Konnunsuon tuulivoimahanke

MELU- JA VARJOSTUSMALLINNUSRAPORTTI

Metsähallitus

P43981

Sisällys

Konnunsuon tuulivoimahanke

1 TAUSTAA

Konnunsuon tuulivoimahankkeen hankeomistajat Metsähallitus ja Neova Oy suunnittelevat tuulivoimapuiston rakentamista Pyhännän kunnan alueelle. Vaihtoehdossa 1 (VE1) suunnitellaan 34 voimalan ja vaihtoehdossa 2 (VE 2) 30 voimalan rakentamista.

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

2 LÄHTÖTIEDOT JA MENETELMÄT

2.1 Melu

2.1.1 Melumallinnus ISO 9613-2

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

Melumallinnuksessa on käytetty Siemens Gamesan V170-6.6 MW voimalan melupäästöarvoja. Melun päästöarvoihin on lisätty epävarmuusarvo + 2 dB, jolloin lähtömelutasoksi muodostuu 108 dB (106 + 2 dB). Voimalamallin roottorin halkaisija 170 metriä ja napakorkeutena on käytetty 215 metriä, joten kokonaiskorkeudeksi muodostuu 300 m. Konnunsuon voimaloiden tarkemmat tiedot esitetään taulukossa 1.

Konnunsuon tuulivoimapuiston eteläpuolelle on suunnitteilla Lapinsalon tuulivoimapuisto ja lounaispuolelle Pilpankankaan tuulivoimapuisto. Hankkeiden yhteisvaikutuksia tarkastellessa Pilpankankaan tuulivoimaloiden äänenpainetasot on mallinnettu voimalaitostyypillä, jonka napakorkeus on 200 metriä ja roottorinhalkaisija 200 metriä. Voimaloiden kokonaiskorkeus on näin ollen 300 metriä. Pilpankankaan voimalaitoksen lähtömelutasona on hankevastaavalta saatujen tietojen mukaisesti käytetty 106,9 dB(A) + 2 dB (108,9 dB(A)) Melun lähtöarvot perustuvat Vestas V172-7.2 MW voimalamallin meluspektriin (Taukukko 2). Lapinsalon tuulivoimaloiden äänenpainetasot on mallinnettu voimalaitostyypillä, jonka napakorkeus on 200 metriä ja roottorinhalkaisija 163 metriä. Voimaloiden kokonaiskorkeus on

näin ollen 281,5 metriä. Lapinsalon voimalaitoksen lähtömelutasona on hankevastaavalta saatujen tietojen mukaisesti käytetty 108,4 dB(A) + 1,5 dB (109,9 dB(A)) Melun lähtöarvot perustuvat Nordex N163-6.x voimalamallin meluspektriin (Taulukko 3).

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

Taulukko 1. Konnunsuon tuulivoimahankkeen mallinnusohjelma ja tuulivoimaloiden ääniteho-tasot sekä melun erityispiirteet.

MALLINNUSOHJELMAN TIEDOT							
Mallinnusohjelma ja versio: WindPRO version 3.5.584				Mallinnusmenetelmä: ISO 9613-2			
TUULIVOIMALOIDEN TIEDOT							
Tuulivoimalan valmistaja: Siemens Gamesa (SG)				Tyyppi: SG 6.6-170		Sarjanumero/t:-	
Nimellisteho: 6,6 MW		Napakorkeus: 215 m		Roottorin halkaisija: 170 m		Tornin tyyppi: teräs/hybridi	
Mahdollisuudet vaikuttaa tuulivoimalan melupäästöön käytön aikana ja sen vaikutus meluun							
Lapakulman säätö		Pyörimisnopeus		Muu, mikä:			
Kyllä	dB	Kyllä	dB	Noise mode säätö:			
~~Ei~~		~~Ei~~		Noise mode, lähtömelutaso		106 dB(A)	
AKUSTISET TIEDOT/LASKENNAN LÄHTÖTIEDOT							
SG-F18.16-TR-00891_R00_Standard Acoustic Emission Document, SG 6.6-170, Rev. 0 Lähtömelutasoon on lisätty epävarmuusarvoksi 2 dB(A)							
Oktaaveittain [Hz], dB(A)		1/3-oktaaveittain [Hz], dB(A)					
		12,5	57,2	125,0	90,2	1250,0	99,5
62,5	88,5	16,0	61,6	160,0	91,7	1600,0	*99,3*
125	95,4	20	*65,7*	200,0	92	2000,0	*96,4*
250	98,1	25	*69,7*	250,0	93,5	2500,0	*94*
500	99,9	31,5	*73,7*	315,0	*94,1*	3150,0	*92,7*
1000	103,8	40	*77,5*	400,0	*93*	4000,0	*90,3*
2000	101,9	50,0	*80,3*	500,0	*94,8*	5000,0	*86,8*
4000	95,3	63,0	*83,1*	630,0	*96,8*	6300,0	*82,9*
8000	85,0	80,0	*85,9*	800,0	*98,1*	8000,0	*79,2*
108 dB(A)		100,0	89,8	1000,0	99,3	10000	75,5
Melun erityispiirteiden mittaus ja havainnot:							
Kapeakaistaisuus / Tonaalisuus		Impulssimaisuus		Merkityksellinen sykintä (amplitudimodulaatio)		Muu, Mikä:	
~~kyllä~~	Ei	~~kyllä~~	Ei	~~kyllä~~	Ei	~~kyllä~~	Ei

Taulukko 2. Pilpankankaan tuulivoimahankkeen mallinnusohjelma ja tuulivoimaloiden äänitehotasot voimalaitoksella Generic RD200–7.2 MW sekä melun erityispiirteet.

MALLINNUSOHJELMAN TIEDOT							
Mallinnusohjelma ja versio:				Mallinnusmenetelmä: ISO 9613-2			
TUULIVOIMALAN TIEDOT							
Tuulivoimalan valmistaja: Generic				Tyyppi: Generic RD200–7.2 MW		Sarjanu-	
Nimellisteho: 7,2 MW		Napakorkeus: 200 m		Roottorin halkaisija: 200 m		Tornin tyyppi: teräs/hybridi	
Mahdollisuudet vaikuttaa tuulivoimalan melupäästöön käytön aikana ja sen vaikutus meluun							
Lapakulman säätö		Pyörimisnopeus		Muu, mikä			
Kyllä	- dB	Kyllä	- dB	Noise mode säätö: PO7200, STE			
~~Ei~~		~~Ei~~		Noise mode, lähtömelutaso	106,9 dB		

AKUSTISET TIEDOT/LASKENNAN LÄHTÖTIEDOT							
Vestas V172-7.2MW Third Octaves. Asiakirja nro: 0128-4336_00, 30.6.2022 (Original instruction T05 0128-4336 VER 00) **Taulukossa esitetään mallinnuksessa käytetty melupäästö varmuusarvoineen (+ 2,0 dB(A))**							
Oktaaveittain [Hz],dB(A)		1/3-oktaaveittain [Hz] LWA dB					
		20	63,7	200	98	1600	94,4
63	92,4	25	68,9	250	98,6	2000	92,4
125	100	31,5	73,8	315	98,8	2500	90,1
250	103,3	40	78,6	400	98,9	3150	87,5
500	103,5	50	83	500	98,7	4000	84,5
1000	101,9	63	86,8	630	98,6	5000	81,1
2000	97,4	80	90,2	800	98,1	6300	77,4
4000	89,9	100	92,9	1000	97,2	8000	73,3
8000	79,2	125	95,2	1250	95,9	10000	68,9
$L_{WA,tot}$ =108,9 dB(A)		160	96,8				
Melun erityispiirteiden mittaus ja havainnot:							
Kapeakaistaisuus / Tonaalisuus		Impulssimaisuus		Merkityksellinen sykintä (amplitudimodulaatio)		Muu, Mikä:	
~~kyllä~~	ei	~~kyllä~~	ei	~~kyllä~~	ei	~~kyllä~~	ei

Taulukko 3. Lapinsalon tuulivoimahankkeen mallinnusohjelma ja tuulivoimaloiden äänitehotasot sekä melun erityispiirteet.

MALLINNUSOHJELMAN TIEDOT					
Mallinnusohjelma ja versio:				Mallinnusmenetelmä: ISO 9613-2	
TUULIVOIMALAN (TUULIVOIMALOIDEN TIEDOT)					
Tuulivoimalan valmistaja: Nordex				Tyyppi: N163-6,8 MW	Sarjanumero/t:-
Nimellisteho: 6.8 MW		Napakorkeus: 200 m		Roottorin halkaisija:163 m	Tornin tyyppi: teräs/hybridi
Mahdollisuudet vaikuttaa tuulivoimalan melupäästöön käytön aikana ja sen vaikutus meluun					
Lapakulman säätö		Pyörimisnopeus		Muu, mikä	
Kyllä	- dB	Kyllä	- dB	Noise mode säätö: Mode 1, no STE	Kyllä
~~Ei~~		~~Ei~~		Noise mode, lähtömelutaso	108,4 dB

AKUSTISET TIEDOT/LASKENNAN LÄHTÖTIEDOT
Third octave sound power levels N163/6.X, F008_277_A17_EN, revision 02, 2021-11-08 Valmistajan ilmoittama tuulivoimalan tuottama äänitehotaso vastaa keskitäänitasoa ja lisäämällä epävarmuus 1,5 dB(A) saadaan äänitehotaso vastaamaan takuuarvoa. Nordexin mukaan:*"The warranted sound power levels are calculated expected mean values. This is common practise in the industry and also other OEMs are following the same approach. Within the Noise Emission Warranty Nordex warrants that a single measurement will be within the confidence interval according to IEC 61400-14. Please further be advised, that we limit the Confidence Interval according to the Noise Emission Warranty to a maximum value of 1.5dB(A)."* Mallinnuksiin on lisätty 1,5 dB(A) epävarmuusarvo voimalaitoksen äänitehotasoihin. Mallinnuksissa on käytetty voimalamallia, jossa ei ole melua vaimentavaa sahalaitaa (serrated trailing edge).

Oktaaveittain, [Hz],dB(A)		1/3-oktaaveittain [Hz] LWA dB					
		20	75,8	200	95,8	1600	100,2
63	93,8	25	79,2	250	96,8	2000	98,1
125	98,6	31,5	81,1	315	97,9	2500	94,6
250	101,7	40	82,3	400	98	3150	90,2
500	103,2	50	84,5	500	98,1	4000	84,6
1000	104,8	63	88,8	630	99,2	5000	78,7
2000	103	80	91,3	800	99,7	6300	70,6
4000	91,5	100	91,9	1000	100	8000	61,9
8000	71,3	125	94,5	1250	100,4	10000	56,5
109,9 dB(A)		160	94,5				

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

Taulukko 4. Käytetyt laskenta-asetukset ISO 9613-2 -mallinnuksissa.

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

2.1.2 Matalataajuinen melu

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

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

Taulukko 5. Suomalaisen pientalon julkisivun äänitasoeron alalikiarvo Anojanssi-projektin tulosten mukaisesti.

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

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

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

2.2 Varjostusmallinnus

Tuulivoimaloiden varjostusvaikutuksia mallinnettiin WindPRO-ohjelman Shadow-moduulilla. Tuulivoimaloiden varjostusvaikutukset on mallinnettu Konnunsuon hankkeessa sekä yhteisvaikutushankkeissa (Lapinsalo, Konnunsuo ja Pilpankangas) käyttäen roottorinhalkaisijaltaan 200 metristä voimalaitosta 200 metriä korkealla tornilla. Kokonaiskorkeudeltaan voimalat ovat mallinnuksissa 300 metriä (Taulukko 6).

Taulukko 6. Konnunsuon, Pilpankankaan ja Lapinsalon tuulivoimahankkeiden mallinnusohjelma ja tuulivoimaloiden koko varjostusmallinnuksissa.

MALLINNUSOHJELMAN TIEDOT			
Mallinnusohjelma ja versio: WindPRO, (3.5.584)			
TUULIVOIMALAN (TUULIVOIMALOIDEN TIEDOT)			
Tuulivoimalan valmistaja: Generic		Tyyppi: RD200	Sarjanumero/t:-
Nimellisteho: 7,2 MW	Napakorkeus: 200 m	Roottorin halkaisija: 200 m	Tornin tyyppi: teräs/hybridi
Lavan maksimileveys: 4,71 m	Lavan leveys 90 % etäisyydellä tyvestä: 1,44 m		

Laskennassa varjot huomioidaan, kun aurinko on vähintään 3 astetta horisontin yläpuolella. Varjoksi lasketaan tilanne, jossa siipi peittää vähintään 20 % auringosta.

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

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

Auringon keskimääräiset paistetunnit perustuvat Oulun lentoaseman sääaseman mitattuihin auringon paistetunteihin vuosilta 1981-2010. Laskentojen tuulen suunta ja

nopeusjakaumana käytettiin NASA:n MERRA-dataa (Modern Era Retrospective-analysis for Research and Applications) hankealueen läheisyydeltä.

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

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

2.3 Paikkatietoaineistot

Korkeustiedot perustuvat Maanmittauslaitoksen (MML) maastotietokannan korkeuskäyräaineistoon. Korkeusaseman intrapoloitimenetelmänä kohteille on käytetty WindPron TIN menetelmää. Rakennusten käyttötarkoitus on arvoitu MML:n maastotietokannan mukaan. Yksi maastotietokannan mukaan lomarakennukseksi luokiteltu rakennus on kunnan tietojen mukaan todellisuudessa autiotalo.

2.4 Raja- ja ohjearvot

2.4.1 Melu

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

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

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

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

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

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

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

2.4.2 Varjostus

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

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

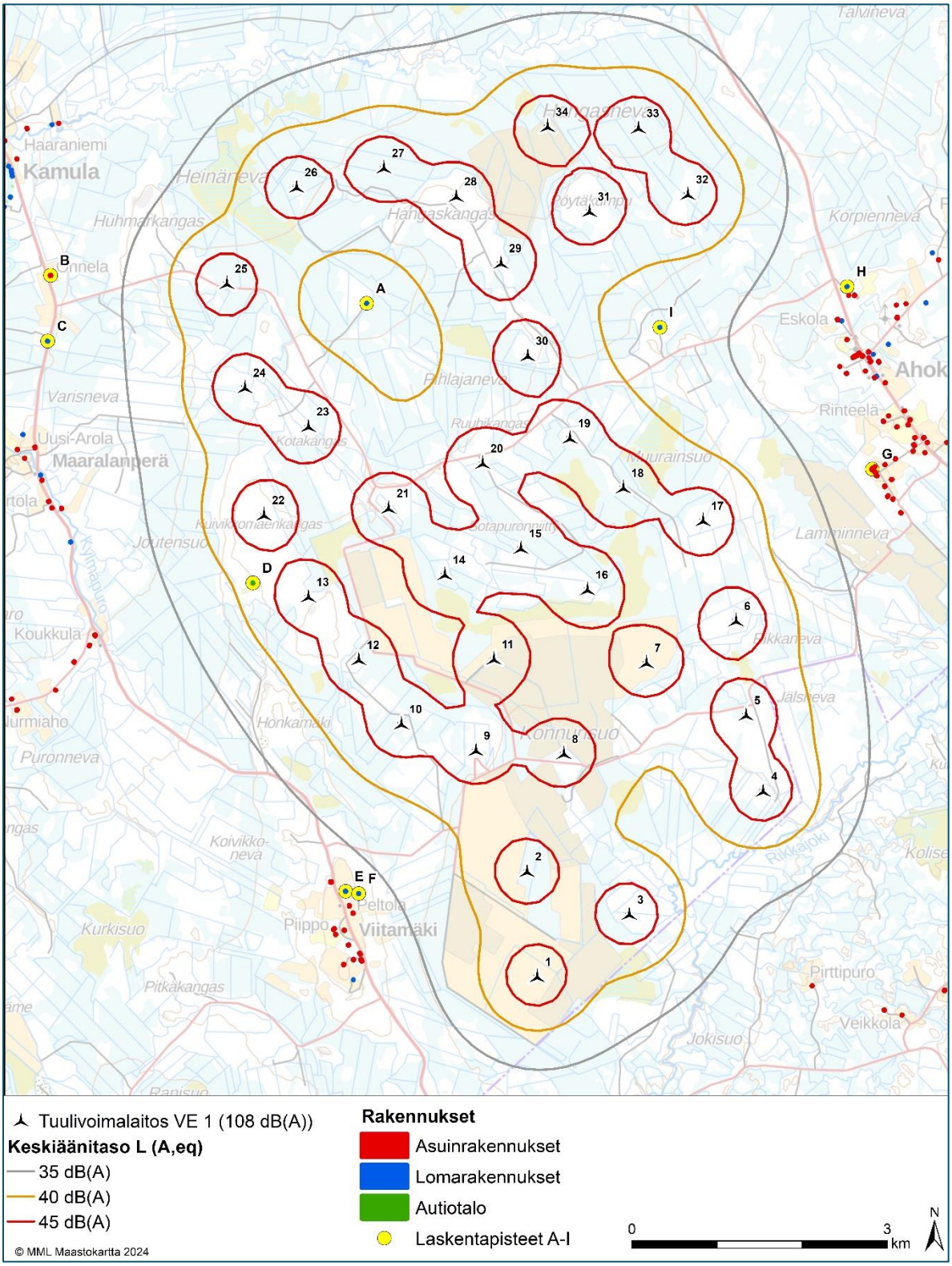
Arvioinnissa on tarkasteltu vaikutuksia alueella, jossa varjoja tai välkettä mallinnuksen mukaisessa todellisessa tilanteessa (”real case”) esiintyy vähintään kahdeksan tuntia vuodessa.

3 MELUMALLINNUSTEN TULOKSET

1.1 Melun laskentatulokset ISO 9613-2

1.1.1 VE 1

Hankevaihtoehdon 1 (VE 1) mallinnuksen laskentatulosten perusteella lähimpien asuinrakennusten ja lomarakennusten pihapiirissä melutasot ovat alle 40 dB(A). Autiotalon (laskentapiste D) alueella melutaso on 42 dB(A). Kuvassa 1 esitetään melumallinnuksen tulokset hankevaihtoehdossa 1 (VE1). Oranssi käyrä on 40 dB melualueen raja. Laskentapisteiden pihapiiriin lasketut äänitasot esitetään taulukossa 9. Hankevaihtoehdon 1 melumallinnuksen tarkemmat laskentatulokset löytyvät liitteestä 1.



