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# Vuorimäen tuulivoimapuisto, Iisalmi

Melu- ja varjostusmallinnusraportti

**ABO**  
**WIND**

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7.6.2024

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# Vuorimäen tuulivoimapuisto, Iisalmi

## 1 MELU- JA VARJOSTUSMALLINNUKSEN TAVOITTEET

ABO Wind Oy suunnittelee Vuorimäen tuulivoimapuistoa Iisalmen kaupungin länsiosaan Pielaveden ja Kiuruveden rajalle. Tuulivoimahankkeen aiheuttamia melu- ja varjostusvaikutuksia on arvioitu laadullisella mallinnuksella tuulivoimaloiden aiheuttamista äänenpainetasoista ja varjostuksista. Mallinnuksen tavoitteena on osoittaa, kuinka laajalle alueelle kyseiset vaikutukset ulottuvat ja arvioida vaikutukset lähiseudun ympärivuotiselle ja vapaa-ajan asutukselle.

Tuulivoimaloiden aiheuttamia melu- ja varjostusvaikutuksia on arvioitu WindPRO-ohjelmalla tuulivoimamaosayleiskaavan ehdotusvaiheen voimaloiden sijoitussuunnitelman mukaisesti. Melu- ja varjostusmallinnukset on laatinut Henri Korhonen FCG Finnish Consulting Group Oy:stä. Laaduntarkastuksen on tehnyt Henna-Riikka Rintamäki (FCG).

## 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 suhteellisenä kosteutena 70 % ja maanpinnan kovuutena arvoa 0,4. Laskenta on tehty 4,0 m maan pinnan tasosta (Taulukko 3).

Mallinnuksissa käytetty voimalamäärä on yhteensä 17 kpl. Tuulivoimaloiden äänenpainetasot on mallinnettu hankevaihtoehdoissa käyttäen V172-7,2 MW voimalaitosta, jossa on ääntä vaimentavat sahalaitasiivet (Taulukko 1). Voimalaitosten napakorkeutena on käytetty 214 metriä, jolloin voimalaitosten kokonaiskorkeudeksi muodostuu 300 metriä. V172-7,2 MW voimalaitoksen valmistajan ilmoittama tuulivoimalan tuottama äänitehotaso on 106,9 dB(A) ja siihen on hankevastaavan pyynnöstä lisätty 2 dB(A) varmuusarvoksi.

Melumallinnusten laskentatuloksia on havainnollistettu ns. keskiäänitasokarttojen avulla. Keskiäänitasokartoissa on melun keskiäänitaso- eli ekvivalenttiäänitasokäyrät (L<sub>Aeq</sub>) 5 dB välein.

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Taulukko 1. Vuorimäen tuulivoimahankkeen mallinnusohjelma ja tuulivoimaloiden äänitehotasot voimalaitoksella V172-7,2 MW sekä melun erityispiirteet.

MALLINNUSOHJELMANTIEDOT							
Mallinnusohjelma ja versio: WindPRO version 3.6				Mallinnusmenetelmä: ISO 9613-2			
TUULIVOIMALOIDEN TIEDOT							
Tuulivoimalan valmistaja: Vestas				Tyyppi: V172 – 7,2 MW		Sarjanumero/t:-	
Nimellisteho: 7,2 MW		Napakorkeus: 214 m		Roottorinhalkaisija: 172 m		Tornin tyyppi: teräs/hybridi	
Mahdollisuudet vaikuttaa tuulivoimalan melupäästöön käytön aikana ja sen vaikutus meluun							
Lapakulman säätö		Pyörimisnopeus		Muu, mikä: PO7200 (STE)			
Kyllä	dB	Kyllä	dB	Noise mode säätö:		Kyllä	
Ei		Ei		Noise mode, lähtömelutaso		106,9 dB(A) + 2 dB (A)	
AKUSTISET TIEDOT/LASKENNA LÄHTÖTIEDOT							
Third octave noise emission V172-7.2MW 50/60 Hz Document no 0128-4336_00 Lähtömelutasoon on lisätty varmuusarvoksi 2 dB(A), asiakkaan pyynnöstä.							
Oktaaveittain [Hz], dB(A)		1/3-oktaaveittain [Hz], dB(A)					
		12,5	53	125,0	95,2	1250,0	95,9
62,5	92,4	16,0	58,6	160,0	96,8	1600,0	94,4
125	100	20	63,7	200,0	98	2000,0	92,4
250	103,3	25	68,9	250,0	98,6	2500,0	90,1
500	103,5	31,5	73,8	315,0	98,8	3150,0	87,5
1000	101,9	40	78,6	400,0	98,9	4000,0	84,5
2000	97,4	50,0	83	500,0	98,7	5000,0	81,1
4000	89,9	63,0	86,8	630,0	98,6	6300,0	77,4
8000	79,2	80,0	90,2	800,0	98,1	8000,0	73,3
<b>108,9 dB(A)</b>		100,0	92,9	1000,0	97,2	10000	68,9
Melun erityispiirteiden mittaus ja havainnot:							
Kapeakaistaisuus / Tonaalisuus		Impulssimaisuus		Merkityksellinen sykintä (amplitudimodulaatio)		Muu, Mikä:	
kyllä	Ei	kyllä	Ei	kyllä	Ei	kyllä	Ei

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Taulukko 2. Käytetyt mallinnusparametrit ISO 9613-2 laskelmissa

AKUSTISET TIEDOT/LASKENNAN LÄHTÖTIEDOT			
Laskenta korkeus		Laskentaruudun koko [m·m]	
ISO 9613-2: 4,0 m		25x25 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
<b>Maan- ja vedenpinnan absorption ja heijastuksen huomioiminen, käytetyt kertoimet</b>			
ISO 9613-2	0,4 / vesialueilla 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

Matalataajuinen melu laskettiin Ympäristöministeriön ohjeen 2/2014 mukaisin menetelmin käyttäen voimalavalmistajalta saatuja arvioita niiden äänitehotasoista.

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, Hakala ja Hongisto, 2019) julkistamien Anojanssi projektin tulosten mukaisten ääneneristävyysarvoin ja tuloksia verrattiin toimenpiderajoihin.

Anojanssi projektissa mitattiin ilmaääneneristävyys standardin ISO 16283-3:2016 mukaan. Projektissa valittiin 13 pientaloa ja 26 julkisivurakennetta niin, että edustettuina oli kevyitä, raskaita, uusia ja vanhoja julkisivurakenteita. Tuloksista johdettiin 84 % persentiili, joka kertoo arvon, joka ylittyi 84 % mitatuista suomalaisista pientaloista.

Taulukko 3. Suomalaisen pientalon julkisivun äänitasoeron alalikiarvo Anojanssi projektin tulosten mukaisesti.

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

Matalataajuisen melun laskelmassa huomioitiin maanpinnan muodon vaikutus ohjeen 4/2014 mukaisesti. Tulokset on esitetty taajuuskohtaisena taulukkona hankealuetta ympäröiville asuin- ja lomarakennuksille.

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## 2.2 Varjostusmallinnus

Tuulivoimaloiden varjostusvaikutukset on mallinnettu käyttäen roottorinhalkaisijaltaan 200 metristä voimalaitosta, jonka napakorkeus on 200 metriä. Kokonaiskorkeudeltaan voimalat ovat tällöin 300 metriä korkeita.

*Taulukko 4. Vuorimäen tuulivoimahankkeen mallinnusohjelma ja tuulivoimaloiden koko varjostusmallinnuksessa.*

MALLINNUSOHJELMAN TIEDOT			
Mallinnusohjelma ja versio: WindPRO versiot 3.6		Mallinnusmenetelmä: ISO 9613-2	
TUULIVOIMALAN (TUULIVOIMALOIDEN TIEDOT)			
Tuulivoimalan valmistaja: Generic		Tyyppi: Generic RD200xHH200	Sarjanumero/t:-
Nimellisteho: -	Napakorkeus: 200 m	Roottorin halkaisija: 200 m	Tornin tyyppi: teräs/hybridi
Lavan maksimi leveys: 4,72 m	90 % säteelle laskettu lapa-leveys: 1,44 m	Maksimivälke-etäisyys 2089 m	

Varjostusvaikutuksia mallinnettiin WindPRO-ohjelman Shadow-moduulilla. Laskennassa varjot huomioidaan, kun aurinko on yli 3 astetta horisontin yläpuolella. Varjoksi lasketaan tilanne, jossa siipi peittää vähintään 20 % auringosta.

Auringon keskimääräiset paistetunnit perustuvat Seinäjoen sääaseman mitattuihin säätietoihin 1991–2020. Laskentojen tuulen suunta ja nopeusjakaumana käytettiin NASA:n MERRA-dataa (Modern Era Retrospective-analysis for Research and Applications) (1993-2023) hankealueen läheisyydestä (Lon: 26,88, Lat: 63,50).

Varjostusmallin laskennassa on huomioitu hankealueen korkeustiedot, tuulivoimaloiden sijainnit, tuulivoimalan napakorkeudet ja roottorin halkaisija sekä hankealueen aikavyöhyke. Lisäksi myös lavan muoto ja leveys vaikuttavat maksimivälke-etäisyyteen, joka mallinnusohjelman mukaan on tälle laitosmallille noin 2089 metriä. Mallinnuksessa otettiin huomioon auringon asema horisontissa eri kellon- ja vuodenaikoina, pilvisuus 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 laskenta-alueen kokoa 5,0 x 5,0 metriä. Laskentaikkunoiden suunnat asennettiin voimaloita kohti ns. "greenhouse mode". Mallinnus tehtiin niin sanotulle todelliselle tilanteelle (Real Case), jossa puuston suojaavaa vaikutusta ei huomioitu (Real Case, No forest).

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

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## 2.3 Raja- ja ohjearvot

### 2.3.1 Melu

Valtioneuvoston asetuksessa (1107/2015) tuulivoimaloille on määritelty ohjearvot päivä- ja yöajan keskiäänitasojen maksimiarvolle. Jos tuulivoimalan melu sisältää tonaalisia, kapeakaistaisia tai impulssimaisia komponentteja, mallinnustuloksiin tulee asetuksen 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 äänenvoimakkuuteen.

*Taulukko 5. 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 terveystieteiden ministeriön 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 6. Matalataajuisen sisämelun tunnin keskiäänitason toimenpiderajat nukkumiseen tarkoitetuissa tiloissa.*

Terssikaista Hz	20	25	31,5	40	50	63	80	100	125	160	200
Keskiäänitaso L <sub>Zeq</sub> ,1h, dB	74	64	56	49	44	42	40	38	36	34	32
Edellisestä laskettu keski-äänitaso A-painotettuna L <sub>Aeq</sub> ,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<sub>Aeq</sub>, 1h mitattuna niissä tiloissa, jotka on tarkoitettu nukkumiseen.

### 2.3.2 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 2016).

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Useissa maissa on annettu raja-arvoja tai suosituksia hyväksyttävän välkevaikutuksen määrästä. Esimerkiksi Tanskassa sovelletaan yleensä enintään 10 tunnin vuotuista todellisentilanteen raja-arvoa. Ruotsissa todellisen tilanteen raja-arvon suositus on kahdeksan tuntia vuodessa ja 30 minuuttia päivässä. Suomessa välkevaikutukselle ei ole määritelty omia suosituksia tai raja-arvoja.

Arvioinnissa on tarkasteltu vaikutuksia alueella, jossa varjoja tai välkettä mallinnuksen mukaisessa todellisessa tilanteessa ("Real Case") esiintyy vähintään kahdeksan tuntia vuodessa.

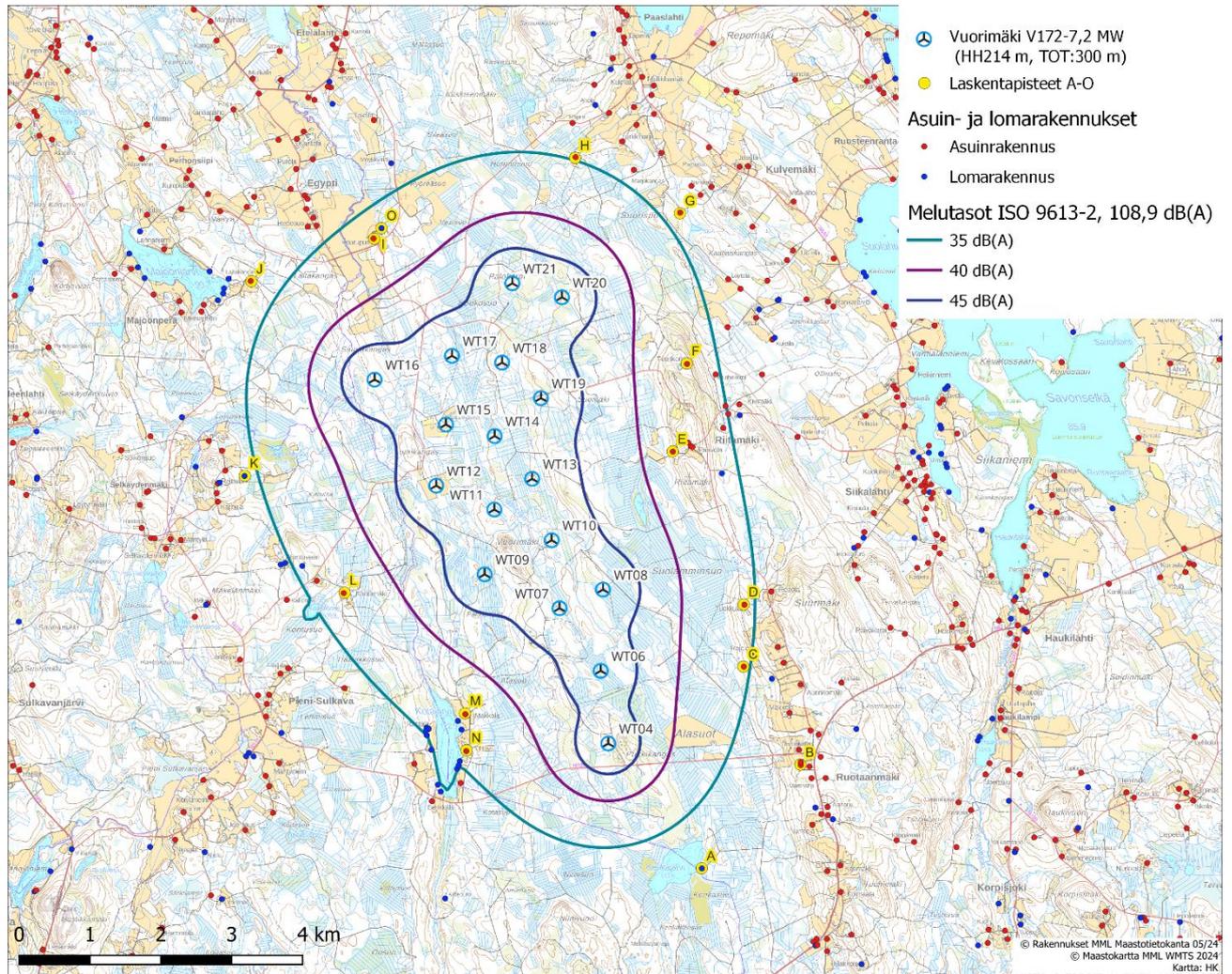
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### 3 MELU- JA VARJOSTUSMALLINNUSTEN TULOKSET

#### 3.1 Melu

##### 3.1.1 Melun laskentatulokset (ISO 9613-2)

Melumallinnuksen tulosten mukaan melutaso 40 dB(A) ei ylitä lähimmillä asuin- ja lomarakennuksilla (Kuva 1, Taulukko 7). Katso tarkemmat laskentatulokset liitteestä 1.



Kuva 1. Melumallinnuksen tulos

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Taulukko 7. Laskennalliset melutasot Vuorimäen tuulivoimahankkeen ympäristössä

Laskentapiste	ETRS89-TM35 Itä	ETRS89-TM35 Pohjoinen	Z (m)	Laskenta-korkeus (m)	Melutaso dB(A)
A - Lomarakennus	496 179	7 036 433	150	4	32,9
B - Asuinrakennus	497 572	7 037 905	187,1	4	31,1
C - Asuinrakennus	496 767	7 039 301	157,3	4	35,4
D - Asuinrakennus	496 772	7 040 186	172,2	4	35,6
E - Asuinrakennus	495 769	7 042 361	159,2	4	38,1
F - Asuinrakennus	495 967	7 043 612	170	4	36,7
G - Asuinrakennus	495 873	7 045 750	112,3	4	34,0
H - Asuinrakennus	494 394	7 046 537	110	4	34,8
I - Asuinrakennus	491 559	7 045 388	105	4	36,7
J - Asuinrakennus	489 826	7 044 782	117,5	4	33,3
K - Lomarakennus	489 734	7 042 016	123,3	4	34,3
L - Asuinrakennus	491 142	7 040 353	138,9	4	36,8
M - Asuinrakennus	492 839	7 038 637	127,5	4	37,3
N - Asuinrakennus	492 862	7 038 112	132,5	4	35,8
O - Lomarakennus	491 663	7 045 538	102,6	4	36,6

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### 3.1.2 Matalataajuiset melutasot

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.

Vuorimäen tuulivoimahankkeen aiheuttama matalataajuinen melu ei hankevaihtoehdoissa ylitä Sosiaali- ja terveysministeriön asumisterveysohjearvoa laskentapisteiden sisätiloissa.

Mallinnuksen tulokset laskentapisteittäin on esitetty taulukossa 8. Taulukossa näkyy toimenpiderajan alitus (negatiivinen arvo) tai ylitys (positiivinen arvo).

Tarkemmat matalataajuisen melun rakennuskohtaiset laskentatulokset on esitetty kuvaajilla liitteessä 2.

*Taulukko 8. Matalataajuisen melun laskentatulokset*

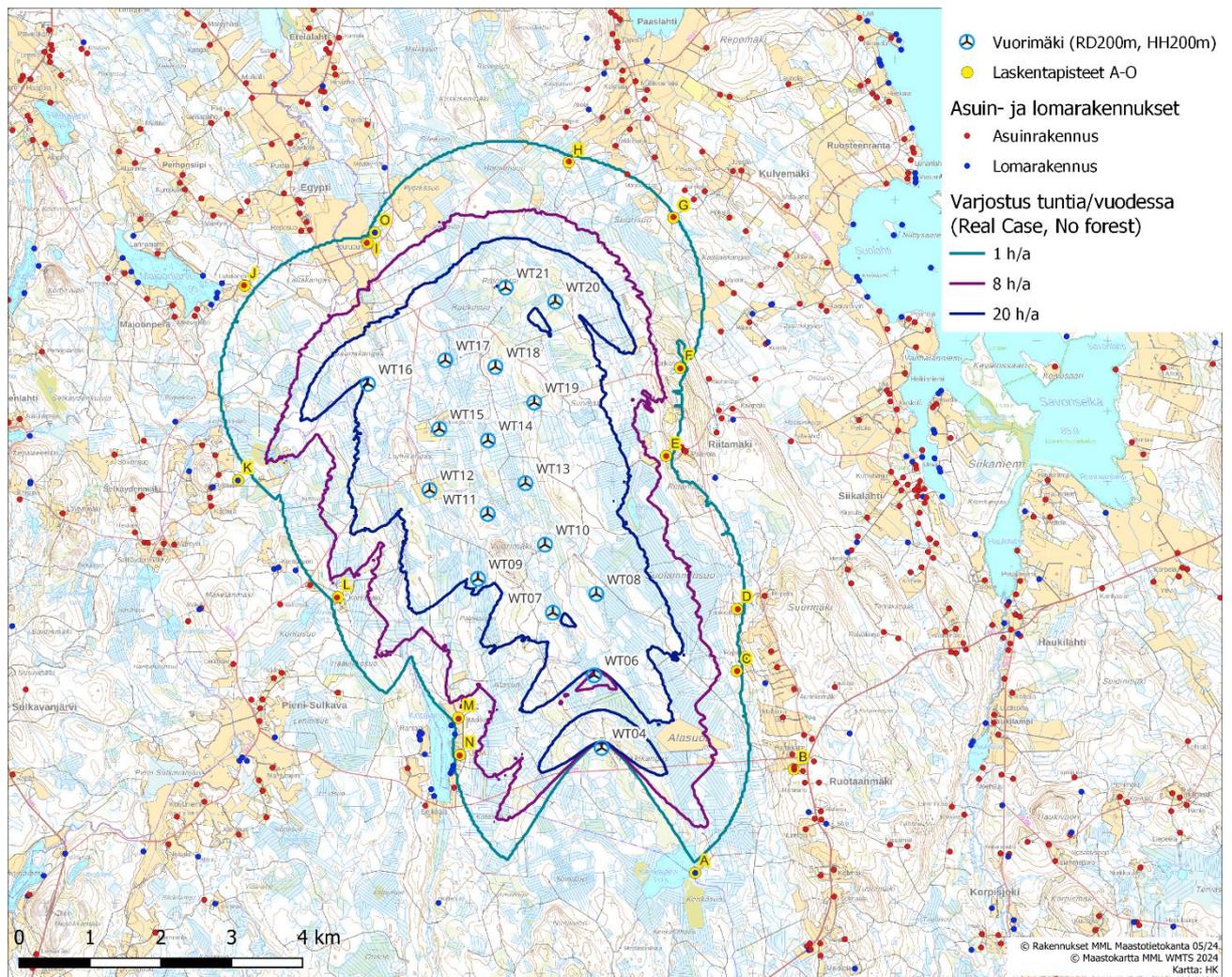
Laskentapiste	Äänitaso ulkona		Äänitaso sisällä	
	L <sub>eq,1h</sub> – Asumisterveys ohje sisällä	Hz	L <sub>eq,1h</sub> – Asumisterveys ohje sisällä	Hz
A - Lomarakennus	3,4	100	-10,4	50
B - Asuinrakennus	3,3	100	-10,5	50
C - Asuinrakennus	6,5	100	-7,5	50
D - Asuinrakennus	6,8	100	-7,2	50
E - Asuinrakennus	8,9	100	-5,2	50
F - Asuinrakennus	7,7	100	-6,3	50
G - Asuinrakennus	5,5	100	-8,5	50
H - Asuinrakennus	6,0	100	-8,0	50
I - Asuinrakennus	7,6	100	-6,5	50
J - Asuinrakennus	5,0	100	-8,9	50
K - Lomarakennus	5,9	100	-8,0	50
L - Asuinrakennus	7,8	100	-6,2	50
M - Asuinrakennus	8,1	100	-6,0	50
N - Asuinrakennus	6,9	100	-7,1	50
O - Lomarakennus	7,4	100	-6,7	50

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## 3.2 Varjostus

### 3.2.1 Varjostusmallinnus, "Real Case, No forest"

Mallinnustulosten mukaan 8 h/a varjostusalueelle ei sijoitu asuin- tai lomarakennuksia. Mallinnustulosten mukaan varjostusta ilmenee enimmillään 7 h 13 min vuodessa hankealueen lounaispuolella sijaitsevan asuinrakennuksen (laskentapiste M) alueella (Kuva 2, Taulukko 9). Tarkemmat laskentatulokset on esitetty liitteessä 3.



Kuva 2. Varjostusmallinnuksen tulos (puuston suojaavaa vaikutusta ei ole huomioitu)

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Taulukko 9. Varjostusmallinnuksen tulos, kun puuston suojaavaa vaikutusta ei ole huomioitu "Real Case, No forest".

Rakennus	ETRS89-TM35 Itä	ETRS89-TM35 Pohjoinen	Z (m)	Laskentaikuna (m)	Varjostus (h/a)
A - Lomarakennus	496179	7036433	150	5,0 x 5,0	0:00
B - Asuinrakennus	497572	7037905	187,1	5,0 x 5,0	0:00
C - Asuinrakennus	496767	7039301	157,3	5,0 x 5,0	1:51
D - Asuinrakennus	496772	7040186	172,2	5,0 x 5,0	2:00
E - Asuinrakennus	495769	7042361	159,2	5,0 x 5,0	4:13
F - Asuinrakennus	495967	7043612	170	5,0 x 5,0	3:12
G - Asuinrakennus	495873	7045750	112,3	5,0 x 5,0	1:33
H - Asuinrakennus	494394	7046537	110	5,0 x 5,0	3:36
I - Asuinrakennus	491559	7045388	105	5,0 x 5,0	5:53
J - Asuinrakennus	489826	7044782	117,5	5,0 x 5,0	0:00
K - Lomarakennus	489734	7042016	123,3	5,0 x 5,0	0:00
L - Asuinrakennus	491142	7040353	138,9	5,0 x 5,0	4:47
M - Asuinrakennus	492839	7038637	127,5	5,0 x 5,0	7:13
N - Asuinrakennus	492862	7038112	132,5	5,0 x 5,0	2:13
O - Lomarakennus	491 663	7 045 538	102,6	5,0 x 5,0	3:23

**FCG Finnish Consulting Group Oy**

Henri Korhonen, YTM  
Laatija

Henna-Riikka Rintamäki, ins.AMK  
Tarkastaja

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**Liite 1. Melun leviämismallinnuksen tulokset ISO 9613-2, YM 2 /2014**

## DECIBEL - Main Result

Calculation: Vuorimäki\_17xV172-7.2MW\_HH214

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\_Iisalmi\_11

Area type with hard ground: vesistö

Ground factor for hard ground: 0,0

Meteorological coefficient, CO:

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:

Fixed penalty added to source noise of WTGs with pure tones

WTG catalogue

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.:

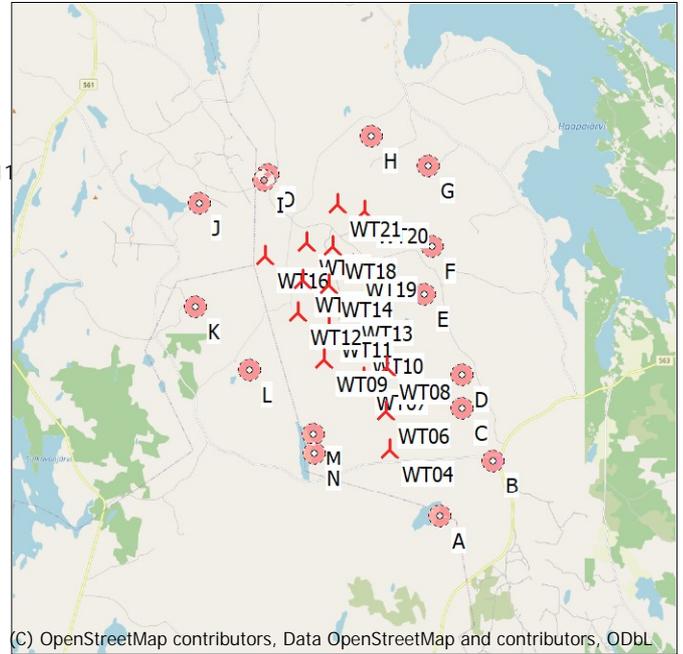
0,0 dB(A)

All coordinates are in

Finish TM ETRS-TM35FIN-ETRS89

WTGs

	East	North	Z	Row data/Description	WTG type			Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data		Wind speed [m/s]	LwA_ref [dB(A)]
					Valid	Manufact.	Type-generator				Creator	Name		
WT04	494 862	7 038 207	154,8	VESTAS V172-7.2 7200 17...	Yes	VESTAS	V172-7.2-7 200	7 200	172,0	214,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
WT06	494 754	7 039 241	147,5	VESTAS V172-7.2 7200 17...	Yes	VESTAS	V172-7.2-7 200	7 200	172,0	214,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
WT07	494 173	7 040 131	140,0	VESTAS V172-7.2 7200 17...	Yes	VESTAS	V172-7.2-7 200	7 200	172,0	214,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
WT08	494 786	7 040 397	147,5	VESTAS V172-7.2 7200 17...	Yes	VESTAS	V172-7.2-7 200	7 200	172,0	214,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
WT09	493 117	7 040 613	120,0	VESTAS V172-7.2 7200 17...	Yes	VESTAS	V172-7.2-7 200	7 200	172,0	214,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
WT10	494 062	7 041 098	135,0	VESTAS V172-7.2 7200 17...	Yes	VESTAS	V172-7.2-7 200	7 200	172,0	214,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
WT11	493 253	7 041 535	121,6	VESTAS V172-7.2 7200 17...	Yes	VESTAS	V172-7.2-7 200	7 200	172,0	214,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
WT12	492 433	7 041 875	113,9	VESTAS V172-7.2 7200 17...	Yes	VESTAS	V172-7.2-7 200	7 200	172,0	214,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
WT13	493 787	7 041 972	127,4	VESTAS V172-7.2 7200 17...	Yes	VESTAS	V172-7.2-7 200	7 200	172,0	214,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
WT14	493 258	7 042 580	121,3	VESTAS V172-7.2 7200 17...	Yes	VESTAS	V172-7.2-7 200	7 200	172,0	214,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
WT15	492 571	7 042 744	108,0	VESTAS V172-7.2 7200 17...	Yes	VESTAS	V172-7.2-7 200	7 200	172,0	214,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
WT16	491 564	7 043 384	109,1	VESTAS V172-7.2 7200 17...	Yes	VESTAS	V172-7.2-7 200	7 200	172,0	214,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
WT17	492 656	7 043 721	115,0	VESTAS V172-7.2 7200 17...	Yes	VESTAS	V172-7.2-7 200	7 200	172,0	214,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
WT18	493 363	7 043 625	130,0	VESTAS V172-7.2 7200 17...	Yes	VESTAS	V172-7.2-7 200	7 200	172,0	214,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
WT19	493 912	7 043 119	137,4	VESTAS V172-7.2 7200 17...	Yes	VESTAS	V172-7.2-7 200	7 200	172,0	214,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
WT20	494 208	7 044 554	140,0	VESTAS V172-7.2 7200 17...	Yes	VESTAS	V172-7.2-7 200	7 200	172,0	214,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
WT21	493 507	7 044 753	124,6	VESTAS V172-7.2 7200 17...	Yes	VESTAS	V172-7.2-7 200	7 200	172,0	214,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9



▲ New WTG

Scale 1:200 000

■ Noise sensitive area

## Calculation Results

### Sound level

Noise sensitive area

No.	Name	East	North	Z	Immission height [m]	Demands		Sound level		Distance to noise demand [m]
						Noise [dB(A)]	From WTGs [dB(A)]	Noise [dB(A)]	From WTGs [dB(A)]	
A	A-Lomarakennus	496 179	7 036 433	150,0	4,0	40,0	32,9	1 387		
B	B-Asuinrakennus	497 572	7 037 905	187,2	4,0	40,0	31,1	1 835		
C	C-Asuinrakennus	496 767	7 039 301	157,3	4,0	40,0	35,4	906		
D	D-Asuinrakennus	496 772	7 040 186	172,8	4,0	40,0	35,6	875		
E	E-Asuinrakennus	495 769	7 042 361	158,8	4,0	40,0	38,1	448		
F	F-Asuinrakennus	495 967	7 043 612	170,0	4,0	40,0	36,7	752		
G	G-Asuinrakennus	495 873	7 045 750	112,3	4,0	40,0	34,0	1 092		
H	H-Asuinrakennus	494 394	7 046 537	110,0	4,0	40,0	34,8	893		
I	I-Asuinrakennus	491 559	7 045 388	105,0	4,0	40,0	36,7	682		
J	J-Asuinrakennus	489 826	7 044 782	117,5	4,0	40,0	33,3	1 290		
K	K-Lomarakennus	489 734	7 042 016	123,2	4,0	40,0	34,3	1 243		
L	L-Asuinrakennus	491 142	7 040 353	138,9	4,0	40,0	36,8	676		
M	M-Asuinrakennus	492 839	7 038 637	127,5	4,0	40,0	37,3	611		

To be continued on next page...

