: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



12: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



Shadow receptors

D: Asuinrakennus D (Noppala)

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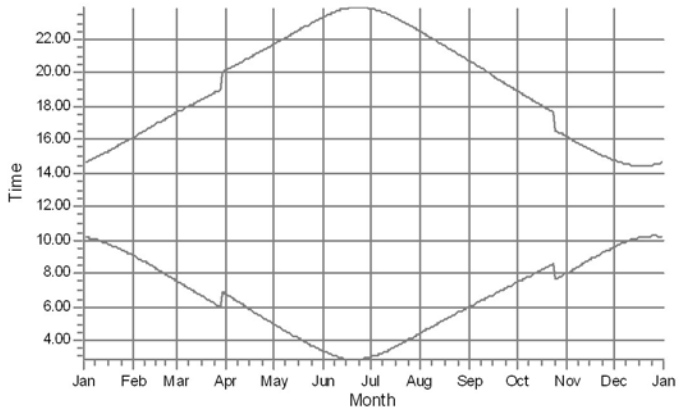
Calculated:
22.11.2023 16.55/3.6.377

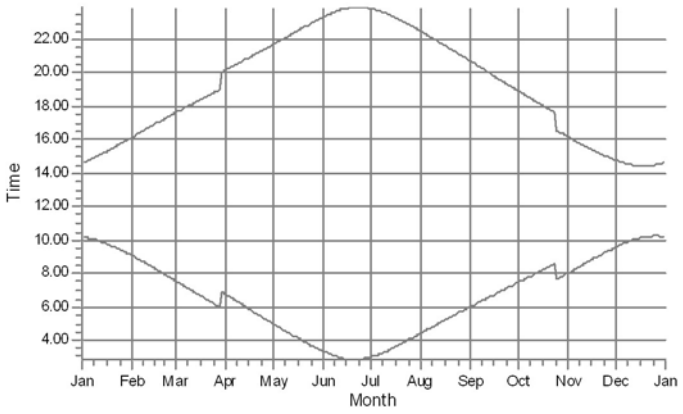
SHADOW - Calendar per WTG, graphical

Calculation: Shadow_Pajukoski II VE2_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)

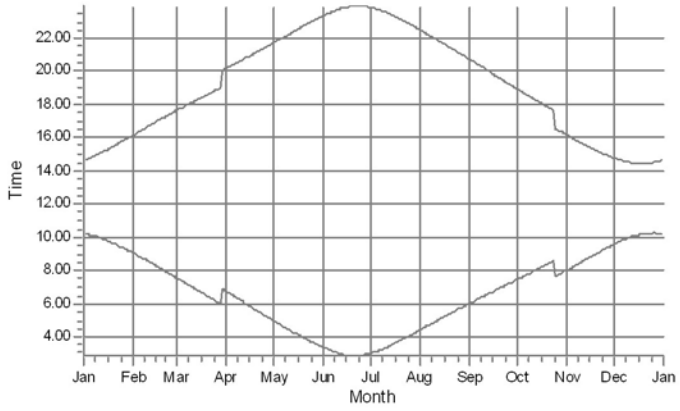
13: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



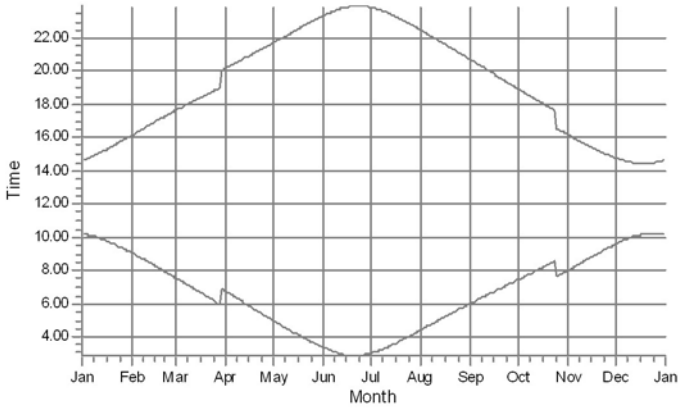
14: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



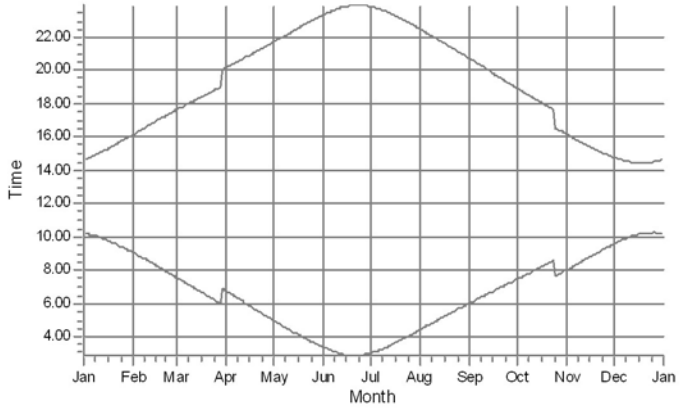
15: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