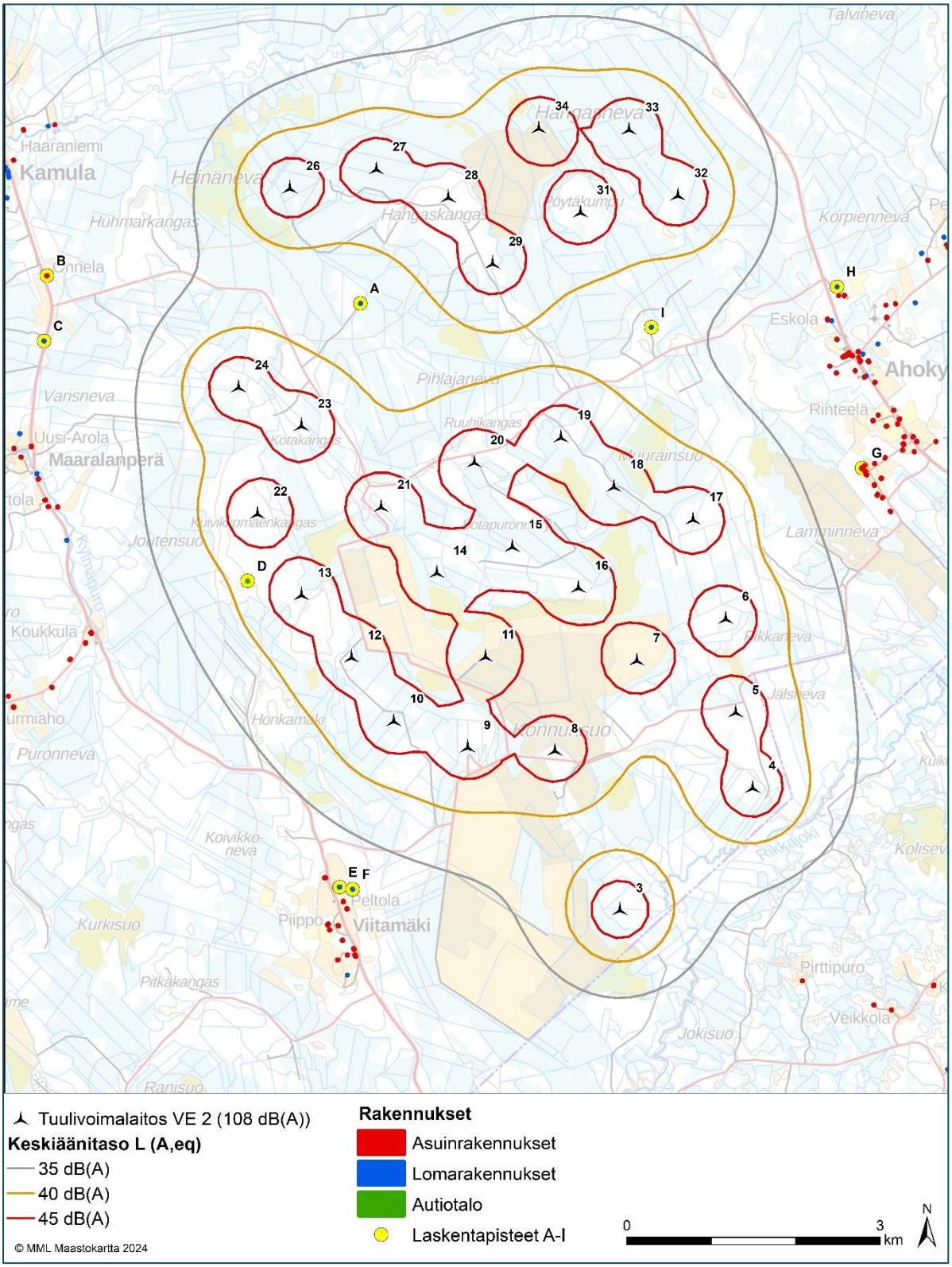
Kuva 1 VE1 melumallinnuksen tulos.

Taulukko 9. Konnunsuon hankevaihtoehdossa 1 (VE 1) mallinnetut äänitasot

	ETRS89-TM35 Itä	ETRS89-TM35 Pohjoinen	Z (m)	Äänitaso (dB(A))
Lomarakennus A	471650	7097381	157,6	38,4
Asuinrakennus B	467933	7097709	139,1	30,4
Lomarakennus C	467899	7096936	139,8	30,6
Autiotalo D	470313	7094090	168,7	42,0
Lomarakennus E	471402	7090461	195	33,2
Lomarakennus F	471557	7090435	188,1	33,6
Asuinrakennus G	477593	7095429	191,1	31,7
Lomarakennus H	477297	7097577	190,8	30,8
Lomarakennus I	475097	7097098	176,3	37,4

1.1.2 VE 2

Hankevaihtoehdon 2 (VE 2) mallinnuksen laskentatulosten perusteella lähimpien asuinrakennusten ja lomarakennusten pihapiirissä melutasot ovat alle 40 dB(A). Autiotalon (laskentapiste D) alueella melutaso on 42 dB(A). Kuvassa 2 esitetään melumallinnuksen tulokset hankevaihtoehdossa 2 (VE2). Oranssi käyrä on 40 dB melualueen raja. Laskentapisteiden pihapiiriin lasketut äänitasot esitetään taulukossa 10. Hankevaihtoehdon 2 melumallinnuksen tarkemmat laskentatulokset löytyvät liitteestä 2.



Kuva 2. VE2 melumallinnuksen tulos.

Taulukko 10. Konnunsuon hankevaihtoehdossa 2 (VE 2) mallinnetut äänitasot

	ETRS89-TM35 Itä	ETRS89-TM35 Pohjoinen	Z (m)	Äänitaso (dB(A))
Lomarakennus A	471650	7097381	157,6	37,7
Asuinrakennus B	467933	7097709	139,1	28,5
Lomarakennus C	467899	7096936	139,8	29,1
Autiotalo D	470313	7094090	168,7	42,0
Lomarakennus E	471402	7090461	195	31,8
Lomarakennus F	471557	7090435	188,1	32,0
Asuinrakennus G	477593	7095429	191,1	31,5
Lomarakennus H	477297	7097577	190,8	30,6
Lomarakennus I	475097	7097098	176,3	36,7

3.1.1 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.

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

Taulukoissa 11-12 esitetään hankevaihtoehdoissa VE 1 ja VE 2 sisätiloihin aiheutuva matalataajuinen melu, joka on saatu vähentämällä rakennuksen ulkopuolelle mallinnetuista äänitasoista edellä mainitut ääneneristyksen alalikiarvot taajuuskaistoittain. Toimenpiderajojen ylityksiä ei ole. Taulukossa esitetään vertailun vuoksi myös rakennusten ulkopuolelle mallinnettu matalataajuinen melu.

Hankevaihtoehdossa 1 sisätilojen laskennalliset äänitasot jäävät vähintään 3,4-10,4 dB ja hankevaihtoehdossa 2 vähintään 3,5-11,5 dB toimenpiderajoista. Äänitasot ovat lähimpinä toimenpiderajoja kohteissa Autiotalo D sekä Lomarakennus A. Liitteinä 3-4 esitetään sisätiloihin laskettu matalataajuinen melu graafeina hankevaihtoehdoissa 1 ja 2 kunkin laskentapisteen osalta.

Taulukko 11. Matalataajuisen melun mallinnustulokset hankevaihtoehdossa 1 kohteissa A-I, verrattuna Sosiaali- ja terveysministeriön toimenpiderajaan.

Rakennus	Äänitaso ulkona		Äänitaso sisällä	
	L eq,1h – Asumisterveys- ohje sisällä	Hz	L eq,1h – Asumisterveys- ohje sisällä	Hz
Lomarakennus A	9,5	100	-3,9	50
Asuinrakennus B	4,6	100	-8,1	50
Lomarakennus C	5,0	100	-7,8	50
Autiotalo D	11,4	100	-2,1	50
Lomarakennus E	10,4	80	-2,7	50
Lomarakennus F	10,5	80	-2,6	50
Asuinrakennus G	6,9	80	-5,7	50
Lomarakennus H	5,3	100	-7,2	50
Lomarakennus I	8,9	100	-4,4	50

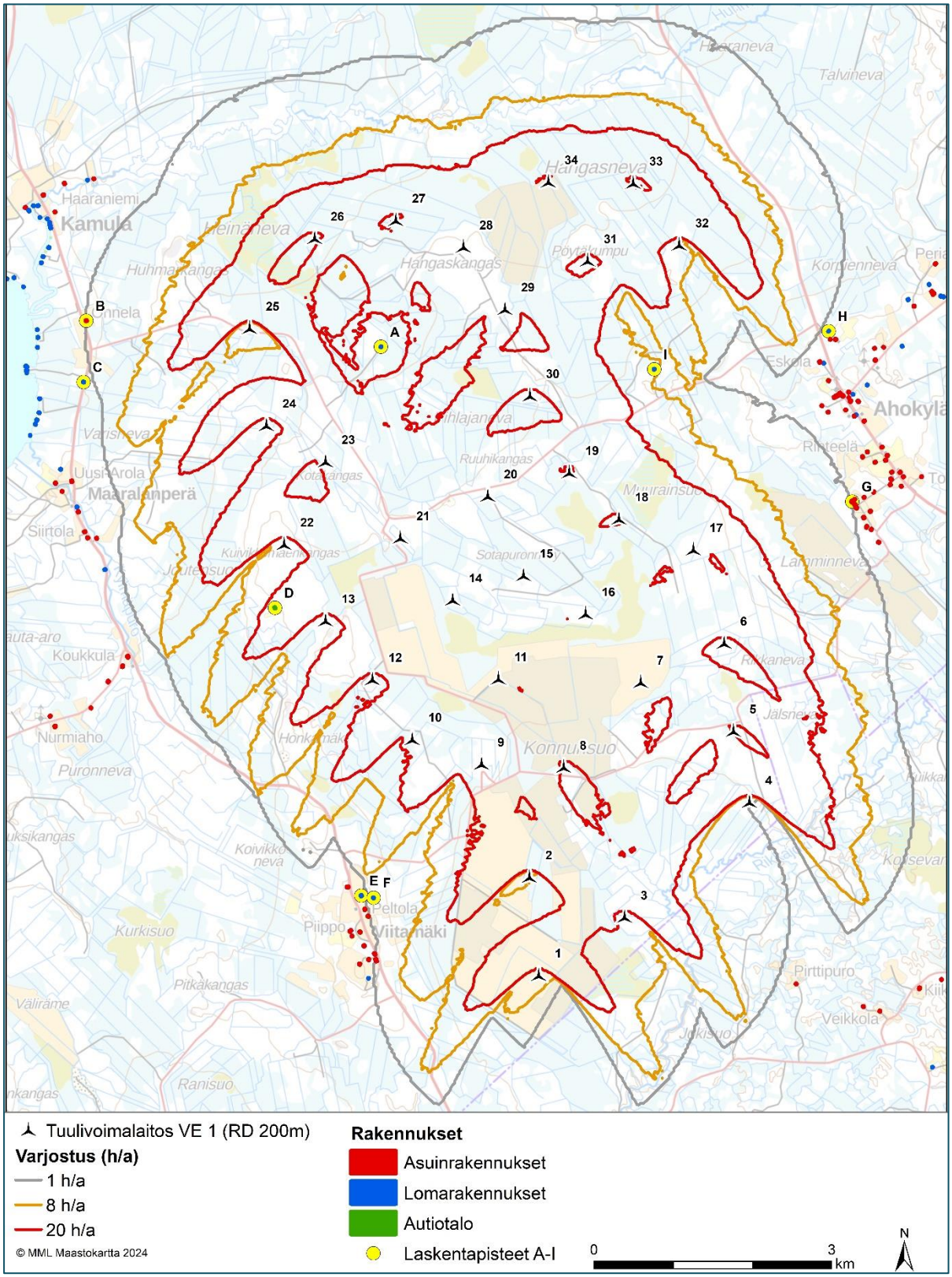
Taulukko 12. Matalataajuisen melun mallinnustulokset hankevaihtoehdossa 2 kohteissa A-I, verrattuna Sosiaali- ja terveysministeriön toimenpiderajaan.

Rakennus	Äänitaso ulkona		Äänitaso sisällä	
	L eq,1h – Asumisterveys- ohje sisällä	Hz	L eq,1h – Asumisterveys- ohje sisällä	Hz
Lomarakennus A	8,9	100	-4,4	50
Asuinrakennus B	3,8	100	-8,7	50
Lomarakennus C	4,4	100	-8,2	50
Autiotalo D	11,3	100	-2,2	50
Lomarakennus E	10,1	80	-3,1	50
Lomarakennus F	10,1	80	-3,0	50
Asuinrakennus G	7,6	80	-5,1	50
Lomarakennus H	5,4	80	-7,1	50
Lomarakennus I	8,5	100	-4,6	50

4 VARJOSTUSMALLINNUSTEN TULOKSET

1.2 Hankevaihtoehto 1 (VE 1)

Konnunsuon tuulivoimapuiston hankevaihtoehdon 1 (VE 1) voimaloiden aiheuttama varjostus on esitetty seuraavassa kuvassa (Kuva 3) ja mallinnuspisteiden a-i varjostustunnit taulukossa 13. Varjostusmallinnuksen tuloksen mukaan yli 8h/a varjostusvaikutusta ilmenee lomarakennuksen A, Lomarakennuksen I ja Autiotalon D alueella. Mallinnuksen tarkemmat tiedot on esitetty liitteessä 5.



Kuva 3. VE1 varjostusmallinnuksen tulos

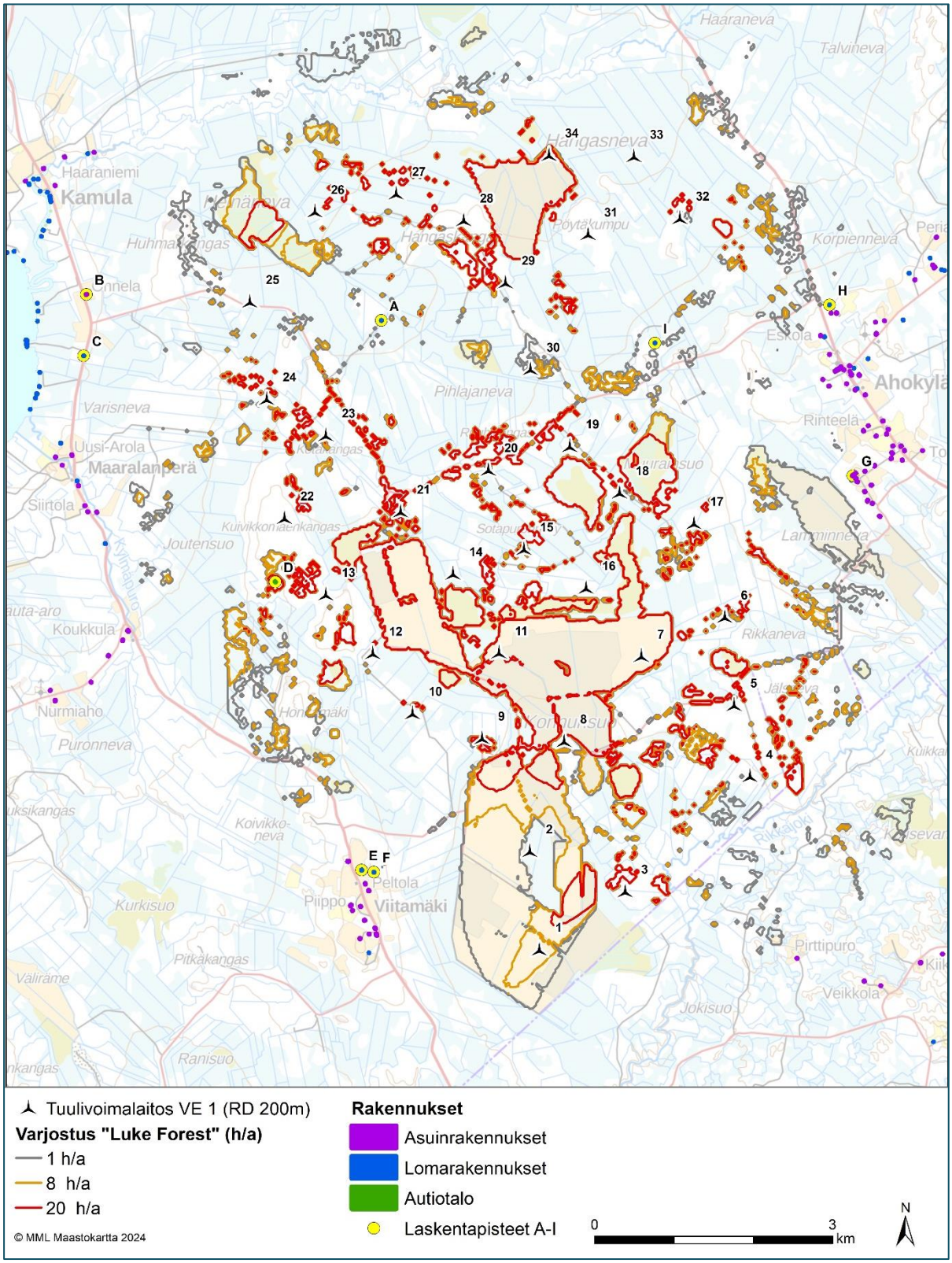
Taulukko 13. Hankevaihtoehdon 1 laskennalliset varjostusvaikutukset laskentapisteissä A-I.

	ETRS89-TM35 Itä	ETRS89-TM35 Pohjoinen	Z (m)	Laskentaikkuna (m)	Varjostus (h/a)
Lomarakennus A	471650	7097381	157,6	5,0 x 5,0	15:46
Asuinrakennus B	467933	7097709	139,1	5,0 x 5,0	1:58
Lomarakennus C	467899	7096936	139,8	5,0 x 5,0	0:00
Autiotalo D	470313	7094090	168,7	5,0 x 5,0	29:44
Lomarakennus E	471402	7090461	195	5,0 x 5,0	0:00
Lomarakennus F	471557	7090435	188,1	5,0 x 5,0	2:16
Asuinrakennus G	477593	7095429	191,1	5,0 x 5,0	0:00
Lomarakennus H	477297	7097577	190,8	5,0 x 5,0	0:00
Lomarakennus I	475097	7097098	176,3	5,0 x 5,0	9:45

Huomioitaessa puuston suojaava vaikutus vaihtoehdossa VE 1, on tuulivoimahanketta lähimpien asuin- ja lomarakennusten pihapiirissä varjostusvaikutus alle 8 h/a, mutta ylittyy laskentapisteessä autiotalo D (Taulukko 14). Konnunsuon tuulivoimapuiston hankevaihtoehdon 1 (VE 1) aiheuttama varjostus, kun puuston suojaava vaikutus huomioidaan, on esitetty kuvassa 4 ja mallinnuspisteiden a-i varjostustunnit taulukossa 14. Mallinnuksen tarkemmat tiedot on esitetty liitteessä 7.

Taulukko 14. Hankevaihtoehdon 1 laskennalliset varjostusvaikutukset laskentapisteissä A-I, kun puuston suojaava vaikutus huomioidaan.