## DECIBEL - Main Result

Calculation: Vuorimäki\_17xV172-7.2MW\_HH214

...continued from previous page

No.	Name	East	North	Z [m]	Immission height [m]	Demands Noise [dB(A)]	Sound level From WTGs [dB(A)]	Distance to noise demand [m]
N	N-Asuinrakennus	492 862	7 038 112	132,5	4,0	40,0	35,8	935
O	O-Lomarakennus	491 663	7 045 538	102,6	4,0	40,0	36,6	742

### Distances (m)

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
WT04	2210	2727	2197	2750	4252	5517	7610	8343	7904	8282	6388	4294	2068	2002	7998
WT06	3149	3119	2014	2228	3281	4536	6604	7305	6928	7416	5736	3779	2008	2204	7015
WT07	4207	4063	2723	2599	2742	3916	5870	6410	5871	6367	4823	3039	2003	2408	5961
WT08	4202	3738	2264	1997	2197	3426	5462	6153	5944	6621	5305	3644	2624	2987	6016
WT09	5182	5214	3879	3680	3176	4137	5829	6060	5023	5311	3663	1992	1996	2514	5135
WT10	5123	4745	3248	2860	2124	3155	4992	5449	4967	5614	4424	3013	2748	3218	5047
WT11	5882	5642	4164	3769	2648	3418	4963	5131	4209	4721	3552	2419	2927	3445	4308
WT12	6607	6494	5041	4656	3372	3938	5182	5058	3621	3905	2703	1995	3263	3787	3744
WT13	6034	5556	4002	3479	2020	2728	4315	4605	4078	4857	4053	3101	3467	3970	4151
WT14	6806	6362	4803	4253	2521	2899	4109	4117	3282	4078	3569	3071	3965	4486	3361
WT15	7270	6959	5428	4919	3221	3505	4465	4208	2831	3419	2929	2785	4116	4641	2938
WT16	8344	8131	6614	6112	4328	4409	4916	4237	2005	2231	2284	3059	4915	5429	2157
WT17	8096	7616	6037	5426	3398	3313	3804	3309	1995	3023	3383	3692	5088	5613	2071
WT18	7724	7102	5503	4843	2718	2605	3289	3090	2522	3722	3969	3954	5015	5535	2559
WT19	7061	6371	4768	4097	2006	2114	3281	3452	3268	4411	4321	3914	4609	5116	3303
WT20	8358	7452	5844	5066	2692	1996	2050	1992	2776	4388	5144	5200	6073	6581	2728
WT21	8739	7963	6352	5614	3292	2712	2568	1993	2049	3682	4661	4995	6152	6672	2005

Project:

Iisalmi\_11\_9\_2023\_melu\_ja\_varjo\_VE3

Licensed user:

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Osmontie 34, PO Box 950  
FI-00601 Helsinki  
+358104095666  
Henri Korhonen / henri.korhonen@fcg.fi  
Calculated:  
6.6.2024 15.51/3.6.355

## DECIBEL - Assumptions for noise calculation

Calculation: Vuorimäki\_17xV172-7.2MW\_HH214

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\_Iisalmi\_11\_9\_2023\_melu\_ja\_varjo\_VE3\_0.w2r (1)

Area type with hard ground: vesistöt

Ground factor for hard ground: 0,0

Meteorological coefficient, CO:

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:

Fixed penalty added to source noise of WTGs with pure tones

WTG catalogue

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]							
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 V172-7.2 7200 172.0 IO!

Noise: V172 - 7,2 MW PO7200 STE + 2dB

Source	Source/Date	Creator	Edited
Manufacturer	11.9.2023	USER	6.6.2024 15.33

Status	Hub height [m]	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones	Octave data								
					63	125	250	500	1000	2000	4000	8000	
					[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
From Windcat	214,0	8,0	108,9	No	92,4	100,0	103,3	103,5	101,9	97,4	89,9	79,2	

Noise sensitive area: A A-Lomarakennus

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

Noise sensitive area: B B-Asuinrakennus

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

Noise sensitive area: C C-Asuinrakennus

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

Project:

Iisalmi\_11\_9\_2023\_melu\_ja\_varjo\_VE3

Licensed user:

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Osmontie 34, PO Box 950  
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+358104095666  
Henri Korhonen / henri.korhonen@fcg.fi  
Calculated:  
6.6.2024 15.51/3.6.355

## DECIBEL - Assumptions for noise calculation

Calculation: Vuorimäki\_17xV172-7.2MW\_HH214

Noise sensitive area: D D-Asuinrakennus

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

Noise sensitive area: E E-Asuinrakennus

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

Noise sensitive area: F F-Asuinrakennus

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

Noise sensitive area: G G-Asuinrakennus

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

Noise sensitive area: H H-Asuinrakennus

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

Noise sensitive area: I I-Asuinrakennus

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

Noise sensitive area: J J-Asuinrakennus

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

Noise sensitive area: K K-Lomarakennus

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

Noise sensitive area: L L-Asuinrakennus

Predefined calculation standard:

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

Uncertainty margin: Use default value from calculation model

Project:

Iisalmi\_11\_9\_2023\_melu\_ja\_varjo\_VE3

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+358104095666

Henri Korhonen / henri.korhonen@fcg.fi

Calculated:

6.6.2024 15.51/3.6.355

## DECIBEL - Assumptions for noise calculation

Calculation: Vuorimäki\_17xV172-7.2MW\_HH214

Noise demand: 40,0 dB(A)

No distance demand

Noise sensitive area: M M-Asuinrakennus

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

Noise sensitive area: N N-Asuinrakennus

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

Noise sensitive area: O O-Lomarakennus

Predefined calculation standard:

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

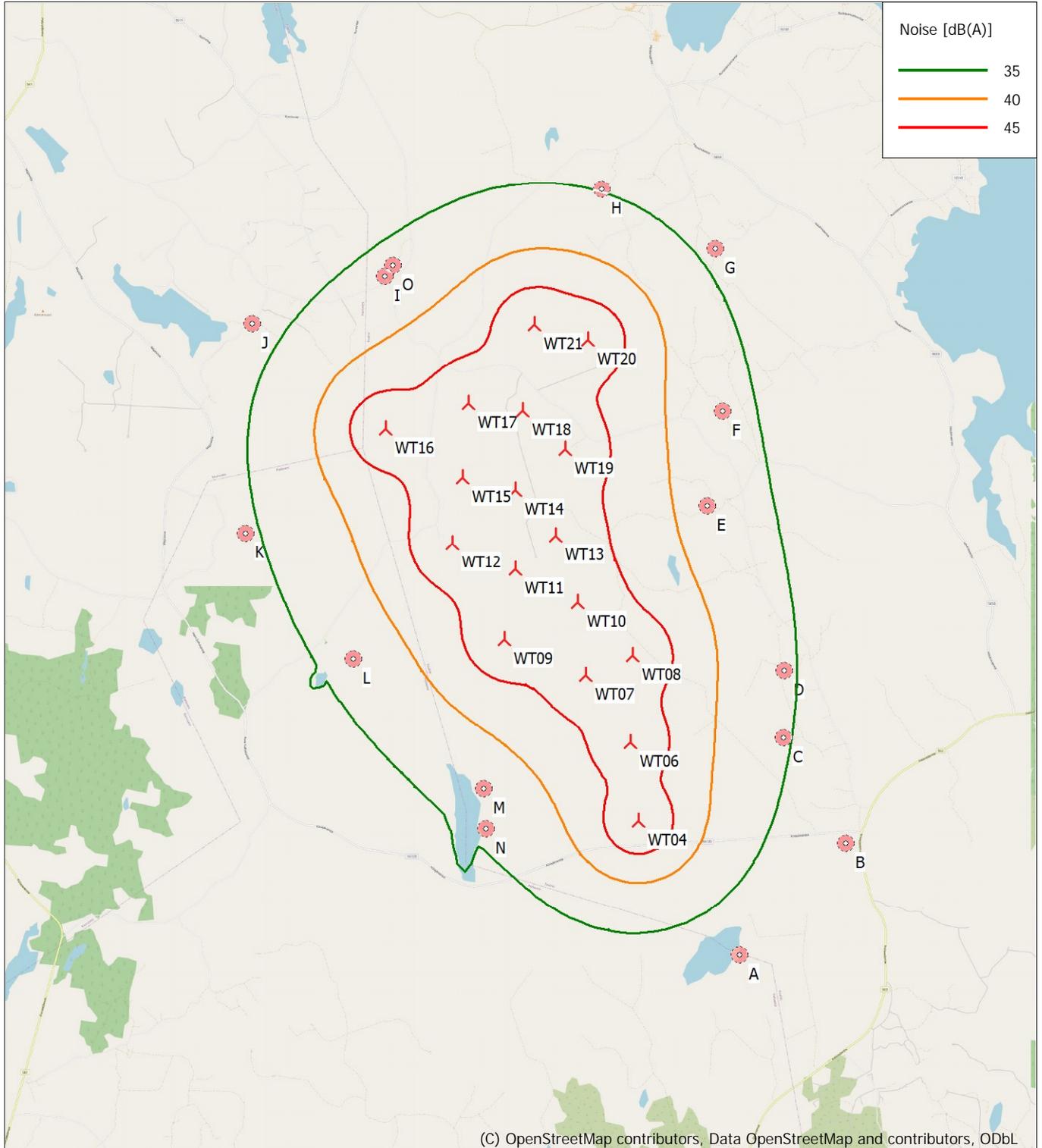
Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

## DECIBEL - Map 8,0 m/s

Calculation: Vuorimäki\_17xV172-7.2MW\_HH214



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



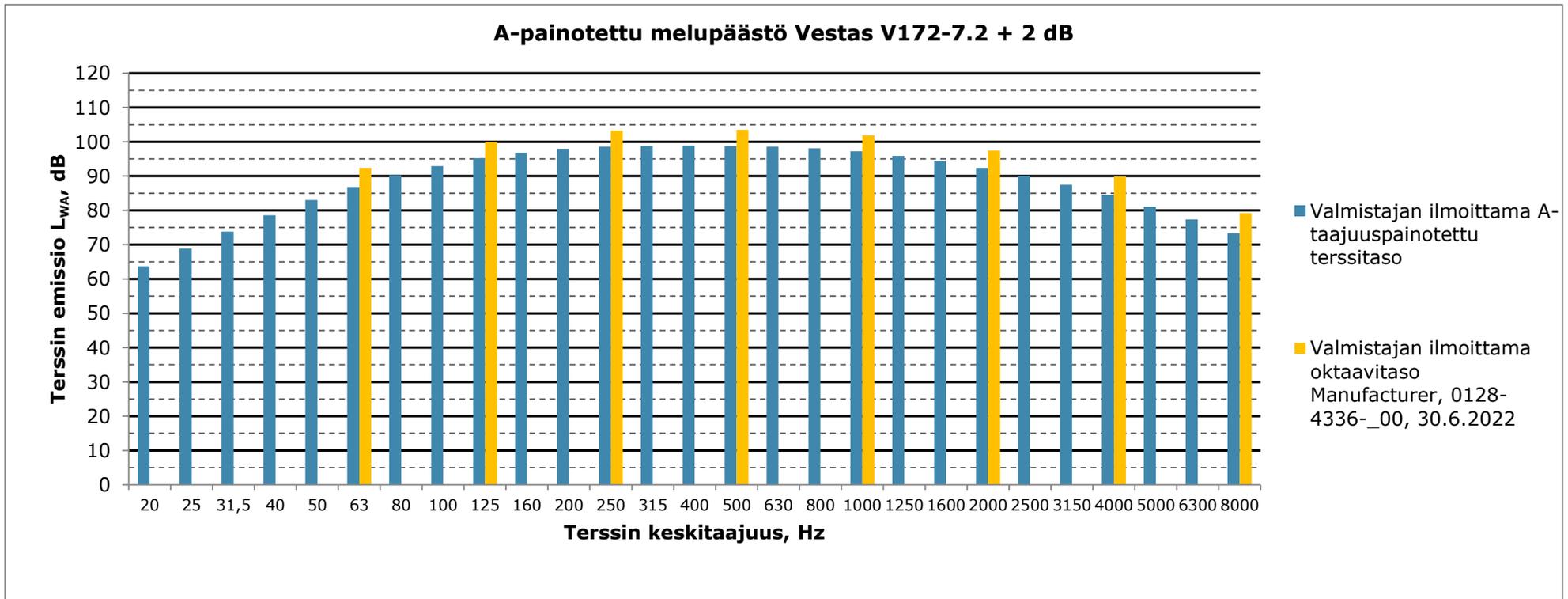
Map: EMD OpenStreetMap, Print scale 1:75 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 493 318 North: 7 041 480

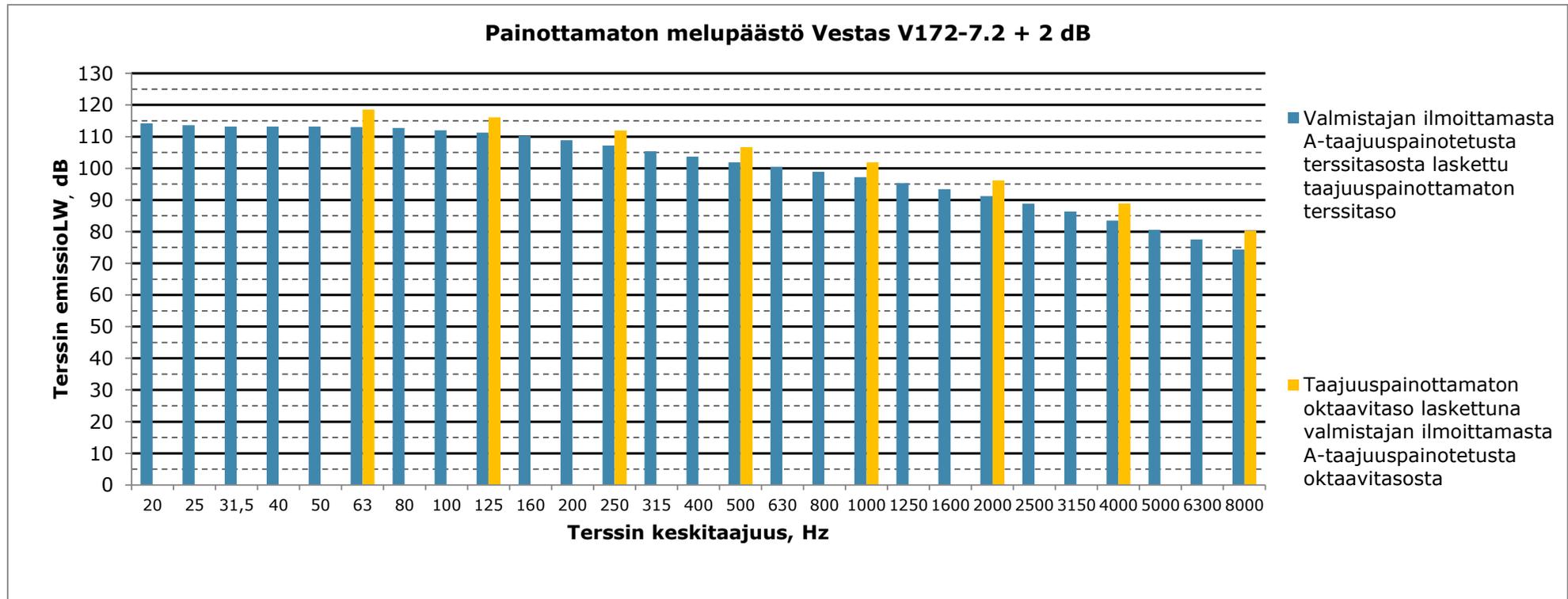
New WTG

Noise sensitive area

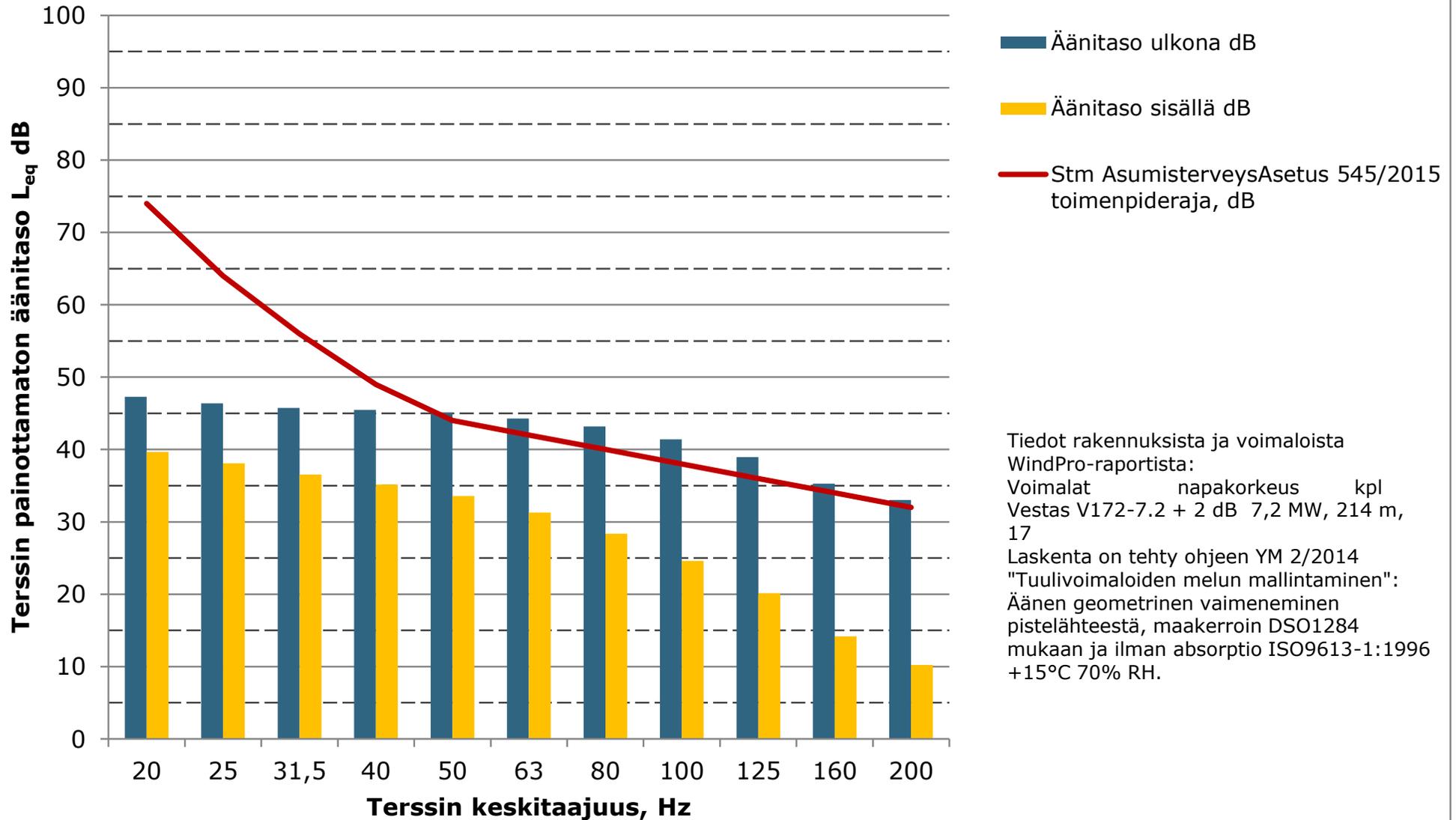
Noise calculation model: ISO 9613-2 General. Wind speed: 8,0 m/s  
Height above sea level from active line object

## Liite 2. Matalataajuisen melun rakennuskohtaiset arvot



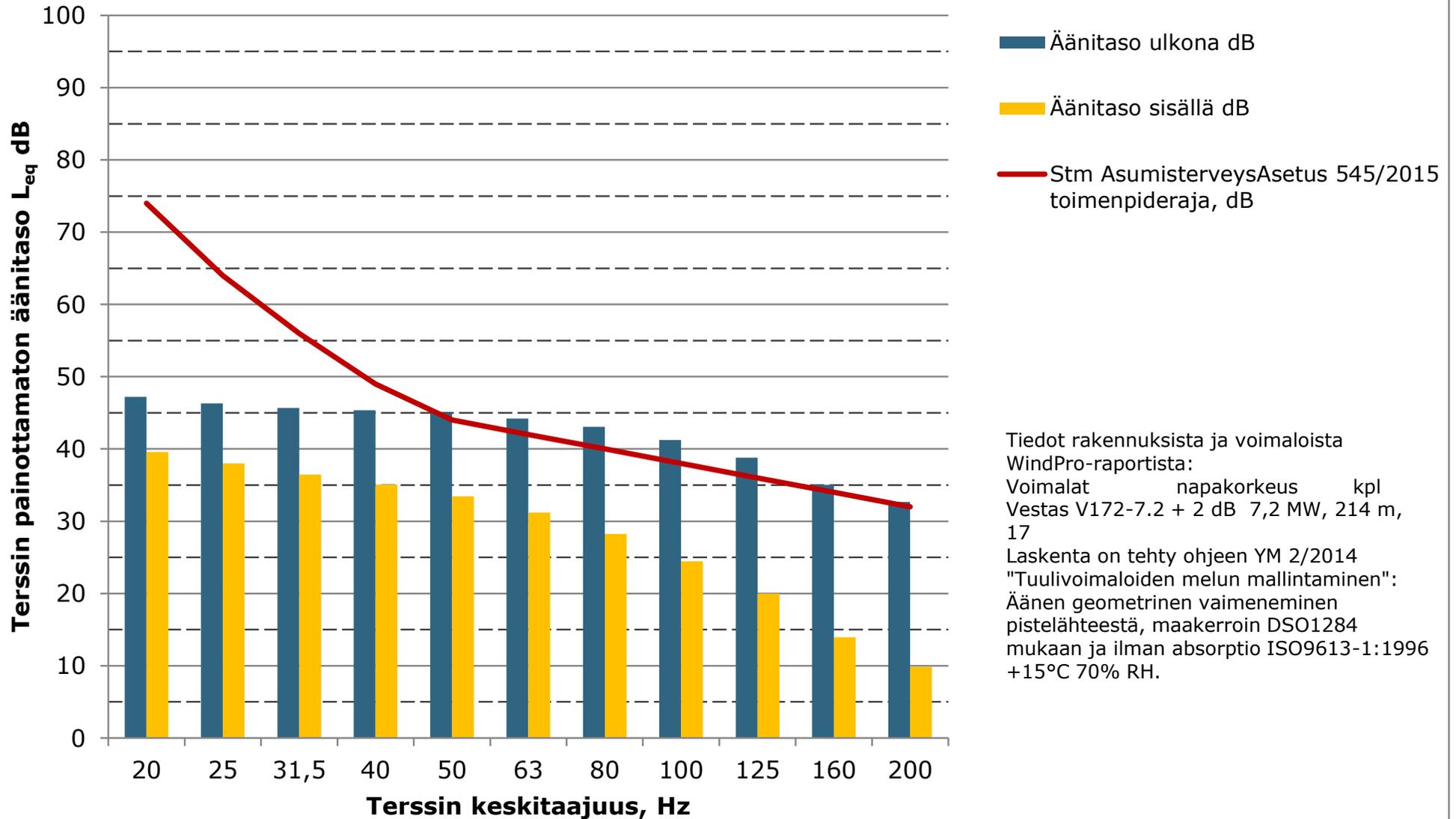


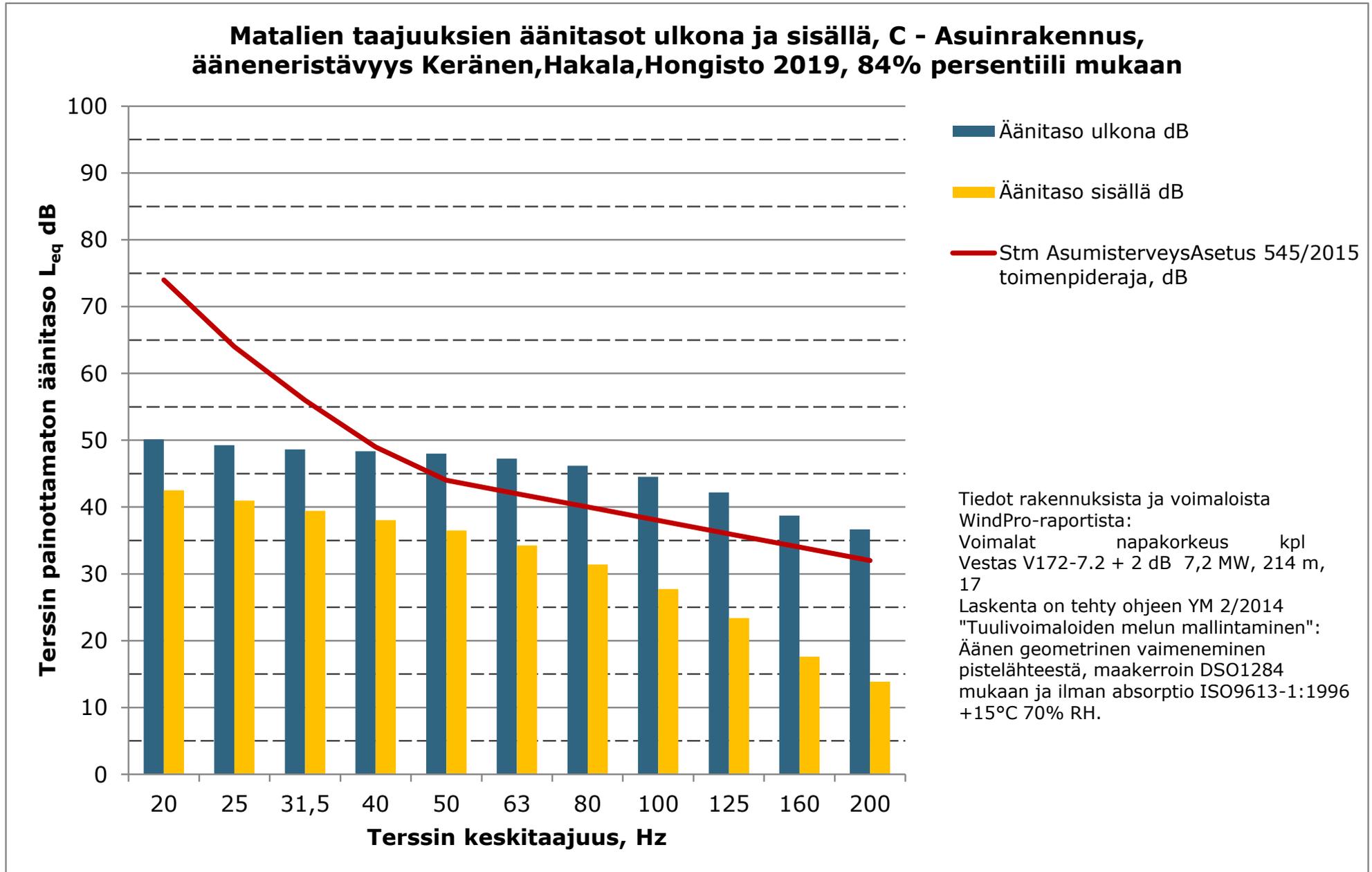
**Matalien taajuuksien äänitasot ulkona ja sisällä, A - Lomarakennus, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persenttiili mukaan**

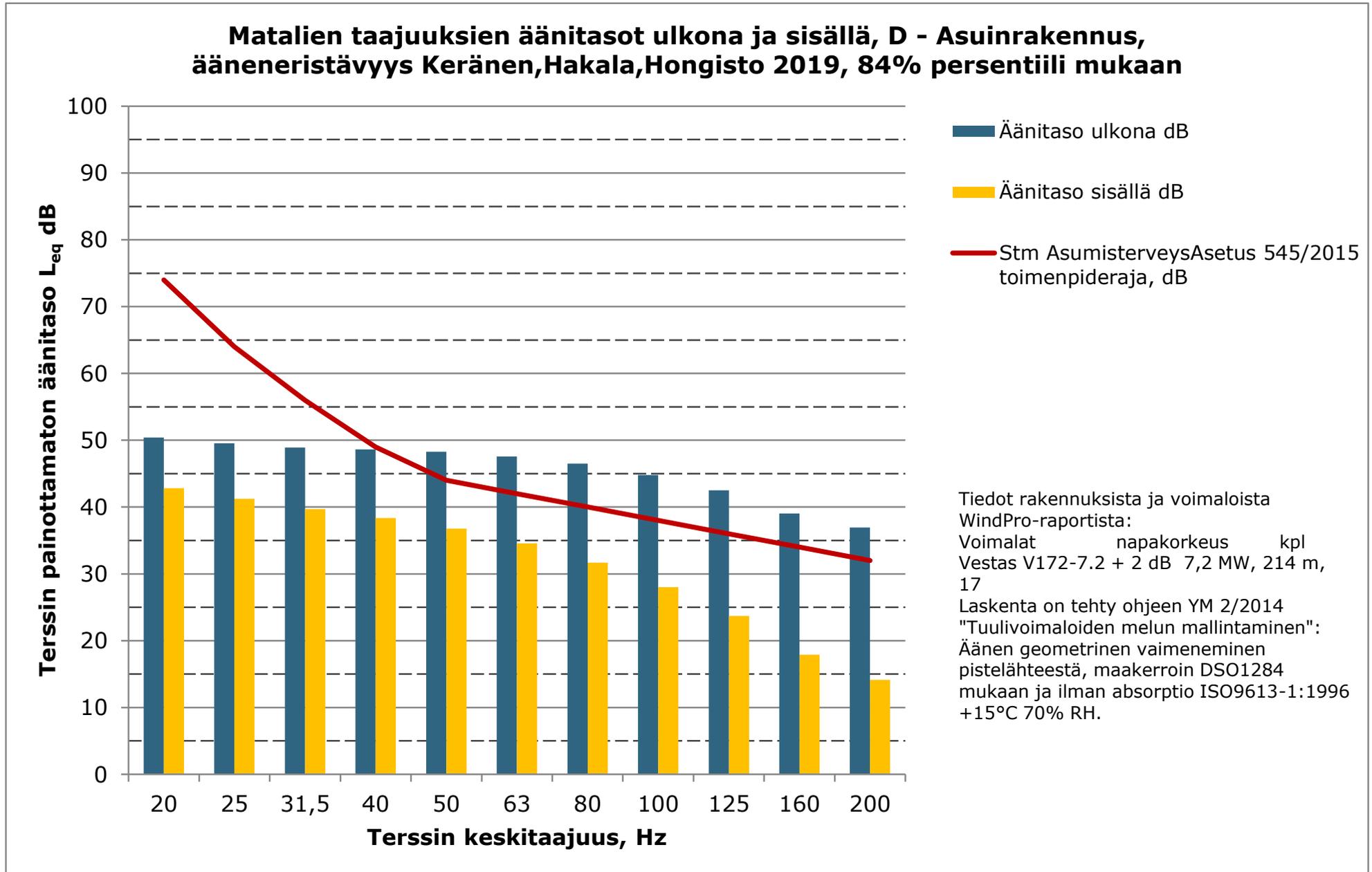


Tiedot rakennuksista ja voimaloista WindPro-raportista:  
 Voimalat napakorkeus kpl  
 Vestas V172-7.2 + 2 dB 7,2 MW, 214 m, 17  
 Laskenta on tehty ohjeen YM 2/2014 "Tuulivoimaloiden melun mallintaminen":  
 Äänen geometrinen vaimeneminen pistelähteestä, maakerroin DSO1284 mukaan ja ilman absorptio ISO9613-1:1996 +15°C 70% RH.