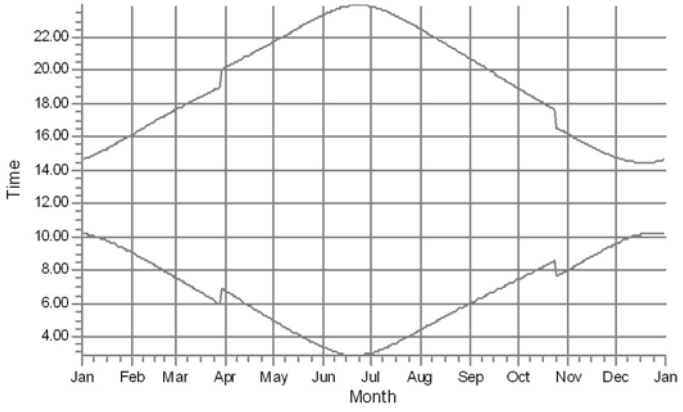
16: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



17: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



18: VESTAS V126-3.3 GridStreame 3300 126.0 !O! hub: 137,0 m (TOT: 20



Shadow receptors

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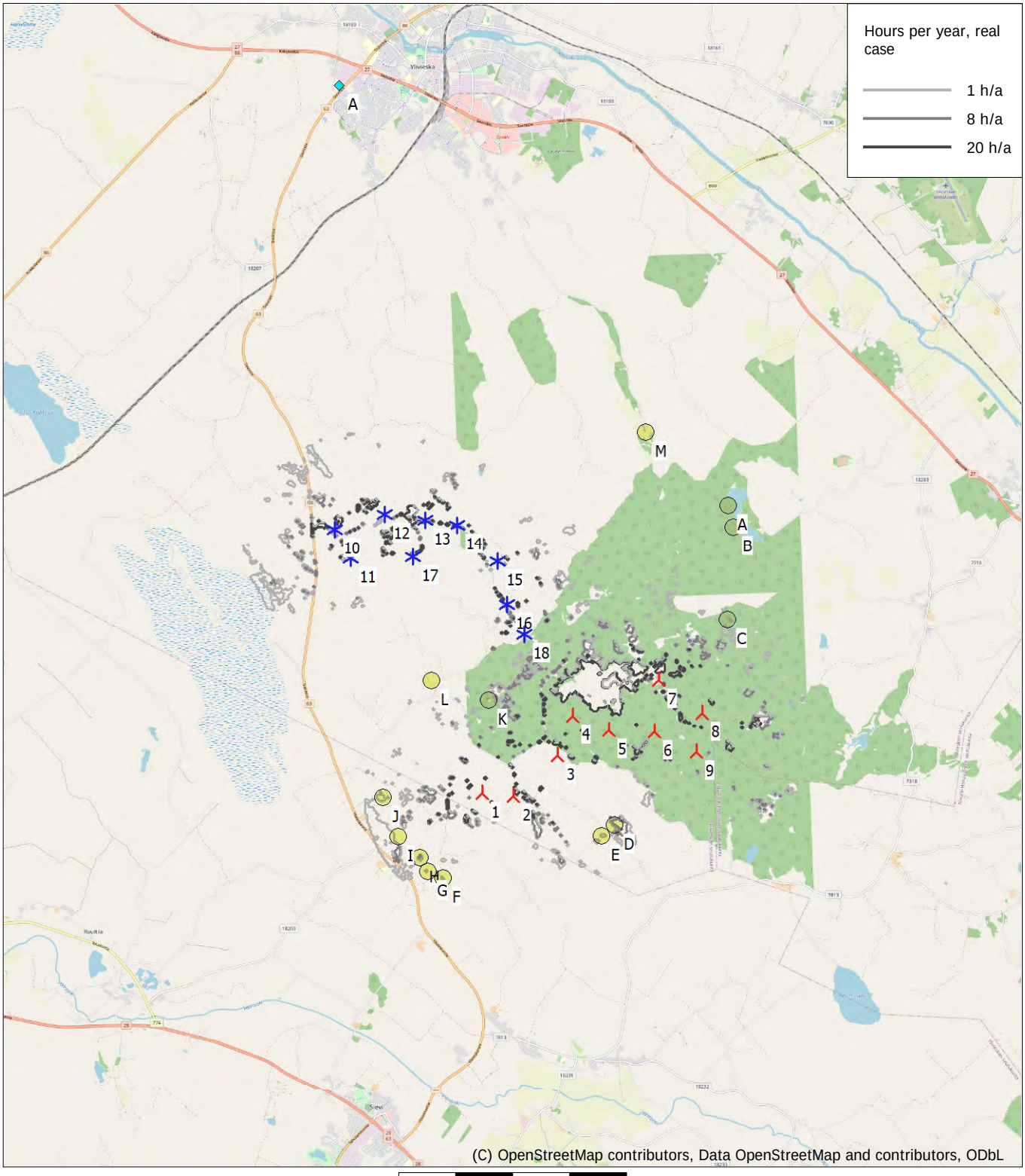
Henna-Riikka Rintamäki / henna-riikka.rintamaki@fcg.fi
Calculated:
22.11.2023 16.55/3.6.377

SHADOW - Map

Calculation: Shadow_Pajukoski II VE2_RD200x9xHH200_20230215_YV Pajukoski I V126 3,3MWx9xHH137 (real case, Luke forest)



Map: EMD OpenStreetMap , Print scale 1:100 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 381 270 North: 7 098 650

New WTG Existing WTG Obstacle Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_Pajukoski tv-hanke_0.wpo (5)

Time step: 4 minutes, Day step: 14 days, Map resolution: 30 m, Visibility resolution: 15 m, Eye height: 1,5 m