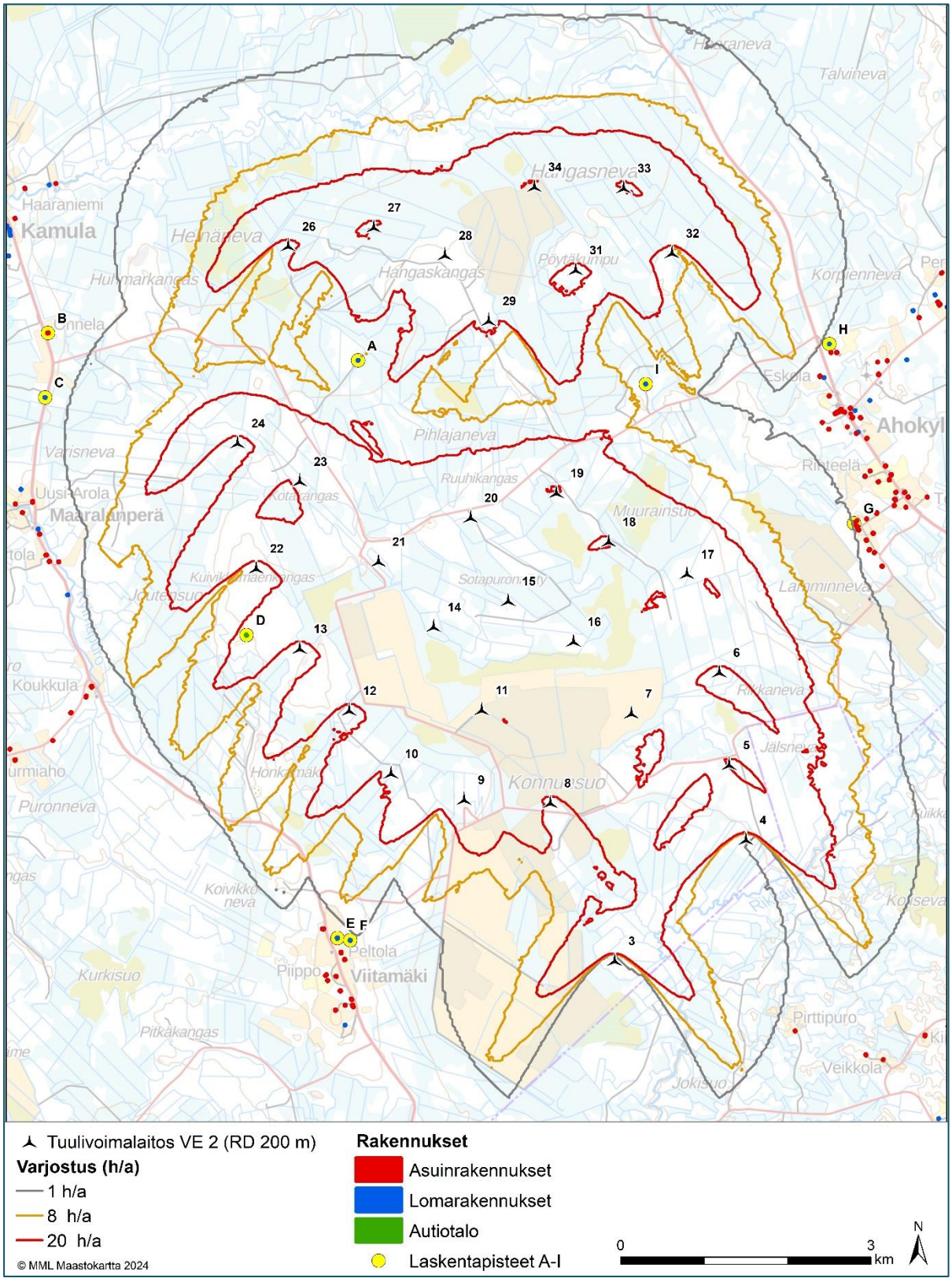
	ETRS89-TM35 Itä	ETRS89-TM35 Pohjoinen	Z (m)	Laskentaikkuna (m)	Varjostus (h/a)
Lomarakennus A	471650	7097381	157,6	5,0 x 5,0	0:00
Asuinrakennus B	467933	7097709	139,1	5,0 x 5,0	0:00
Lomarakennus C	467899	7096936	139,8	5,0 x 5,0	0:00
Autiotalo D	470313	7094090	168,7	5,0 x 5,0	29:44
Lomarakennus E	471402	7090461	195	5,0 x 5,0	0:00
Lomarakennus F	471557	7090435	188,1	5,0 x 5,0	0:00
Asuinrakennus G	477593	7095429	191,1	5,0 x 5,0	0:00
Lomarakennus H	477297	7097577	190,8	5,0 x 5,0	0:00
Lomarakennus I	475097	7097098	176,3	5,0 x 5,0	0:00



Kuva 4 VE1 varjostusmallinnuksen tulos, kun puuston suojaava vaikutus huomioidaan

1.3 Hankevaihtoehto 2 (VE 2)

Konnunsuon tuulivoimapuiston hankevaihtoehdon 2 (VE 2) voimaloiden aiheuttama varjostus on esitetty kuvassa 5 ja mallinnuspisteiden a-i varjostustunnit taulukossa 15. Varjostusmallinnuksen tuloksen mukaan yli 8h/a varjostusvaikutusta ilmenee lomarakennuksen A ja autiotalon D alueella. Mallinnuksen tarkemmat tiedot on esitetty liitteessä 6.

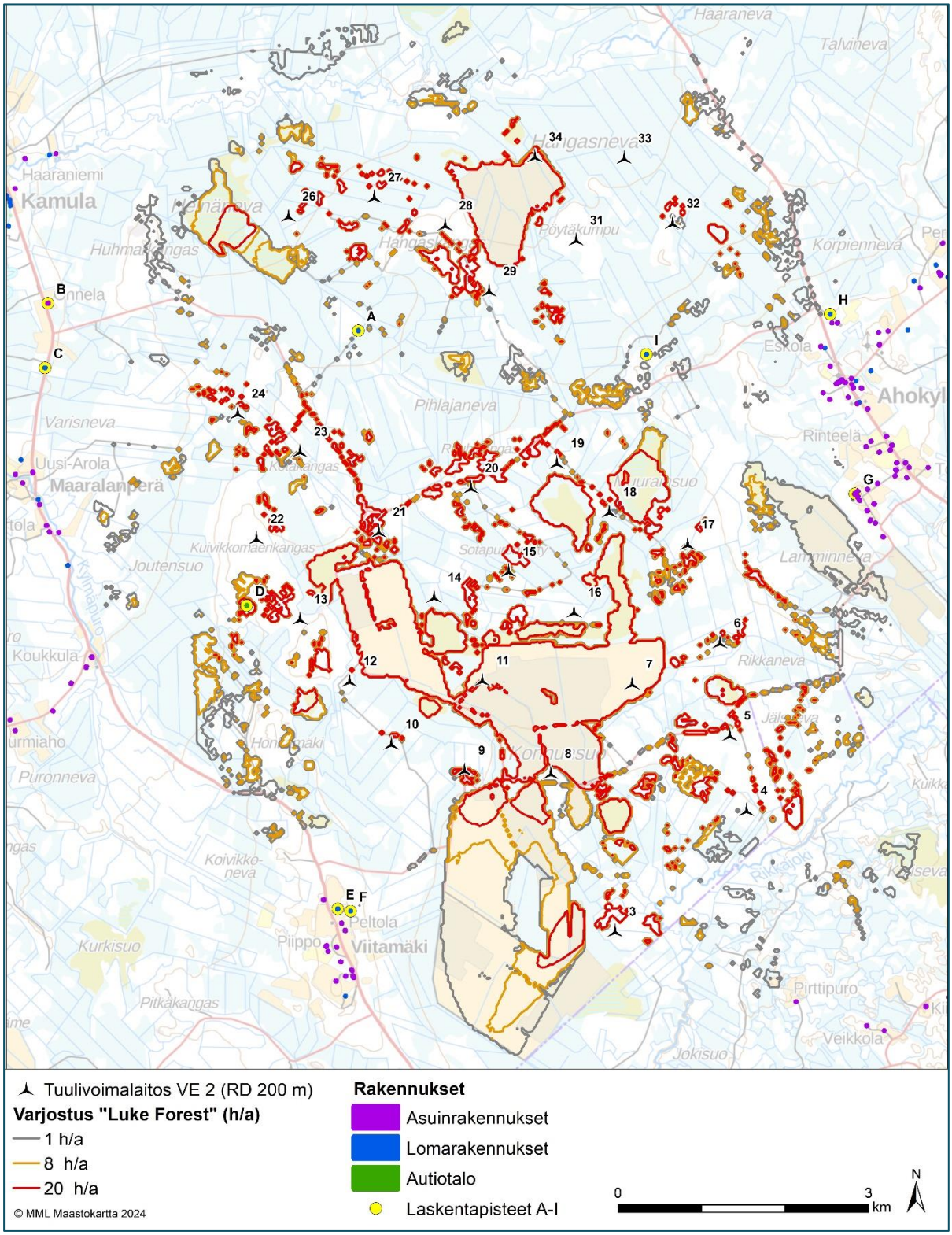


Kuva 5. VE2 varjostusmallinnuksen tulos

Taulukko 15. Hankevaihtoehdon 2 laskennalliset varjostusvaikutukset laskentapisteissä A-I.

	ETRS89-TM35 Itä	ETRS89-TM35 Pohjoinen	Z (m)	Laskentaikkuna (m)	Varjostus (h/a)
Lomarakennus A	471650	7097381	157,6	5,0 x 5,0	10:11
Asuinrakennus B	467933	7097709	139,1	5,0 x 5,0	0:00
Lomarakennus C	467899	7096936	139,8	5,0 x 5,0	0:00
Autiotalo D	470313	7094090	168,7	5,0 x 5,0	29:44
Lomarakennus E	471402	7090461	195	5,0 x 5,0	0:00
Lomarakennus F	471557	7090435	188,1	5,0 x 5,0	0:00
Asuinrakennus G	477593	7095429	191,1	5,0 x 5,0	0:00
Lomarakennus H	477297	7097577	190,8	5,0 x 5,0	0:00
Lomarakennus I	475097	7097098	176,3	5,0 x 5,0	6:48

Huomioitaessa puuston suojaava vaikutus vaihtoehdossa VE 2, on tuulivoimahanketta lähimpien asuin- ja lomarakennusten pihapiirissä varjostusvaikutus yli 8 h/a laskentapisteessä autiotalo D (Taulukko 16). Konnunsuon tuulivoimapuiston hankevaihtoehdon 2 (VE 2) aiheuttama varjostus, kun puuston suojaava vaikutus huomioidaan, on esitetty kuvassa 6 ja mallinnuspisteiden a-i varjostustunnit taulukossa 14. Mallinnuksen tarkemmat tiedot on esitetty liitteessä 8.



Kuva 6. VE2 varjostusmallinnuksen tulos, kun puuston suojaava vaikutus huomioidaan

Taulukko 16. Hankevaihtoehdon 2 laskennalliset varjostusvaikutukset laskentapisteissä A-I, kun puuston suojaava vaikutus huomioidaan.

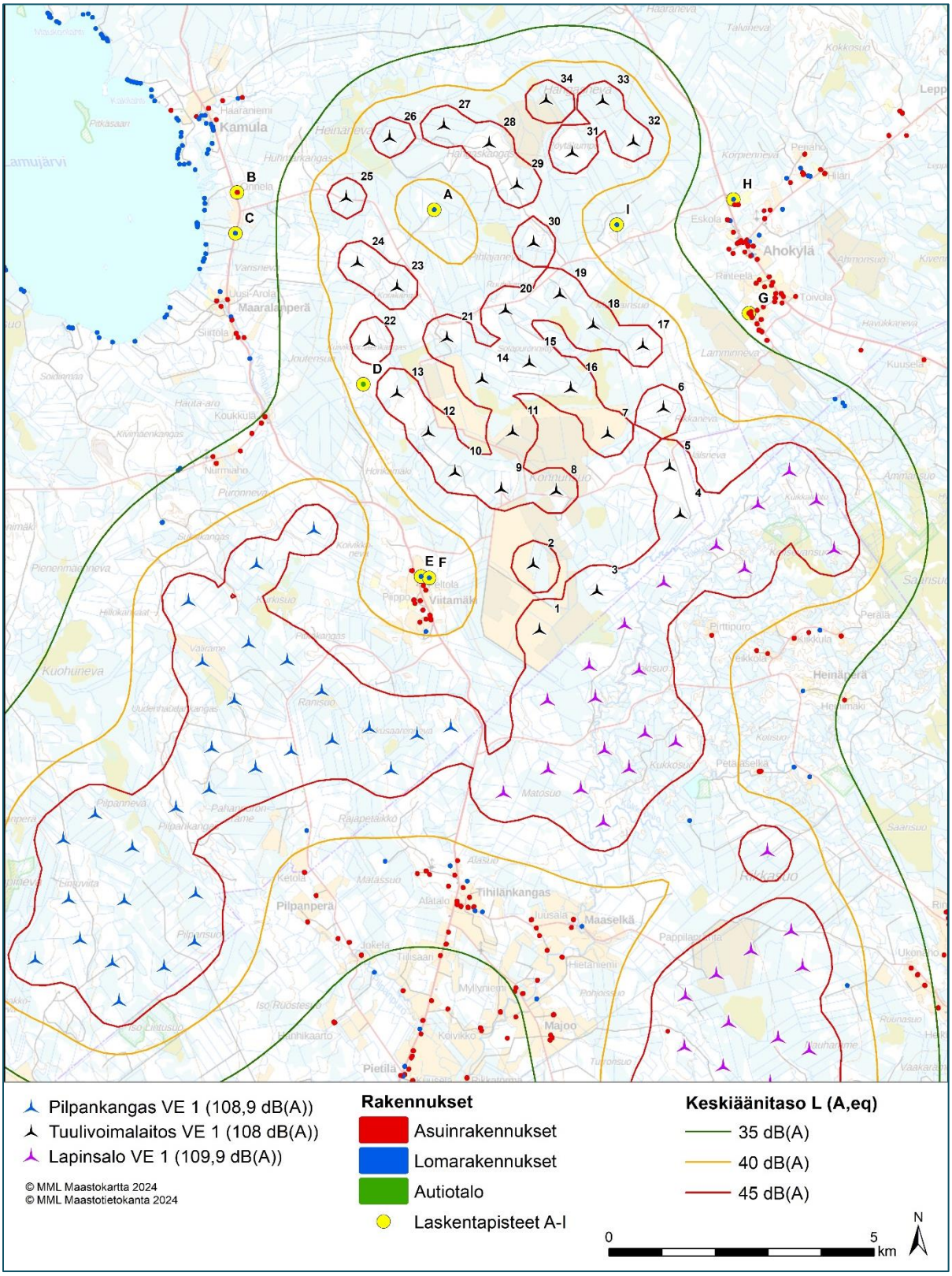
	ETRS89-TM35 Itä	ETRS89-TM35 Pohjoinen	Z (m)	Laskentaikkuna (m)	Varjostus (h/a)
Lomarakennus A	471650	7097381	157,6	5,0 x 5,0	0:00
Asuinrakennus B	467933	7097709	139,1	5,0 x 5,0	0:00
Lomarakennus C	467899	7096936	139,8	5,0 x 5,0	0:00
Autiotalo D	470313	7094090	168,7	5,0 x 5,0	29:44
Lomarakennus E	471402	7090461	195	5,0 x 5,0	0:00
Lomarakennus F	471557	7090435	188,1	5,0 x 5,0	0:00
Asuinrakennus G	477593	7095429	191,1	5,0 x 5,0	0:00
Lomarakennus H	477297	7097577	190,8	5,0 x 5,0	0:00
Lomarakennus I	475097	7097098	176,3	5,0 x 5,0	0:00

2 MELUN JA VARJOSTUKSEN YHTEISMALLINNUSTEN TULOKSET

2.1 Melu

2.1.1 Yhteismelun laskentatulokset ISO 9613-2

Konnunsuon hankevaihtoehdon 1 (VE1) yhteismelun mallinnuksen mukaan melutaso 40 dB(A) ei ylity Konnunsuon lähimpien asuinrakennusten ja lomarakennusten pihapiirissä. Autiotalon (laskentapiste D) alueella melutaso on 42 dB(A). Kuvassa 7 esitetään melumallinnuksen tulokset hankevaihtoehdossa 1 (VE1). Laskentapisteiden pihapiiriin lasketut äänitasot esitetään taulukossa 17. Hankevaihtoehdon 1 yhteismelun mallinnuksen tarkemmat laskentatulokset löytyvät liitteestä 9.

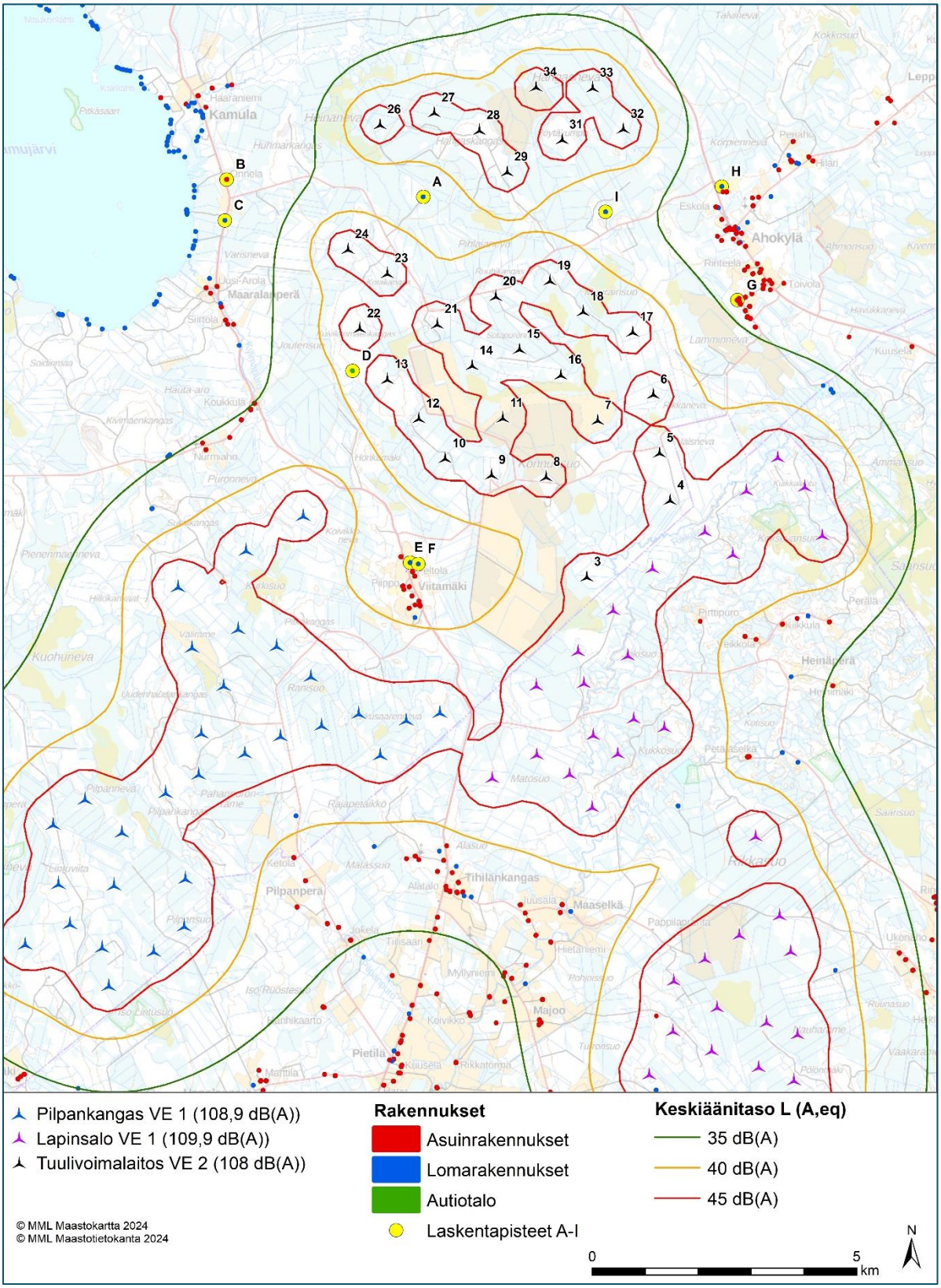


Kuva 1. Yhteismelumallinnuksen tulos hankevaihtoehdossa 1 (VE1).