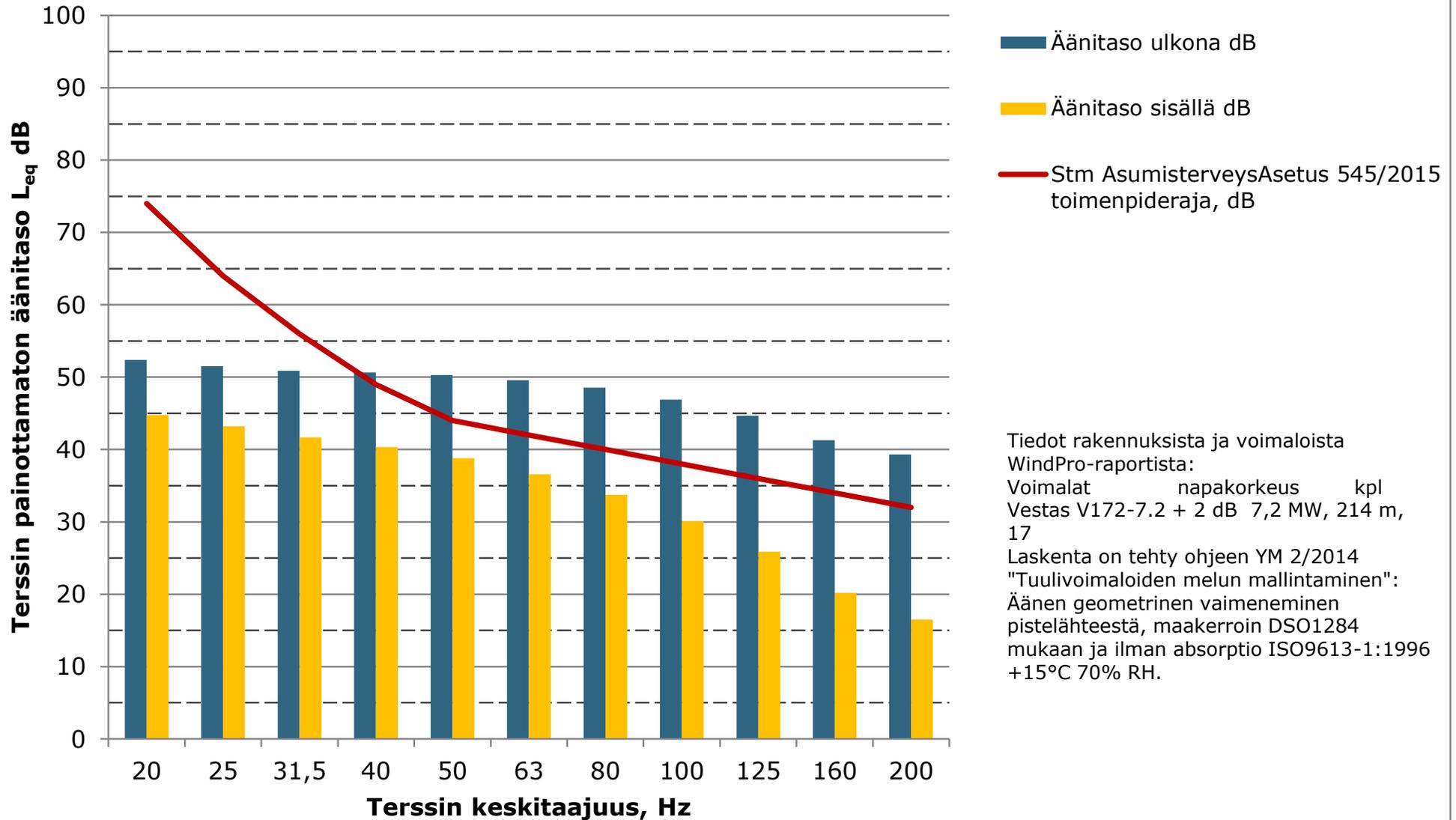
**Matalien taajuuksien äänitasot ulkona ja sisällä, B - Asuinrakennus, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persenttiili mukaan**



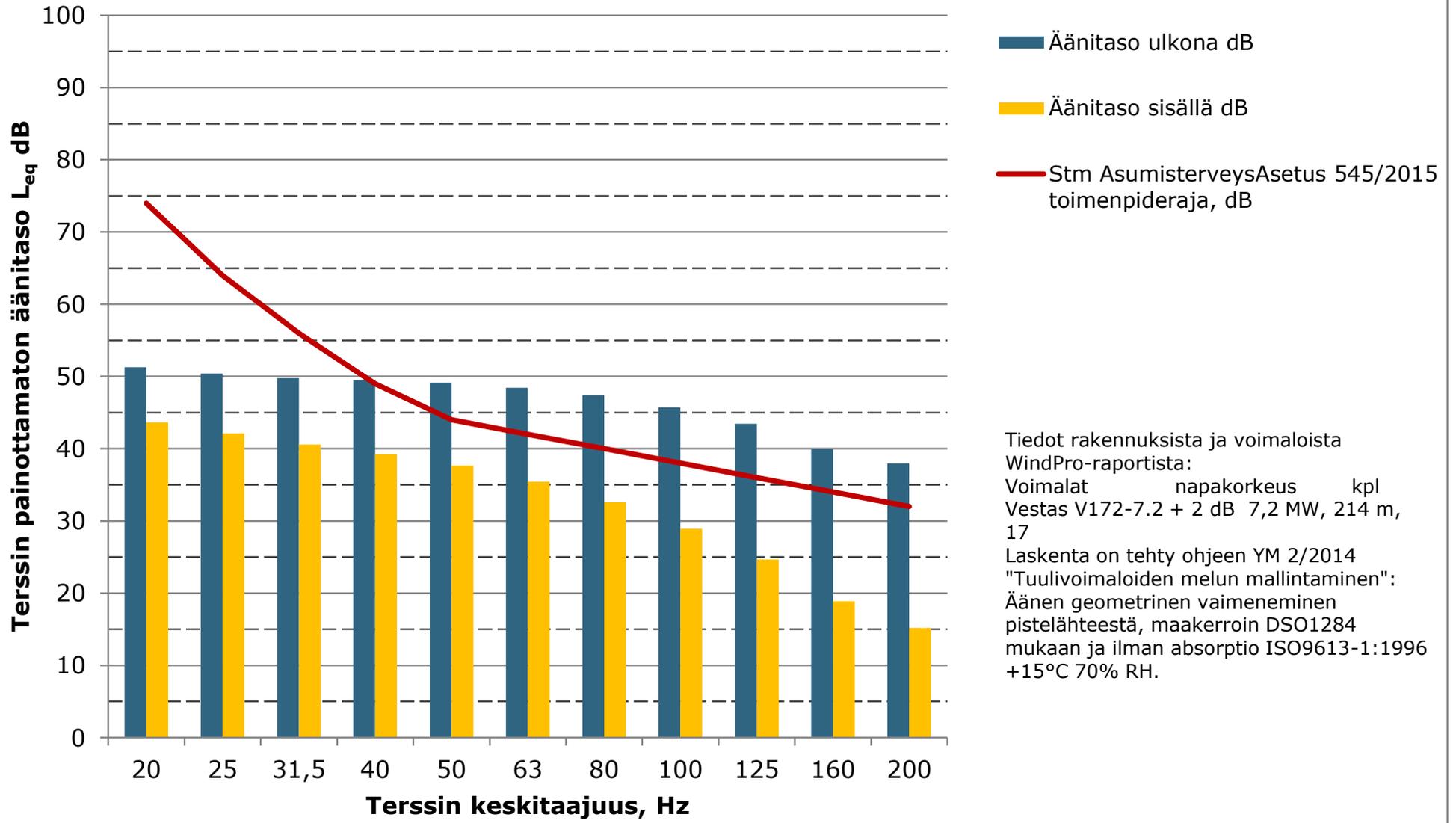




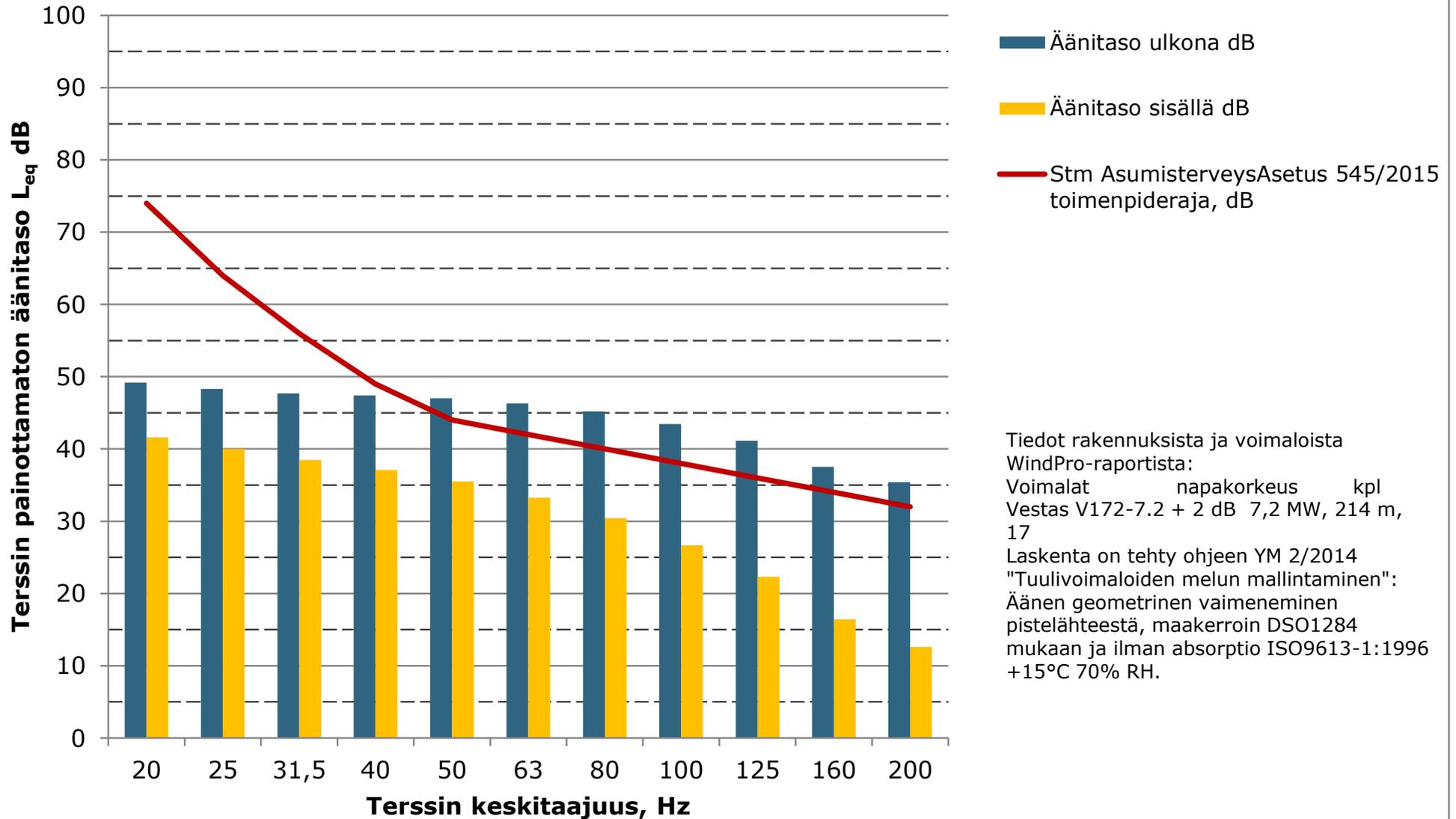
### Matalien taajuuksien äänitasot ulkona ja sisällä, E - Asuinrakennus, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persenttiili mukaan



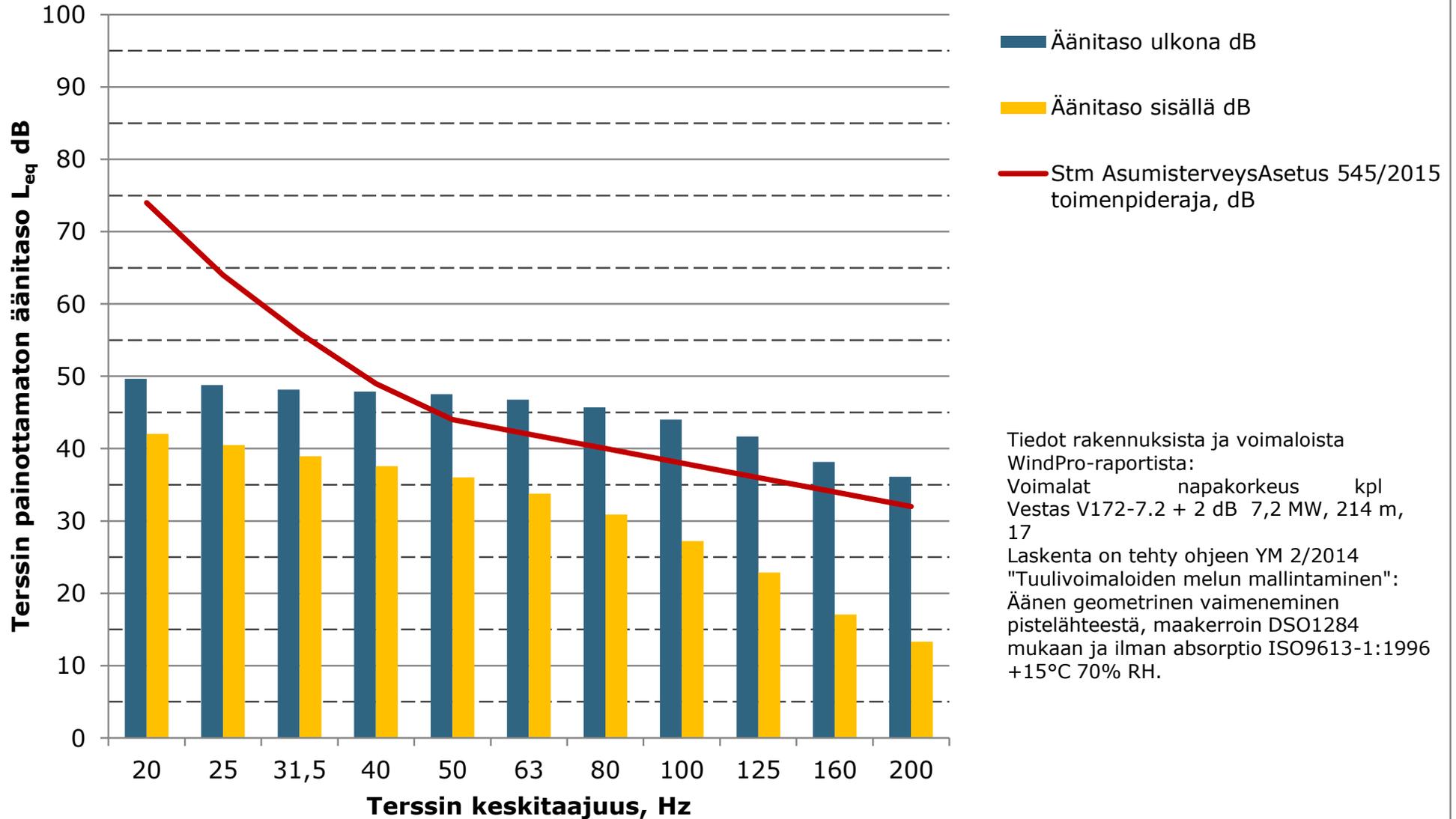
**Matalien taajuuksien äänitasot ulkona ja sisällä, F - Asuinrakennus, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persenttiili mukaan**



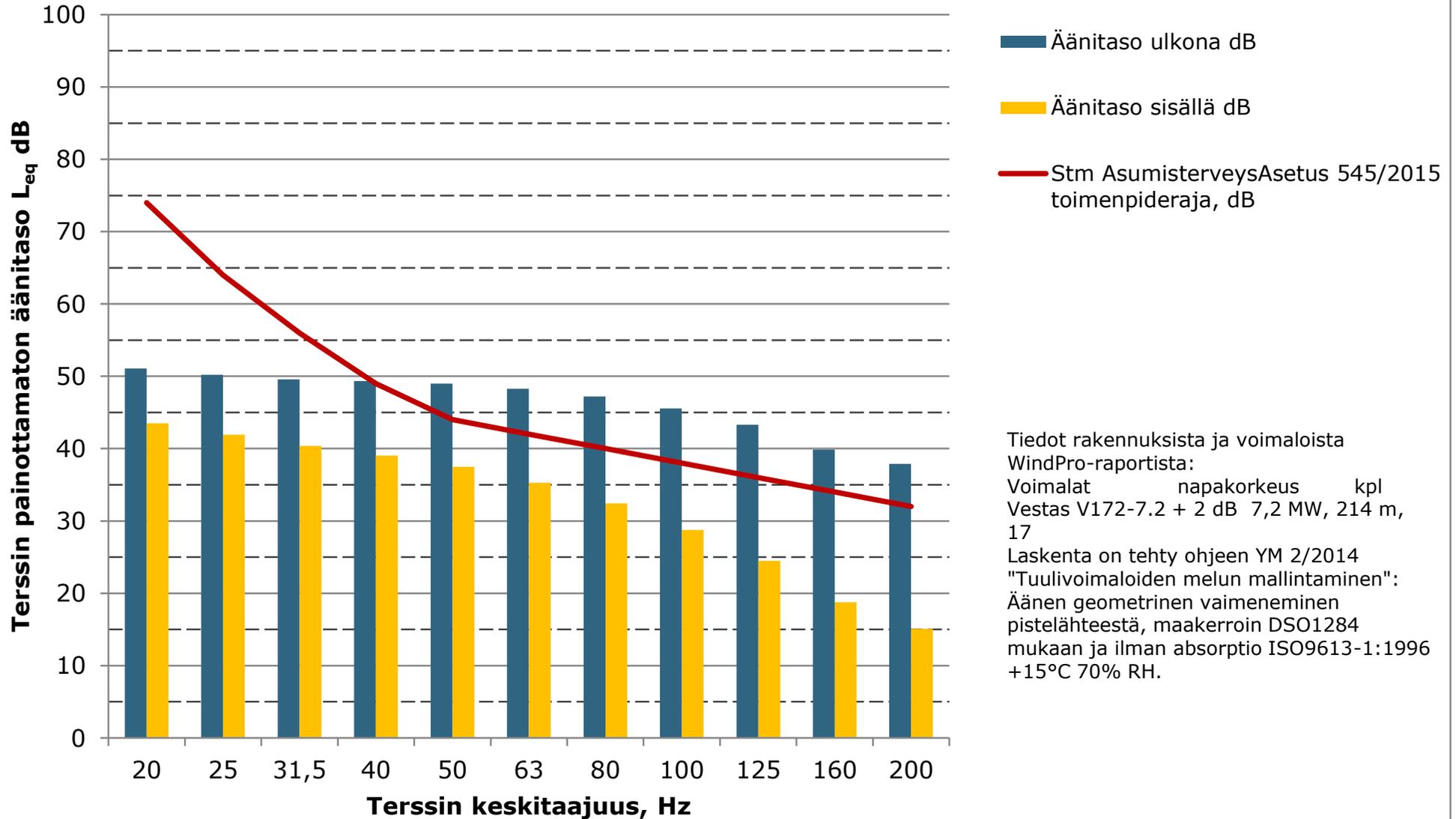
**Matalien taajuuksien äänitasot ulkona ja sisällä, G - Asuinrakennus, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persenttiili mukaan**



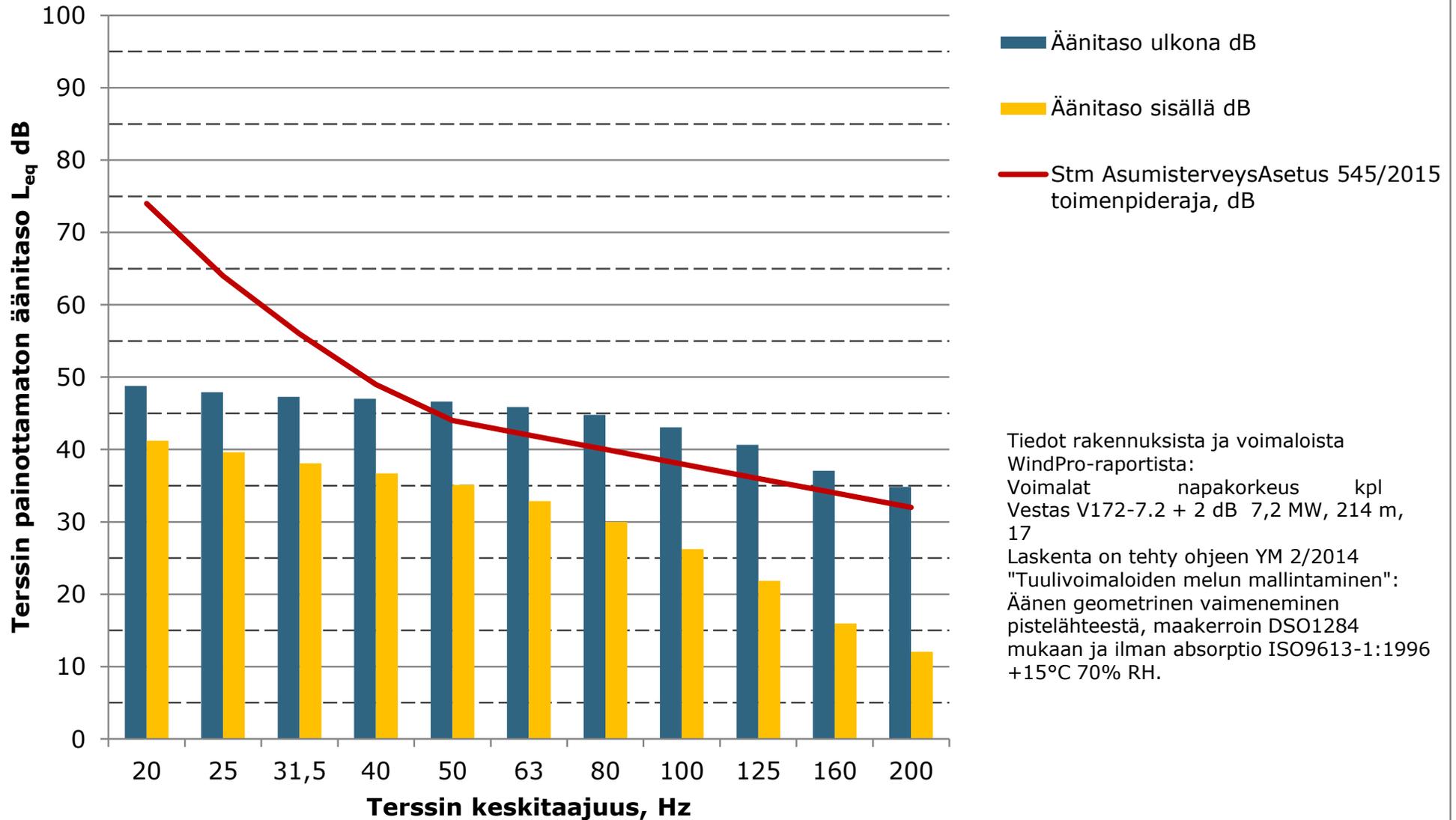
### Matalien taajuuksien äänitasot ulkona ja sisällä, H - Asuinrakennus, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persenttiili mukaan

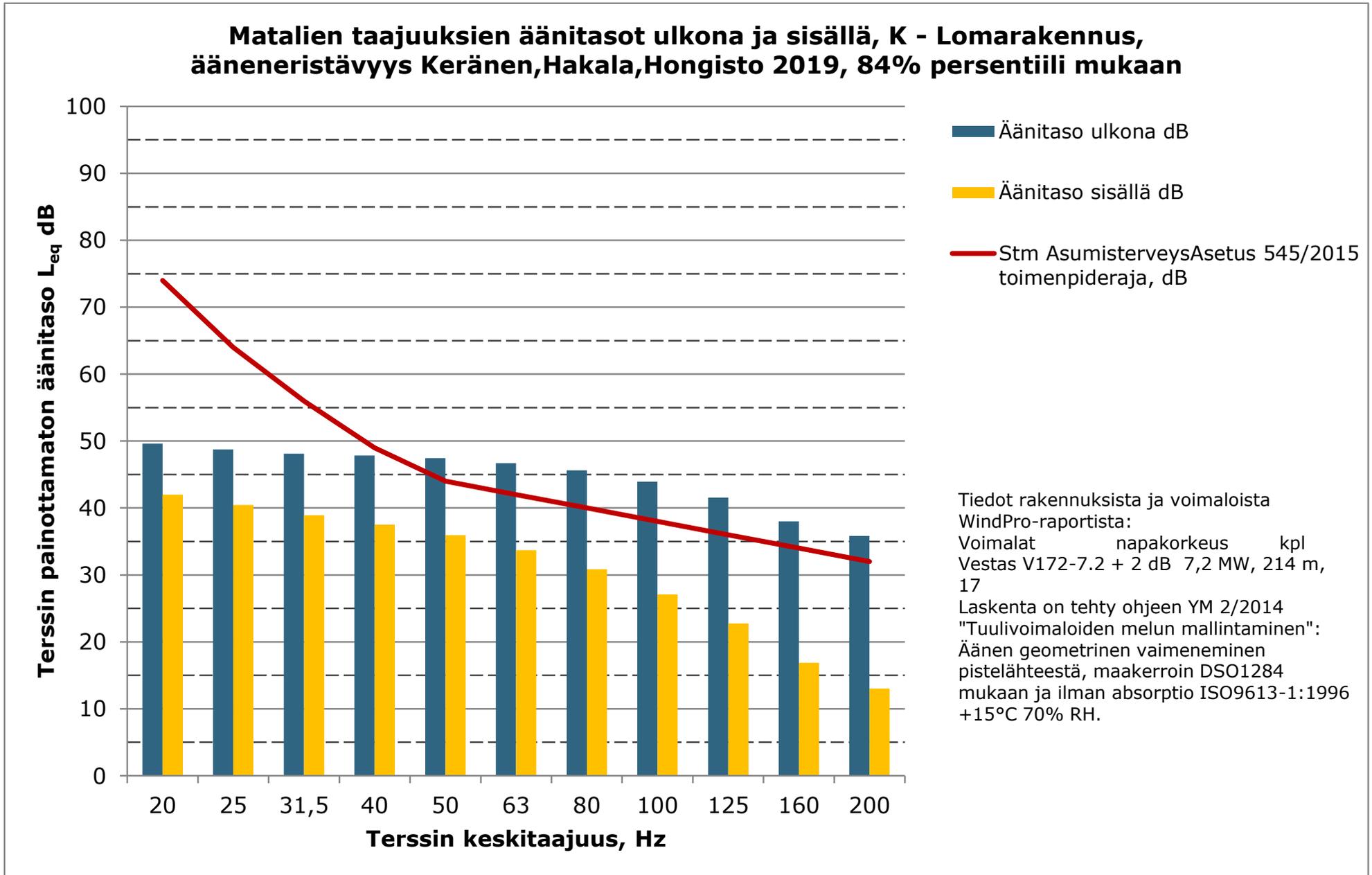


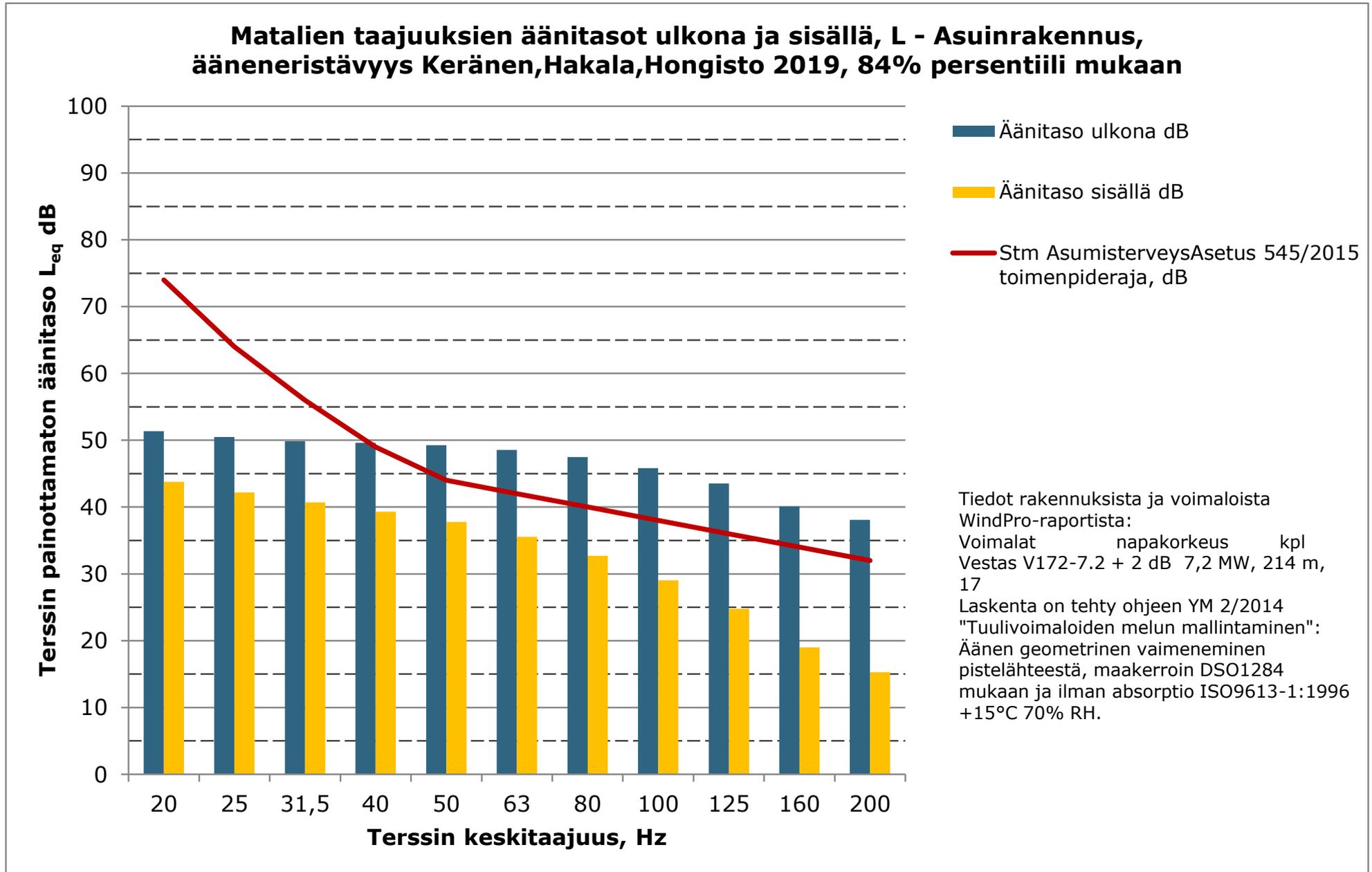
### Matalien taajuuksien äänitasot ulkona ja sisällä, I - Asuinrakennus, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persenttiili mukaan