Taulukko 17. Laskennalliset yhteismelutasot Konnunsuon tuulivoimahankkeen ympäristön laskentapisteissä hankevaihtoehdossa 1 (VE1).

	ETRS89-TM35 Itä	ETRS89-TM35 Pohjoinen	Z (m)	Äänitaso (dB(A))
Lomarakennus A	471650	7097381	157,6	38,7
Asuinrakennus B	467933	7097709	139,1	31,7
Lomarakennus C	467899	7096936	139,8	32,0
Autiotalo D	470313	7094090	168,7	42,4
Lomarakennus E	471402	7090461	195	38,5
Lomarakennus F	471557	7090435	188,1	38,6
Asuinrakennus G	477593	7095429	191,1	34,2
Lomarakennus H	477297	7097577	190,8	32,2
Lomarakennus I	475097	7097098	176,3	37,8

Konnunsuon hankevaihtoehdon 2 (VE2) yhteismelun mallinnuksen mukaan melutaso 40 dB(A) ei ylity Konnunsuon lähimpien asuinrakennusten ja lomarakennusten pihapiirissä. Autiotalon (laskentapiste D) alueella melutaso on 42,3 dB(A). Kuvassa 8 esitetään melumallinnuksen tulokset hankevaihtoehdossa 2 (VE2). Laskentapisteiden pihapiiriin lasketut äänitasot esitetään taulukossa 18. Hankevaihtoehdon 2 yhteismelun mallinnuksen tarkemmat laskentatulokset löytyvät liitteestä 10.



Kuva 2. Yhteismelumallinnuksen tulos hankevaihtoehdossa 2 (VE2).

Taulukko18. Laskennalliset yhteismelutasot Konnunsuon tuulivoimahankkeen ympäristössä hankevaihtoehdossa 2 (VE2).

	ETRS89-TM35 Itä	ETRS89-TM35 Pohjoinen	Z (m)	Äänitaso (dB(A))
Lomarakennus A	471650	7097381	157,6	38,0
Asuinrakennus B	467933	7097709	139,1	30,4
Lomarakennus C	467899	7096936	139,8	31,1
Autiotalo D	470313	7094090	168,7	42,3
Lomarakennus E	471402	7090461	195	38,2
Lomarakennus F	471557	7090435	188,1	38,1
Asuinrakennus G	477593	7095429	191,1	34,1
Lomarakennus H	477297	7097577	190,8	32,0
Lomarakennus I	475097	7097098	176,3	37,2

2.1.2 Matalataajuiset melutasot (yhteisvaikutus)

Konnunsuon ja sen lähistöllä olevien tuulivoimahankkeiden (Lapinsalo ja Pilpankangas) aiheuttama matalataajuinen yhteismelu ei Konnunsuon kummassakaan hankevaihtoehdossa ylitä Sosiaali- ja terveysministeriön asumisterveysohjearvoa laskentapisteiden sisätiloissa.

Taulukoissa 19-20 on esitetty matalataajuisen melun laskentatulokset hankevaihtoehdoissa VE1 ja VE2. Taulukoissa esitetään toimenpiderajan alitus (negatiivinen arvo) tai ylitys (positiivinen arvo).

Tarkemmat matalataajuisen yhteismelun laskentatulokset ja kuvaajat on esitetty liitteissä 11–12.

Taulukko 19. Matalataajuisen melun mallinnustulokset hankevaihtoehdossa 1 kohteissa A-I, verrattuna Sosiaali- ja terveysministeriön toimenpiderajaan.

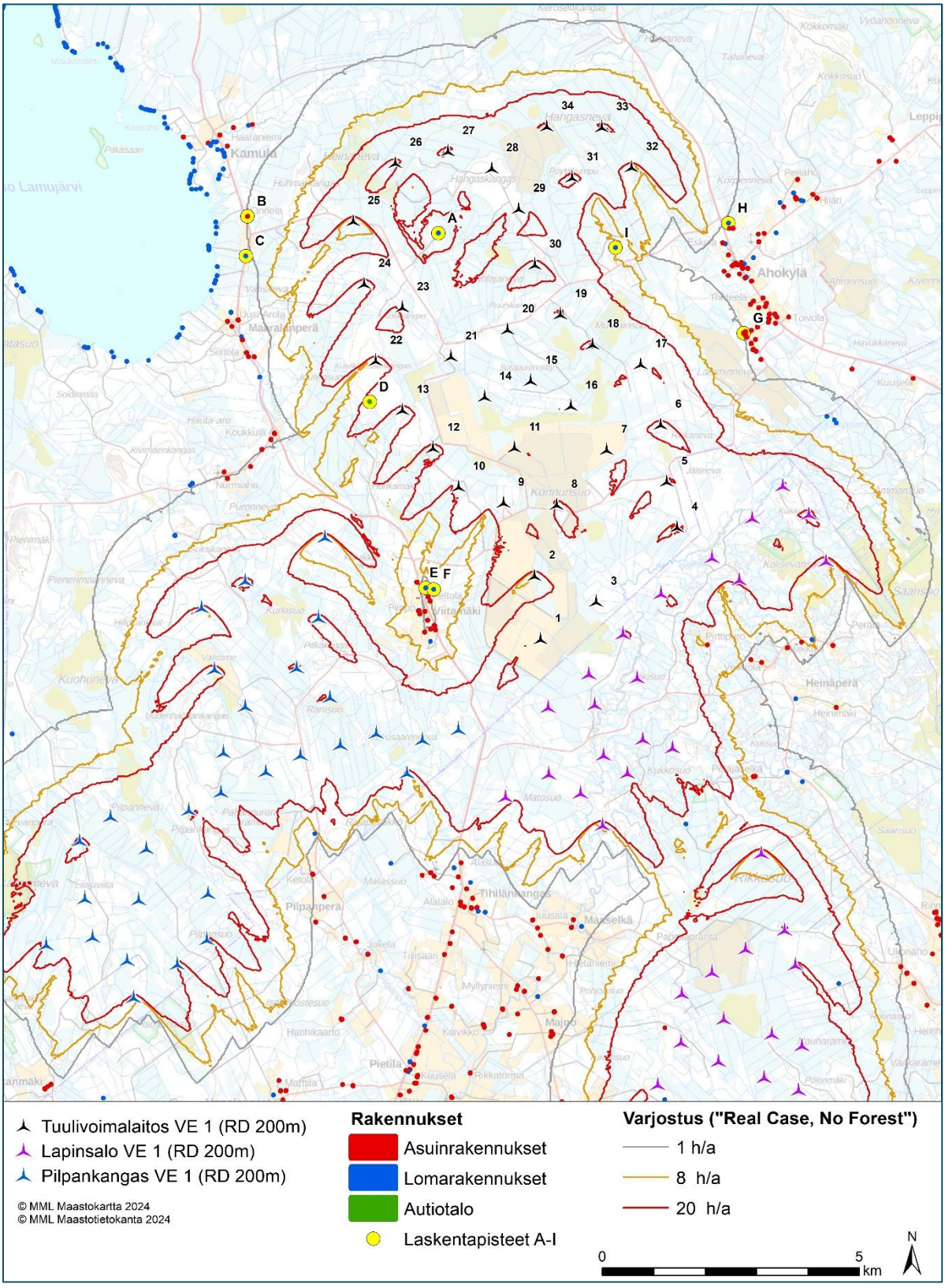
Rakennus	Äänitaso ulkona		Äänitaso sisällä	
	L eq,1h – Asumisterveys- ohje sisällä	Hz	L eq,1h – Asumisterveys- ohje sisällä	Hz
Lomarakennus A	9,5	100	-3,9	50
Asuinrakennus B	4,6	100	-8,1	50
Lomarakennus C	5,0	100	-7,8	50
Autiotalo D	11,4	100	-2,1	50
Lomarakennus E	10,4	80	-2,7	50
Lomarakennus F	10,5	80	-2,6	50
Asuinrakennus G	6,9	80	-5,7	50
Lomarakennus H	5,3	100	-7,2	50
Lomarakennus I	8,9	100	-4,4	50

Taulukko 20. Matalataajuisen melun mallinnustulokset hankevaihtoehdossa 2 kohteissa A-I, verrattuna Sosiaali- ja terveysministeriön toimenpiderajaan.

Rakennus	Äänitaso ulkona		Äänitaso sisällä	
	L eq,1h – Asumisterveys- ohje sisällä	Hz	L eq,1h – Asumisterveys- ohje sisällä	Hz
Lomarakennus A	8,7	100	-4,7	50
Asuinrakennus B	3,5	100	-9,0	50
Lomarakennus C	4,2	100	-8,5	50
Autiotalo D	11,3	100	-2,3	50
Lomarakennus E	10,0	80	-3,2	50
Lomarakennus F	10,0	80	-3,2	50
Asuinrakennus G	6,9	80	-5,7	50
Lomarakennus H	5,1	100	-7,5	50
Lomarakennus I	8,7	100	-4,5	50

2.2 Varjostus

Konnunsuon tuulivoimapuiston hankevaihtoehdon 1 (VE 1) sekä Pilpankankaan ja Lapinsalon voimaloiden aiheuttama varjostuksen yhteisvaikutus on esitetty seuraavassa kuvassa (Kuva 9) ja mallinnuspisteiden a-i varjostustunnit taulukossa 21. Varjostusmallinnuksen tuloksen mukaan yli 8h/a varjostusvaikutusta ilmenee lomarakennuksen A, Lomarakennuksen I ja Autiotalon D alueella. Mallinnuksen tarkemmat tiedot on esitetty liitteessä 13.

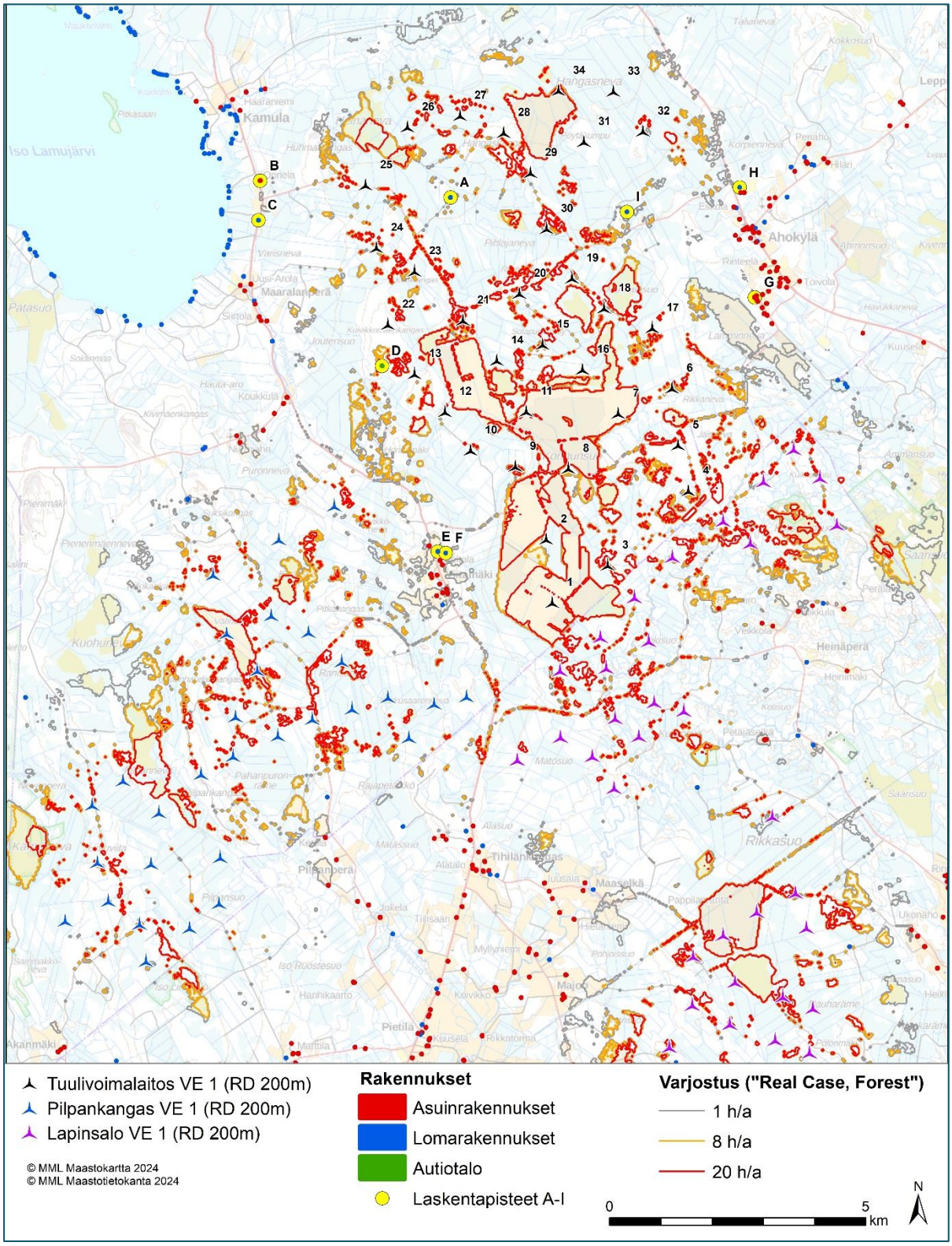


Kuva 9. Varjostuksen yhteismallinnuksen tulos hankevaihtoehdossa 1 (VE1).

Taulukko 21. Hankevaihtoehdon 1 laskennalliset varjostuksen yhteisvaikutukset laskentapisteissä A-I.

	ETRS89-TM35 Itä	ETRS89-TM35 Pohjoinen	Z (m)	Laskentaikkuna (m)	Varjostus (h/a)
Lomarakennus A	471650	7097381	157,6	5,0 x 5,0	15:47
Asuinrakennus B	467933	7097709	139,1	5,0 x 5,0	1:58
Lomarakennus C	467899	7096936	139,8	5,0 x 5,0	0:00
Autiotalo D	470313	7094090	168,7	5,0 x 5,0	29:46
Lomarakennus E	471402	7090461	195	5,0 x 5,0	0:00
Lomarakennus F	471557	7090435	188,1	5,0 x 5,0	2:16
Asuinrakennus G	477593	7095429	191,1	5,0 x 5,0	0:00
Lomarakennus H	477297	7097577	190,8	5,0 x 5,0	0:00
Lomarakennus I	475097	7097098	176,3	5,0 x 5,0	9:46

Huomioitaessa puuston suojaava vaikutus Konnunsuon vaihtoehdon VE 1 varjostuksen yhteismallinnuksessa, on tuulivoimahanketta lähimpien asuin- ja lomarakennusten pihapiirissä varjostusvaikutus alle 8 h/a, mutta ylittyy laskentapisteessä autiotalo D. Puuston huomioiva varjostuksen yhteismallinnuksen tulos Konnunsuon tuulivoimapuiston hankevaihtoehdossa 1 (VE 1), on esitetty kuvassa 10 ja mallinnuspisteiden a-i varjostustunnit taulukossa 22. Mallinnuksen tarkemmat tiedot on esitetty liitteessä 14

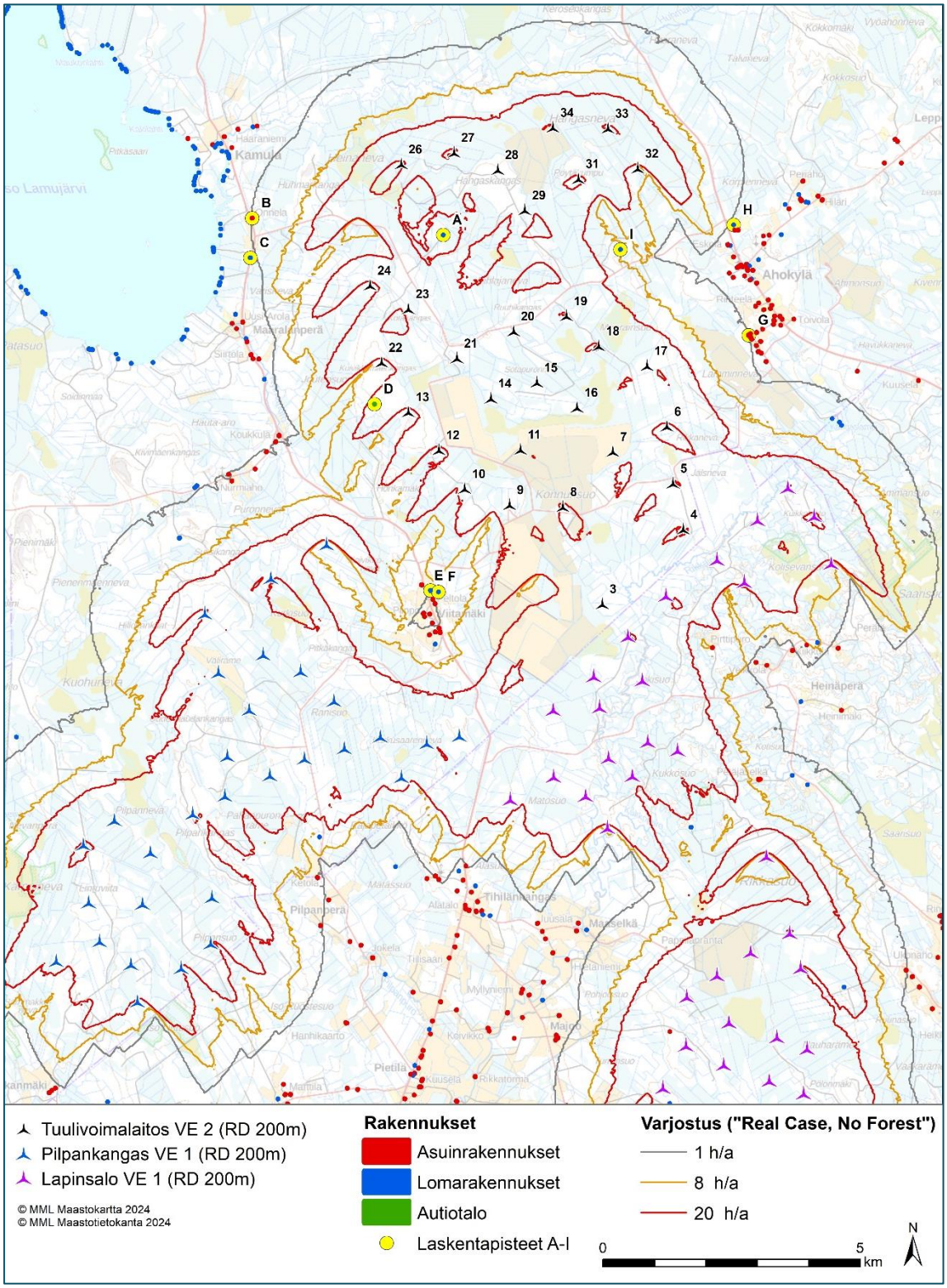


Kuva 10. Varjostuksen yhteismallinnuksen tulos hankevaihtoehdossa 1 (VE1), kun puuston suojaava vaikutus huomioidaan (”Real Case, Forest”)

Taulukko 22. Hankevaihtoehdon 1 laskennalliset varjostuksen yhteisvaikutukset laskentapisteissä A-I, kun puuston suojaava vaikutus huomioidaan ("Real Case, Forest")

	ETRS89-TM35 Itä	ETRS89-TM35 Pohjoinen	Z (m)	Laskentaikkuna (m)	Varjostus (h/a)
Lomarakennus A	471650	7097381	157,6	5,0 x 5,0	0:00
Asuinrakennus B	467933	7097709	139,1	5,0 x 5,0	1:58
Lomarakennus C	467899	7096936	139,8	5,0 x 5,0	0:00
Autiotalo D	470313	7094090	168,7	5,0 x 5,0	29:46
Lomarakennus E	471402	7090461	195	5,0 x 5,0	0:00
Lomarakennus F	471557	7090435	188,1	5,0 x 5,0	2:16
Asuinrakennus G	477593	7095429	191,1	5,0 x 5,0	0:00
Lomarakennus H	477297	7097577	190,8	5,0 x 5,0	0:00
Lomarakennus I	475097	7097098	176,3	5,0 x 5,0	0:00

Konnunsuon tuulivoimapuiston hankevaihtoehdon 2 (VE 2) sekä Pilpankankaan ja Lapinsalon voimaloiden aiheuttama varjostuksen yhteisvaikutus on esitetty seuraavassa kuvassa (Kuva 11) ja mallinnuspisteiden a-i varjostustunnit taulukossa 23. Varjostusmallinnuksen tuloksen mukaan yli 8h/a varjostusvaikutusta ilmenee lomarakennuksen A ja Autiotalon D alueella. Mallinnuksen tarkemmat tiedot on esitetty liitteessä 15.

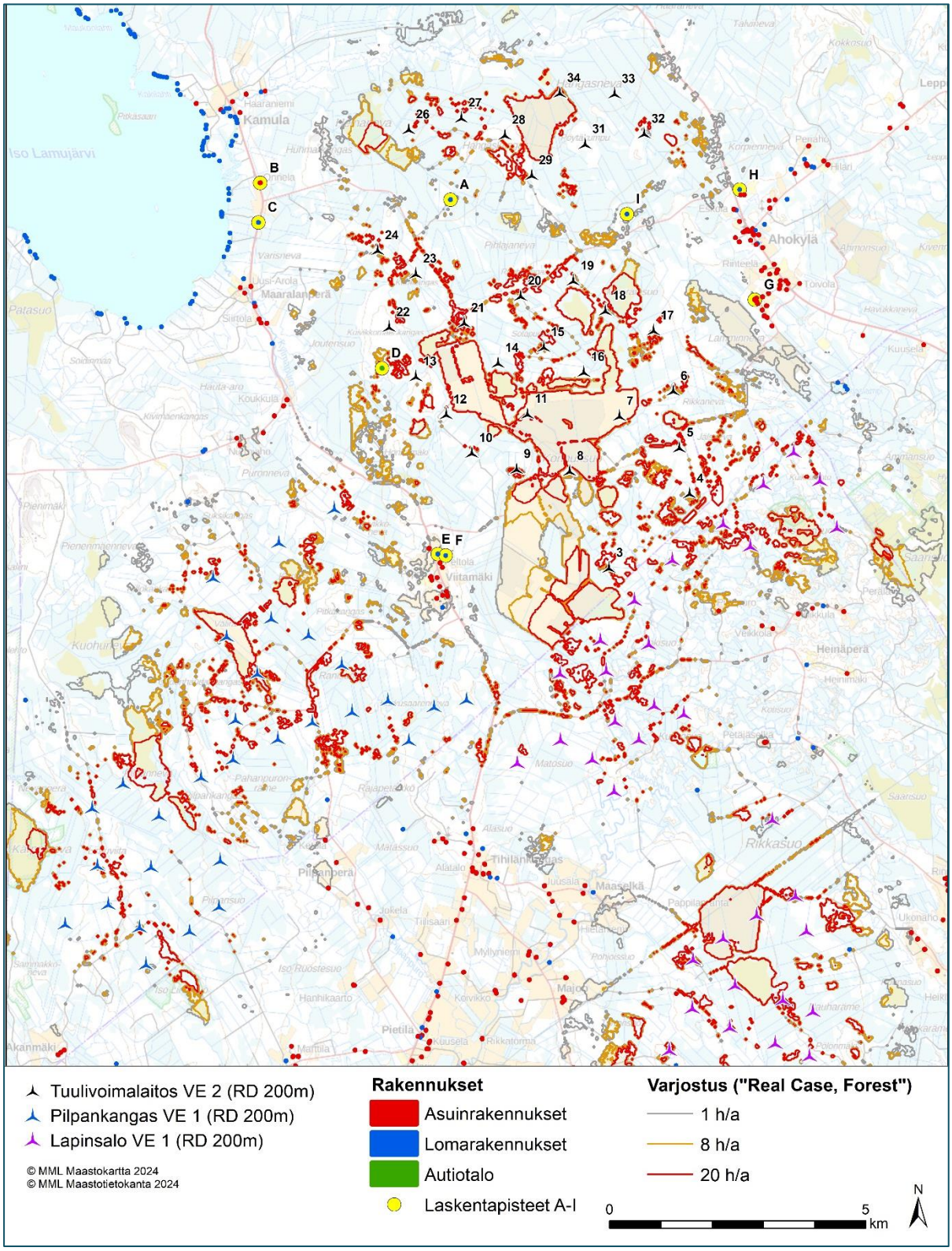


Kuva 11. Varjostuksen yhteismallinnuksen tulos hankevaihtoehdossa 2 (VE2)

Taulukko 23. Hankevaihtoehdon 2 laskennalliset varjostuksen yhteisvaikutukset laskentapisteissä A-I.

	ETRS89-TM35 Itä	ETRS89-TM35 Pohjoinen	Z (m)	Laskentaikkuna (m)	Varjostus (h/a)
Lomarakennus A	471650	7097381	157,6	5,0 x 5,0	10:12
Asuinrakennus B	467933	7097709	139,1	5,0 x 5,0	0:00
Lomarakennus C	467899	7096936	139,8	5,0 x 5,0	0:00
Autiotalo D	470313	7094090	168,7	5,0 x 5,0	29:46
Lomarakennus E	471402	7090461	195	5,0 x 5,0	0:00
Lomarakennus F	471557	7090435	188,1	5,0 x 5,0	2:16
Asuinrakennus G	477593	7095429	191,1	5,0 x 5,0	0:00
Lomarakennus H	477297	7097577	190,8	5,0 x 5,0	0:00
Lomarakennus I	475097	7097098	176,3	5,0 x 5,0	6:49

Huomioitaessa puuston suojaava vaikutus Konnunsuon vaihtoehdon VE 2 varjostuksen yhteismallinnuksessa, on tuulivoimahanketta lähimpien asuin- ja lomarakennusten pihapiirissä varjostusvaikutus alle 8 h/a, mutta ylittyy laskentapisteessä autiotalo D. Puuston huomioiva varjostuksen yhteismallinnuksen tulos Konnunsuon tuulivoimapuiston hankevaihtoehdossa 2 (VE 2), on esitetty kuvassa 12 ja mallinnuspisteiden a-i varjostustunnit taulukossa 24. Mallinnuksen tarkemmat tiedot on esitetty liitteessä 16.



Kuva 12. Varjostuksen yhteismallinnuksen tulos hankevaihtoehdossa 2 (VE2), kun puuston suojaava vaikutus huomioidaan (”Real Case, Forest”)

Taulukko 24. Hankevaihtoehdon 2 laskennalliset varjostuksen yhteisvaikutukset laskentapisteissä A-I, kun puuston suojaava vaikutus huomioidaan ("Real Case, Forest")

	ETRS89-TM35 Itä	ETRS89-TM35 Pohjoinen	Z (m)	Laskentaikkuna (m)	Varjostus (h/a)
Lomarakennus A	471650	7097381	157,6	5,0 x 5,0	0:00
Asuinrakennus B	467933	7097709	139,1	5,0 x 5,0	0:00
Lomarakennus C	467899	7096936	139,8	5,0 x 5,0	0:00
Autiotalo D	470313	7094090	168,7	5,0 x 5,0	29:46
Lomarakennus E	471402	7090461	195	5,0 x 5,0	0:00
Lomarakennus F	471557	7090435	188,1	5,0 x 5,0	0:00
Asuinrakennus G	477593	7095429	191,1	5,0 x 5,0	0:00
Lomarakennus H	477297	7097577	190,8	5,0 x 5,0	0:00
Lomarakennus I	475097	7097098	176,3	5,0 x 5,0	0:00

FCG Finnish Consulting Group Oy

Johanna Harju, ins. AMK
Laatija

Henna-Riikka Rintamäki, ins. AMK
Tarkastaja

Liite 1: Melun leviämismallinnuksen (ISO 9613-2, YM 2/2014) tulokset WindPro-raporttina vaihtoehdossa VE1.

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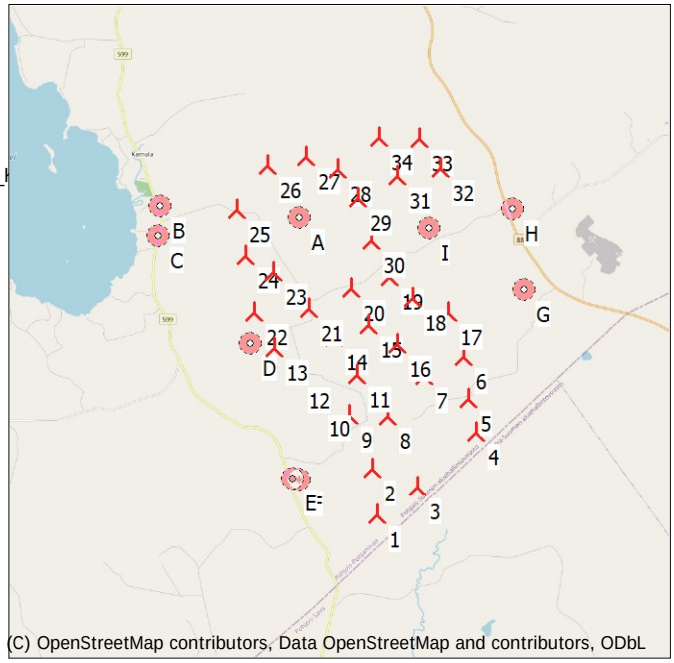
Calculated:
23.1.2024 15.54/3.5.584

DECIBEL - Main Result

Calculation: VE1_34WTG_Konnunsuo_SG170__HH215_+2dB_202401

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

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



WTGs

	East	North	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]
1	473 642	7 089 459	165,9	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
2	473 523	7 090 697	166,4	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
3	474 724	7 090 192	163,2	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
4	476 298	7 091 642	169,7	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
5	476 097	7 092 538	175,0	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
6	475 979	7 093 646	177,2	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
7	474 928	7 093 153	170,9	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
8	473 955	7 092 082	169,2	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
9	472 921	7 092 121	171,2	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
10	472 045	7 092 434	174,8	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
11	473 133	7 093 196	170,1	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
12	471 545	7 093 189	175,1	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
13	470 952	7 093 929	178,3	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
14	472 556	7 094 191	172,5	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
15	473 450	7 094 501	175,0	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
16	474 232	7 094 014	173,4	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
17	475 592	7 094 825	177,5	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
18	474 653	7 095 212	177,9	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
19	474 026	7 095 796	179,2	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
20	472 999	7 095 500	175,0	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
21	471 895	7 094 973	170,5	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
22	470 430	7 094 892	173,5	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
23	470 952	7 095 933	163,7	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
24	470 207	7 096 391	155,8	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
25	469 994	7 097 616	152,3	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
26	470 814	7 098 750	149,2	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
27	471 839	7 098 977	152,4	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
28	472 690	7 098 642	163,3	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
29	473 217	7 097 856	165,0	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
30	473 530	7 096 766	168,7	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
31	474 257	7 098 465	167,5	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
32	475 413	7 098 667	166,8	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
33	474 833	7 099 446	158,5	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
34	473 764	7 099 462	155,4	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0

Calculation Results

Sound level

Noise sensitive area No.	Name	East	North	Z [m]	Immission height [m]	Demands Noise [dB(A)]	Sound level From WTGs [dB(A)]	Distance to noise demand [m]
A	Lomarakennus A	471 650	7 097 381	157,6	4,0	40,0	38,4	584
B	Asuinrakennus B	467 933	7 097 709	139,1	4,0	40,0	30,4	1 397

To be continued on next page...

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Calculated:
23.1.2024 15.54/3.5.584

DECIBEL - Main Result

Calculation: VE1_34WTG_Konnunsuo_SG170__HH215_+2dB_202401

...continued from previous page

Noise sensitive area						Demands	Sound level	
No.	Name	East	North	Z [m]	Immission height [m]	Noise [dB(A)]	From WTGs [dB(A)]	Distance to noise demand [m]
C	Lomarakennus C	467 899	7 096 936	139,8	4,0	40,0	30,6	1 516
D	Autiotalo D	470 313	7 094 090	168,7	4,0	40,0	42,0	-235
E	Lomarakennus E	471 402	7 090 461	195,0	4,0	40,0	33,2	1 271
F	Lomarakennus F	471 557	7 090 435	188,1	4,0	40,0	33,6	1 234
G	Asuinrakennus G	477 593	7 095 429	191,1	4,0	40,0	31,7	1 365
H	Lomarakennus H	477 297	7 097 577	190,8	4,0	40,0	30,8	1 509
I	Lomarakennus I	475 097	7 097 098	176,3	4,0	40,0	37,4	675

Distances (m)

WTG	A	B	C	D	E	F	G	H	I
1	8169	10033	9428	5703	2454	2302	7160	8903	7777
2	6941	8967	8400	4671	2134	1984	6241	7847	6591
3	7819	10131	9595	5887	3333	3177	5971	7821	6916
4	7385	10333	9928	6466	5036	4892	4003	6019	5587
5	6575	9664	9304	5989	5134	5003	3255	5180	4669
6	5718	9014	8725	5684	5577	5465	2405	4146	3563
7	5349	8347	7982	4709	4436	4330	3505	5018	3948
8	5779	8242	7761	4159	3024	2909	4943	6431	5144
9	5411	7490	6957	3267	2250	2169	5725	6994	5432
10	4963	6689	6120	2397	2075	2058	6305	7351	5574
11	4440	6885	6433	2959	3237	3180	4987	6044	4368
12	4194	5786	5228	1526	2732	2754	6450	7235	5282
13	3522	4837	4285	659	3497	3546	6809	7319	5218
14	3316	5809	5406	2245	3904	3886	5187	5826	3861
15	3396	6382	6061	3164	4529	4485	4246	4926	3076
16	4243	7303	6975	3920	4543	4468	3646	4700	3203
17	4698	8184	7977	5330	6049	5962	2091	3238	2326
18	3705	7169	6971	4483	5757	5692	2948	3548	1938
19	2856	6386	6232	4086	5946	5902	3586	3724	1686
20	2315	5527	5299	3034	5286	5266	4594	4773	2637
21	2420	4815	4452	1812	4539	4551	5716	5997	3843
22	2772	3765	3254	810	4536	4597	7183	7373	5162
23	1607	3502	3213	1951	5491	5531	6660	6555	4306
24	1750	2628	2371	2304	6050	6107	7449	7189	4941
25	1672	2063	2203	3540	7292	7349	7907	7303	5129
26	1605	3063	3433	4687	8310	8349	7549	6589	4591
27	1607	4107	4437	5120	8527	8546	6760	5635	3761
28	1635	4848	5086	5136	8282	8285	5862	4728	2859
29	1637	5286	5397	4756	7615	7605	5004	4090	2028
30	1978	5676	5634	4185	6654	6631	4277	3853	1602
31	2824	6369	6539	5891	8498	8472	4511	3167	1605
32	3977	7541	7711	6853	9134	9090	3904	2177	1601
33	3794	7115	7375	7009	9618	9589	4874	3093	2363
34	2966	6089	6386	6385	9306	9293	5561	4005	2714

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Johanna Harju / johanna.harju@fcg.fi
Calculated:
23.1.2024 15.54/3.5.584

DECIBEL - Assumptions for noise calculation

Calculation: VE1_34WTG_Konnunsuo_SG170__HH215_+2dB_202401

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_Pyhäntä_Konnunsuo_0.w2r (5)
Area type with hard ground: jarvi_laatikko
Ground factor for hard ground: 0,0
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure tones penalty is added to total noise impact at receptors
Noise sensitive area
Height above ground level, when no value in NSA object:
4,0 m; Don't allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)
Octave data required
Frequency dependent air absorption

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

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89

WTG: Siemens Gamesa SG 6.6-170 6600 170.0 !O!
Noise: (AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB

Source	Source/Date	Creator	Edited
SGRE	4.10.2022	USER	9.1.2024 16.03

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					Octave data							
Status	Hub height [m]	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones	63 [dB]	125 [dB]	250 [dB]	500 [dB]	1000 [dB]	2000 [dB]	4000 [dB]	8000 [dB]
From Windcat	215,0	8,0	108,0	No	88,5	95,4	98,1	99,9	103,8	101,9	95,3	85,0

Noise sensitive area: A Lomarakennus A

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

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

Noise sensitive area: B Asuinrakennus B

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

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

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Calculated:
23.1.2024 15.54/3.5.584

DECIBEL - Assumptions for noise calculation

Calculation: VE1_34WTG_Konnunsuo_SG170__HH215_+2dB_202401

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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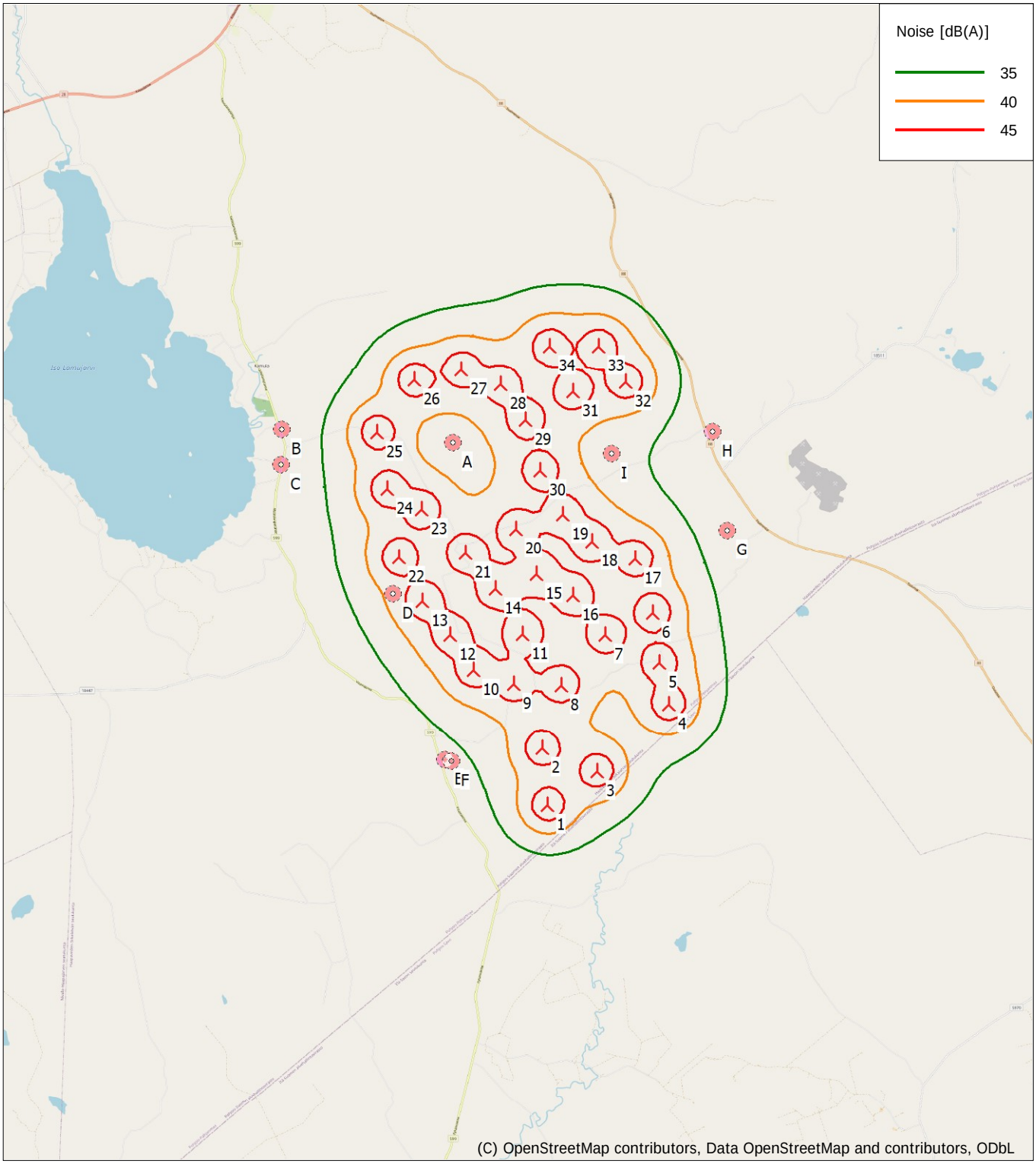
Calculated:
23.1.2024 15.54/3.5.584

DECIBEL - Map 8,0 m/s

Calculation: VE1_34WTG_Konnunsuo_SG170__HH215_+2dB_202401



0 2,5 5 7,5 10km

Map: EMD OpenStreetMap , Print scale 1:125 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 473 146 North: 7 094 460

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: Melun leviämismallinnuksen (ISO 9613-2, YM 2/2014) tulokset WindPro-raporttina vaihtoehdossa VE2.