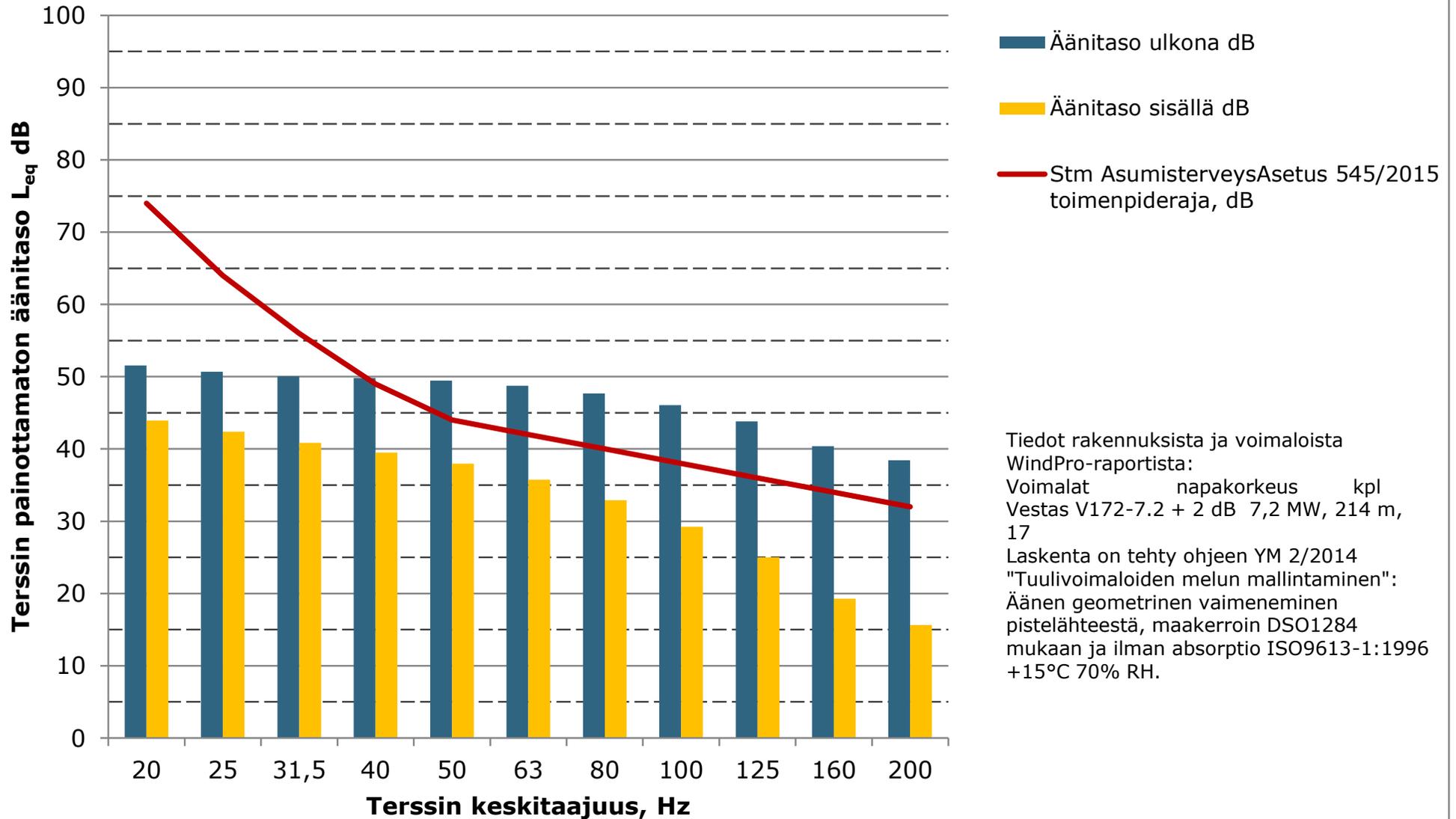
### Matalien taajuuksien äänitasot ulkona ja sisällä, J - Asuinrakennus, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persenttiili mukaan

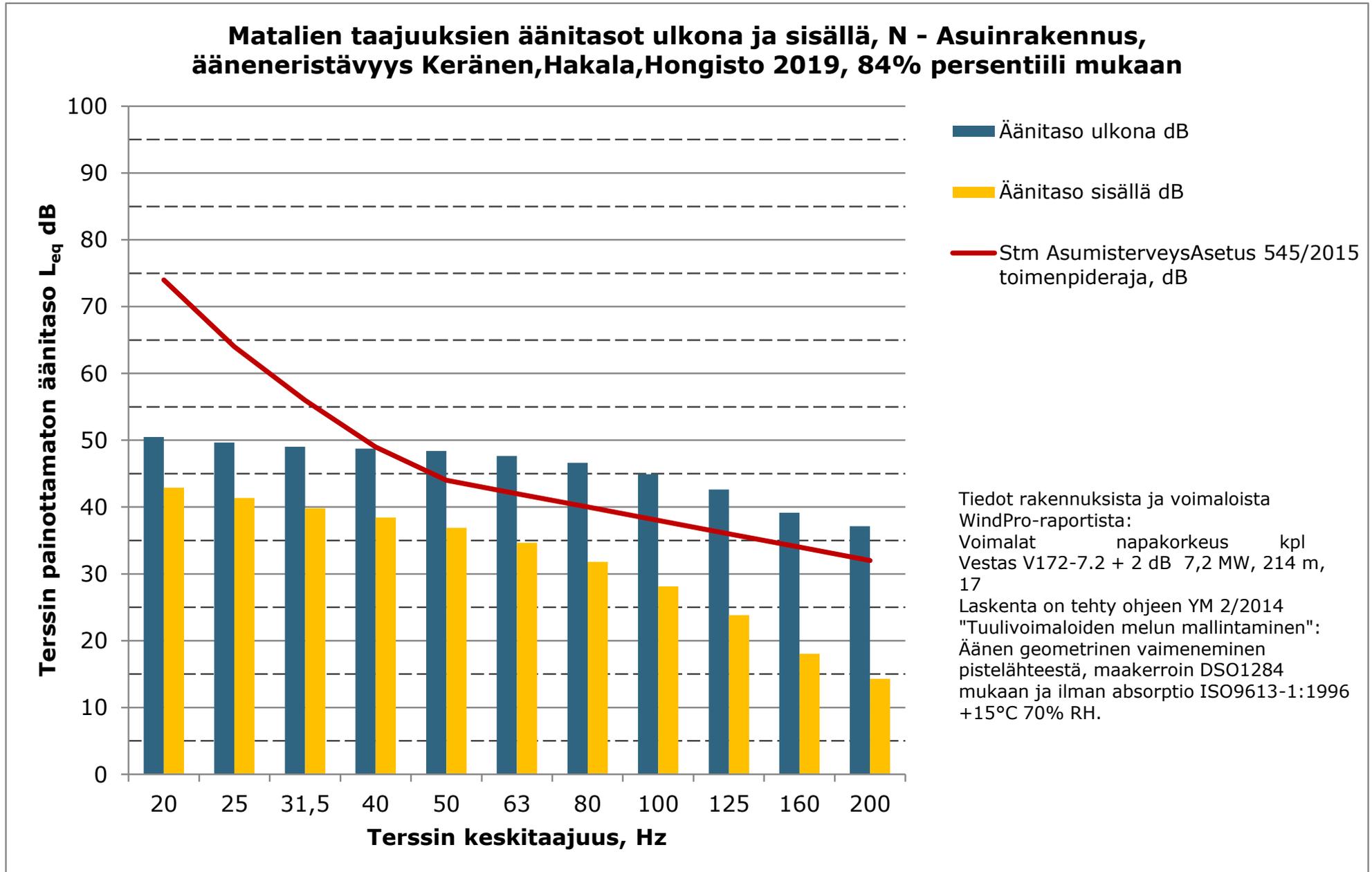




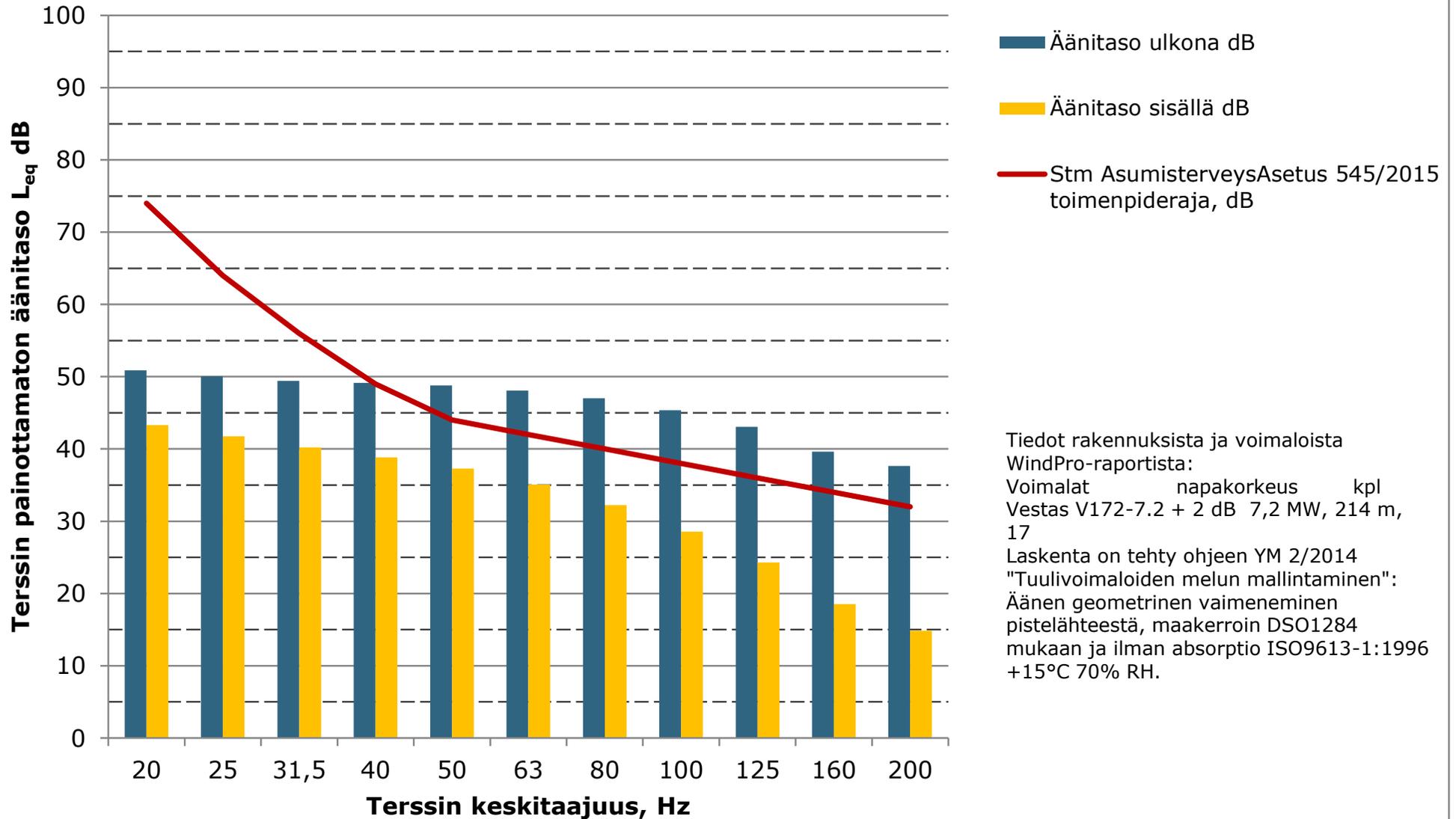


**Matalien taajuuksien äänitasot ulkona ja sisällä, M - Asuinrakennus, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persenttiili mukaan**





**Matalien taajuuksien äänitasot ulkona ja sisällä, O - Lomarakenus, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan**



7.6.2024

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**Liite 3. Varjostusmallinnuksen tulokset "Real Case, No forest"**

Project:

Iisalmi\_11\_9\_2023\_melu\_ja\_varjo\_VE3

Licensed user:

FCG Finnish Consulting Group Oy  
 Osmontie 34, PO Box 950  
 FI-00601 Helsinki  
 +358104095666  
 Henri Korhonen / henri.korhonen@fcg.fi  
 Calculated:  
 6.6.2024 16.00/3.6.355

## SHADOW - Main Result

Calculation: Vuorimäki\_17xG200\_HH200\_No\_Forest  
 Assumptions for shadow calculations

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

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

Sunshine probability S (Average daily sunshine hours) []  
 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,00 2,82 4,23 6,60 8,77 9,10 8,87 6,80 4,67 2,52 1,17 0,58

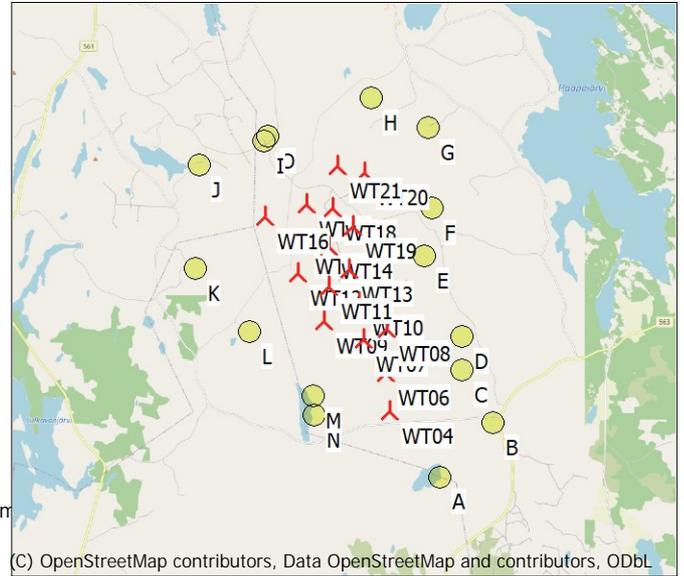
Operational time  
 N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 542 404 384 420 571 797 968 981 843 750 680 691 8 031

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\_Iisalmi\_11\_9\_2023\_m  
 Receptor grid resolution: 1,0 m

All coordinates are in  
 Finish TM ETRS-TM35FIN-ETRS89

### WTGs

	East	North	Z	Row data/Description	WTG type			Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
					Valid	Manufact.	Type-generator				Calculation distance [m]	RPM [RPM]
			[m]									
WT04	494 862	7 038 207	154,8	Generic RD200 HH200 720...Yes	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 089	10,5
WT06	494 754	7 039 241	147,5	Generic RD200 HH200 720...Yes	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 089	10,5
WT07	494 173	7 040 131	140,0	Generic RD200 HH200 720...Yes	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 089	10,5
WT08	494 786	7 040 397	147,5	Generic RD200 HH200 720...Yes	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 089	10,5
WT09	493 117	7 040 613	120,0	Generic RD200 HH200 720...Yes	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 089	10,5
WT10	494 062	7 041 098	135,0	Generic RD200 HH200 720...Yes	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 089	10,5
WT11	493 253	7 041 535	121,6	Generic RD200 HH200 720...Yes	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 089	10,5
WT12	492 433	7 041 875	113,9	Generic RD200 HH200 720...Yes	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 089	10,5
WT13	493 787	7 041 972	127,4	Generic RD200 HH200 720...Yes	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 089	10,5
WT14	493 258	7 042 580	121,3	Generic RD200 HH200 720...Yes	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 089	10,5
WT15	492 571	7 042 744	108,0	Generic RD200 HH200 720...Yes	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 089	10,5
WT16	491 564	7 043 384	109,1	Generic RD200 HH200 720...Yes	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 089	10,5
WT17	492 656	7 043 721	115,0	Generic RD200 HH200 720...Yes	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 089	10,5
WT18	493 363	7 043 625	130,0	Generic RD200 HH200 720...Yes	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 089	10,5
WT19	493 912	7 043 119	137,4	Generic RD200 HH200 720...Yes	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 089	10,5
WT20	494 208	7 044 554	140,0	Generic RD200 HH200 720...Yes	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 089	10,5
WT21	493 507	7 044 753	124,6	Generic RD200 HH200 720...Yes	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 089	10,5



### 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	A-Lomarakennus	496 179	7 036 433	150,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
B	B-Asuinrakennus	497 572	7 037 905	187,2	5,0	5,0	1,0	90,0	"Green house mode"	6,0
C	C-Asuinrakennus	496 767	7 039 301	157,3	5,0	5,0	1,0	90,0	"Green house mode"	6,0
D	D-Asuinrakennus	496 772	7 040 186	172,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
E	E-Asuinrakennus	495 769	7 042 361	158,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
F	F-Asuinrakennus	495 967	7 043 612	170,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
G	G-Asuinrakennus	495 873	7 045 750	112,3	5,0	5,0	1,0	90,0	"Green house mode"	6,0
H	H-Asuinrakennus	494 394	7 046 537	110,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
I	I-Asuinrakennus	491 559	7 045 388	105,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
J	J-Asuinrakennus	489 826	7 044 782	117,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
K	K-Lomarakennus	489 734	7 042 016	123,2	5,0	5,0	1,0	90,0	"Green house mode"	6,0
L	L-Asuinrakennus	491 142	7 040 353	138,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0
M	M-Asuinrakennus	492 839	7 038 637	127,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0

To be continued on next page...

## SHADOW - Main Result

Calculation: Vuorimäki\_17xG200\_HH200\_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]
N	N-Asuinrakennus	492 862	7 038 112	132,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
O	O-Lomarakennus	491 663	7 045 538	102,6	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	A-Lomarakennus	0:00
B	B-Asuinrakennus	0:00
C	C-Asuinrakennus	1:51
D	D-Asuinrakennus	2:00
E	E-Asuinrakennus	4:13
F	F-Asuinrakennus	3:12
G	G-Asuinrakennus	1:33
H	H-Asuinrakennus	3:36
I	I-Asuinrakennus	5:53
J	J-Asuinrakennus	0:00
K	K-Lomarakennus	0:00
L	L-Asuinrakennus	4:47
M	M-Asuinrakennus	7:13
N	N-Asuinrakennus	2:13
O	O-Lomarakennus	3:23

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

No.	Name	Expected [h/year]
WT04	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (36)	3:59
WT06	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (37)	4:35
WT07	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (38)	2:43
WT08	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (39)	2:00
WT09	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (41)	2:08
WT10	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (40)	0:00
WT11	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (43)	0:00
WT12	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (42)	2:39
WT13	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (44)	1:30
WT14	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (46)	0:00
WT15	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (47)	0:00
WT16	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (48)	2:19
WT17	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (49)	3:17
WT18	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (50)	0:00
WT19	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (45)	2:44
WT20	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (51)	6:41
WT21	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (52)	5:01

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

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

## SHADOW - Calendar

Calculation: Vuorimäki\_17xG200\_HH200\_No\_Forest  
 Assumptions for shadow calculations

Shadow receptor: A - A-Lomarakennus

Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,00 2,82 4,23 6,60 8,77 9,10 8,87 6,80 4,67 2,52 1,17 0,58

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 542 404 384 420 571 797 968 981 843 750 680 691 8 031

	January	February	March	April	May	June	July	August	September	October	November	December
1	09.55	08.51	07.22	06.36	04.53	03.22	03.04	04.23	05.55	07.18	07.49	09.20
	14.37	16.03	17.30	20.00	21.29	23.01	23.28	22.13	20.30	18.46	16.03	14.43
2	09.54	08.48	07.19	06.32	04.50	03.19	03.05	04.26	05.57	07.21	07.52	09.22
	14.39	16.06	17.33	20.03	21.32	23.04	23.27	22.10	20.26	18.42	16.00	14.41
3	09.53	08.45	07.15	06.29	04.47	03.17	03.07	04.29	06.00	07.24	07.55	09.25
	14.41	16.09	17.36	20.06	21.35	23.06	23.26	22.07	20.23	18.39	15.57	14.39
4	09.52	08.42	07.12	06.25	04.43	03.15	03.09	04.32	06.03	07.27	07.58	09.27
	14.43	16.12	17.39	20.09	21.38	23.09	23.24	22.04	20.19	18.36	15.53	14.38
5	09.51	08.39	07.09	06.22	04.40	03.13	03.11	04.35	06.06	07.30	08.02	09.30
	14.45	16.16	17.42	20.12	21.41	23.11	23.22	22.00	20.16	18.32	15.50	14.36
6	09.50	08.36	07.05	06.18	04.37	03.11	03.12	04.38	06.09	07.32	08.05	09.32
	14.47	16.19	17.45	20.15	21.44	23.13	23.21	21.57	20.12	18.29	15.47	14.34
7	09.48	08.33	07.02	06.15	04.34	03.09	03.15	04.41	06.12	07.35	08.08	09.35
	14.50	16.22	17.48	20.17	21.47	23.15	23.19	21.54	20.09	18.25	15.44	14.33
8	09.47	08.30	06.58	06.11	04.30	03.08	03.17	04.44	06.14	07.38	08.11	09.37
	14.52	16.25	17.51	20.20	21.51	23.17	23.17	21.51	20.05	18.22	15.41	14.32
9	09.45	08.27	06.55	06.08	04.27	03.06	03.19	04.47	06.17	07.41	08.14	09.39
	14.54	16.28	17.54	20.23	21.54	23.19	23.15	21.47	20.02	18.18	15.38	14.30
10	09.44	08.24	06.52	06.05	04.24	03.04	03.21	04.50	06.20	07.44	08.17	09.41
	14.57	16.31	17.57	20.26	21.57	23.21	23.13	21.44	19.59	18.15	15.35	14.29
11	09.42	08.21	06.48	06.01	04.21	03.03	03.24	04.53	06.23	07.47	08.20	09.43
	15.00	16.35	18.00	20.29	22.00	23.23	23.11	21.41	19.55	18.12	15.32	14.28
12	09.40	08.18	06.45	05.58	04.18	03.02	03.26	04.56	06.25	07.49	08.23	09.45
	15.02	16.38	18.03	20.32	22.03	23.25	23.09	21.37	19.52	18.08	15.30	14.27
13	09.38	08.14	06.41	05.54	04.15	03.00	03.29	04.59	06.28	07.52	08.26	09.46
	15.05	16.41	18.05	20.35	22.06	23.26	23.06	21.34	19.48	18.05	15.27	14.27
14	09.36	08.11	06.38	05.51	04.12	02.58	03.31	05.02	06.31	07.55	08.30	09.48
	15.08	16.44	18.08	20.38	22.09	23.27	23.04	21.31	19.45	18.02	15.24	14.26
15	09.34	08.08	06.34	05.47	04.08	02.58	03.34	05.05	06.34	07.58	08.33	09.49
	15.11	16.47	18.11	20.41	22.12	23.29	23.01	21.28	19.41	17.58	15.21	14.26
16	09.32	08.05	06.31	05.44	04.05	02.57	03.37	05.08	06.37	08.01	08.36	09.51
	15.13	16.50	18.14	20.44	22.15	23.30	22.59	21.24	19.38	17.55	15.18	14.25
17	09.30	08.02	06.28	05.41	04.02	02.57	03.39	05.11	06.39	08.04	08.39	09.52
	15.16	16.53	18.17	20.47	22.18	23.31	22.56	21.21	19.34	17.51	15.16	14.25
18	09.28	07.58	06.24	05.37	03.59	02.56	03.42	05.14	06.42	08.07	08.42	09.53
	15.19	16.57	18.20	20.50	22.21	23.31	22.54	21.17	19.31	17.48	15.13	14.25
19	09.25	07.55	06.21	05.34	03.56	02.56	03.45	05.17	06.45	08.10	08.45	09.54
	15.22	17.00	18.23	20.53	22.24	23.32	22.51	21.14	19.27	17.45	15.10	14.25
20	09.23	07.52	06.17	05.30	03.53	02.56	03.48	05.20	06.48	08.13	08.48	09.55
	15.25	17.03	18.26	20.56	22.27	23.33	22.48	21.11	19.24	17.42	15.08	14.25
21	09.21	07.49	06.14	05.27	03.51	02.56	03.50	05.23	06.50	08.16	08.51	09.56
	15.28	17.06	18.28	20.59	22.30	23.33	22.46	21.07	19.20	17.38	15.05	14.25
22	09.18	07.45	06.10	05.23	03.48	02.56	03.53	05.26	06.53	08.19	08.54	09.56
	15.31	17.09	18.31	21.02	22.33	23.33	22.43	21.04	19.17	17.35	15.03	14.26
23	09.16	07.42	06.07	05.20	03.45	02.57	03.56	05.29	06.56	08.22	08.57	09.57
	15.34	17.12	18.34	21.05	22.36	23.33	22.40	21.01	19.13	17.32	15.00	14.26
24	09.13	07.39	06.03	05.17	03.42	02.57	03.59	05.32	06.59	08.25	09.00	09.57
	15.37	17.15	18.37	21.08	22.39	23.33	22.37	20.57	19.10	17.28	14.58	14.27
25	09.10	07.35	06.00	05.13	03.39	02.58	04.02	05.35	07.02	07.28	09.03	09.57
	15.41	17.18	18.40	21.11	22.42	23.33	22.34	20.54	19.07	16.25	14.56	14.28
26	09.08	07.32	05.56	05.10	03.37	02.59	04.05	05.37	07.04	07.31	09.06	09.58
	15.44	17.21	18.43	21.14	22.45	23.32	22.31	20.50	19.03	16.22	14.53	14.29
27	09.05	07.29	05.53	05.07	03.34	03.00	04.08	05.40	07.07	07.34	09.09	09.57
	15.47	17.24	18.46	21.17	22.48	23.32	22.28	20.47	19.00	16.19	14.51	14.30
28	09.02	07.25	05.50	05.03	03.31	03.00	04.11	05.43	07.10	07.37	09.12	09.57
	15.50	17.27	18.49	21.20	22.51	23.31	22.25	20.43	18.56	16.15	14.49	14.31
29	08.59		06.46	05.00	03.29	03.01	04.14	05.46	07.13	07.40	09.14	09.57
	15.53		19.51	21.23	22.53	23.30	22.22	20.40	18.53	16.12	14.47	14.32
30	08.57		06.43	04.57	03.26	03.02	04.17	05.49	07.15	07.43	09.17	09.57
	15.56		19.54	21.26	22.56	23.29	22.19	20.37	18.49	16.09	14.45	14.34
31	08.54		06.39		03.24		04.20	05.52		07.46		09.56
	16.00		19.57		22.59		22.16	20.33		16.06		14.35
Potential sun hours	179	241	363	448	562	610	598	504	392	307	204	147
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

### SHADOW - Calendar

Calculation: Vuorimäki\_17xG200\_HH200\_No\_Forest  
 Assumptions for shadow calculations

Shadow receptor: B - B-Asuinrakennus

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,00	2,82	4,23	6,60	8,77	9,10	8,87	6,80	4,67	2,52	1,17	0,58

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
542	404	384	420	571	797	968	981	843	750	680	691	8 031

	January	February	March	April	May	June	July	August	September	October	November	December
1	09.55	08.51	07.22	06.36	04.53	03.21	03.03	04.23	05.54	07.18	07.49	09.20
	14.37	16.03	17.30	20.00	21.29	23.01	23.28	22.13	20.30	18.46	16.03	14.43
2	09.54	08.48	07.19	06.32	04.50	03.19	03.05	04.26	05.57	07.21	07.52	09.22
	14.39	16.06	17.33	20.03	21.32	23.04	23.27	22.10	20.26	18.42	15.59	14.41
3	09.53	08.45	07.15	06.29	04.46	03.17	03.07	04.29	06.00	07.24	07.55	09.25
	14.41	16.09	17.36	20.06	21.35	23.06	23.26	22.07	20.23	18.39	15.56	14.39
4	09.52	08.42	07.12	06.25	04.43	03.15	03.08	04.32	06.03	07.27	07.58	09.28
	14.43	16.12	17.39	20.09	21.38	23.09	23.24	22.04	20.19	18.35	15.53	14.37
5	09.51	08.39	07.08	06.22	04.40	03.13	03.10	04.35	06.06	07.29	08.01	09.30
	14.45	16.15	17.42	20.12	21.41	23.11	23.23	22.00	20.16	18.32	15.50	14.36
6	09.50	08.36	07.05	06.18	04.37	03.11	03.12	04.38	06.09	07.32	08.05	09.32
	14.47	16.19	17.45	20.14	21.44	23.13	23.21	21.57	20.12	18.29	15.47	14.34
7	09.48	08.33	07.02	06.15	04.33	03.09	03.14	04.41	06.11	07.35	08.08	09.35
	14.49	16.22	17.48	20.17	21.47	23.15	23.19	21.54	20.09	18.25	15.44	14.33
8	09.47	08.30	06.58	06.11	04.30	03.07	03.16	04.44	06.14	07.38	08.11	09.37
	14.52	16.25	17.51	20.20	21.51	23.18	23.17	21.51	20.05	18.22	15.41	14.31
9	09.45	08.27	06.55	06.08	04.27	03.06	03.19	04.47	06.17	07.41	08.14	09.39
	14.54	16.28	17.54	20.23	21.54	23.19	23.15	21.47	20.02	18.18	15.38	14.30
10	09.44	08.24	06.51	06.04	04.24	03.04	03.21	04.50	06.20	07.44	08.17	09.41
	14.57	16.31	17.57	20.26	21.57	23.21	23.13	21.44	19.58	18.15	15.35	14.29
11	09.42	08.21	06.48	06.01	04.21	03.03	03.23	04.53	06.23	07.47	08.20	09.43
	14.59	16.34	17.59	20.29	22.00	23.23	23.11	21.41	19.55	18.12	15.32	14.28
12	09.40	08.18	06.45	05.58	04.18	03.01	03.26	04.56	06.25	07.49	08.23	09.45
	15.02	16.38	18.02	20.32	22.03	23.25	23.09	21.37	19.51	18.08	15.29	14.27
13	09.38	08.14	06.41	05.54	04.14	03.00	03.28	04.59	06.28	07.52	08.26	09.46
	15.05	16.41	18.05	20.35	22.06	23.26	23.06	21.34	19.48	18.05	15.27	14.26
14	09.36	08.11	06.38	05.51	04.11	02.58	03.31	05.02	06.31	07.55	08.30	09.48
	15.07	16.44	18.08	20.38	22.09	23.28	23.04	21.31	19.45	18.01	15.24	14.26
15	09.34	08.08	06.34	05.47	04.08	02.57	03.34	05.05	06.34	07.58	08.33	09.49
	15.10	16.47	18.11	20.41	22.12	23.29	23.02	21.27	19.41	17.58	15.21	14.25
16	09.32	08.05	06.31	05.44	04.05	02.57	03.36	05.08	06.36	08.01	08.36	09.51
	15.13	16.50	18.14	20.44	22.15	23.30	22.59	21.24	19.38	17.55	15.18	14.25
17	09.30	08.02	06.27	05.40	04.02	02.56	03.39	05.11	06.39	08.04	08.39	09.52
	15.16	16.53	18.17	20.47	22.18	23.31	22.56	21.21	19.34	17.51	15.15	14.25
18	09.28	07.58	06.24	05.37	03.59	02.56	03.42	05.14	06.42	08.07	08.42	09.53
	15.19	16.56	18.20	20.50	22.21	23.32	22.54	21.17	19.31	17.48	15.13	14.24
19	09.25	07.55	06.21	05.34	03.56	02.56	03.45	05.17	06.45	08.10	08.45	09.54
	15.22	16.59	18.23	20.53	22.24	23.32	22.51	21.14	19.27	17.45	15.10	14.24
20	09.23	07.52	06.17	05.30	03.53	02.56	03.47	05.20	06.48	08.13	08.48	09.55
	15.25	17.03	18.26	20.56	22.27	23.33	22.48	21.11	19.24	17.41	15.08	14.25
21	09.21	07.49	06.14	05.27	03.50	02.56	03.50	05.23	06.50	08.16	08.51	09.56
	15.28	17.06	18.28	20.59	22.30	23.33	22.46	21.07	19.20	17.38	15.05	14.25
22	09.18	07.45	06.10	05.23	03.47	02.56	03.53	05.26	06.53	08.19	08.54	09.56
	15.31	17.09	18.31	21.02	22.33	23.33	22.43	21.04	19.17	17.35	15.02	14.25
23	09.16	07.42	06.07	05.20	03.45	02.56	03.56	05.29	06.56	08.22	08.57	09.57
	15.34	17.12	18.34	21.05	22.36	23.33	22.40	21.00	19.13	17.31	15.00	14.26
24	09.13	07.39	06.03	05.17	03.42	02.57	03.59	05.31	06.59	08.25	09.00	09.57
	15.37	17.15	18.37	21.08	22.39	23.33	22.37	20.57	19.10	17.28	14.58	14.27
25	09.10	07.35	06.00	05.13	03.39	02.58	04.02	05.34	07.01	07.28	09.03	09.58
	15.40	17.18	18.40	21.11	22.42	23.33	22.34	20.54	19.06	16.25	14.55	14.27
26	09.08	07.32	05.56	05.10	03.36	02.58	04.05	05.37	07.04	07.31	09.06	09.58
	15.43	17.21	18.43	21.14	22.45	23.33	22.31	20.50	19.03	16.22	14.53	14.28
27	09.05	07.29	05.53	05.06	03.34	02.59	04.08	05.40	07.07	07.34	09.09	09.58
	15.47	17.24	18.46	21.17	22.48	23.32	22.28	20.47	18.59	16.18	14.51	14.29
28	09.02	07.25	05.49	05.03	03.31	03.01	04.11	05.43	07.10	07.37	09.12	09.57
	15.50	17.27	18.48	21.20	22.51	23.31	22.25	20.43	18.56	16.15	14.49	14.31
29	08.59		06.46	05.00	03.29	03.01	04.14	05.46	07.13	07.40	09.14	09.57
	15.53		19.51	21.23	22.53	23.30	22.22	20.40	18.53	16.12	14.47	14.32
30	08.57		06.42	04.56	03.26	03.02	04.17	05.49	07.15	07.43	09.17	09.57
	15.56		19.54	21.26	22.56	23.29	22.19	20.36	18.49	16.09	14.45	14.33
31	08.54		06.39		03.24		04.20	05.52		07.46		09.56
	15.59		19.57		22.59		22.16	20.33		16.06		14.35
Potential sun hours	178	241	363	448	562	611	599	504	392	307	204	147
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:

Iisalmi\_11\_9\_2023\_melu\_ja\_varjo\_VE3

Licensed user:

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Henri Korhonen / henri.korhonen@fcg.fi
Calculated:
6.6.2024 16.00/3.6.355

SHADOW - Calendar

Calculation: Vuorimäki\_17xG200\_HH200\_No\_Forest Shadow receptor: C - C-Asuinrakennus
Assumptions for shadow calculations Sunshine probability S (Average daily sunshine hours) []
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1,00 2,82 4,23 6,60 8,77 9,10 8,87 6,80 4,67 2,52 1,17 0,58

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
542 404 384 420 571 797 968 981 843 750 680 691 8 031

Table with columns for months (January to December) and rows for days (1-31) and summary rows (Potential sun hours, 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)



Project:

Iisalmi\_11\_9\_2023\_melu\_ja\_varjo\_VE3

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 Calculated:  
 6.6.2024 16.00/3.6.355

## SHADOW - Calendar

Calculation: Vuorimäki\_17xG200\_HH200\_No\_Forest  
 Assumptions for shadow calculations

Shadow receptor: D - D-Asuinrakennus

Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,00 2,82 4,23 6,60 8,77 9,10 8,87 6,80 4,67 2,52 1,17 0,58

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 542 404 384 420 571 797 968 981 843 750 680 691 8 031

	January	February	March	April	May	June	July	August	September	October	November	December
1	09.56 14.37	08.51 16.02	07.22 17.30	06.36 20.00	19.23 (WT08) 21.29	04.53 23.02	03.21 23.29	03.03 22.13	05.54 20.30	19.14 (WT08) 18.46	07.18 16.03	07.49 14.42
2	09.55 14.39	08.48 16.06	07.19 17.33	06.32 20.03	19.20 (WT08) 21.32	04.50 23.04	03.19 23.28	03.05 22.10	05.57 20.26	19.13 (WT08) 18.42	07.21 15.59	07.52 14.41
3	09.54 14.41	08.45 16.09	07.15 17.36	06.29 20.06	19.19 (WT08) 21.35	04.46 23.07	03.17 23.26	03.06 22.07	06.00 20.23	19.12 (WT08) 18.39	07.24 15.56	07.55 14.39
4	09.53 14.43	08.42 16.12	07.12 17.39	06.25 20.09	19.18 (WT08) 21.38	04.43 23.09	03.15 23.25	03.08 22.04	06.03 20.19	19.12 (WT08) 18.35	07.27 15.53	07.59 14.37
5	09.52 14.45	08.39 16.15	07.09 17.42	06.22 20.12	19.16 (WT08) 21.42	04.40 23.12	03.12 23.23	03.10 22.01	06.06 20.16	19.12 (WT08) 18.32	07.30 15.50	08.02 14.35
6	09.50 14.47	08.36 16.18	07.05 17.45	06.18 20.15	19.16 (WT08) 21.45	04.37 23.14	03.11 23.21	03.12 21.57	06.09 20.12	19.11 (WT08) 18.29	07.32 15.47	08.05 14.34
7	09.49 14.49	08.33 16.22	07.02 17.48	06.15 20.17	19.15 (WT08) 21.48	04.33 23.16	03.09 23.20	03.14 21.54	06.11 20.09	19.12 (WT08) 18.25	07.35 15.44	08.08 14.33
8	09.47 14.52	08.30 16.25	06.58 17.51	06.11 20.20	19.15 (WT08) 21.51	04.30 23.18	03.07 23.18	03.16 21.51	06.14 20.05	19.12 (WT08) 18.22	07.38 15.41	08.11 14.31
9	09.46 14.54	08.27 16.28	06.55 17.54	06.08 20.23	19.15 (WT08) 21.54	04.27 23.20	03.05 23.16	03.18 21.48	06.17 20.02	19.13 (WT08) 18.18	07.41 15.38	08.14 14.30
10	09.44 14.57	08.24 16.31	06.52 17.57	06.04 20.26	19.14 (WT08) 21.57	04.24 23.22	03.04 23.13	03.21 21.44	06.20 19.59	19.13 (WT08) 18.15	07.44 15.35	08.17 14.29
11	09.42 14.59	08.21 16.34	06.48 18.00	06.01 20.29	19.15 (WT08) 22.00	04.21 23.24	03.02 23.11	03.23 21.41	06.23 19.55	19.15 (WT08) 18.12	07.47 15.32	08.20 14.28
12	09.41 15.02	08.18 16.38	06.45 18.02	05.58 20.32	19.16 (WT08) 22.03	04.17 23.25	03.01 23.09	03.26 21.38	06.25 19.52	19.18 (WT08) 18.08	07.49 15.29	08.24 14.27
13	09.39 15.05	08.15 16.41	06.41 18.05	05.54 20.35	19.16 (WT08) 22.06	04.14 23.27	03.00 23.07	03.28 21.34	06.28 19.48	19.13 (WT08) 18.05	07.52 15.26	08.27 14.26
14	09.37 15.07	08.11 16.44	06.38 18.08	05.51 20.38	19.14 (WT08) 22.09	04.11 23.28	02.58 23.04	03.31 21.31	06.31 19.45	19.18 (WT08) 18.01	07.55 15.24	08.30 14.26
15	09.35 15.10	08.08 16.47	06.34 18.11	05.47 20.41	19.20 (WT08) 22.12	04.08 23.29	02.57 23.02	03.33 21.28	06.34 19.41	19.15 (WT08) 17.58	07.58 15.21	08.33 14.25
16	09.32 15.13	08.05 16.50	06.31 18.14	05.44 20.44	19.30 (WT08) 22.16	04.05 23.30	02.56 22.59	03.36 21.24	06.36 19.38	03.06 17.55	05.08 15.18	08.36 14.25
17	09.30 15.16	08.02 16.53	06.28 18.17	05.40 20.47	19.30 (WT08) 22.19	04.02 23.31	02.56 23.27	03.39 21.21	06.39 19.34	03.04 17.51	05.11 15.15	08.39 14.24
18	09.28 15.19	07.59 16.56	06.24 18.20	05.37 20.50	19.30 (WT08) 22.22	03.59 23.32	02.55 22.54	03.41 21.18	06.42 19.31	03.04 17.48	05.14 15.13	08.42 14.24
19	09.26 15.22	07.55 16.59	06.21 18.23	05.33 20.53	19.30 (WT08) 22.25	03.56 23.33	02.55 22.52	03.44 21.14	06.45 19.27	03.05 17.45	05.17 15.10	08.45 14.24
20	09.23 15.25	07.52 17.03	06.17 18.26	05.30 20.56	19.30 (WT08) 22.28	03.53 23.33	02.55 22.49	03.47 21.11	06.48 19.24	03.06 17.41	05.20 15.07	08.48 14.24
21	09.21 15.28	07.49 17.06	06.14 18.28	05.27 20.59	19.30 (WT08) 22.31	03.50 23.34	02.55 22.46	03.50 21.07	06.50 19.20	03.07 17.38	05.23 15.05	08.51 14.25
22	09.18 15.31	07.45 17.09	06.10 18.31	05.23 21.02	19.30 (WT08) 22.34	03.47 23.34	02.56 22.43	03.53 21.04	06.53 19.17	03.08 17.35	05.26 15.02	08.54 14.25
23	09.16 15.34	07.42 17.12	06.07 18.34	05.20 21.05	19.30 (WT08) 22.37	03.44 23.34	02.56 22.40	03.56 21.01	06.56 19.13	03.09 17.31	05.29 15.00	08.57 14.26
24	09.13 15.37	07.39 17.15	06.03 18.37	05.16 21.08	19.30 (WT08) 22.40	03.42 23.34	02.57 22.37	03.59 20.57	06.59 19.10	03.10 17.28	05.31 14.57	09.00 14.26
25	09.11 15.40	07.35 17.18	06.00 18.40	05.13 21.11	19.30 (WT08) 22.43	03.39 23.33	02.57 22.35	04.02 20.54	07.01 19.06	03.11 17.25	05.34 14.55	09.03 14.27
26	09.08 15.43	07.32 17.21	05.56 18.43	05.10 21.14	19.30 (WT08) 22.46	03.36 23.33	02.58 22.32	04.05 20.50	07.04 19.03	03.12 17.22	05.37 14.53	09.06 14.28
27	09.05 15.47	07.29 17.24	05.53 18.46	05.06 21.17	19.30 (WT08) 22.48	03.34 23.32	02.59 22.29	04.08 20.47	07.07 19.00	03.13 17.18	05.40 14.51	09.09 14.29
28	09.02 15.50	07.25 17.27	05.49 18.49	05.03 21.20	19.30 (WT08) 22.51	03.31 23.32	03.00 22.26	04.11 20.44	07.10 18.56	03.14 17.15	05.43 14.48	09.12 14.30
29	09.00 15.53	07.21 17.31	05.46 18.51	05.00 21.23	19.30 (WT08) 22.54	03.28 23.31	03.00 22.23	04.14 20.40	07.13 18.53	03.15 17.12	05.46 14.46	09.15 14.32
30	08.57 15.56	06.43 17.34	05.43 18.54	04.56 21.26	19.30 (WT08) 22.56	03.26 23.30	03.02 22.19	04.17 20.37	07.15 18.49	03.16 17.09	05.49 14.44	09.17 14.33
31	08.54 15.59	06.39 17.37	05.39 18.57	04.56 21.29	19.30 (WT08) 22.59	03.24 23.33	03.00 22.16	04.20 20.33	07.16 18.42	03.17 17.06	05.52 14.42	09.18 14.35
Potential sun hours	178	241	363	449	563	611	599	504	392	307	203	146
Total, worst case				260				62	198			
Sun reduction				0.44				0.42	0.36			
Oper. time red.				0.92				0.92	0.92			
Wind dir. red.				0.62				0.62	0.62			
Total reduction				0.25				0.24	0.20			
Total, real				66				15	40			

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

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

Project:

Iisalmi\_11\_9\_2023\_melu\_ja\_varjo\_VE3

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Henri Korhonen / henri.korhonen@fcg.fi
Calculated:
6.6.2024 16.00/3.6.355

SHADOW - Calendar

Calculation: Vuorimäki\_17xG200\_HH200\_No\_Forest
Assumptions for shadow calculations

Shadow receptor: E - E-Asuinrakennus

Sunshine probability S (Average daily sunshine hours) []

Table with 12 columns (Jan-Dec) and 1 row of values: 1,00 2,82 4,23 6,60 8,77 9,10 8,87 6,80 4,67 2,52 1,17 0,58

Operational time

Table with 13 columns (N-Sum) and 1 row of values: 542 404 384 420 571 797 968 981 843 750 680 691 8 031

Main data table with columns for months (January-June) and rows for each day (1-31) showing sun rise/set times, potential sun hours, and various reduction factors.

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

Summary table with 4 columns: Day in month, Sun rise/set, Minutes with flicker, and WTG causing flicker times.



## SHADOW - Calendar

Calculation: Vuorimäki\_17xG200\_HH200\_No\_Forest  
 Assumptions for shadow calculations

Shadow receptor: E - E-Asuinrakennus

Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,00 2,82 4,23 6,60 8,77 9,10 8,87 6,80 4,67 2,52 1,17 0,58

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 542 404 384 420 571 797 968 981 843 750 680 691 8 031

	July	August	September	October	November	December	
1	03.03	04.23	05.54	07.18	18.06 (WT13)	07.49	09.20
	23.29	22.13	20.30	18.46	2 18.08 (WT13)	16.02	14.42
2	03.04	04.26	05.57	07.21		07.53	09.23
	23.28	22.10	20.26	18.42		15.59	14.40
3	03.06	04.29	06.00	07.24		07.56	09.26
	23.27	22.07	20.23	18.39		15.56	14.39
4	03.08	04.32	06.03	07.27		07.59	09.28
	23.25	22.04	20.19	18.35		15.53	14.37
5	03.10	04.35	20.27 (WT19)	06.06	07.30	08.02	09.31
	23.23	22.01	7 20.34 (WT19)	20.16	18.32	15.50	14.35
6	03.12	04.38	20.23 (WT19)	06.09	07.32	08.05	09.33
	23.22	21.58	12 20.35 (WT19)	20.13	18.29	15.47	14.34
7	03.14	04.41	20.22 (WT19)	06.11	07.35	08.08	09.35
	23.20	21.54	15 20.37 (WT19)	20.09	18.25	15.44	14.32
8	03.16	04.44	20.21 (WT19)	06.14	07.38	08.11	09.37
	23.18	21.51	18 20.39 (WT19)	20.06	18.22	15.41	14.31
9	03.18	04.47	20.19 (WT19)	06.17	07.41	08.14	09.40
	23.16	21.48	20 20.39 (WT19)	20.02	18.18	15.38	14.30
10	03.20	04.50	20.18 (WT19)	06.20	07.44	08.18	09.42
	23.14	21.45	22 20.40 (WT19)	19.59	18.15	15.35	14.29
11	03.23	04.53	20.17 (WT19)	06.23	07.47	08.21	09.44
	23.12	21.41	23 20.40 (WT19)	19.55	18.12	15.32	14.28
12	03.25	04.56	20.17 (WT19)	06.25	07.50	08.24	09.45
	23.09	21.38	23 20.40 (WT19)	19.52	18.08	15.29	14.27
13	03.28	04.59	20.17 (WT19)	06.28	07.53	08.27	09.47
	23.07	21.35	24 20.41 (WT19)	19.48	18.05	15.26	14.26
14	03.30	05.02	20.16 (WT19)	06.31	07.55	08.30	09.49
	23.05	21.31	24 20.40 (WT19)	19.45	18.01	15.24	14.25
15	03.33	05.05	20.16 (WT19)	06.34	07.58	08.33	09.50
	23.02	21.28	24 20.40 (WT19)	19.41	17.58	15.21	14.25
16	03.36	05.08	20.16 (WT19)	06.37	08.01	08.36	09.52
	23.00	21.25	24 20.40 (WT19)	19.38	17.55	15.18	14.24
17	03.39	05.11	20.16 (WT19)	06.39	08.04	08.39	09.53
	22.57	21.21	23 20.39 (WT19)	19.34	17.51	15.15	14.24
18	03.41	05.14	20.16 (WT19)	06.42	10 18.13 (WT13)	08.07	09.54
	22.55	21.18	21 20.37 (WT19)	19.31	10 18.23 (WT13)	17.48	14.24
19	03.44	05.17	20.17 (WT19)	06.45	18.11 (WT13)	08.10	09.55
	22.52	21.14	17 20.34 (WT19)	19.27	14 18.25 (WT13)	17.45	14.24
20	03.47	05.20	20.17 (WT19)	06.48	18.08 (WT13)	08.13	09.56
	22.49	21.11	13 20.30 (WT19)	19.24	18 18.26 (WT13)	17.41	14.24
21	03.50	05.23	20.18 (WT19)	06.50	18.07 (WT13)	08.16	09.57
	22.46	21.08	10 20.28 (WT19)	19.20	20 18.27 (WT13)	17.38	14.24
22	03.53	05.26	20.20 (WT19)	06.53	18.06 (WT13)	08.19	09.57
	22.44	21.04	5 20.25 (WT19)	19.17	21 18.27 (WT13)	17.35	14.25
23	03.56	05.29	06.56	18.05 (WT13)	08.22	08.58	09.58
	22.41	21.01	19.13	23 18.28 (WT13)	17.31	15.00	14.25
24	03.59	05.31	06.59	18.04 (WT13)	08.25	09.01	09.58
	22.38	20.57	19.10	23 18.27 (WT13)	17.28	14.57	14.26
25	04.02	05.34	07.02	18.03 (WT13)	07.28	09.04	09.58
	22.35	20.54	19.07	24 18.27 (WT13)	16.25	14.55	14.27
26	04.05	05.37	07.04	18.03 (WT13)	07.31	09.06	09.58
	22.32	20.51	19.03	23 18.26 (WT13)	16.22	14.53	14.28
27	04.08	05.40	07.07	18.03 (WT13)	07.34	09.09	09.58
	22.29	20.47	19.00	19 18.22 (WT13)	16.18	14.50	14.29
28	04.11	05.43	07.10	18.04 (WT13)	07.37	09.12	09.58
	22.26	20.44	18.56	15 18.19 (WT13)	16.15	14.48	14.30
29	04.14	05.46	07.13	18.05 (WT13)	07.40	09.15	09.58
	22.23	20.40	18.53	11 18.16 (WT13)	16.12	14.46	14.31
30	04.17	05.49	07.16	18.05 (WT13)	07.43	09.18	09.57
	22.20	20.37	18.49	6 18.11 (WT13)	16.09	14.44	14.33
31	04.20	05.52			07.46		09.57
	22.17	20.33			16.06		14.34
Potential sun hours	599	505	392	307		203	146
Total, worst case			325	227			
Sun reduction			0,42	0,36		0,25	
Oper. time red.			0,92	0,92			
Wind dir. red.			0,64	0,60			
Total reduction			0,24	0,20		0,14	
Total, real			79	45			

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

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

Project:

Iisalmi\_11\_9\_2023\_melu\_ja\_varjo\_VE3

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 Calculated:  
 6.6.2024 16.00/3.6.355

## SHADOW - Calendar

Calculation: Vuorimäki\_17xG200\_HH200\_No\_Forest  
 Assumptions for shadow calculations

Shadow receptor: F - F-Asuinrakennus

Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,00 2,82 4,23 6,60 8,77 9,10 8,87 6,80 4,67 2,52 1,17 0,58

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 542 404 384 420 571 797 968 981 843 750 680 691 8 031

	January	February	March	April	May	June
1	09.56	08.51	07.22	06.36	04.53	20.33 (WT20)
	14.36	16.02	17.30	20.00	21.29	15 20.48 (WT20)
2	09.55	08.49	07.19	06.32	04.50	20.32 (WT20)
	14.38	16.06	17.33	20.03	21.33	18 20.50 (WT20)
3	09.54	08.46	07.16	06.29	04.46	20.31 (WT20)
	14.40	16.09	17.36	20.06	21.36	22 20.53 (WT20)
4	09.53	08.43	07.12	06.25	04.43	20.31 (WT20)
	14.42	16.12	17.39	20.09	21.39	24 20.55 (WT20)
5	09.52	08.40	07.09	06.22	04.40	20.30 (WT20)
	14.44	16.15	17.42	20.12	21.42	25 20.55 (WT20)
6	09.51	08.37	07.05	06.18	04.36	20.30 (WT20)
	14.47	16.18	17.45	20.15	21.45	24 20.54 (WT20)
7	09.49	08.34	07.02	06.15	04.33	20.30 (WT20)
	14.49	16.22	17.48	20.18	21.48	24 20.54 (WT20)
8	09.48	08.30	06.59	06.11	04.30	20.30 (WT20)
	14.51	16.25	17.51	20.21	21.51	25 20.55 (WT20)
9	09.46	08.27	06.55	06.08	04.27	20.30 (WT20)
	14.54	16.28	17.54	20.23	21.54	24 20.54 (WT20)
10	09.45	08.24	06.52	06.04	04.24	20.31 (WT20)
	14.56	16.31	17.57	20.26	21.57	22 20.53 (WT20)
11	09.43	08.21	06.48	06.01	04.20	20.32 (WT20)
	14.59	16.34	18.00	20.29	22.00	21 20.53 (WT20)
12	09.41	08.18	06.45	05.57	04.17	20.32 (WT20)
	15.01	16.37	18.02	20.32	22.04	20 20.52 (WT20)
13	09.39	08.15	06.41	05.54	04.14	20.32 (WT20)
	15.04	16.41	18.05	20.35	22.07	19 20.51 (WT20)
14	09.37	08.12	06.38	05.51	04.11	20.34 (WT20)
	15.07	16.44	18.08	20.38	22.10	17 20.51 (WT20)
15	09.35	08.08	06.34	05.47	04.08	20.35 (WT20)
	15.10	16.47	18.11	20.41	22.13	14 20.49 (WT20)
16	09.33	08.05	06.31	05.44	04.05	20.37 (WT20)
	15.13	16.50	18.14	20.44	22.16	11 20.48 (WT20)
17	09.31	08.02	06.28	05.40	04.02	20.39 (WT20)
	15.16	16.53	18.17	20.47	22.19	6 20.45 (WT20)
18	09.28	07.59	06.24	05.37	03.59	20.42 (WT20)
	15.19	16.56	18.20	20.50	22.22	20.45 (WT20)
19	09.26	07.55	06.21	05.33	03.56	20.44 (WT20)
	15.22	16.59	18.23	20.53	22.25	20.47 (WT20)
20	09.24	07.52	06.17	05.30	03.53	20.46 (WT20)
	15.25	17.02	18.26	20.56	22.28	20.49 (WT20)
21	09.21	07.49	06.14	05.27	03.50	20.48 (WT20)
	15.28	17.06	18.29	20.59	22.31	20.51 (WT20)
22	09.19	07.46	06.10	05.23	03.47	20.50 (WT20)
	15.31	17.09	18.31	21.02	22.34	20.53 (WT20)
23	09.16	07.42	06.07	05.20	03.44	20.52 (WT20)
	15.34	17.12	18.34	21.05	22.37	20.55 (WT20)
24	09.14	07.39	06.03	05.16	03.41	20.54 (WT20)
	15.37	17.15	18.37	21.08	22.40	20.57 (WT20)
25	09.11	07.36	06.00	05.13	03.39	20.56 (WT20)
	15.40	17.18	18.40	21.11	22.43	20.59 (WT20)
26	09.08	07.32	05.56	05.10	03.36	20.60 (WT20)
	15.43	17.21	18.43	21.14	22.46	20.63 (WT20)
27	09.06	07.29	05.53	05.06	03.33	20.64 (WT20)
	15.46	17.24	18.46	21.17	22.49	20.67 (WT20)
28	09.03	07.26	05.49	05.03	03.31	20.68 (WT20)
	15.50	17.27	18.49	21.20	22.52	20.71 (WT20)
29	09.00		06.46	05.00	03.28	20.72 (WT20)
	15.53		19.52	21.23	22.54	20.75 (WT20)
30	08.57		06.43	04.56	03.26	20.76 (WT20)
	15.56		19.54	21.26	22.57	20.79 (WT20)
31	08.54		06.39		03.23	20.80 (WT20)
	15.59		19.57		23.00	20.83 (WT20)
Potential sun hours	178	241	363	449	563	612
Total, worst case				23		331
Sun reduction				0,44		0,48
Oper. time red.				0,92		0,92
Wind dir. red.				0,65		0,65
Total reduction				0,26		0,29
Total, real				6		95

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

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

Project:

Iisalmi\_11\_9\_2023\_melu\_ja\_varjo\_VE3

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 Henri Korhonen / henri.korhonen@fcg.fi  
 Calculated:  
 6.6.2024 16.00/3.6.355

## SHADOW - Calendar

Calculation: Vuorimäki\_17xG200\_HH200\_No\_Forest  
 Assumptions for shadow calculations

Shadow receptor: F - F-Asuinrakennus

Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,00 2,82 4,23 6,60 8,77 9,10 8,87 6,80 4,67 2,52 1,17 0,58

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 542 404 384 420 571 797 968 981 843 750 680 691 8 031

	July	August	September	October	November	December	
1	03.02	04.23	20.42 (WT20)	05.54	07.18	07.49	09.21
	23.29	22.14	21.03 (WT20)	20.30	18.46	16.02	14.42
2	03.04	04.26	20.41 (WT20)	05.57	07.21	07.53	09.23
	23.28	22.10	21.04 (WT20)	20.26	18.42	15.59	14.40
3	03.06	04.29	20.40 (WT20)	06.00	07.24	07.56	09.26
	23.27	22.07	21.03 (WT20)	20.23	18.39	15.56	14.38
4	03.07	04.32	20.40 (WT20)	06.03	07.27	07.59	09.28
	23.25	22.04	21.04 (WT20)	20.20	18.35	15.53	14.37
5	03.09	04.35	20.40 (WT20)	06.06	07.30	08.02	09.31
	23.24	22.01	21.05 (WT20)	20.16	18.32	15.50	14.35
6	03.11	04.38	20.40 (WT20)	06.09	07.32	08.05	09.33
	23.22	21.58	21.04 (WT20)	20.13	18.29	15.47	14.34
7	03.13	04.41	20.40 (WT20)	06.11	07.35	08.08	09.35
	23.20	21.54	21.05 (WT20)	20.09	18.25	15.44	14.32
8	03.16	04.44	20.39 (WT20)	06.14	07.38	08.11	09.38
	23.18	21.51	21.04 (WT20)	20.06	18.22	15.41	14.31
9	03.18	04.47	20.40 (WT20)	06.17	07.41	08.14	09.40
	23.16	21.48	21.04 (WT20)	20.02	18.18	15.38	14.30
10	03.20	04.50	20.40 (WT20)	06.20	07.44	08.18	09.42
	23.14	21.45	21.01 (WT20)	19.59	18.15	15.35	14.28
11	03.23	04.53	20.40 (WT20)	06.23	07.47	08.21	09.44
	23.12	21.41	20.58 (WT20)	19.55	18.12	15.32	14.27
12	03.25	04.56	20.41 (WT20)	06.25	07.50	08.24	09.46
	23.10	21.38	20.55 (WT20)	19.52	18.08	15.29	14.27
13	03.28	04.59	20.42 (WT20)	06.28	07.53	08.27	09.47
	23.07	21.35	20.52 (WT20)	19.48	18.05	15.26	14.26
14	03.30	05.02	20.42 (WT20)	06.31	07.55	08.30	09.49
	23.05	21.31	20.49 (WT20)	19.45	18.01	15.23	14.25
15	03.33	05.05	20.44 (WT20)	06.34	07.58	08.33	09.50
	23.02	21.28	20.46 (WT20)	19.41	17.58	15.21	14.25
16	03.36	05.08		06.37	08.01	08.36	09.52
	23.00	21.25		19.38	17.55	15.18	14.24
17	03.38	05.11		06.39	08.04	08.39	09.53
	22.57	21.21		19.34	17.51	15.15	14.24
18	03.41	05.14		06.42	08.07	08.43	09.54
	22.55	21.18		19.31	17.48	15.12	14.24
19	03.44	05.17		06.45	08.10	08.46	09.55
	22.52	21.14		19.27	17.45	15.10	14.24
20	03.47	05.20		06.48	08.13	08.49	09.56
	22.49	21.11		19.24	17.41	15.07	14.24
21	03.50	05.23		06.50	08.16	08.52	09.57
	22.46	21.08		19.20	17.38	15.05	14.24
22	03.53	05.26		06.53	08.19	08.55	09.57
	22.44	21.04		19.17	17.35	15.02	14.25
23	03.56	05.28		06.56	08.22	08.58	09.58
	22.41	21.01		19.13	17.31	15.00	14.25
24	03.58	05.31		06.59	08.25	09.01	09.58
	22.38	20.57		19.10	17.28	14.57	14.26
25	04.01	05.34		07.02	07.28	09.04	09.58
	22.35	20.54		19.07	16.25	14.55	14.27
26	04.04	05.37		07.04	07.31	09.07	09.59
	22.32	20.51		19.03	16.22	14.53	14.28
27	04.07	20.49 (WT20)	05.40	07.07	07.34	09.09	09.58
	22.29	8 20.57 (WT20)	20.47	19.00	16.18	14.50	14.29
28	04.10	20.46 (WT20)	05.43	07.10	07.37	09.12	09.58
	22.26	13 20.59 (WT20)	20.44	18.56	16.15	14.48	14.30
29	04.13	20.45 (WT20)	05.46	07.13	07.40	09.15	09.58
	22.23	16 21.01 (WT20)	20.40	18.53	16.12	14.46	14.31
30	04.16	20.43 (WT20)	05.49	07.16	07.43	09.18	09.57
	22.20	18 21.01 (WT20)	20.37	18.49	16.09	14.44	14.33
31	04.19	20.43 (WT20)	05.52		07.46		09.57
	22.17	20 21.03 (WT20)	20.33		16.06		14.34
Potential sun hours	599		505	392	307	203	146
Total, worst case		75	286				
Sun reduction		0,46	0,42				
Oper. time red.		0,92	0,92				
Wind dir. red.		0,65	0,65				
Total reduction		0,27	0,25				
Total, real		20	71				

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

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

Project:

Iisalmi\_11\_9\_2023\_melu\_ja\_varjo\_VE3

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Calculated:
6.6.2024 16.00/3.6.355

SHADOW - Calendar

Calculation: Vuorimäki\_17xG200\_HH200\_No\_Forest
Assumptions for shadow calculations

Shadow receptor: G - G-Asuinrakennus

Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1,00 2,82 4,23 6,60 8,77 9,10 8,87 6,80 4,67 2,52 1,17 0,58

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
542 404 384 420 571 797 968 981 843 750 680 691 8 031

Table with columns for months (January to December) and rows for each day of the month, showing sun rise/set times, shadow reduction, and operational time. Includes summary rows for 'Potential sun hours' and 'Total, real'.