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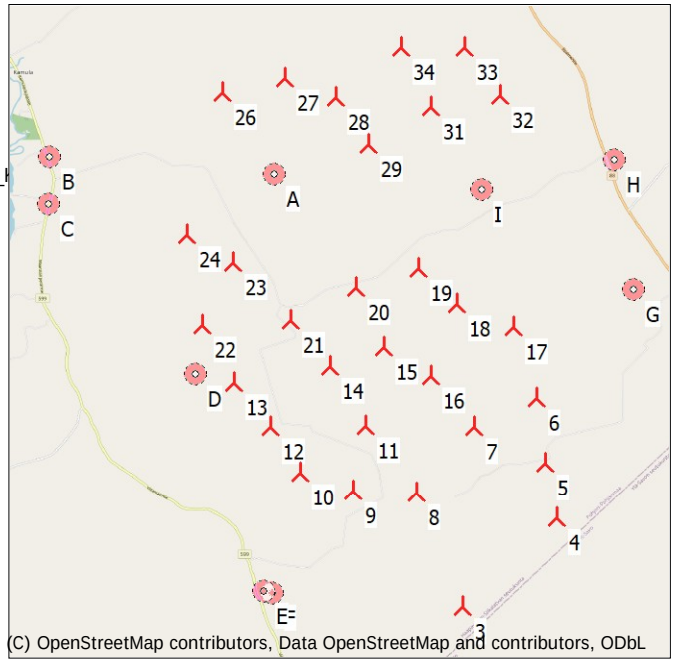
Calculated:
24.1.2024 8.46/3.5.584

DECIBEL - Main Result

Calculation: VE2_30WTG_Konnunsuo_SG170__HH215_+2dB_202401

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

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



Scale 1:125 000
New WTG
Noise sensitive area

WTGs

	East	North	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]
3	474 724	7 090 192	163,2	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
4	476 298	7 091 642	169,7	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
5	476 097	7 092 538	175,0	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
6	475 979	7 093 646	177,2	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
7	474 928	7 093 153	170,9	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
8	473 955	7 092 082	169,2	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
9	472 921	7 092 121	171,2	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
10	472 045	7 092 434	174,8	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
11	473 133	7 093 196	170,1	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
12	471 545	7 093 189	175,1	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
13	470 952	7 093 929	178,3	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
14	472 556	7 094 191	172,5	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
15	473 450	7 094 501	175,0	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
16	474 232	7 094 014	173,4	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
17	475 592	7 094 825	177,5	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
18	474 653	7 095 212	177,9	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
19	474 026	7 095 796	179,2	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
20	472 999	7 095 500	175,0	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
21	471 895	7 094 973	170,5	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
22	470 430	7 094 892	173,5	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
23	470 952	7 095 933	163,7	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
24	470 207	7 096 391	155,8	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
26	470 814	7 098 750	149,2	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
27	471 839	7 098 977	152,4	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
28	472 690	7 098 642	163,3	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
29	473 217	7 097 856	165,0	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
31	474 257	7 098 465	167,5	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
32	475 413	7 098 667	166,8	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
33	474 833	7 099 446	158,5	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0
34	473 764	7 099 462	155,4	Siemens Gamesa SG 6.6-170 ...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB	8,0	108,0

Calculation Results

Sound level

Noise sensitive area						Demands	Sound level		
No.	Name	East	North	Z [m]	Immission height [m]	Noise [dB(A)]	From WTGs [dB(A)]	Distance to noise demand [m]	
A	Lomarakennus A	471 650	7 097 381	157,6	4,0	40,0	37,7	656	
B	Asuinrakennus B	467 933	7 097 709	139,1	4,0	40,0	28,5	1 966	
C	Lomarakennus C	467 899	7 096 936	139,8	4,0	40,0	29,1	1 711	
D	Autiotalo D	470 313	7 094 090	168,7	4,0	40,0	42,0	-229	
E	Lomarakennus E	471 402	7 090 461	195,0	4,0	40,0	31,8	1 304	

To be continued on next page...

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Calculated:
24.1.2024 8.46/3.5.584

DECIBEL - Main Result

Calculation: VE2_30WTG_Konnunsuo_SG170__HH215_+2dB_202401

...continued from previous page

Noise sensitive area						Demands	Sound level	
No.	Name	East	North	Z [m]	Immission height [m]	Noise [dB(A)]	From WTGs [dB(A)]	Distance to noise demand [m]
F	Lomarakennus F	471 557	7 090 435	188,1	4,0	40,0	32,0	1 272
G	Asuinrakennus G	477 593	7 095 429	191,1	4,0	40,0	31,5	1 373
H	Lomarakennus H	477 297	7 097 577	190,8	4,0	40,0	30,6	1 518
I	Lomarakennus I	475 097	7 097 098	176,3	4,0	40,0	36,7	766

Distances (m)

WTG	A	B	C	D	E	F	G	H	I
3	7819	10131	9595	5887	3333	3177	5971	7821	6916
4	7385	10333	9928	6466	5036	4892	4003	6019	5587
5	6575	9664	9304	5989	5134	5003	3255	5180	4669
6	5718	9014	8725	5684	5577	5465	2405	4146	3563
7	5349	8347	7982	4709	4436	4330	3505	5018	3948
8	5779	8242	7761	4159	3024	2909	4943	6431	5144
9	5411	7490	6957	3267	2250	2169	5725	6994	5432
10	4963	6689	6120	2397	2075	2058	6305	7351	5574
11	4440	6885	6433	2959	3237	3180	4987	6044	4368
12	4194	5786	5228	1526	2732	2754	6450	7235	5282
13	3522	4837	4285	659	3497	3546	6809	7319	5218
14	3316	5809	5406	2245	3904	3886	5187	5826	3861
15	3396	6382	6061	3164	4529	4485	4246	4926	3076
16	4243	7303	6975	3920	4543	4468	3646	4700	3203
17	4698	8184	7977	5330	6049	5962	2091	3238	2326
18	3705	7169	6971	4483	5757	5692	2948	3548	1938
19	2856	6386	6232	4086	5946	5902	3586	3724	1686
20	2315	5527	5299	3034	5286	5266	4594	4773	2637
21	2420	4815	4452	1812	4539	4551	5716	5997	3843
22	2772	3765	3254	810	4536	4597	7183	7373	5162
23	1607	3502	3213	1951	5491	5531	6660	6555	4306
24	1750	2628	2371	2304	6050	6107	7449	7189	4941
26	1605	3063	3433	4687	8310	8349	7549	6589	4591
27	1607	4107	4437	5120	8527	8546	6760	5635	3761
28	1635	4848	5086	5136	8282	8285	5862	4728	2859
29	1637	5286	5397	4756	7615	7605	5004	4090	2028
31	2824	6369	6539	5891	8498	8472	4511	3167	1605
32	3977	7541	7711	6853	9134	9090	3904	2177	1601
33	3794	7115	7375	7009	9618	9589	4874	3093	2363
34	2966	6089	6386	6385	9306	9293	5561	4005	2714

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Calculated:
24.1.2024 8.46/3.5.584

DECIBEL - Assumptions for noise calculation

Calculation: VE2_30WTG_Konnunsuo_SG170__HH215_+2dB_202401

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_Pyhäntä_Konnunsuo_0.w2r (5)
Area type with hard ground: jarvi_laatikko
Ground factor for hard ground: 0,0
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure tones penalty is added to total noise impact at receptors
Noise sensitive area
Height above ground level, when no value in NSA object:
4,0 m; Don't allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)
Octave data required
Frequency dependent air absorption

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

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89

WTG: Siemens Gamesa SG 6.6-170 6600 170.0 !O!
Noise: (AM 0, 6.6MW) - 106dB(A)_Konnnu + 2 dB

Source	Source/Date	Creator	Edited
SGRE	4.10.2022	USER	9.1.2024 16.03

Siemens Gamesa Renewable Energy and its affiliates reserve the right to change the above specifications without prior notice.

					Octave data							
Status	Hub height [m]	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones	63 [dB]	125 [dB]	250 [dB]	500 [dB]	1000 [dB]	2000 [dB]	4000 [dB]	8000 [dB]
From Windcat	215,0	8,0	108,0	No	88,5	95,4	98,1	99,9	103,8	101,9	95,3	85,0

Noise sensitive area: A Lomarakennus A

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

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

Noise sensitive area: B Asuinrakennus B

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

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

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Calculated:
24.1.2024 8.46/3.5.584

DECIBEL - Assumptions for noise calculation

Calculation: VE2_30WTG_Konnunsuo_SG170__HH215_+2dB_202401

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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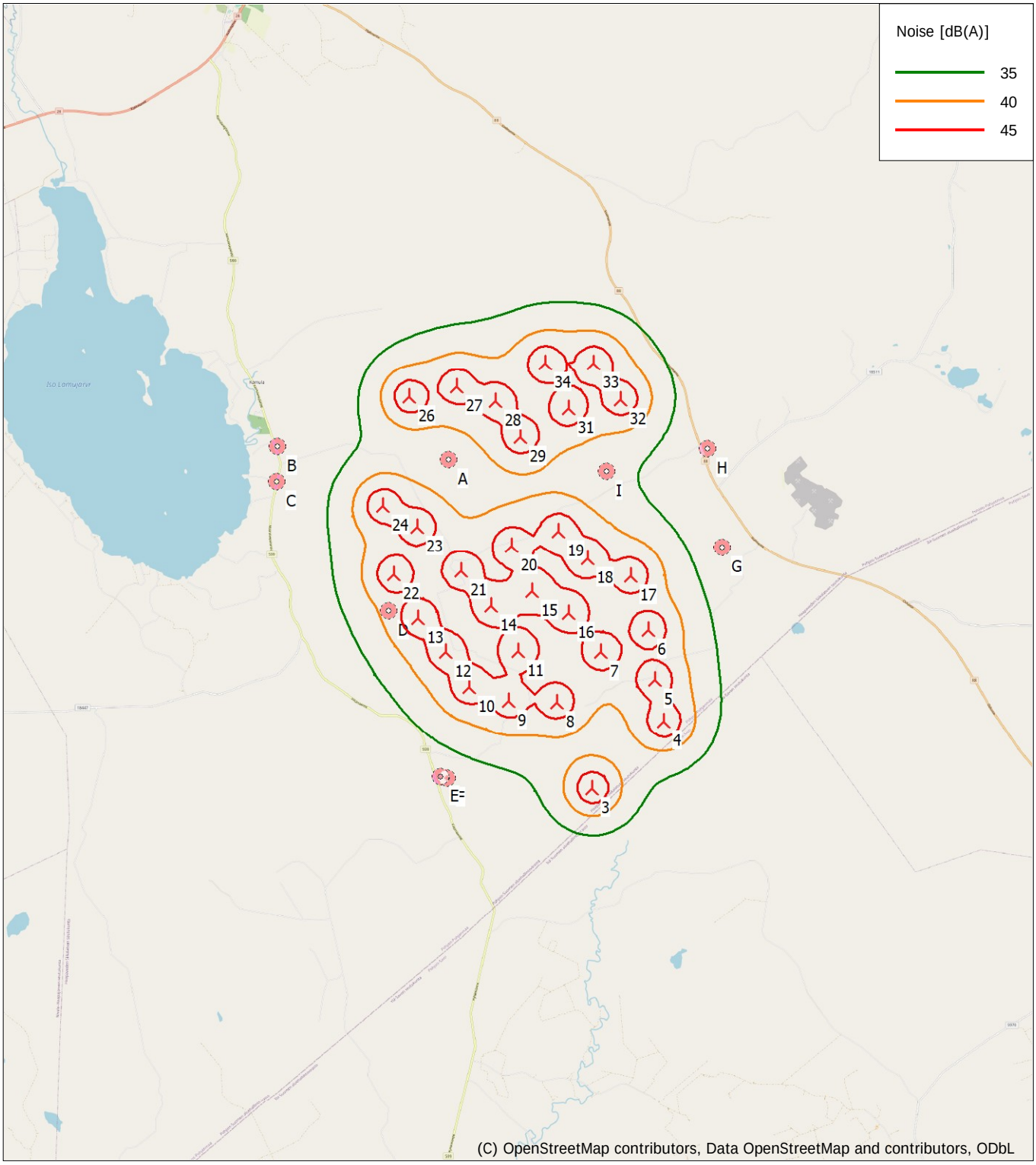
Calculated:
24.1.2024 8.46/3.5.584

DECIBEL - Map 8,0 m/s

Calculation: VE2_30WTG_Konnunsuo_SG170__HH215_+2dB_202401



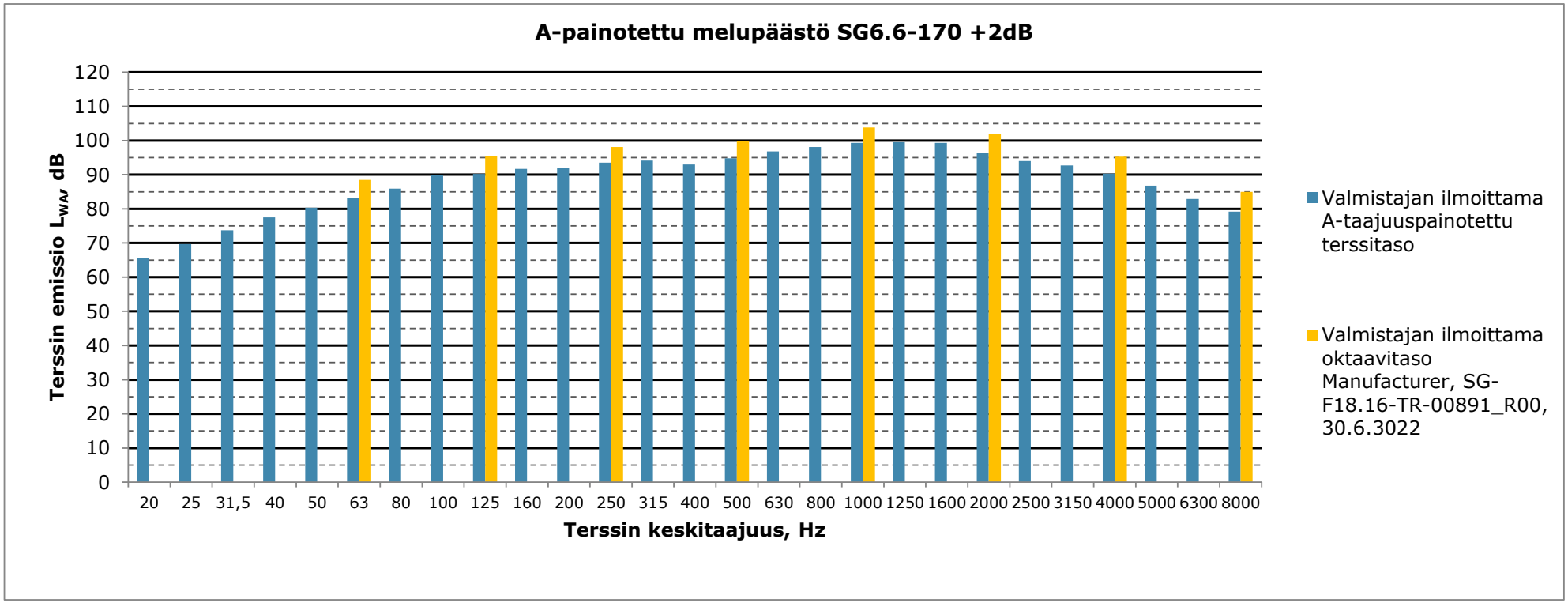
0 2,5 5 7,5 10km

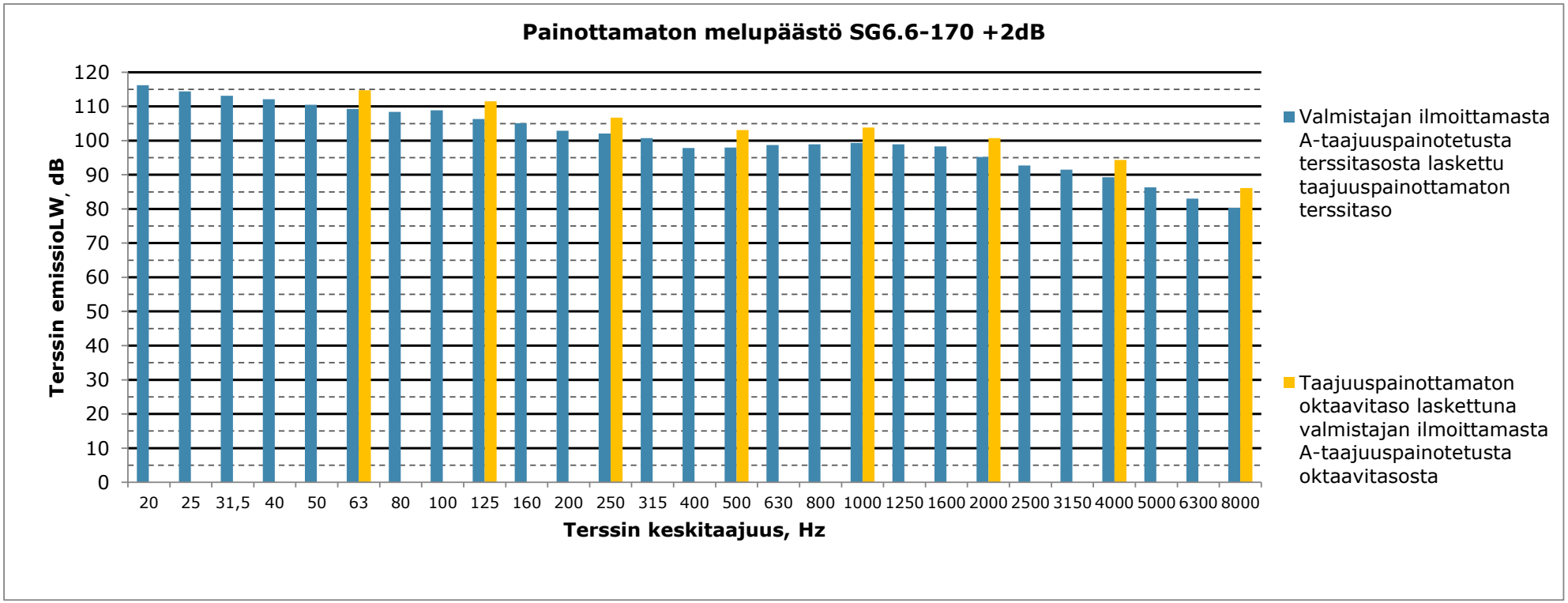
Map: EMD OpenStreetMap , Print scale 1:125 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 473 252 North: 7 094 827