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

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

Project:

Iisalmi\_11\_9\_2023\_melu\_ja\_varjo\_VE3

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 Henri Korhonen / henri.korhonen@fcg.fi  
 Calculated:  
 6.6.2024 16.00/3.6.355

## SHADOW - Calendar

Calculation: Vuorimäki\_17xG200\_HH200\_No\_Forest  
 Assumptions for shadow calculations

Shadow receptor: H - H-Asuinrakennus

Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,00 2,82 4,23 6,60 8,77 9,10 8,87 6,80 4,67 2,52 1,17 0,58

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 542 404 384 420 571 797 968 981 843 750 680 691 8 031

	January	February	March	April	May	June
1	09.57	08.52	12.44 (WT20)	07.22	06.36	04.53
	14.36	16.02	32 14.28 (WT21)	17.30	20.00	21.30
2	09.56	08.49	14.04 (WT21)	07.19	06.32	04.49
	14.38	16.05	23 14.27 (WT21)	17.33	20.03	21.33
3	09.55	08.46	14.04 (WT21)	07.16	06.29	04.46
	14.40	16.09	23 14.27 (WT21)	17.36	20.06	21.36
4	09.54	12.36 (WT20)	08.43	14.05 (WT21)	07.12	06.25
	14.42	5 12.41 (WT20)	16.12	22 14.27 (WT21)	17.39	20.09
5	09.52	12.34 (WT20)	08.40	14.06 (WT21)	07.09	06.22
	14.44	9 12.43 (WT20)	16.15	20 14.26 (WT21)	17.42	20.12
6	09.51	12.34 (WT20)	08.37	14.07 (WT21)	07.06	06.18
	14.46	11 12.45 (WT20)	16.18	18 14.25 (WT21)	17.45	20.15
7	09.50	12.33 (WT20)	08.34	14.09 (WT21)	07.02	06.15
	14.49	13 12.46 (WT20)	16.22	15 14.24 (WT21)	17.48	20.18
8	09.48	12.32 (WT20)	08.31	14.11 (WT21)	06.59	06.11
	14.51	15 12.47 (WT20)	16.25	11 14.22 (WT21)	17.51	20.21
9	09.47	12.33 (WT20)	08.28	06.55	06.08	04.27
	14.53	16 12.49 (WT20)	16.28	17.54	20.24	21.55
10	09.45	12.32 (WT20)	08.25	06.52	06.04	04.23
	14.56	18 12.50 (WT20)	16.31	17.57	20.27	21.58
11	09.43	12.32 (WT20)	08.21	06.48	06.01	04.20
	14.59	19 12.51 (WT20)	16.34	18.00	20.30	22.01
12	09.41	12.32 (WT20)	08.18	06.45	05.58	04.17
	15.01	20 12.52 (WT20)	16.37	18.03	20.32	22.04
13	09.39	12.32 (WT20)	08.15	06.42	05.54	04.14
	15.04	21 12.53 (WT20)	16.41	18.05	20.35	22.07
14	09.37	12.31 (WT20)	08.12	06.38	05.51	04.11
	15.07	22 12.53 (WT20)	16.44	18.08	20.38	22.10
15	09.35	12.32 (WT20)	08.09	06.35	05.47	04.08
	15.10	23 12.55 (WT20)	16.47	18.11	20.41	22.13
16	09.33	12.32 (WT20)	08.05	06.31	05.44	04.05
	15.13	23 12.55 (WT20)	16.50	18.14	20.44	22.16
17	09.31	12.31 (WT20)	08.02	06.28	05.40	04.02
	15.15	24 12.55 (WT20)	16.53	18.17	20.47	22.19
18	09.29	12.32 (WT20)	07.59	06.24	05.37	03.59
	15.18	26 14.13 (WT21)	16.56	18.20	20.50	22.22
19	09.26	12.32 (WT20)	07.56	06.21	05.33	03.56
	15.21	35 14.17 (WT21)	16.59	18.23	20.53	22.26
20	09.24	12.32 (WT20)	07.52	06.17	05.30	03.53
	15.24	38 14.19 (WT21)	17.03	18.26	20.56	22.29
21	09.22	12.33 (WT20)	07.49	06.14	05.27	03.50
	15.27	41 14.21 (WT21)	17.06	18.29	20.59	22.32
22	09.19	12.33 (WT20)	07.46	06.10	05.23	03.47
	15.31	43 14.22 (WT21)	17.09	18.32	21.02	22.35
23	09.17	12.33 (WT20)	07.43	06.07	05.20	03.44
	15.34	44 14.23 (WT21)	17.12	18.34	21.05	22.38
24	09.14	12.34 (WT20)	07.39	06.03	05.16	03.41
	15.37	45 14.24 (WT21)	17.15	18.37	21.08	22.41
25	09.11	12.34 (WT20)	07.36	06.00	05.13	03.38
	15.40	46 14.25 (WT21)	17.18	18.40	21.11	22.43
26	09.09	12.34 (WT20)	07.33	05.57	05.10	03.36
	15.43	46 14.25 (WT21)	17.21	18.43	21.14	22.46
27	09.06	12.36 (WT20)	07.29	05.53	05.06	03.33
	15.46	46 14.27 (WT21)	17.24	18.46	21.17	22.49
28	09.03	12.36 (WT20)	07.26	05.50	05.03	03.30
	15.49	46 14.27 (WT21)	17.27	18.49	21.21	22.52
29	09.00	12.37 (WT20)		06.46	04.59	03.28
	15.53	44 14.27 (WT21)		19.52	21.24	22.55
30	08.57	12.39 (WT20)		06.43	04.56	03.25
	15.56	42 14.28 (WT21)		19.55	21.27	22.58
31	08.55	12.40 (WT20)		06.39		03.23
	15.59	38 14.27 (WT21)		19.57		23.00
Potential sun hours	178	240	363	449	563	612
Total, worst case	819	164				
Sun reduction	0,17	0,33				
Oper. time red.	0,92	0,92				
Wind dir. red.	0,65	0,64				
Total reduction	0,10	0,19				
Total, real	86	32				

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

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

## SHADOW - Calendar

Calculation: Vuorimäki\_17xG200\_HH200\_No\_Forest  
 Assumptions for shadow calculations

Shadow receptor: H - H-Asuinrakennus

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,00	2,82	4,23	6,60	8,77	9,10	8,87	6,80	4,67	2,52	1,17	0,58

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
542	404	384	420	571	797	968	981	843	750	680	691	8 031

	July	August	September	October	November	December	
1	03.02	04.22	05.54	07.18	07.50	09.21	12.14 (WT20)
	23.30	22.14	20.30	18.46	16.02	14.42	19 12.33 (WT20)
2	03.04	04.25	05.57	07.21	07.53	13.45 (WT21)	09.24 12.14 (WT20)
	23.29	22.11	20.27	18.42	15.59	3 13.48 (WT21)	14.40 18 12.32 (WT20)
3	03.05	04.28	06.00	07.24	07.56	13.40 (WT21)	09.26 12.16 (WT20)
	23.27	22.08	20.23	18.39	15.56	11 13.51 (WT21)	14.38 16 12.32 (WT20)
4	03.07	04.32	06.03	07.27	07.59	13.38 (WT21)	09.29 12.17 (WT20)
	23.26	22.04	20.20	18.36	15.53	16 13.54 (WT21)	14.37 15 12.32 (WT20)
5	03.09	04.35	06.06	07.30	08.02	13.37 (WT21)	09.31 12.18 (WT20)
	23.24	22.01	20.16	18.32	15.50	18 13.55 (WT21)	14.35 14 12.32 (WT20)
6	03.11	04.38	06.09	07.33	08.05	13.36 (WT21)	09.34 12.19 (WT20)
	23.23	21.58	20.13	18.29	15.47	21 13.57 (WT21)	14.33 12 12.31 (WT20)
7	03.13	04.41	06.11	07.35	08.08	13.35 (WT21)	09.36 12.21 (WT20)
	23.21	21.55	20.09	18.25	15.44	22 13.57 (WT21)	14.32 9 12.30 (WT20)
8	03.15	04.44	06.14	07.38	08.12	13.34 (WT21)	09.38 12.23 (WT20)
	23.19	21.51	20.06	18.22	15.41	23 13.57 (WT21)	14.31 6 12.29 (WT20)
9	03.18	04.47	06.17	07.41	08.15	13.34 (WT21)	09.40
	23.17	21.48	20.02	18.18	15.38	24 13.58 (WT21)	14.29
10	03.20	04.50	06.20	07.44	08.18	12.14 (WT20)	09.42
	23.15	21.45	19.59	18.15	15.35	34 13.59 (WT21)	14.28
11	03.22	04.53	06.23	07.47	08.21	12.12 (WT20)	09.44
	23.12	21.42	19.55	18.12	15.32	39 13.59 (WT21)	14.27
12	03.25	04.56	06.25	07.50	08.24	12.11 (WT20)	09.46
	23.10	21.38	19.52	18.08	15.29	40 13.59 (WT21)	14.26
13	03.27	04.59	06.28	07.53	08.27	12.10 (WT20)	09.48
	23.08	21.35	19.48	18.05	15.26	43 13.59 (WT21)	14.26
14	03.30	05.02	06.31	07.56	08.30	12.08 (WT20)	09.49
	23.05	21.32	19.45	18.01	15.23	45 13.58 (WT21)	14.25
15	03.33	05.05	06.34	07.59	08.34	12.07 (WT20)	09.51
	23.03	21.28	19.41	17.58	15.21	46 13.58 (WT21)	14.24
16	03.35	05.08	06.37	08.01	08.37	12.08 (WT20)	09.52
	23.00	21.25	19.38	17.55	15.18	46 13.59 (WT21)	14.24
17	03.38	05.11	06.39	08.04	08.40	12.08 (WT20)	09.54
	22.58	21.22	19.34	17.51	15.15	46 13.59 (WT21)	14.24
18	03.41	05.14	06.42	08.07	08.43	12.08 (WT20)	09.55
	22.55	21.18	19.31	17.48	15.12	45 13.58 (WT21)	14.24
19	03.44	05.17	06.45	08.10	08.46	12.08 (WT20)	09.56
	22.52	21.15	19.28	17.45	15.10	44 13.58 (WT21)	14.24
20	03.47	05.20	06.48	08.13	08.49	12.08 (WT20)	09.57
	22.50	21.11	19.24	17.41	15.07	43 13.57 (WT21)	14.24
21	03.49	05.23	06.51	08.16	08.52	12.08 (WT20)	09.57
	22.47	21.08	19.21	17.38	15.04	41 13.56 (WT21)	14.24
22	03.52	05.26	06.53	08.19	08.55	12.08 (WT20)	09.58
	22.44	21.05	19.17	17.35	15.02	38 13.55 (WT21)	14.24
23	03.55	05.28	06.56	08.22	08.58	12.08 (WT20)	09.58
	22.41	21.01	19.14	17.31	14.59	35 13.53 (WT21)	14.25
24	03.58	05.31	06.59	08.25	09.01	12.09 (WT20)	09.59
	22.38	20.58	19.10	17.28	14.57	28 13.51 (WT21)	14.26
25	04.01	05.34	07.02	07.28	09.04	12.09 (WT20)	09.59
	22.35	20.54	19.07	16.25	14.55	24 12.33 (WT20)	14.26
26	04.04	05.37	07.04	07.31	09.07	12.10 (WT20)	09.59
	22.32	20.51	19.03	16.22	14.52	23 12.33 (WT20)	14.27
27	04.07	05.40	07.07	07.34	09.10	12.11 (WT20)	09.59
	22.29	20.47	19.00	16.18	14.50	23 12.34 (WT20)	14.28
28	04.10	05.43	07.10	07.37	09.13	12.11 (WT20)	09.59
	22.26	20.44	18.56	16.15	14.48	22 12.33 (WT20)	14.30
29	04.13	05.46	07.13	07.41	09.16	12.12 (WT20)	09.58
	22.23	20.40	18.53	16.12	14.46	21 12.33 (WT20)	14.31
30	04.16	05.49	07.16	07.44	09.18	12.13 (WT20)	09.58
	22.20	20.37	18.49	16.09	14.44	20 12.33 (WT20)	14.32
31	04.19	05.52	07.19	07.47	09.21	12.14 (WT20)	09.57
	22.17	20.34	18.46	16.06	14.42	19 12.33 (WT20)	14.33
Potential sun hours	600	505	392	306	203	145	
Total, worst case					884		109
Sun reduction					0,17		0,12
Oper. time red.					0,92		0,92
Wind dir. red.					0,65		0,66
Total reduction					0,10		0,07
Total, real					91		8

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: Vuorimäki\_17xG200\_HH200\_No\_Forest  
 Assumptions for shadow calculations

Shadow receptor: I - I-Asuinrakennus

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,00	2,82	4,23	6,60	8,77	9,10	8,87	6,80	4,67	2,52	1,17	0,58

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
542	404	384	420	571	797	968	981	843	750	680	691	8 031

		January		February		March		April		May		June	
1	09.57	12.06 (WT16)	08.52	09.55 (WT17)	07.23			06.36	04.53	03.21			
	14.37	16	12.22 (WT16)	16.03	10.18 (WT17)	17.30		20.01	21.30	23.03			
2	09.56	12.06 (WT16)	08.49	09.54 (WT17)	07.19			06.32	04.50	03.19			
	14.38	17	12.23 (WT16)	16.06	10.18 (WT17)	17.33		20.03	21.33	23.05			
3	09.55	12.06 (WT16)	08.46	09.54 (WT17)	07.16			06.29	04.46	03.16			
	14.40	18	12.24 (WT16)	16.09	10.18 (WT17)	17.36		20.06	21.36	23.08			
4	09.54	12.06 (WT16)	08.43	09.54 (WT17)	07.13			06.25	04.43	03.14			
	14.42	19	12.25 (WT16)	16.12	10.19 (WT17)	17.39		20.09	21.39	23.10			
5	09.53	12.06 (WT16)	08.40	09.54 (WT17)	07.09			06.22	04.40	03.12			
	14.44	19	12.25 (WT16)	16.15	10.19 (WT17)	17.42		20.12	21.42	23.13			
6	09.51	12.06 (WT16)	08.37	09.55 (WT17)	07.06			06.19	04.37	03.10			
	14.47	21	12.27 (WT16)	16.19	10.19 (WT17)	17.45		20.15	21.45	23.15			
7	09.50	12.06 (WT16)	08.34	09.55 (WT17)	07.02		07.38 (WT21)	06.15	04.33	03.08			
	14.49	21	12.27 (WT16)	16.22	10.19 (WT17)	17.48	2	07.40 (WT21)	20.18	21.49			
8	09.48	12.06 (WT16)	08.31	09.55 (WT17)	06.59			07.33 (WT21)	06.12	04.30			
	14.51	22	12.28 (WT16)	16.25	10.18 (WT17)	17.51	11	07.44 (WT21)	20.21	21.52			
9	09.47	12.07 (WT16)	08.28	09.57 (WT17)	06.55			07.31 (WT21)	06.08	04.27			
	14.54	22	12.29 (WT16)	16.28	10.18 (WT17)	17.54	16	07.47 (WT21)	20.24	21.55			
10	09.45	12.06 (WT16)	08.25	09.57 (WT17)	06.52			07.29 (WT21)	06.05	04.24			
	14.56	23	12.29 (WT16)	16.31	10.17 (WT17)	17.57	18	07.47 (WT21)	20.27	21.58			
11	09.43	12.06 (WT16)	08.22	09.59 (WT17)	06.49			07.27 (WT21)	06.01	04.21			
	14.59	24	12.30 (WT16)	16.35	10.16 (WT17)	18.00	21	07.48 (WT21)	20.30	22.01			
12	09.41	12.07 (WT16)	08.18	10.00 (WT17)	06.45			07.27 (WT21)	05.58	04.17			
	15.02	24	12.31 (WT16)	16.38	10.14 (WT17)	18.03	21	07.48 (WT21)	20.33	22.04			
13	09.40	12.07 (WT16)	08.15	10.02 (WT17)	06.42			07.26 (WT21)	05.54	04.14			
	15.04	24	12.31 (WT16)	16.41	10.11 (WT17)	18.06	22	07.48 (WT21)	20.36	22.07			
14	09.38	12.07 (WT16)	08.12		06.38			07.26 (WT21)	05.51	04.11			
	15.07	24	12.31 (WT16)	16.44	18.09	23	07.49 (WT21)	20.39	22.10	23.29			
15	09.35	12.08 (WT16)	08.09		06.35			07.25 (WT21)	05.47	04.08			
	15.10	24	12.32 (WT16)	16.47	18.12	23	07.48 (WT21)	20.42	22.13	23.31			
16	09.33	12.08 (WT16)	08.06		06.31			07.26 (WT21)	05.44	04.05			
	15.13	24	12.32 (WT16)	16.50	18.14	22	07.48 (WT21)	20.44	22.16	23.32			
17	09.31	12.08 (WT16)	08.02		06.28			07.25 (WT21)	05.41	04.02			
	15.16	24	12.32 (WT16)	16.53	18.17	21	07.46 (WT21)	20.47	22.20	23.33			
18	09.29	12.09 (WT16)	07.59		06.24			07.26 (WT21)	05.37	03.59			
	15.19	24	12.33 (WT16)	16.57	18.20	20	07.46 (WT21)	20.50	22.23	23.34			
19	09.27	12.09 (WT16)	07.56		06.21			07.27 (WT21)	05.34	03.56			
	15.22	24	12.33 (WT16)	17.00	18.23	17	07.44 (WT21)	20.53	22.26	23.34			
20	09.24	12.09 (WT16)	07.53		06.18			07.28 (WT21)	05.30	03.53			
	15.25	24	12.33 (WT16)	17.03	18.26	14	07.42 (WT21)	20.56	22.29	23.35			
21	09.22	12.10 (WT16)	07.49		06.14			07.30 (WT21)	05.27	03.50			
	15.28	24	12.34 (WT16)	17.06	18.29	9	07.39 (WT21)	20.59	22.32	23.35			
22	09.19	12.10 (WT16)	07.46		06.11			05.23	03.47	02.55			
	15.31	23	12.33 (WT16)	17.09	18.32			21.02	22.35	23.35			
23	09.17	12.11 (WT16)	07.43		06.07			05.20	03.44	02.55			
	15.34	22	12.33 (WT16)	17.12	18.35			21.05	22.38	23.35			
24	09.14	12.12 (WT16)	07.39		06.04			05.17	03.41	02.56			
	15.37	21	12.33 (WT16)	17.15	18.38			21.09	22.41	23.35			
25	09.11	10.02 (WT17)	07.36		06.00			05.13	03.39	02.57			
	15.40	26	12.33 (WT16)	17.18	18.40			21.12	22.44	23.35			
26	09.09	09.59 (WT17)	07.33		05.57			05.10	03.36	02.58			
	15.43	29	12.31 (WT16)	17.21	18.43			21.15	22.46	23.34			
27	09.06	09.58 (WT17)	07.29		05.53			05.07	03.33	02.59			
	15.47	30	12.31 (WT16)	17.24	18.46			21.18	22.49	23.34			
28	09.03	09.56 (WT17)	07.26		05.50			05.03	03.31	03.00			
	15.50	30	12.29 (WT16)	17.27	18.49			21.21	22.52	23.33			
29	09.00	09.56 (WT17)			06.46			05.00	03.28	03.00			
	15.53	26	12.27 (WT16)		19.52			21.24	22.55	23.32			
30	08.58	09.55 (WT17)			06.43			04.56	03.26	03.01			
	15.56	21	10.16 (WT17)		19.55			21.27	22.58	23.31			
31	08.55	09.54 (WT17)			06.39				03.23				
	15.59	23	10.17 (WT17)		19.58				23.00				
Potential sun hours	178		241		363			449	563	612			
Total, worst case	713		273		260								
Sun reduction	0,17		0,33		0,36								
Oper. time red.	0,92		0,92		0,92								
Wind dir. red.	0,67		0,67		0,62								
Total reduction	0,11		0,20		0,21								
Total, real	76		55		54								

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

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

## SHADOW - Calendar

Calculation: Vuorimäki\_17xG200\_HH200\_No\_Forest  
 Assumptions for shadow calculations

Shadow receptor: I - I-Asuinrakennus

Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,00 2,82 4,23 6,60 8,77 9,10 8,87 6,80 4,67 2,52 1,17 0,58

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 542 404 384 420 571 797 968 981 843 750 680 691 8 031

	July	August	September	October	November	December					
1	03.02	04.23	05.55	07.19	08.06 (WT21)	07.50	09.26 (WT17)	09.21	11.48 (WT16)		
	23.30	22.14	20.30	18.46	22 08.28 (WT21)	16.03	20 09.46 (WT17)	14.42	24 12.12 (WT16)		
2	03.04	04.26	05.58	07.21	08.06 (WT21)	07.53	09.26 (WT17)	09.24	11.49 (WT16)		
	23.29	22.11	20.27	18.43	21 08.27 (WT21)	16.00	21 09.47 (WT17)	14.40	23 12.12 (WT16)		
3	03.06	04.29	06.00	07.24	08.07 (WT21)	07.56	09.26 (WT17)	09.26	11.50 (WT16)		
	23.27	22.08	20.23	18.39	19 08.26 (WT21)	15.56	22 09.48 (WT17)	14.39	22 12.12 (WT16)		
4	03.07	04.32	06.03	07.27	08.07 (WT21)	07.59	09.24 (WT17)	09.29	11.50 (WT16)		
	23.26	22.05	20.20	18.36	17 08.24 (WT21)	15.53	24 09.48 (WT17)	14.37	22 12.12 (WT16)		
5	03.09	04.35	06.06	07.30	08.08 (WT21)	08.02	09.25 (WT17)	09.31	11.51 (WT16)		
	23.24	22.01	20.16	18.32	14 08.22 (WT21)	15.50	24 09.49 (WT17)	14.35	22 12.13 (WT16)		
6	03.11	04.38	06.09	07.33	08.11 (WT21)	08.06	09.25 (WT17)	09.34	11.52 (WT16)		
	23.23	21.58	20.13	18.29	8 08.19 (WT21)	15.47	24 09.49 (WT17)	14.34	20 12.12 (WT16)		
7	03.13	04.41	06.12	07.36		08.09	09.24 (WT17)	09.36	11.53 (WT16)		
	23.21	21.55	20.09	18.25		15.44	24 09.48 (WT17)	14.32	20 12.13 (WT16)		
8	03.16	04.44	06.15	07.39		08.12	09.24 (WT17)	09.38	11.53 (WT16)		
	23.19	21.52	20.06	18.22		15.41	25 09.49 (WT17)	14.31	19 12.12 (WT16)		
9	03.18	04.47	06.17	07.41		08.15	09.25 (WT17)	09.40	11.55 (WT16)		
	23.17	21.48	20.03	18.19		15.38	24 09.49 (WT17)	14.30	18 12.13 (WT16)		
10	03.20	04.50	06.20	07.44		08.18	09.25 (WT17)	09.42	11.55 (WT16)		
	23.15	21.45	19.59	18.15		15.35	23 09.48 (WT17)	14.29	17 12.12 (WT16)		
11	03.23	04.53	06.23	07.47		08.21	09.26 (WT17)	09.44	11.56 (WT16)		
	23.12	21.42	19.56	18.12		15.32	22 09.48 (WT17)	14.28	17 12.13 (WT16)		
12	03.25	04.56	06.26	07.50		08.24	09.27 (WT17)	09.46	11.57 (WT16)		
	23.10	21.38	19.52	18.08		15.29	21 09.48 (WT17)	14.27	15 12.12 (WT16)		
13	03.28	04.59	06.28	07.53		08.27	09.28 (WT17)	09.48	11.58 (WT16)		
	23.08	21.35	19.49	18.05		15.26	25 11.59 (WT16)	14.26	15 12.13 (WT16)		
14	03.30	05.02	06.31	07.56		08.31	09.29 (WT17)	09.49	11.59 (WT16)		
	23.05	21.32	19.45	18.02		15.24	30 12.02 (WT16)	14.25	13 12.12 (WT16)		
15	03.33	05.05	06.34	07.59		08.34	09.31 (WT17)	09.51	11.59 (WT16)		
	23.03	21.28	19.42	17.58		15.21	30 12.04 (WT16)	14.25	13 12.12 (WT16)		
16	03.36	05.08	06.37	08.02		08.37	09.33 (WT17)	09.52	12.00 (WT16)		
	23.00	21.25	19.38	17.55		15.18	29 12.05 (WT16)	14.24	13 12.13 (WT16)		
17	03.38	05.11	06.40	08.05		08.40	09.36 (WT17)	09.54	12.01 (WT16)		
	22.58	21.22	19.35	17.52		15.15	24 12.06 (WT16)	14.24	12 12.13 (WT16)		
18	03.41	05.14	06.42	08.08		08.43	11.46 (WT16)	09.55	12.02 (WT16)		
	22.55	21.18	19.31	17.48		15.13	21 12.07 (WT16)	14.24	11 12.13 (WT16)		
19	03.44	05.17	06.45	08.11		08.46	11.46 (WT16)	09.56	12.03 (WT16)		
	22.53	21.15	19.28	17.45		15.10	22 12.08 (WT16)	14.24	10 12.13 (WT16)		
20	03.47	05.20	06.48	08.13		08.49	11.45 (WT16)	09.57	12.03 (WT16)		
	22.50	21.12	19.24	17.42		15.07	24 12.09 (WT16)	14.24	10 12.13 (WT16)		
21	03.50	05.23	06.51	08.16		08.52	11.45 (WT16)	09.57	12.04 (WT16)		
	22.47	21.08	19.21	17.38		15.05	24 12.09 (WT16)	14.24	10 12.14 (WT16)		
22	03.53	05.26	06.54	08.17 (WT21)		08.55	11.45 (WT16)	09.58	12.04 (WT16)		
	22.44	21.05	19.17	5 08.22 (WT21)		17.35	15.02	24 12.09 (WT16)	14.25	10 12.14 (WT16)	
23	03.56	05.29	06.56	08.13 (WT21)		08.22	08.58	11.46 (WT16)	09.58	12.05 (WT16)	
	22.41	21.01	19.14	13 08.26 (WT21)		17.32	15.00	24 12.10 (WT16)	14.25	10 12.15 (WT16)	
24	03.59	05.32	06.59	08.11 (WT21)		08.25	09.01	11.46 (WT16)	09.59	12.04 (WT16)	
	22.38	20.58	19.10	16 08.27 (WT21)		17.28	14.57	25 12.11 (WT16)	14.26	11 12.15 (WT16)	
25	04.02	05.35	07.02	08.10 (WT21)		07.28	09.04	11.46 (WT16)	09.59	12.05 (WT16)	
	22.35	20.54	19.07	19 08.29 (WT21)		16.25	14.55	25 12.11 (WT16)	14.27	11 12.16 (WT16)	
26	04.05	05.37	07.05	08.08 (WT21)		07.32	09.07	11.46 (WT16)	09.59	12.06 (WT16)	
	22.33	20.51	19.03	20 08.28 (WT21)		16.22	14.53	25 12.11 (WT16)	14.28	11 12.17 (WT16)	
27	04.08	05.40	07.07	08.07 (WT21)		07.35	09.10	11.47 (WT16)	09.59	12.05 (WT16)	
	22.30	20.48	19.00	22 08.29 (WT21)		16.19	14.51	25 12.12 (WT16)	14.29	12 12.17 (WT16)	
28	04.11	05.43	07.10	08.06 (WT21)		07.38	09.13	11.47 (WT16)	09.59	12.06 (WT16)	
	22.26	20.44	18.56	23 08.29 (WT21)		16.15	14.48	25 12.12 (WT16)	14.30	12 12.18 (WT16)	
29	04.14	05.46	07.13	08.06 (WT21)		07.41	09.16	11.47 (WT16)	09.59	12.05 (WT16)	
	22.23	20.41	18.53	23 08.29 (WT21)		16.12	10 09.42 (WT17)	14.46	24 12.11 (WT16)	14.31	14 12.19 (WT16)
30	04.17	05.49	07.16	08.06 (WT21)		07.44	09.18	11.48 (WT16)	09.58	12.06 (WT16)	
	22.20	20.37	18.50	23 08.29 (WT21)		16.09	15 09.44 (WT17)	14.44	24 12.12 (WT16)	14.33	14 12.20 (WT16)
31	04.20	05.52		07.47		09.28 (WT17)		09.58		12.05 (WT16)	
	22.17	20.34		16.06	18 09.46 (WT17)			14.34	16 12.21 (WT16)		
Potential sun hours	600	505	392	307	203			146			
Total, worst case			164	144	724			467			
Sun reduction			0,36	0,25	0,17			0,12			
Oper. time red.			0,92	0,92	0,92			0,92			
Wind dir. red.			0,62	0,64	0,67			0,67			
Total reduction			0,21	0,15	0,11			0,08			
Total, real			34	22	77			35			

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: Vuorimäki\_17xG200\_HH200\_No\_Forest  
 Assumptions for shadow calculations

Shadow receptor: J - J-Asuinrakennus

Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,00 2,82 4,23 6,60 8,77 9,10 8,87 6,80 4,67 2,52 1,17 0,58

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 542 404 384 420 571 797 968 981 843 750 680 691 8 031

	January	February	March	April	May	June	July	August	September	October	November	December
1	09.57	08.52	07.23	06.36	04.53	03.21	03.03	04.23	05.55	07.19	07.50	09.21
	14.37	16.03	17.30	20.01	21.30	23.03	23.30	22.14	20.30	18.46	16.03	14.42
2	09.56	08.49	07.19	06.33	04.50	03.19	03.04	04.26	05.58	07.22	07.53	09.24
	14.39	16.06	17.33	20.04	21.33	23.06	23.29	22.11	20.27	18.43	16.00	14.41
3	09.55	08.46	07.16	06.29	04.47	03.17	03.06	04.29	06.01	07.24	07.56	09.26
	14.41	16.09	17.36	20.07	21.36	23.08	23.27	22.08	20.23	18.39	15.57	14.39
4	09.54	08.43	07.13	06.26	04.43	03.14	03.08	04.32	06.03	07.27	07.59	09.29
	14.43	16.12	17.39	20.09	21.39	23.10	23.26	22.05	20.20	18.36	15.53	14.37
5	09.53	08.40	07.09	06.22	04.40	03.12	03.10	04.35	06.06	07.30	08.02	09.31
	14.45	16.16	17.42	20.12	21.42	23.13	23.24	22.01	20.17	18.32	15.50	14.35
6	09.51	08.37	07.06	06.19	04.37	03.10	03.12	04.38	06.09	07.33	08.06	09.34
	14.47	16.19	17.45	20.15	21.46	23.15	23.23	21.58	20.13	18.29	15.47	14.34
7	09.50	08.34	07.02	06.15	04.34	03.08	03.14	04.41	06.12	07.36	08.09	09.36
	14.49	16.22	17.48	20.18	21.49	23.17	23.21	21.55	20.10	18.26	15.44	14.33
8	09.48	08.31	06.59	06.12	04.30	03.07	03.16	04.44	06.15	07.39	08.12	09.38
	14.52	16.25	17.51	20.21	21.52	23.19	23.19	21.52	20.06	18.22	15.41	14.31
9	09.47	08.28	06.56	06.08	04.27	03.05	03.18	04.47	06.17	07.42	08.15	09.40
	14.54	16.28	17.54	20.24	21.55	23.21	23.17	21.48	20.03	18.19	15.38	14.30
10	09.45	08.25	06.52	06.05	04.24	03.03	03.21	04.50	06.20	07.44	08.18	09.42
	14.57	16.32	17.57	20.27	21.58	23.23	23.15	21.45	19.59	18.15	15.35	14.29
11	09.43	08.22	06.49	06.01	04.21	03.02	03.23	04.53	06.23	07.47	08.21	09.44
	14.59	16.35	18.00	20.30	22.01	23.25	23.13	21.42	19.56	18.12	15.32	14.28
12	09.42	08.19	06.45	05.58	04.18	03.01	03.25	04.56	06.26	07.50	08.24	09.46
	15.02	16.38	18.03	20.33	22.04	23.27	23.10	21.39	19.52	18.09	15.30	14.27
13	09.40	08.15	06.42	05.54	04.14	02.58	03.28	04.59	06.29	07.53	08.28	09.48
	15.05	16.41	18.06	20.36	22.07	23.28	23.08	21.35	19.49	18.05	15.27	14.26
14	09.38	08.12	06.38	05.51	04.11	02.57	03.31	05.02	06.31	07.56	08.31	09.50
	15.07	16.44	18.09	20.39	22.10	23.29	23.06	21.32	19.45	18.02	15.24	14.26
15	09.36	08.09	06.35	05.48	04.08	02.57	03.33	05.05	06.34	07.59	08.34	09.51
	15.10	16.47	18.12	20.42	22.13	23.31	23.03	21.29	19.42	17.58	15.21	14.25
16	09.33	08.06	06.32	05.44	04.05	02.56	03.36	05.08	06.37	08.02	08.37	09.52
	15.13	16.51	18.15	20.45	22.17	23.32	23.01	21.25	19.38	17.55	15.18	14.25
17	09.31	08.03	06.28	05.41	04.02	02.55	03.39	05.11	06.40	08.05	08.40	09.54
	15.16	16.54	18.17	20.48	22.20	23.33	22.58	21.22	19.35	17.52	15.16	14.24
18	09.29	07.59	06.25	05.37	03.59	02.55	03.41	05.14	06.43	08.08	08.43	09.55
	15.19	16.57	18.20	20.51	22.23	23.34	22.55	21.18	19.31	17.48	15.13	14.24
19	09.27	07.56	06.21	05.34	03.56	02.55	03.44	05.17	06.45	08.11	08.46	09.56
	15.22	17.00	18.23	20.54	22.26	23.34	22.53	21.15	19.28	17.45	15.10	14.24
20	09.24	07.53	06.18	05.30	03.53	02.55	03.47	05.20	06.48	08.14	08.49	09.57
	15.25	17.03	18.26	20.57	22.29	23.35	22.50	21.12	19.24	17.42	15.08	14.24
21	09.22	07.49	06.14	05.27	03.50	02.55	03.50	05.23	06.51	08.17	08.52	09.57
	15.28	17.06	18.29	21.00	22.32	23.35	22.47	21.08	19.21	17.38	15.05	14.25
22	09.19	07.46	06.11	05.24	03.47	02.55	03.53	05.26	06.54	08.20	08.55	09.58
	15.31	17.09	18.32	21.03	22.35	23.35	22.44	21.05	19.17	17.35	15.02	14.25
23	09.17	07.43	06.07	05.20	03.45	02.56	03.56	05.29	06.56	08.23	08.58	09.59
	15.34	17.12	18.35	21.06	22.38	23.35	22.41	21.01	19.14	17.32	15.00	14.26
24	09.14	07.40	06.04	05.17	03.42	02.56	03.59	05.32	06.59	08.26	09.01	09.59
	15.37	17.15	18.38	21.09	22.41	23.35	22.38	20.58	19.10	17.29	14.58	14.26
25	09.11	07.36	06.00	05.13	03.39	02.57	04.02	05.35	07.02	07.29	09.04	09.59
	15.40	17.18	18.41	21.12	22.44	23.35	22.36	20.55	19.07	16.25	14.55	14.27
26	09.09	07.33	05.57	05.10	03.36	02.58	04.05	05.38	07.05	07.32	09.07	09.59
	15.44	17.21	18.43	21.15	22.47	23.34	22.33	20.51	19.04	16.22	14.53	14.28
27	09.06	07.29	05.53	05.07	03.34	02.59	04.08	05.41	07.08	07.35	09.10	09.59
	15.47	17.24	18.46	21.18	22.49	23.34	22.30	20.48	19.00	16.19	14.51	14.29
28	09.03	07.26	05.50	05.03	03.31	03.00	04.11	05.43	07.10	07.38	09.13	09.59
	15.50	17.27	18.49	21.21	22.52	23.33	22.27	20.44	18.57	16.16	14.49	14.30
29	09.01		06.46	05.00	03.28	03.00	04.14	05.46	07.13	07.41	09.16	09.59
	15.53		19.52	21.24	22.55	23.32	22.23	20.41	18.53	16.12	14.46	14.32
30	08.58		06.43	04.57	03.26	03.01	04.17	05.49	07.16	07.44	09.18	09.58
	15.56		19.55	21.27	22.58	23.31	22.20	20.37	18.50	16.09	14.44	14.33
31	08.55		06.40		03.23		04.20	05.52		07.47		09.58
	16.00		19.58		23.00		22.17	20.34		16.06		14.35
Potential sun hours	178	241	363	449	563	612	600	505	392	307	203	146
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

### SHADOW - Calendar

Calculation: Vuorimäki\_17xG200\_HH200\_No\_Forest  
 Assumptions for shadow calculations

Shadow receptor: K - K-Lomarakennus

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,00	2,82	4,23	6,60	8,77	9,10	8,87	6,80	4,67	2,52	1,17	0,58

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
542	404	384	420	571	797	968	981	843	750	680	691	8 031

	January	February	March	April	May	June	July	August	September	October	November	December
1	09.56	08.52	07.23	06.36	04.53	03.21	03.03	04.23	05.55	07.19	07.50	09.21
	14.37	16.03	17.30	20.01	21.30	23.03	23.30	22.14	20.30	18.46	16.03	14.43
2	09.56	08.49	07.19	06.33	04.50	03.19	03.05	04.26	05.58	07.22	07.53	09.24
	14.39	16.06	17.33	20.04	21.33	23.05	23.28	22.11	20.27	18.43	16.00	14.41
3	09.55	08.46	07.16	06.29	04.47	03.17	03.06	04.29	06.01	07.24	07.56	09.26
	14.41	16.09	17.36	20.06	21.36	23.08	23.27	22.08	20.23	18.39	15.57	14.39
4	09.53	08.43	07.13	06.26	04.44	03.15	03.08	04.32	06.03	07.27	07.59	09.29
	14.43	16.13	17.39	20.09	21.39	23.10	23.26	22.04	20.20	18.36	15.54	14.37
5	09.52	08.40	07.09	06.22	04.40	03.13	03.10	04.35	06.06	07.30	08.02	09.31
	14.45	16.16	17.42	20.12	21.42	23.12	23.24	22.01	20.16	18.33	15.51	14.36
6	09.51	08.37	07.06	06.19	04.37	03.11	03.12	04.38	06.09	07.33	08.05	09.33
	14.47	16.19	17.45	20.15	21.45	23.15	23.22	21.58	20.13	18.29	15.48	14.34
7	09.50	08.34	07.02	06.15	04.34	03.09	03.14	04.41	06.12	07.36	08.09	09.36
	14.50	16.22	17.48	20.18	21.48	23.17	23.20	21.55	20.10	18.26	15.44	14.33
8	09.48	08.31	06.59	06.12	04.31	03.07	03.16	04.44	06.15	07.39	08.12	09.38
	14.52	16.25	17.51	20.21	21.52	23.19	23.18	21.52	20.06	18.22	15.41	14.32
9	09.47	08.28	06.56	06.08	04.27	03.05	03.19	04.47	06.18	07.41	08.15	09.40
	14.54	16.29	17.54	20.24	21.55	23.21	23.16	21.48	20.03	18.19	15.38	14.30
10	09.45	08.25	06.52	06.05	04.24	03.04	03.21	04.50	06.20	07.44	08.18	09.42
	14.57	16.32	17.57	20.27	21.58	23.23	23.14	21.45	19.59	18.15	15.36	14.29
11	09.43	08.22	06.49	06.01	04.21	03.02	03.23	04.53	06.23	07.47	08.21	09.44
	15.00	16.35	18.00	20.30	22.01	23.24	23.12	21.42	19.56	18.12	15.33	14.28
12	09.41	08.18	06.45	05.58	04.18	03.01	03.26	04.56	06.26	07.50	08.24	09.46
	15.02	16.38	18.03	20.33	22.04	23.26	23.10	21.38	19.52	18.09	15.30	14.27
13	09.39	08.15	06.42	05.55	04.15	03.00	03.28	04.59	06.29	07.53	08.27	09.48
	15.05	16.41	18.06	20.36	22.07	23.28	23.08	21.35	19.49	18.05	15.27	14.27
14	09.37	08.12	06.38	05.51	04.12	02.58	03.31	05.02	06.31	07.56	08.30	09.49
	15.08	16.44	18.09	20.39	22.10	23.29	23.05	21.32	19.45	18.02	15.24	14.26
15	09.35	08.09	06.35	05.48	04.08	02.57	03.34	05.05	06.34	07.59	08.34	09.51
	15.10	16.47	18.12	20.42	22.13	23.30	23.03	21.28	19.42	17.59	15.21	14.25
16	09.33	08.06	06.32	05.44	04.05	02.57	03.36	05.08	06.37	08.02	08.37	09.52
	15.13	16.51	18.15	20.45	22.16	23.31	23.00	21.25	19.38	17.55	15.18	14.25
17	09.31	08.02	06.28	05.41	04.02	02.56	03.39	05.11	06.40	08.05	08.40	09.53
	15.16	16.54	18.17	20.47	22.19	23.32	22.58	21.22	19.35	17.52	15.16	14.25
18	09.29	07.59	06.25	05.37	03.59	02.56	03.42	05.14	06.43	08.08	08.43	09.54
	15.19	16.57	18.20	20.50	22.22	23.33	22.55	21.18	19.31	17.49	15.13	14.25
19	09.26	07.56	06.21	05.34	03.56	02.55	03.45	05.17	06.45	08.11	08.46	09.55
	15.22	17.00	18.23	20.53	22.25	23.34	22.52	21.15	19.28	17.45	15.10	14.25
20	09.24	07.53	06.18	05.31	03.53	02.55	03.47	05.20	06.48	08.14	08.49	09.56
	15.25	17.03	18.26	20.56	22.28	23.34	22.50	21.11	19.24	17.42	15.08	14.25
21	09.22	07.49	06.14	05.27	03.51	02.56	03.50	05.23	06.51	08.16	08.52	09.57
	15.28	17.06	18.29	20.59	22.31	23.35	22.47	21.08	19.21	17.39	15.05	14.25
22	09.19	07.46	06.11	05.24	03.48	02.56	03.53	05.26	06.54	08.19	08.55	09.58
	15.31	17.09	18.32	21.02	22.34	23.35	22.44	21.05	19.17	17.35	15.03	14.25
23	09.16	07.43	06.07	05.20	03.45	02.56	03.56	05.29	06.56	08.22	08.58	09.58
	15.34	17.12	18.35	21.05	22.37	23.35	22.41	21.01	19.14	17.32	15.00	14.26
24	09.14	07.39	06.04	05.17	03.42	02.57	03.59	05.32	06.59	08.25	09.01	09.59
	15.38	17.15	18.38	21.08	22.40	23.35	22.38	20.58	19.10	17.29	14.58	14.27
25	09.11	07.36	06.00	05.14	03.39	02.57	04.02	05.35	07.02	07.28	09.04	09.59
	15.41	17.18	18.41	21.12	22.43	23.34	22.35	20.54	19.07	16.25	14.56	14.27
26	09.09	07.33	05.57	05.10	03.37	02.58	04.05	05.38	07.05	07.32	09.07	09.59
	15.44	17.21	18.43	21.15	22.46	23.34	22.32	20.51	19.04	16.22	14.53	14.28
27	09.06	07.29	05.53	05.07	03.34	02.59	04.08	05.41	07.08	07.35	09.10	09.59
	15.47	17.24	18.46	21.18	22.49	23.33	22.29	20.48	19.00	16.19	14.51	14.29
28	09.03	07.26	05.50	05.03	03.31	03.01	04.11	05.44	07.10	07.38	09.13	09.59
	15.50	17.27	18.49	21.21	22.52	23.33	22.26	20.44	18.57	16.16	14.49	14.31
29	09.00		06.47	05.00	03.29	03.01	04.14	05.46	07.13	07.41	09.15	09.58
	15.53		19.52	21.24	22.55	23.32	22.23	20.41	18.53	16.13	14.47	14.32
30	08.58		06.43	04.57	03.26	03.02	04.17	05.49	07.16	07.44	09.18	09.58
	15.57		19.55	21.27	22.57	23.31	22.20	20.37	18.50	16.09	14.45	14.33
31	08.55		06.40		03.24		04.20	05.52		07.47		09.57
	16.00		19.58		23.00		22.17	20.34		16.06		14.35
Potential sun hours	178	241	363	449	563	611	599	505	392	307	203	146
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:

Iisalmi\_11\_9\_2023\_melu\_ja\_varjo\_VE3

Licensed user:

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 Henri Korhonen / henri.korhonen@fcg.fi  
 Calculated:  
 6.6.2024 16.00/3.6.355

## SHADOW - Calendar

Calculation: Vuorimäki\_17xG200\_HH200\_No\_Forest  
 Assumptions for shadow calculations

Shadow receptor: L - L-Asuinrakennus

Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,00 2,82 4,23 6,60 8,77 9,10 8,87 6,80 4,67 2,52 1,17 0,58

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 542 404 384 420 571 797 968 981 843 750 680 691 8 031

	January	February	March	April	May	June	
1	09.56	08.52	07.23	06.36	04.53	03.22	
	14.37	16.03	17.30	20.01	21.30	23.02	
2	09.55	08.49	07.19	06.33	04.50	03.19	04.15 (WT12)
	14.39	16.06	17.33	20.03	21.33	23.05	2 04.17 (WT12)
3	09.54	08.46	07.16	06.29	07.00 (WT09)	04.47	03.17 04.14 (WT12)
	14.41	16.09	17.36	20.06	2 07.02 (WT09)	21.36	23.07 4 04.18 (WT12)
4	09.53	08.43	07.12	06.26	06.57 (WT09)	04.44	03.15 04.12 (WT12)
	14.43	16.13	17.39	20.09	8 07.05 (WT09)	21.39	23.10 7 04.19 (WT12)
5	09.52	08.40	07.09	06.22	06.54 (WT09)	04.40	03.13 04.11 (WT12)
	14.45	16.16	17.42	20.12	13 07.07 (WT09)	21.42	23.12 8 04.19 (WT12)
6	09.51	08.37	07.06	06.19	06.50 (WT09)	04.37	03.11 04.10 (WT12)
	14.47	16.19	17.45	20.15	17 07.07 (WT09)	21.45	23.14 10 04.20 (WT12)
7	09.49	08.34	07.02	06.15	06.47 (WT09)	04.34	03.09 04.09 (WT12)
	14.50	16.22	17.48	20.18	21 07.08 (WT09)	21.48	23.16 12 04.21 (WT12)
8	09.48	08.31	06.59	06.12	06.44 (WT09)	04.31	03.07 04.07 (WT12)
	14.52	16.25	17.51	20.21	23 07.07 (WT09)	21.51	23.18 14 04.21 (WT12)
9	09.46	08.28	06.55	06.08	06.44 (WT09)	04.27	03.06 04.06 (WT12)
	14.54	16.28	17.54	20.24	24 07.08 (WT09)	21.54	23.20 15 04.21 (WT12)
10	09.45	08.24	06.52	06.05	06.44 (WT09)	04.24	03.04 04.06 (WT12)
	14.57	16.32	17.57	20.27	24 07.08 (WT09)	21.57	23.22 16 04.22 (WT12)
11	09.43	08.21	06.49	06.01	06.43 (WT09)	04.21	03.03 04.05 (WT12)
	15.00	16.35	18.00	20.30	24 07.07 (WT09)	22.01	23.24 17 04.22 (WT12)
12	09.41	08.18	06.45	05.58	06.43 (WT09)	04.18	03.01 04.04 (WT12)
	15.02	16.38	18.03	20.33	23 07.06 (WT09)	22.04	23.26 19 04.23 (WT12)
13	09.39	08.15	06.42	05.55	06.44 (WT09)	04.15	03.00 04.04 (WT12)
	15.05	16.41	18.06	20.35	22 07.06 (WT09)	22.07	23.27 19 04.23 (WT12)
14	09.37	08.12	06.38	05.51	06.44 (WT09)	04.12	02.58 04.03 (WT12)
	15.08	16.44	18.09	20.38	21 07.05 (WT09)	22.10	23.29 20 04.23 (WT12)
15	09.35	08.09	06.35	05.48	06.44 (WT09)	04.09	02.57 04.03 (WT12)
	15.11	16.47	18.12	20.41	19 07.03 (WT09)	22.13	23.30 21 04.24 (WT12)
16	09.33	08.05	06.31	05.44	06.46 (WT09)	04.05	02.57 04.02 (WT12)
	15.13	16.51	18.14	20.44	16 07.02 (WT09)	22.16	23.31 22 04.24 (WT12)
17	09.31	08.02	06.28	05.41	06.47 (WT09)	04.02	02.56 04.02 (WT12)
	15.16	16.54	18.17	20.47	13 07.00 (WT09)	22.19	23.32 22 04.24 (WT12)
18	09.28	07.59	06.25	05.37	06.51 (WT09)	03.59	02.56 04.02 (WT12)
	15.19	16.57	18.20	20.50	6 06.57 (WT09)	22.22	23.33 23 04.25 (WT12)
19	09.26	07.56	06.21	05.34		03.56	02.56 04.02 (WT12)
	15.22	17.00	18.23	20.53		22.25	23.33 23 04.25 (WT12)
20	09.24	07.52	06.18	05.31		03.54	02.56 04.02 (WT12)
	15.25	17.03	18.26	20.56		22.28	23.34 23 04.25 (WT12)
21	09.21	07.49	06.14	05.27		03.51	02.56 04.02 (WT12)
	15.28	17.06	18.29	20.59		22.31	23.34 23 04.25 (WT12)
22	09.19	07.46	06.11	05.24		03.48	02.56 04.02 (WT12)
	15.31	17.09	18.32	21.02		22.34	23.34 23 04.25 (WT12)
23	09.16	07.43	06.07	05.20		03.45	02.56 04.03 (WT12)
	15.34	17.12	18.35	21.05		22.37	23.34 23 04.26 (WT12)
24	09.14	07.39	06.04	05.17		03.42	02.57 04.03 (WT12)
	15.38	17.15	18.38	21.08		22.40	23.34 23 04.26 (WT12)
25	09.11	07.36	06.00	05.14		03.39	02.58 04.04 (WT12)
	15.41	17.18	18.40	21.11		22.43	23.34 22 04.26 (WT12)
26	09.08	07.33	05.57	05.10		03.37	02.59 04.04 (WT12)
	15.44	17.21	18.43	21.14		22.46	23.34 22 04.26 (WT12)
27	09.06	07.29	05.53	05.07		03.34	03.00 04.05 (WT12)
	15.47	17.24	18.46	21.17		22.49	23.33 21 04.26 (WT12)
28	09.03	07.26	05.50	05.03		03.31	03.00 04.06 (WT12)
	15.50	17.27	18.49	21.20		22.51	23.32 21 04.27 (WT12)
29	09.00		06.46	05.00		03.29	03.01 04.07 (WT12)
	15.53		19.52	21.24		22.54	23.31 20 04.27 (WT12)
30	08.57		06.43	04.57		03.26	03.02 04.08 (WT12)
	15.57		19.55	21.27		22.57	23.30 19 04.27 (WT12)
31	08.54		06.39			03.24	
	16.00		19.58			23.00	
Potential sun hours	178	241	363	449	563	611	
Total, worst case							514
Sun reduction							0,45
Oper. time red.							0,92
Wind dir. red.							0,62
Total reduction							0,25
Total, real							130

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: Vuorimäki\_17xG200\_HH200\_No\_Forest  
 Assumptions for shadow calculations

Shadow receptor: L - L-Asuinrakennus

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,00	2,82	4,23	6,60	8,77	9,10	8,87	6,80	4,67	2,52	1,17	0,58

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
542	404	384	420	571	797	968	981	843	750	680	691	8 031

	July	August	September	October	November	December		
1	03.03	04.09 (WT12)	04.23	05.55	06.43 (WT09)	07.19	07.50	09.21
	23.29	18 04.27 (WT12)	22.14	20.30	24 07.07 (WT09)	18.46	16.03	14.43
2	03.05	04.10 (WT12)	04.26	05.58	06.42 (WT09)	07.21	07.53	09.23
	23.28	17 04.27 (WT12)	22.11	20.27	24 07.06 (WT09)	18.43	16.00	14.41
3	03.07	04.11 (WT12)	04.29	06.01	06.42 (WT09)	07.24	07.56	09.26
	23.27	16 04.27 (WT12)	22.07	20.23	24 07.06 (WT09)	18.39	15.57	14.39
4	03.08	04.12 (WT12)	04.32	06.03	06.42 (WT09)	07.27	07.59	09.28
	23.25	14 04.26 (WT12)	22.04	20.20	23 07.05 (WT09)	18.36	15.54	14.37
5	03.10	04.14 (WT12)	04.35	06.06	06.43 (WT09)	07.30	08.02	09.31
	23.24	13 04.27 (WT12)	22.01	20.16	21 07.04 (WT09)	18.32	15.51	14.36
6	03.12	04.15 (WT12)	04.38	06.09	06.46 (WT09)	07.33	08.05	09.33
	23.22	11 04.26 (WT12)	21.58	20.13	17 07.03 (WT09)	18.29	15.47	14.34
7	03.14	04.17 (WT12)	04.41	06.12	06.49 (WT09)	07.36	08.08	09.35
	23.20	9 04.26 (WT12)	21.55	20.09	13 07.02 (WT09)	18.26	15.44	14.33
8	03.17	04.18 (WT12)	04.44	06.15	06.51 (WT09)	07.38	08.11	09.38
	23.18	7 04.25 (WT12)	21.51	20.06	8 06.59 (WT09)	18.22	15.41	14.32
9	03.19	04.20 (WT12)	04.47	06.17	06.54 (WT09)	07.41	08.15	09.40
	23.16	5 04.25 (WT12)	21.48	20.02	3 06.57 (WT09)	18.19	15.38	14.30
10	03.21	04.22 (WT12)	04.50	06.20		07.44	08.18	09.42
	23.14	3 04.25 (WT12)	21.45	19.59		18.15	15.36	14.29
11	03.23	04.24 (WT12)	04.53	06.23		07.47	08.21	09.44
	23.12	1 04.25 (WT12)	21.41	19.56		18.12	15.33	14.28
12	03.26		04.56	06.26		07.50	08.24	09.46
	23.10		21.38	19.52		18.09	15.30	14.27
13	03.28		04.59	06.29		07.53	08.27	09.47
	23.07		21.35	19.49		18.05	15.27	14.27
14	03.31		05.02	06.31		07.56	08.30	09.49
	23.05		21.31	19.45		18.02	15.24	14.26
15	03.34		05.05	06.34		07.59	08.33	09.50
	23.02		21.28	19.42		17.58	15.21	14.25
16	03.36		05.08	06.37		08.02	08.36	09.52
	23.00		21.25	19.38		17.55	15.18	14.25
17	03.39		05.11	06.40		08.04	08.40	09.53
	22.57		21.21	19.35		17.52	15.16	14.25
18	03.42		05.14	06.42		08.07	08.43	09.54
	22.55		21.18	19.31		17.48	15.13	14.25
19	03.45		05.17	06.45		08.10	08.46	09.55
	22.52		21.15	19.28		17.45	15.10	14.25
20	03.48		05.20	06.48		08.13	08.49	09.56
	22.49		21.11	19.24		17.42	15.08	14.25
21	03.50		05.23	06.51		08.16	08.52	09.57
	22.46		21.08	19.21		17.38	15.05	14.25
22	03.53		05.26	06.54		08.19	08.55	09.57
	22.44		21.05	19.17		17.35	15.03	14.25
23	03.56		05.29	06.56		08.22	08.58	09.58
	22.41		21.01	19.14		17.32	15.00	14.26
24	03.59		05.32	06.59		08.25	09.01	09.58
	22.38		20.58	19.10		17.29	14.58	14.27
25	04.02		05.35	07.02		07.28	09.04	09.58
	22.35		20.54	7 07.00 (WT09)		16.25	14.56	14.28
26	04.05		05.38	07.05		07.31	09.07	09.58
	22.32		20.51	13 07.03 (WT09)		16.22	14.53	14.28
27	04.08		05.41	07.07		07.34	09.10	09.58
	22.29		20.47	17 07.04 (WT09)		16.19	14.51	14.30
28	04.11		05.43	07.10		07.37	09.12	09.58
	22.26		20.44	19 07.05 (WT09)		16.16	14.49	14.31
29	04.14		05.46	07.13		07.40	09.15	09.58
	22.23		20.41	21 07.06 (WT09)		16.12	14.47	14.32
30	04.17		05.49	07.16		07.44	09.18	09.57
	22.20		20.37	22 07.06 (WT09)		16.09	14.45	14.34
31	04.20		05.52	07.19		07.47	09.21	09.57
	22.17		20.34	23 07.06 (WT09)		16.06	14.43	14.35
Potential sun hours	599	504		392		307	203	146
Total, worst case	114	122		157				
Sun reduction	0,46	0,42		0,36				
Oper. time red.	0,92	0,92		0,92				
Wind dir. red.	0,62	0,61		0,61				
Total reduction	0,26	0,23		0,20				
Total, real	30	29		32				

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: Vuorimäki\_17xG200\_HH200\_No\_Forest  
 Assumptions for shadow calculations

Shadow receptor: M - M-Asuinrakennus

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,00	2,82	4,23	6,60	8,77	9,10	8,87	6,80	4,67	2,52	1,17	0,58

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
542	404	384	420	571	797	968	981	843	750	680	691	8 031