New WTG Noise sensitive area

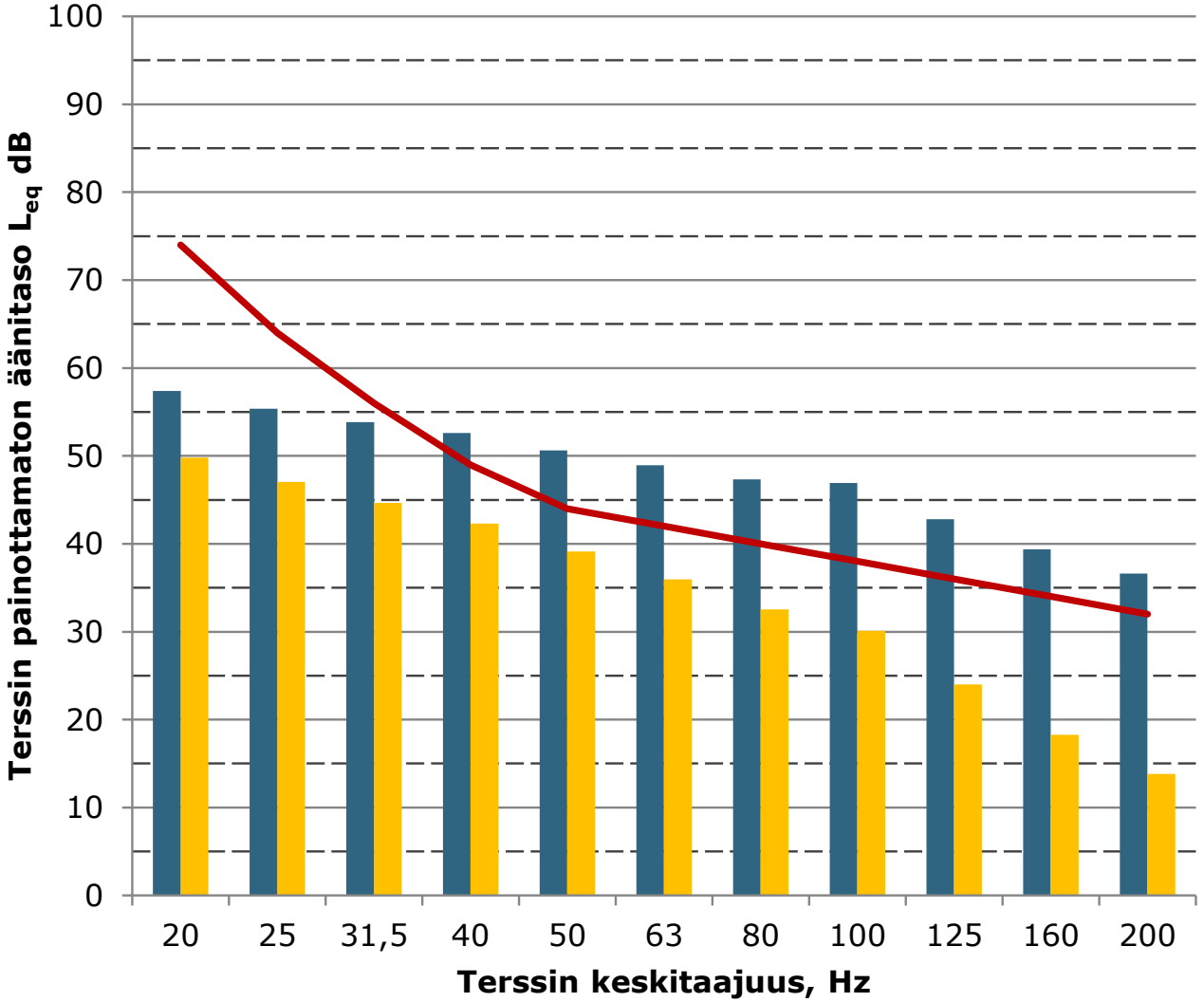
Noise calculation model: ISO 9613-2 General. Wind speed: 8,0 m/s
Height above sea level from active line object

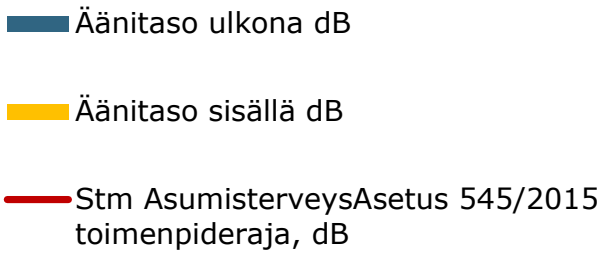
Liite 3: Matalataajuisen melun rakennuskohtaiset arvot vaihtoehdossa VE1.


A-painotettu melupäästö SG6.6-170 +2dB
Terssin emissio L_{WA} dB
120
110
100
90
80
70
60
50
40
30
20
10
0
20 25 31,5 40 50 63 80 100 125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000 5000 6300 8000
Terssin keskitaajuus, Hz
Valmistajan ilmoittama A-taajuuspainotettu terssitaso
Valmistajan ilmoittama oktaavitaso Manufacturer, SG-F18.16-TR-00891_R00, 30.6.3022


Painottamaton melupäästö SG6.6-170 +2dB
Terssin emissioLW, dB
120
110
100
90
80
70
60
50
40
30
20
10
0
20 25 31,5 40 50 63 80 100 125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000 5000 6300 8000
Terssin keskitaajuus, Hz
Valmistajan ilmoittamasta A-taajuuspainotetusta terssitasosta laskettu taajuuspainottamaton terssitaso
Taajuuspainottamaton oktaavitaso laskettuna valmistajan ilmoittamasta A-taajuuspainotetusta oktaavitasosta

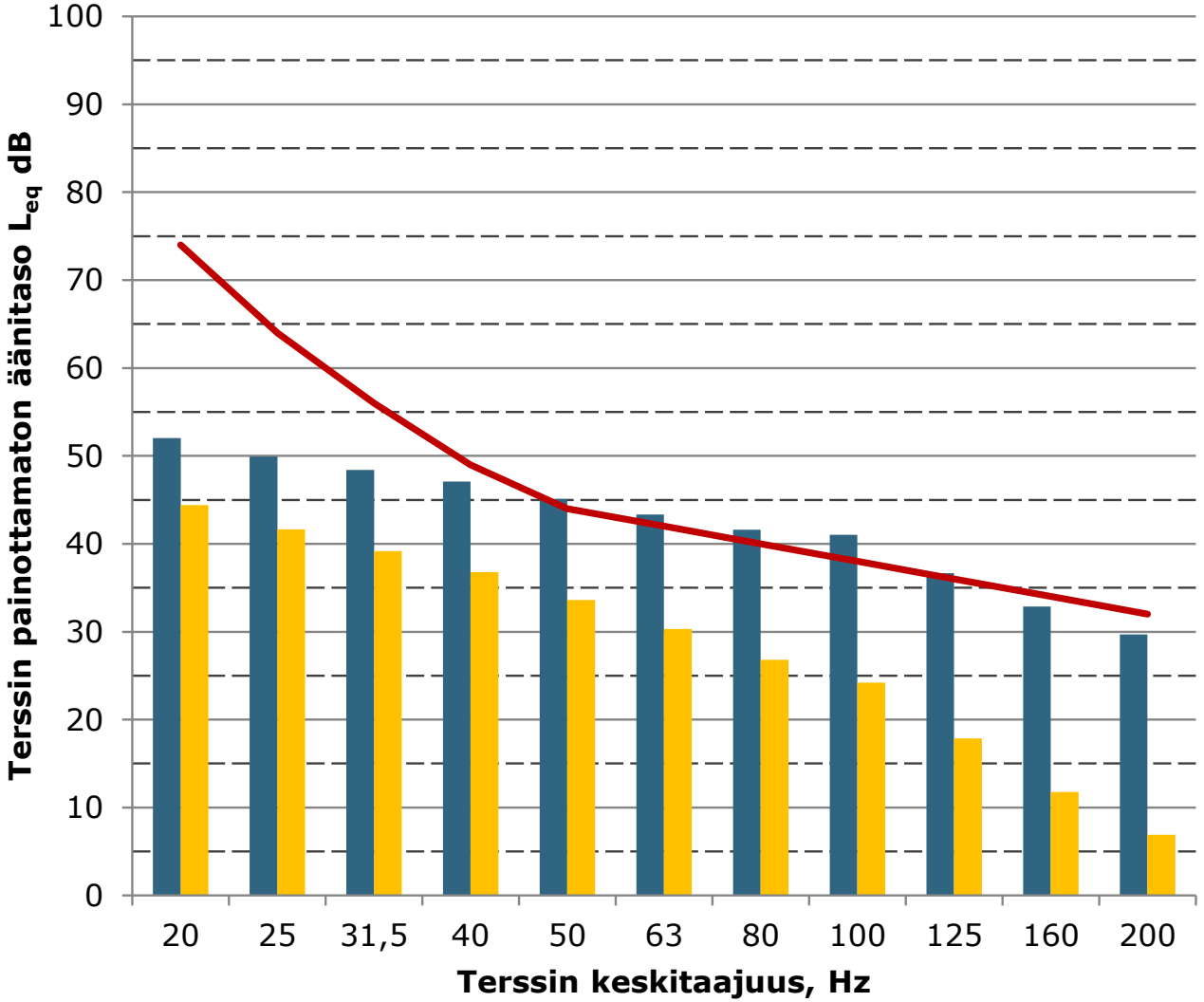
Matalien taajuuksien äänitasot ulkona ja sisällä, Lomarakennus A, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan

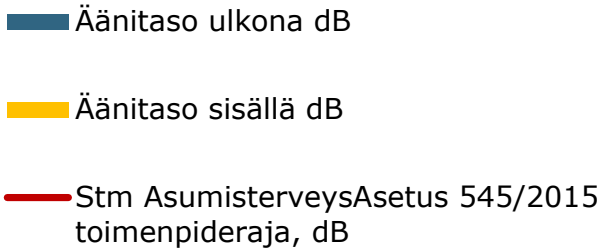




Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus kpl
SG6.6-170 +2dB 6,6 MW, 215 m, 34
Laskenta on tehty ohjeen YM 2/2014 "Tuulivoimaloiden melun mallintaminen":
Äänen geometrinen vaimeneminen pistelähteestä, maakerroin DSO1284 mukaan ja ilman absorptio ISO9613-1:1996 +15°C 70% RH.

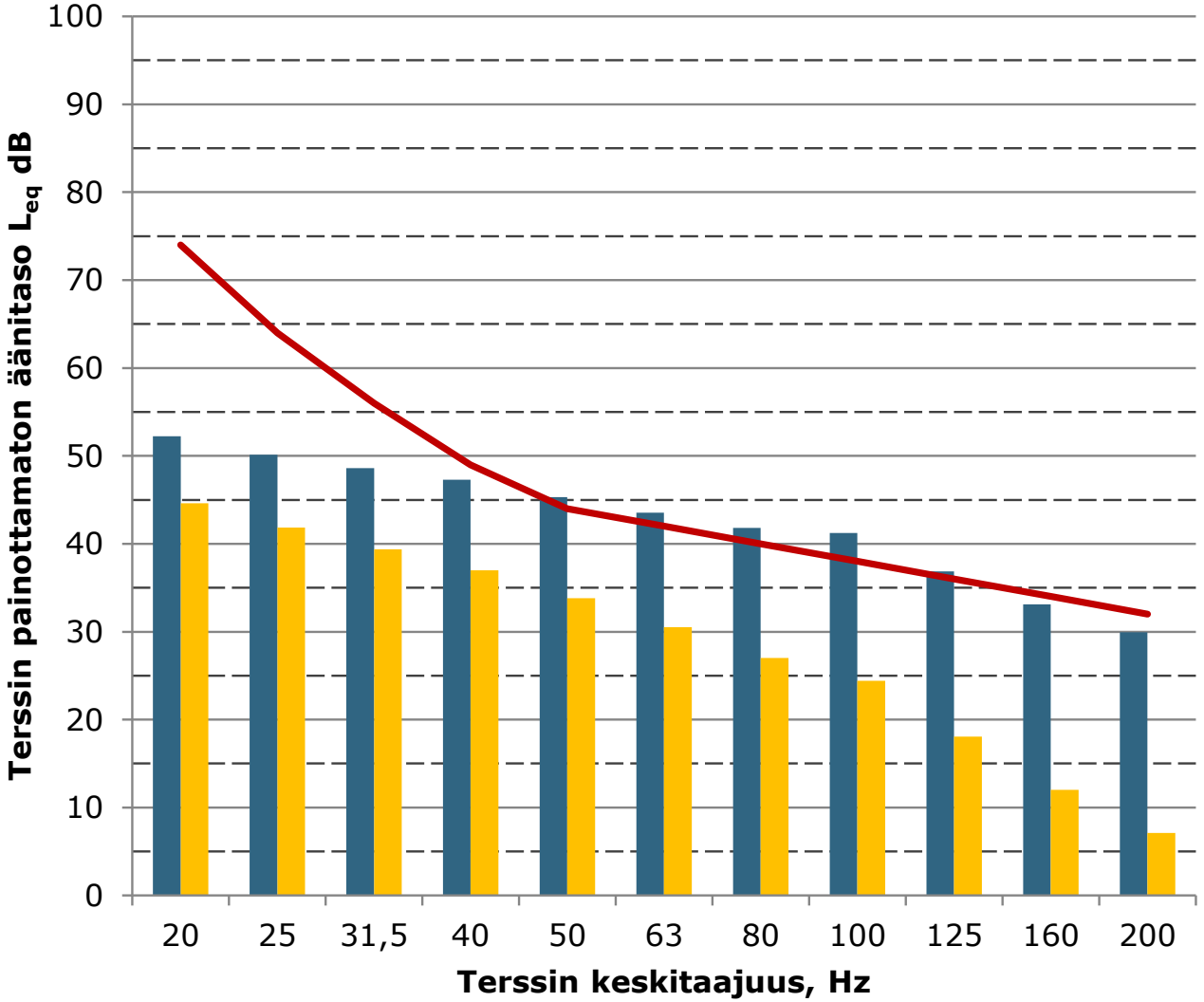
Matalien taajuuksien äänitasot ulkona ja sisällä, Asuinrakennus B, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan

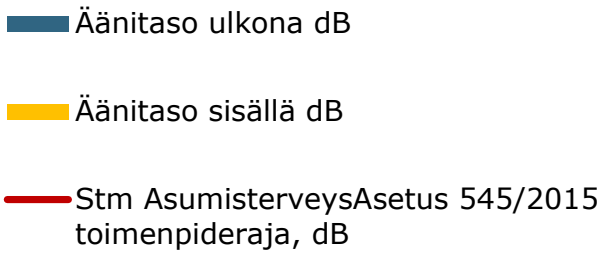




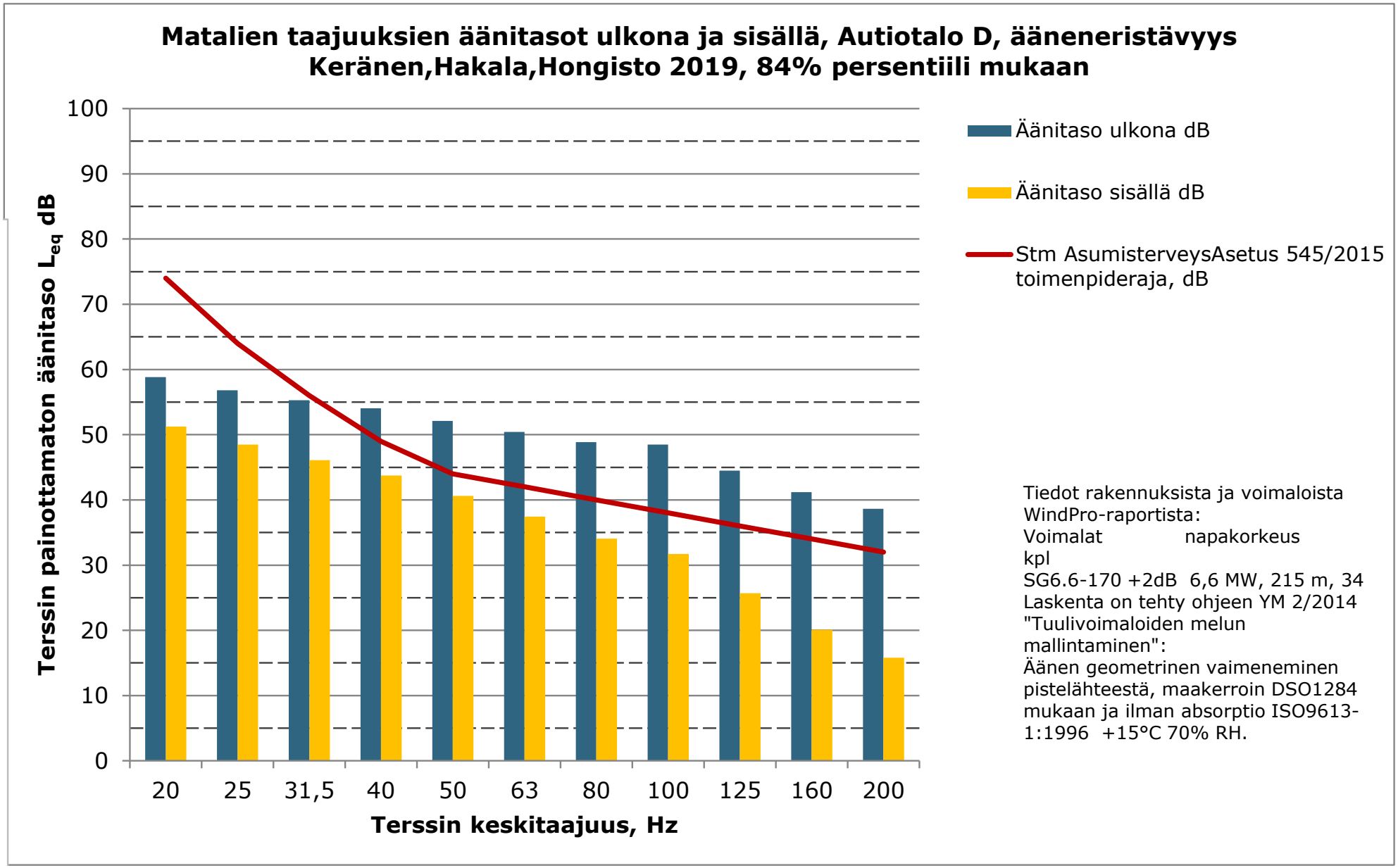
Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus kpl
SG6.6-170 +2dB 6,6 MW, 215 m, 34
Laskenta on tehty ohjeen YM 2/2014 "Tuulivoimaloiden melun mallintaminen":
Äänen geometrinen vaimeneminen pistelähteestä, maakerroin DSO1284 mukaan ja ilman absorptio ISO9613-1:1996 +15°C 70% RH.