	July	August	September	October	November	December				
1	03.04	04.14 (WT07)	04.23	05.55	07.19	07.50	09.20			
	23.29	04.33 (WT07)	22.13	20.30	18.46	16.03	14.43			
2	03.05	04.14 (WT07)	04.26	05.58	07.21	07.53	09.23			
	23.28	04.32 (WT07)	22.10	20.27	18.43	16.00	14.41			
3	03.07	04.15 (WT07)	04.29	06.00	07.24	07.56	09.25			
	23.26	04.32 (WT07)	22.07	20.23	18.39	15.57	14.39			
4	03.09	04.15 (WT07)	04.32	06.03	07.27	07.59	09.28			
	23.25	04.31 (WT07)	22.04	20.20	18.36	15.54	14.38			
5	03.10	04.16 (WT07)	04.35	06.06	07.30	08.02	09.30			
	23.23	04.32 (WT07)	22.01	20.16	18.32	15.51	14.36			
6	03.12	04.17 (WT07)	04.38	06.09	07.33	08.05	09.33			
	23.21	04.31 (WT07)	21.58	20.13	18.29	15.47	14.34			
7	03.14	04.18 (WT07)	04.41	06.12	07.35	08.08	09.35			
	23.20	04.31 (WT07)	21.54	20.09	18.25	15.44	14.33			
8	03.17	04.19 (WT07)	04.44	06.15	07.38	08.11	09.37			
	23.18	04.30 (WT07)	21.51	20.06	18.22	15.41	14.32			
9	03.19	04.21 (WT07)	04.47	06.17	07.41	08.14	09.39			
	23.16	04.29 (WT07)	21.48	20.02	18.19	15.38	14.30			
10	03.21	04.23 (WT07)	04.50	06.17	07.44	08.18	09.41			
	23.14	04.27 (WT07)	21.44	19.59	18.15	15.36	14.29			
11	03.24	04.27 (WT07)	04.53	06.16	07.47	08.21	09.43			
	23.11	21.41	18	06.34 (WT06)	19.55	18.12	15.33	14.28		
12	03.26	04.56	06.15 (WT06)	06.26	07.50	08.24	09.45			
	23.09	21.38	19	06.34 (WT06)	19.52	18.09	15.30	14.27		
13	03.29	04.59	06.14 (WT06)	06.28	07.53	08.27	09.47			
	23.07	21.35	21	06.35 (WT06)	19.48	18.05	15.27	14.27		
14	03.31	05.02	06.14 (WT06)	06.31	07.56	08.30	09.48			
	23.04	21.31	22	06.36 (WT06)	19.45	18.02	15.24	14.26		
15	03.34	05.05	06.12 (WT06)	06.34	07.58 (WT04)	07.58	08.33	09.50		
	23.02	21.28	24	06.36 (WT06)	19.41	5	08.03 (WT04)	17.58	15.21	14.26
16	03.37	05.08	06.12 (WT06)	06.37	07.55 (WT04)	08.01	08.36	09.51		
	22.59	21.25	24	06.36 (WT06)	19.38	12	08.07 (WT04)	17.55	15.18	14.25
17	03.39	05.11	06.12 (WT06)	06.40	07.52 (WT04)	08.04	08.39	09.53		
	22.57	21.21	24	06.36 (WT06)	19.35	16	08.08 (WT04)	17.52	15.16	14.25
18	03.42	05.14	06.11 (WT06)	06.42	07.50 (WT04)	08.07	08.42	09.54		
	22.54	21.18	24	06.35 (WT06)	19.31	19	08.09 (WT04)	17.48	15.13	14.25
19	03.45	05.17	06.12 (WT06)	06.45	07.49 (WT04)	08.10	08.45	09.55		
	22.52	21.14	23	06.35 (WT06)	19.28	21	08.10 (WT04)	17.45	15.10	14.25
20	03.48	05.20	06.12 (WT06)	06.48	07.49 (WT04)	08.13	08.49	09.56		
	22.49	21.11	23	06.35 (WT06)	19.24	21	08.10 (WT04)	17.42	15.08	14.25
21	03.50	05.23	06.12 (WT06)	06.51	07.47 (WT04)	08.16	08.52	09.56		
	22.46	21.08	22	06.34 (WT06)	19.21	23	08.10 (WT04)	17.38	15.05	14.25
22	03.53	05.26	06.13 (WT06)	06.53	07.47 (WT04)	08.19	08.55	09.57		
	22.43	21.04	20	06.33 (WT06)	19.17	23	08.10 (WT04)	17.35	15.03	14.26
23	03.56	05.29	06.14 (WT06)	06.56	07.47 (WT04)	08.22	08.58	09.57		
	22.40	21.01	18	06.32 (WT06)	19.14	22	08.09 (WT04)	17.32	15.00	14.26
24	03.59	05.32	06.14 (WT06)	06.59	07.47 (WT04)	08.25	09.01	09.58		
	22.38	20.57	16	06.30 (WT06)	19.10	22	08.09 (WT04)	17.29	14.58	14.27
25	04.02	05.35	06.16 (WT06)	07.02	07.46 (WT04)	07.28	09.03	09.58		
	22.35	20.54	12	06.28 (WT06)	19.07	21	08.07 (WT04)	16.25	14.56	14.28
26	04.05	05.38	06.20 (WT06)	07.05	07.47 (WT04)	07.31	09.06	09.58		
	22.32	20.51	4	06.24 (WT06)	19.03	19	08.06 (WT04)	16.22	14.53	14.29
27	04.08	05.41	07.07	07.07	07.48 (WT04)	07.34	09.09	09.58		
	22.29	20.47	17	08.05 (WT04)	16.19	14.51	14.30			
28	04.11	05.43	07.10	07.10	07.50 (WT04)	07.37	09.12	09.58		
	22.26	20.44	13	08.03 (WT04)	16.16	14.49	14.31			
29	04.14	05.46	07.13	07.13	07.52 (WT04)	07.40	09.15	09.58		
	22.23	20.40	8	08.00 (WT04)	16.12	14.47	14.32			
30	04.17	05.49	07.16	07.16	07.43	09.18	09.57			
	22.20	20.37	18.50	16.09	14.45	14.34				
31	04.20	05.52	07.16	07.16	07.46	09.18	09.57			
	22.17	20.33	16.06	14.35						
Potential sun hours	599	504	392	307	203	146				
Total, worst case	136	345	262							
Sun reduction	0,46	0,42	0,36							
Oper. time red.	0,92	0,92	0,92							
Wind dir. red.	0,61	0,60	0,62							
Total reduction	0,26	0,23	0,20							
Total, real	35	79	53							

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

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

Project:

Iisalmi\_11\_9\_2023\_melu\_ja\_varjo\_VE3

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 Calculated:  
 6.6.2024 16.00/3.6.355

## SHADOW - Calendar

Calculation: Vuorimäki\_17xG200\_HH200\_No\_Forest  
 Assumptions for shadow calculations

Shadow receptor: N - N-Asuinrakennus

Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,00 2,82 4,23 6,60 8,77 9,10 8,87 6,80 4,67 2,52 1,17 0,58

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 542 404 384 420 571 797 968 981 843 750 680 691 8 031

	January	February	March	April	May	June
1	09.56	08.51	07.22	06.36	07.10 (WT04)	04.53
	14.37	16.03	17.30	20.00	15 07.25 (WT04)	21.29
2	09.55	08.48	07.19	06.32	07.09 (WT04)	04.50
	14.39	16.06	17.33	20.03	17 07.26 (WT04)	21.32
3	09.54	08.45	07.16	06.29	07.07 (WT04)	04.47
	14.41	16.09	17.36	20.06	20 07.27 (WT04)	21.36
4	09.53	08.42	07.12	06.26	07.06 (WT04)	04.44
	14.43	16.13	17.39	20.09	21 07.27 (WT04)	21.39
5	09.52	08.40	07.09	06.22	07.04 (WT04)	04.40
	14.45	16.16	17.42	20.12	23 07.27 (WT04)	21.42
6	09.50	08.36	07.05	06.19	07.04 (WT04)	04.37
	14.47	16.19	17.45	20.15	24 07.28 (WT04)	21.45
7	09.49	08.33	07.02	06.15	07.04 (WT04)	04.34
	14.50	16.22	17.48	20.18	24 07.28 (WT04)	21.48
8	09.47	08.30	06.59	06.12	07.03 (WT04)	04.31
	14.52	16.25	17.51	20.21	24 07.27 (WT04)	21.51
9	09.46	08.27	06.55	06.08	07.04 (WT04)	04.27
	14.55	16.28	17.54	20.24	22 07.26 (WT04)	21.54
10	09.44	08.24	06.52	06.05	07.04 (WT04)	04.24
	14.57	16.32	17.57	20.26	22 07.26 (WT04)	21.57
11	09.42	08.21	06.48	06.01	07.04 (WT04)	04.21
	15.00	16.35	18.00	20.29	20 07.24 (WT04)	22.00
12	09.41	08.18	06.45	05.58	07.05 (WT04)	04.18
	15.02	16.38	18.03	20.32	18 07.23 (WT04)	22.03
13	09.39	08.15	06.42	05.54	07.06 (WT04)	04.15
	15.05	16.41	18.06	20.35	16 07.22 (WT04)	22.06
14	09.37	08.12	06.38	05.51	07.07 (WT04)	04.12
	15.08	16.44	18.09	20.38	12 07.19 (WT04)	22.10
15	09.35	08.08	06.35	05.48	07.12 (WT04)	04.09
	15.11	16.47	18.11	20.41	2 07.14 (WT04)	22.13
16	09.33	08.05	06.31	05.44		04.06
	15.13	16.51	18.14	20.44		22.16
17	09.30	08.02	06.28	05.41		04.02
	15.16	16.54	18.17	20.47		22.19
18	09.28	07.59	06.24	05.37		03.59
	15.19	16.57	18.20	20.50		22.22
19	09.26	07.56	06.21	05.34		03.57
	15.22	17.00	18.23	20.53		22.25
20	09.23	07.52	06.17	05.30		03.54
	15.25	17.03	18.26	20.56		22.28
21	09.21	07.49	06.14	05.27		03.51
	15.28	17.06	18.29	20.59		22.31
22	09.18	07.46	06.11	05.24		03.48
	15.31	17.09	18.32	21.02		22.34
23	09.16	07.42	06.07	05.20		03.45
	15.34	17.12	18.35	21.05		22.37
24	09.13	07.39	06.04	05.17		03.42
	15.38	17.15	18.37	21.08		22.40
25	09.11	07.36	06.00	05.14		03.39
	15.41	17.18	18.40	21.11		22.43
26	09.08	07.32	05.57	05.10		03.37
	15.44	17.21	18.43	21.14		22.45
27	09.05	07.29	05.53	05.07		03.34
	15.47	17.24	18.46	21.17		22.48
28	09.03	07.26	05.50	05.03		03.32
	15.50	17.27	18.49	21.20		22.51
29	09.00		06.46	05.00		03.29
	15.53		19.52	21.23		22.54
30	08.57		06.43	04.57		03.27
	15.57		19.55	21.26		22.57
31	08.54		06.39	07.13 (WT04)		03.24
	16.00		19.57	07.22 (WT04)		22.59
Potential sun hours	178	241	363	448		562
Total, worst case			9	280		
Sun reduction			0,36	0,44		
Oper. time red.			0,92	0,92		
Wind dir. red.			0,62	0,62		
Total reduction			0,21	0,25		
Total, real			2	70		

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

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

Project:

Iisalmi\_11\_9\_2023\_melu\_ja\_varjo\_VE3

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 Calculated:  
 6.6.2024 16.00/3.6.355

## SHADOW - Calendar

Calculation: Vuorimäki\_17xG200\_HH200\_No\_Forest  
 Assumptions for shadow calculations

Shadow receptor: N - N-Asuinrakennus

Sunshine probability S (Average daily sunshine hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  
 1,00 2,82 4,23 6,60 8,77 9,10 8,87 6,80 4,67 2,52 1,17 0,58

Operational time

N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum  
 542 404 384 420 571 797 968 981 843 750 680 691 8 031

	July	August	September	October	November	December
1	03.04	04.23	05.55	07.04 (WT04)	07.19	07.49
	23.29	22.13	20.30	07.24 (WT04)	18.46	16.03
2	03.05	04.26	05.58	07.02 (WT04)	07.21	07.53
	23.27	22.10	20.27	07.24 (WT04)	18.43	16.00
3	03.07	04.29	06.00	07.02 (WT04)	07.24	07.56
	23.26	22.07	20.23	07.24 (WT04)	18.39	15.57
4	03.09	04.32	06.03	07.00 (WT04)	07.27	07.59
	23.25	22.04	20.20	07.24 (WT04)	18.36	15.54
5	03.11	04.35	06.06	07.00 (WT04)	07.30	08.02
	23.23	22.01	20.16	07.24 (WT04)	18.32	15.51
6	03.12	04.38	06.09	07.00 (WT04)	07.33	08.05
	23.21	21.57	20.13	07.24 (WT04)	18.29	15.47
7	03.15	04.41	06.12	07.00 (WT04)	07.35	08.08
	23.19	21.54	20.09	07.22 (WT04)	18.25	15.44
8	03.17	04.44	06.15	07.00 (WT04)	07.38	08.11
	23.18	21.51	20.06	07.22 (WT04)	18.22	15.41
9	03.19	04.47	06.17	07.01 (WT04)	07.41	08.14
	23.16	21.48	20.02	07.21 (WT04)	18.19	15.38
10	03.21	04.50	06.20	07.02 (WT04)	07.44	08.17
	23.13	21.44	19.59	07.20 (WT04)	18.15	15.36
11	03.24	04.53	06.23	07.02 (WT04)	07.47	08.21
	23.11	21.41	19.55	07.17 (WT04)	18.12	15.33
12	03.26	04.56	06.26	07.05 (WT04)	07.50	08.24
	23.09	21.38	19.52	07.15 (WT04)	18.09	15.30
13	03.29	04.59	06.28	07.03 (WT04)	07.53	08.27
	23.07	21.35	19.48	07.03 (WT04)	18.05	15.27
14	03.31	05.02	06.31	07.03 (WT04)	07.56	08.30
	23.04	21.31	19.45	07.03 (WT04)	18.02	15.24
15	03.34	05.05	06.34	07.03 (WT04)	07.58	08.33
	23.02	21.28	19.41	07.03 (WT04)	17.58	15.21
16	03.37	05.08	06.37	07.03 (WT04)	08.01	08.36
	22.59	21.25	19.38	07.03 (WT04)	17.55	15.18
17	03.39	05.11	06.40	07.03 (WT04)	08.04	08.39
	22.57	21.21	19.35	07.03 (WT04)	17.52	15.16
18	03.42	05.14	06.42	07.03 (WT04)	08.07	08.42
	22.54	21.18	19.31	07.03 (WT04)	17.48	15.13
19	03.45	05.17	06.45	07.03 (WT04)	08.10	08.45
	22.52	21.14	19.28	07.03 (WT04)	17.45	15.10
20	03.48	05.20	06.48	07.03 (WT04)	08.13	08.48
	22.49	21.11	19.24	07.03 (WT04)	17.42	15.08
21	03.51	05.23	06.51	07.03 (WT04)	08.16	08.52
	22.46	21.08	19.21	07.03 (WT04)	17.38	15.05
22	03.53	05.26	06.53	07.03 (WT04)	08.19	08.55
	22.43	21.04	19.17	07.03 (WT04)	17.35	15.03
23	03.56	05.29	06.56	07.03 (WT04)	08.22	08.58
	22.40	21.01	19.14	07.03 (WT04)	17.32	15.00
24	03.59	05.32	06.59	07.03 (WT04)	08.25	09.00
	22.38	20.57	19.10	07.03 (WT04)	17.29	14.58
25	04.02	05.35	07.02	07.03 (WT04)	07.28	09.03
	22.35	20.54	19.07	07.03 (WT04)	16.25	14.56
26	04.05	05.38	07.05	07.03 (WT04)	07.31	09.06
	22.32	20.51	19.03	07.03 (WT04)	16.22	14.53
27	04.08	05.41	07.07	07.03 (WT04)	07.34	09.09
	22.29	20.47	19.00	07.03 (WT04)	16.19	14.51
28	04.11	05.43	07.13 (WT04)	07.10	07.37	09.12
	22.26	20.44	18.56	07.10 (WT04)	16.16	14.49
29	04.14	05.46	07.09 (WT04)	07.13	07.40	09.15
	22.23	20.40	18.53	07.13 (WT04)	16.12	14.47
30	04.17	05.49	07.06 (WT04)	07.16	07.43	09.18
	22.20	20.37	18.50	07.16 (WT04)	16.09	14.45
31	04.20	05.52	07.05 (WT04)	07.19	07.46	09.21
	22.16	20.33	18.43	07.19 (WT04)	16.06	14.35
Potential sun hours	599	504	392	307	204	147
Total, worst case		49	243			
Sun reduction		0,42	0,36			
Oper. time red.		0,92	0,92			
Wind dir. red.		0,62	0,62			
Total reduction		0,24	0,20			
Total, real		12	49			

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: Vuorimäki\_17xG200\_HH200\_No\_Forest  
 Assumptions for shadow calculations

Shadow receptor: O - O-Lomarakenus

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,00	2,82	4,23	6,60	8,77	9,10	8,87	6,80	4,67	2,52	1,17	0,58

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
542	404	384	420	571	797	968	981	843	750	680	691	8 031

	January	February	March	April	May	June
1	09.57	08.52	10.13 (WT17)	07.23	06.36	04.53
	14.37	16.03	10.37 (WT17)	17.30	20.01	21.30
2	09.56	08.49	10.13 (WT17)	07.19	07.56 (WT21)	06.32
	14.38	16.06	10.36 (WT17)	17.33	4 08.00 (WT21)	20.03
3	09.55	08.46	10.13 (WT17)	07.16	07.52 (WT21)	06.29
	14.40	16.09	10.36 (WT17)	17.36	12 08.04 (WT21)	20.06
4	09.54	08.43	10.14 (WT17)	07.13	07.49 (WT21)	06.25
	14.42	16.12	10.36 (WT17)	17.39	17 08.06 (WT21)	20.09
5	09.53	08.40	10.15 (WT17)	07.09	07.48 (WT21)	06.22
	14.44	16.15	10.35 (WT17)	17.42	19 08.07 (WT21)	20.12
6	09.51	08.37	10.16 (WT17)	07.06	07.47 (WT21)	06.19
	14.47	16.19	10.35 (WT17)	17.45	21 08.08 (WT21)	20.15
7	09.50	08.34	10.17 (WT17)	07.02	07.46 (WT21)	06.15
	14.49	16.22	10.34 (WT17)	17.48	23 08.09 (WT21)	20.18
8	09.48	08.31	10.19 (WT17)	06.59	07.45 (WT21)	06.12
	14.51	16.25	10.31 (WT17)	17.51	23 08.08 (WT21)	20.21
9	09.47	08.28	10.22 (WT17)	06.55	07.45 (WT21)	06.08
	14.54	16.28	10.29 (WT17)	17.54	24 08.09 (WT21)	20.24
10	09.45	08.25		06.52	07.45 (WT21)	06.05
	14.56	16.31		17.57	23 08.08 (WT21)	20.27
11	09.43	08.22		06.49	07.44 (WT21)	06.01
	14.59	16.35		18.00	23 08.07 (WT21)	20.30
12	09.41	08.18		06.45	07.45 (WT21)	05.58
	15.02	16.38		18.03	22 08.07 (WT21)	20.33
13	09.40	08.15		06.42	07.45 (WT21)	05.54
	15.04	16.41		18.06	21 08.06 (WT21)	20.36
14	09.38	08.12		06.38	07.46 (WT21)	05.51
	15.07	16.44		18.09	19 08.05 (WT21)	20.39
15	09.35	08.09		06.35	07.47 (WT21)	05.47
	15.10	16.47		18.12	15 08.02 (WT21)	20.42
16	09.33	08.06		06.31	07.49 (WT21)	05.44
	15.13	16.50		18.14	11 08.00 (WT21)	20.44
17	09.31	08.02		06.28		05.41
	15.16	16.53		18.17		20.47
18	09.29	07.59		06.24		05.37
	15.19	16.57		18.20		20.50
19	09.27	07.56		06.21		05.34
	15.22	17.00		18.23		20.53
20	09.24	10.20 (WT17)	07.53	06.18		05.30
	15.25	5 10.25 (WT17)	17.03	18.26		20.56
21	09.22	10.17 (WT17)	07.49	06.14		05.27
	15.28	11 10.28 (WT17)	17.06	18.29		20.59
22	09.19	10.15 (WT17)	07.46	06.11		05.23
	15.31	14 10.29 (WT17)	17.09	18.32		21.02
23	09.17	10.14 (WT17)	07.43	06.07		05.20
	15.34	17 10.31 (WT17)	17.12	18.35		21.05
24	09.14	10.14 (WT17)	07.39	06.04		05.17
	15.37	18 10.32 (WT17)	17.15	18.38		21.09
25	09.11	10.13 (WT17)	07.36	06.00		05.13
	15.40	20 10.33 (WT17)	17.18	18.40		21.12
26	09.09	10.12 (WT17)	07.33	05.57		05.10
	15.43	22 10.34 (WT17)	17.21	18.43		21.15
27	09.06	10.13 (WT17)	07.29	05.53		05.06
	15.47	22 10.35 (WT17)	17.24	18.46		21.18
28	09.03	10.12 (WT17)	07.26	05.50		05.03
	15.50	23 10.35 (WT17)	17.27	18.49		21.21
29	09.00	10.13 (WT17)		06.46		05.00
	15.53	23 10.36 (WT17)		19.52		21.24
30	08.58	10.13 (WT17)		06.43		04.56
	15.56	23 10.36 (WT17)		19.55		21.27
31	08.55	10.12 (WT17)		06.39		04.53
	15.59	24 10.36 (WT17)		19.58		21.30
Potential sun hours	178	241	363	449	563	612
Total, worst case	222	167		277		
Sun reduction	0,17	0,33		0,36		
Oper. time red.	0,92	0,92		0,92		
Wind dir. red.	0,67	0,67		0,64		
Total reduction	0,11	0,20		0,21		
Total, real	24	34		59		

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

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

Calculation: Vuorimäki\_17xG200\_HH200\_No\_Forest  
 Assumptions for shadow calculations

Shadow receptor: O - O-Lomarakenus

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,00	2,82	4,23	6,60	8,77	9,10	8,87	6,80	4,67	2,52	1,17	0,58

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
542	404	384	420	571	797	968	981	843	750	680	691	8 031

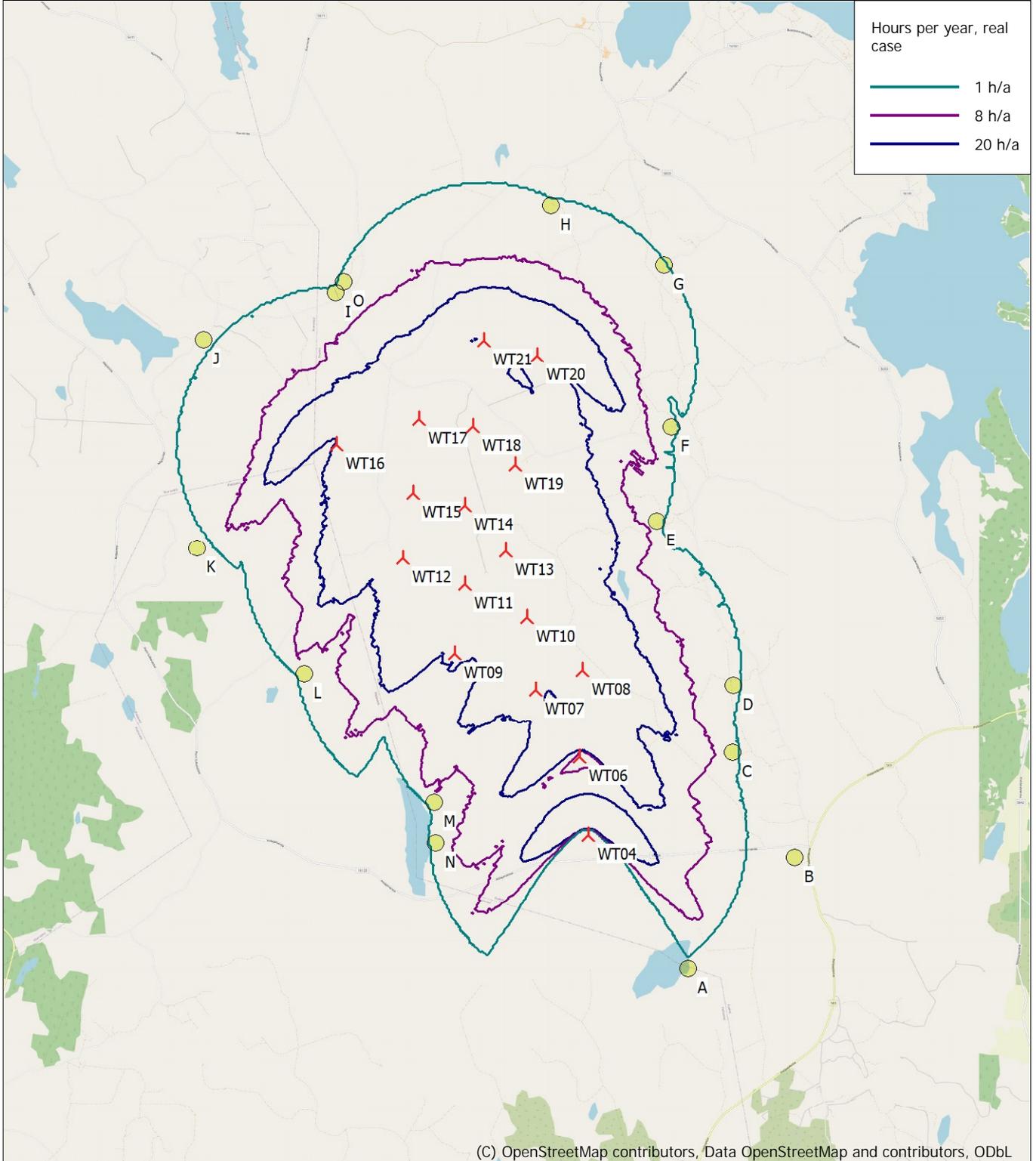
	July	August	September	October	November	December
1	03.02	04.23	05.55	07.19	08.25 (WT21)	07.50
	23.30	22.14	20.30	18.46	21 08.46 (WT21)	16.03
2	03.04	04.26	05.58	07.21	08.24 (WT21)	07.53
	23.29	22.11	20.27	18.43	22 08.46 (WT21)	16.00
3	03.06	04.29	06.00	07.24	08.23 (WT21)	07.56
	23.27	22.08	20.23	18.39	24 08.47 (WT21)	15.56
4	03.07	04.32	06.03	07.27	08.22 (WT21)	07.59
	23.26	22.05	20.20	18.36	23 08.45 (WT21)	15.53
5	03.09	04.35	06.06	07.30	08.22 (WT21)	08.02
	23.24	22.01	20.16	18.32	23 08.45 (WT21)	15.50
6	03.11	04.38	06.09	07.33	08.22 (WT21)	08.06
	23.23	21.58	20.13	18.29	22 08.44 (WT21)	15.47
7	03.13	04.41	06.12	07.36	08.22 (WT21)	08.09
	23.21	21.55	20.09	18.25	22 08.44 (WT21)	15.44
8	03.16	04.44	06.14	07.39	08.22 (WT21)	08.12
	23.19	21.52	20.06	18.22	21 08.43 (WT21)	15.41
9	03.18	04.47	06.17	07.41	08.23 (WT21)	08.15
	23.17	21.48	20.03	18.19	18 08.41 (WT21)	15.38
10	03.20	04.50	06.20	07.44	08.25 (WT21)	08.18
	23.15	21.45	19.59	18.15	14 08.39 (WT21)	15.35
11	03.23	04.53	06.23	07.47	08.27 (WT21)	08.21
	23.13	21.42	19.56	18.12	10 08.37 (WT21)	15.32
12	03.25	04.56	06.26	07.50	08.24	08.24
	23.10	21.38	19.52	18.08	24 10.08 (WT17)	14.27
13	03.28	04.59	06.28	07.53	08.27	09.45 (WT17)
	23.08	21.35	19.49	18.05	23 10.08 (WT17)	14.26
14	03.30	05.02	06.31	07.56	08.31	09.45 (WT17)
	23.05	21.32	19.45	18.02	23 10.08 (WT17)	14.25
15	03.33	05.05	06.34	07.59	08.34	09.46 (WT17)
	23.03	21.28	19.42	17.58	22 10.08 (WT17)	14.25
16	03.36	05.08	06.37	08.02	08.37	09.46 (WT17)
	23.00	21.25	19.38	17.55	21 10.07 (WT17)	14.24
17	03.38	05.11	06.40	08.05	08.40	09.47 (WT17)
	22.58	21.22	19.35	17.52	20 10.07 (WT17)	14.24
18	03.41	05.14	06.42	08.08	08.43	09.48 (WT17)
	22.55	21.18	19.31	17.48	18 10.06 (WT17)	14.24
19	03.44	05.17	06.45	08.10	08.46	09.49 (WT17)
	22.53	21.15	19.28	17.45	17 10.06 (WT17)	14.24
20	03.47	05.20	06.48	08.13	08.49	09.50 (WT17)
	22.50	21.12	19.24	17.42	14 10.04 (WT17)	14.24
21	03.50	05.23	06.51	08.16	08.52	09.52 (WT17)
	22.47	21.08	19.21	17.38	11 10.03 (WT17)	14.24
22	03.53	05.26	06.54	08.19	08.55	09.56 (WT17)
	22.44	21.05	19.17	17.35	5 10.01 (WT17)	14.25
23	03.56	05.29	06.56	08.22	08.58	09.58
	22.41	21.01	19.14	17.32	15.00	14.25
24	03.59	05.32	06.59	08.25	09.01	09.59
	22.38	20.58	19.10	17.28	14.57	14.26
25	04.02	05.35	07.02	07.28	09.04	09.59
	22.35	20.54	19.07	16.25	14.55	14.27
26	04.05	05.37	07.05	07.32	09.07	09.59
	22.33	20.51	19.03	16.22	14.53	14.28
27	04.08	05.40	07.07	08.32 (WT21)	07.35	09.10
	22.30	20.48	19.00	8 08.40 (WT21)	16.19	14.51
28	04.11	05.43	07.10	08.29 (WT21)	07.38	09.13
	22.26	20.44	18.56	14 08.43 (WT21)	16.15	14.48
29	04.14	05.46	07.13	08.27 (WT21)	07.41	09.16
	22.23	20.41	18.53	17 08.44 (WT21)	16.12	14.46
30	04.17	05.49	07.16	08.26 (WT21)	07.44	09.18
	22.20	20.37	18.50	19 08.45 (WT21)	16.09	14.44
31	04.20	05.52		07.47		09.58
	22.17	20.34		16.06		14.34
Potential sun hours	600	505	392	307	203	146
Total, worst case			58	220		391
Sun reduction			0,36	0,25		0,17
Oper. time red.			0,92	0,92		0,92
Wind dir. red.			0,64	0,64		0,67
Total reduction			0,21	0,15		0,11
Total, real			12	33		42

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 - Map

Calculation: Vuorimäki\_17xG200\_HH200\_No\_Forest



Map: EMD OpenStreetMap , Print scale 1:75 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 493 920 North: 7 041 600

🚧 New WTG      🟡 Shadow receptor

Flicker map level: Height Contours: CONTOURLINE\_Iisalmi\_11\_9\_2023\_melu\_ja\_varjo\_VE3\_1.wpo (1)  
Time step: 4 minutes, Day step: 14 days, Map resolution: 30 m, Visibility resolution: 15 m, Eye height: 1,5 m