Matalien taajuuksien äänitasot ulkona ja sisällä, Lomarakennus C, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan

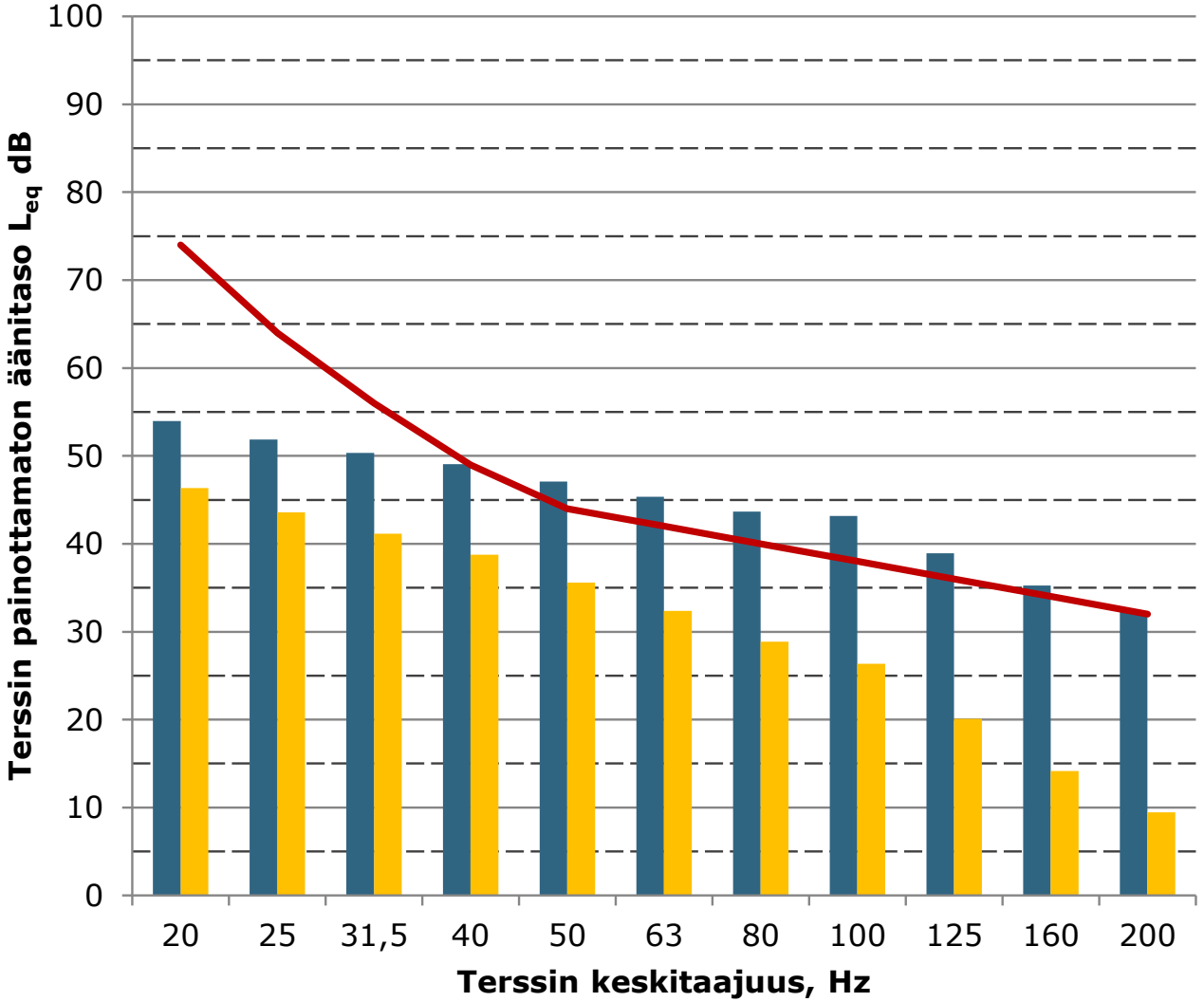


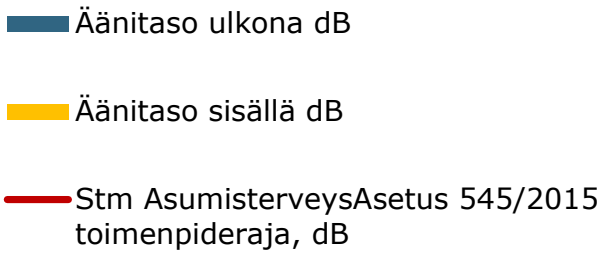


Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus kpl
SG6.6-170 +2dB 6,6 MW, 215 m, 34
Laskenta on tehty ohjeen YM 2/2014 "Tuulivoimaloiden melun mallintaminen":
Äänen geometrinen vaimeneminen pistelähteestä, maakerroin DSO1284 mukaan ja ilman absorptio ISO9613-1:1996 +15°C 70% RH.


Matalien taajuuksien äänitasot ulkona ja sisällä, Autiotalo D, ääneneristävyys
Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan
Terssin painottamaton äänitaso Leq dB
100
90
80
70
60
50
40
30
20
10
0
20
25
31,5
40
50
63
80
100
125
160
200
Terssin keskitaajuus, Hz
Äänitaso ulkona dB
Äänitaso sisällä dB
Stm AsumisterveysAsetus 545/2015 toimenpideraja, dB
Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus
kpl
SG6.6-170 +2dB 6,6 MW, 215 m, 34
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.

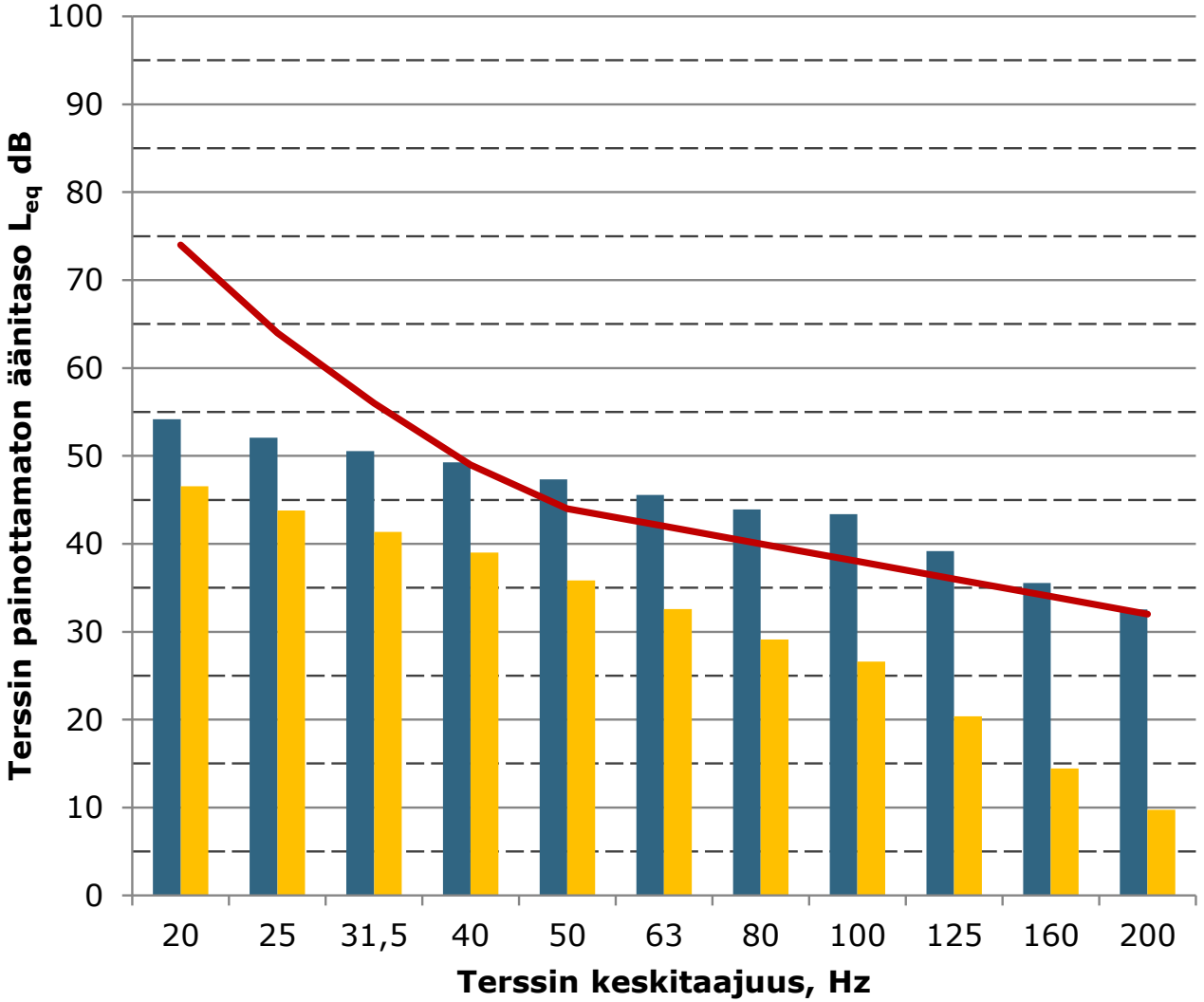
Matalien taajuuksien äänitasot ulkona ja sisällä, Lomarakennus E, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan

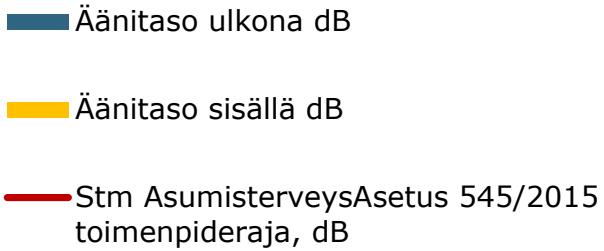




Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus kpl
SG6.6-170 +2dB 6,6 MW, 215 m, 34
Laskenta on tehty ohjeen YM 2/2014 "Tuulivoimaloiden melun mallintaminen":
Äänen geometrinen vaimeneminen pistelähteestä, maakerroin DSO1284 mukaan ja ilman absorptio ISO9613-1:1996 +15°C 70% RH.

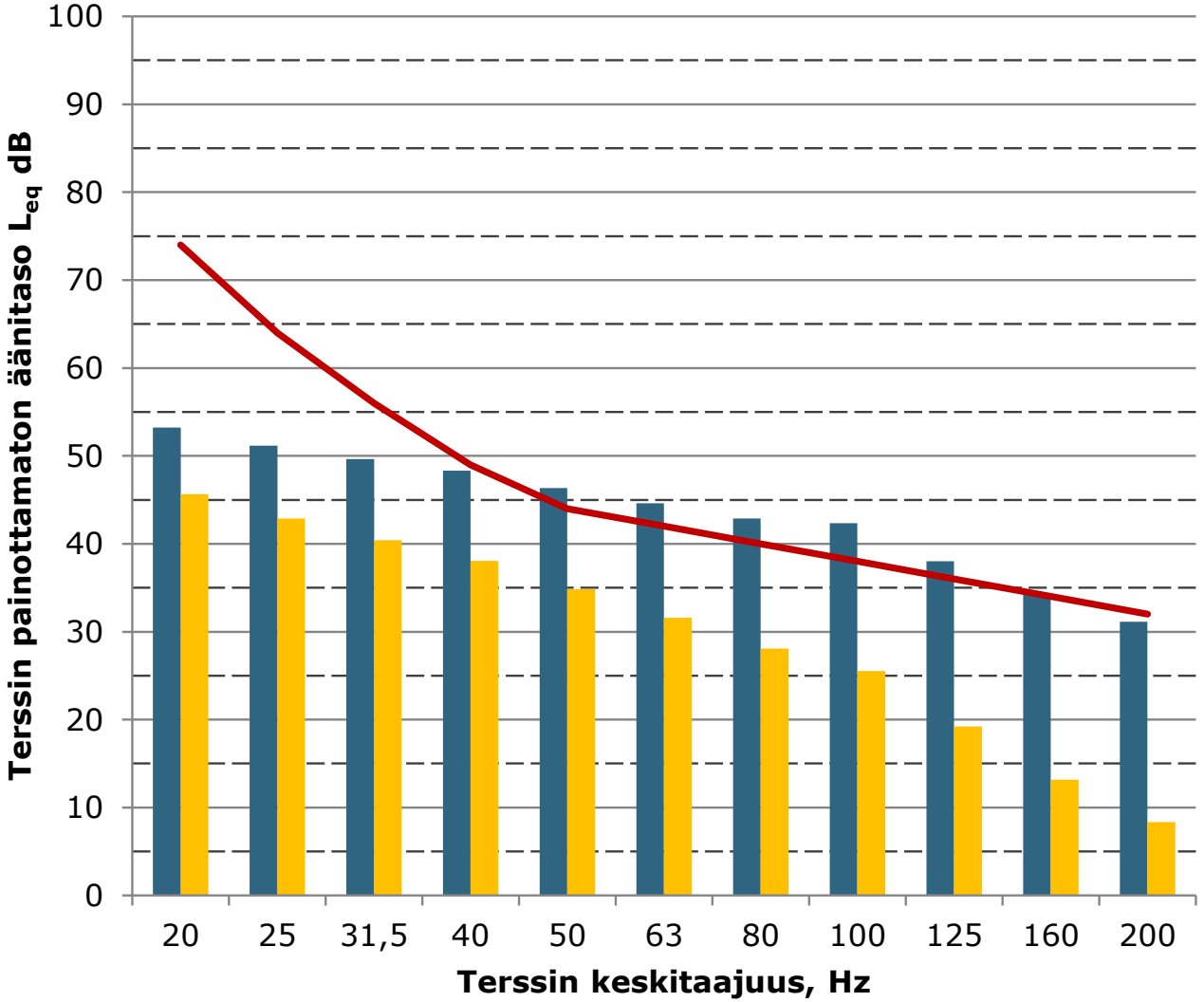
Matalien taajuuksien äänitasot ulkona ja sisällä, Lomarakennus F, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan

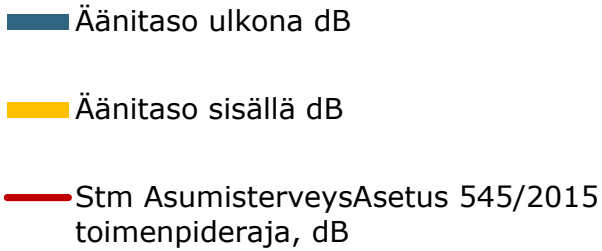




Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus kpl
SG6.6-170 +2dB 6,6 MW, 215 m, 34
Laskenta on tehty ohjeen YM 2/2014 "Tuulivoimaloiden melun mallintaminen":
Äänen geometrinen vaimeneminen pistelähteestä, maakerroin DSO1284 mukaan ja ilman absorptio ISO9613-1:1996 +15°C 70% RH.

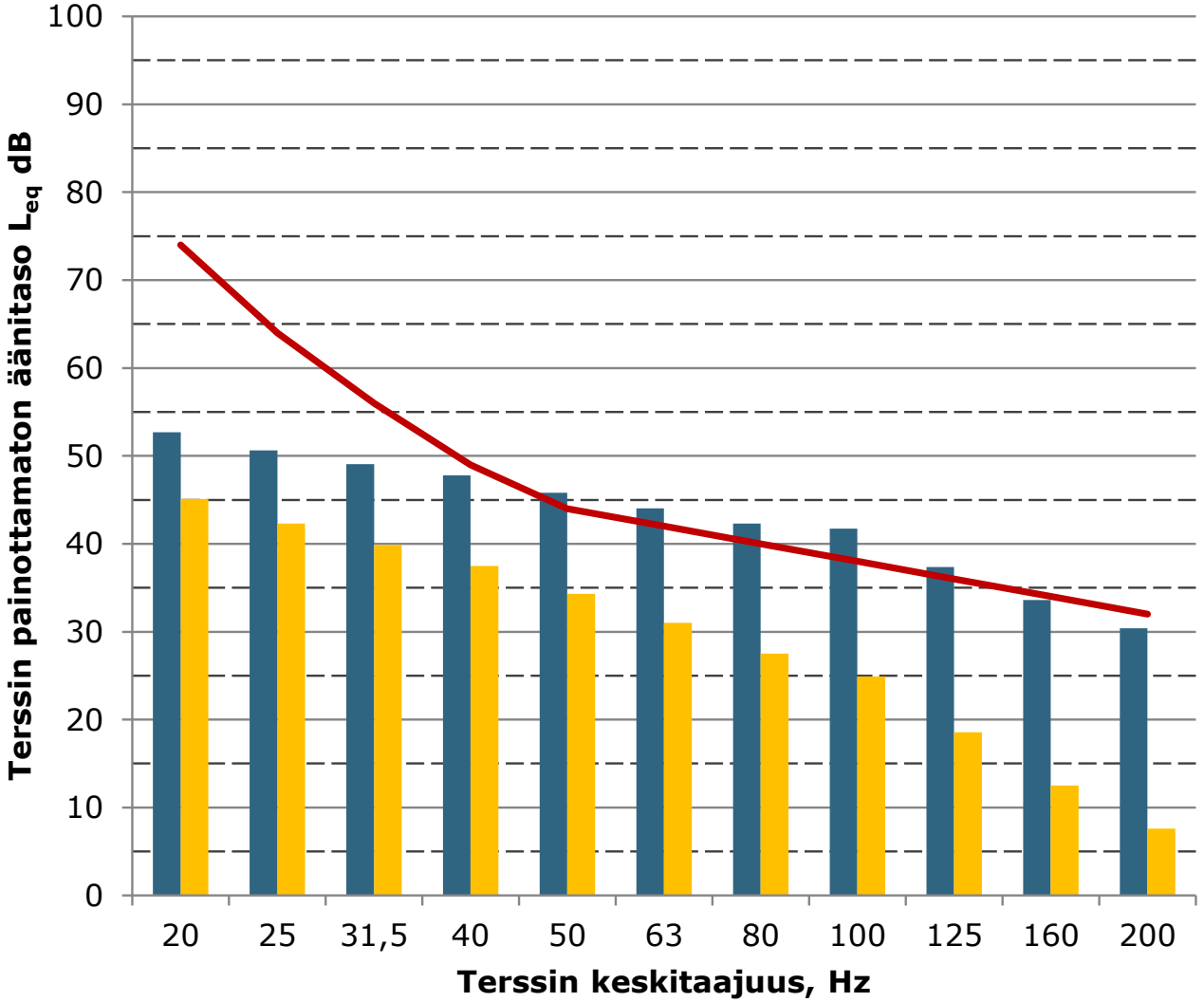
Matalien taajuuksien äänitasot ulkona ja sisällä, Asuinrakennus G, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan





Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus kpl
SG6.6-170 +2dB 6,6 MW, 215 m, 34
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, Lomarakennus H, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan

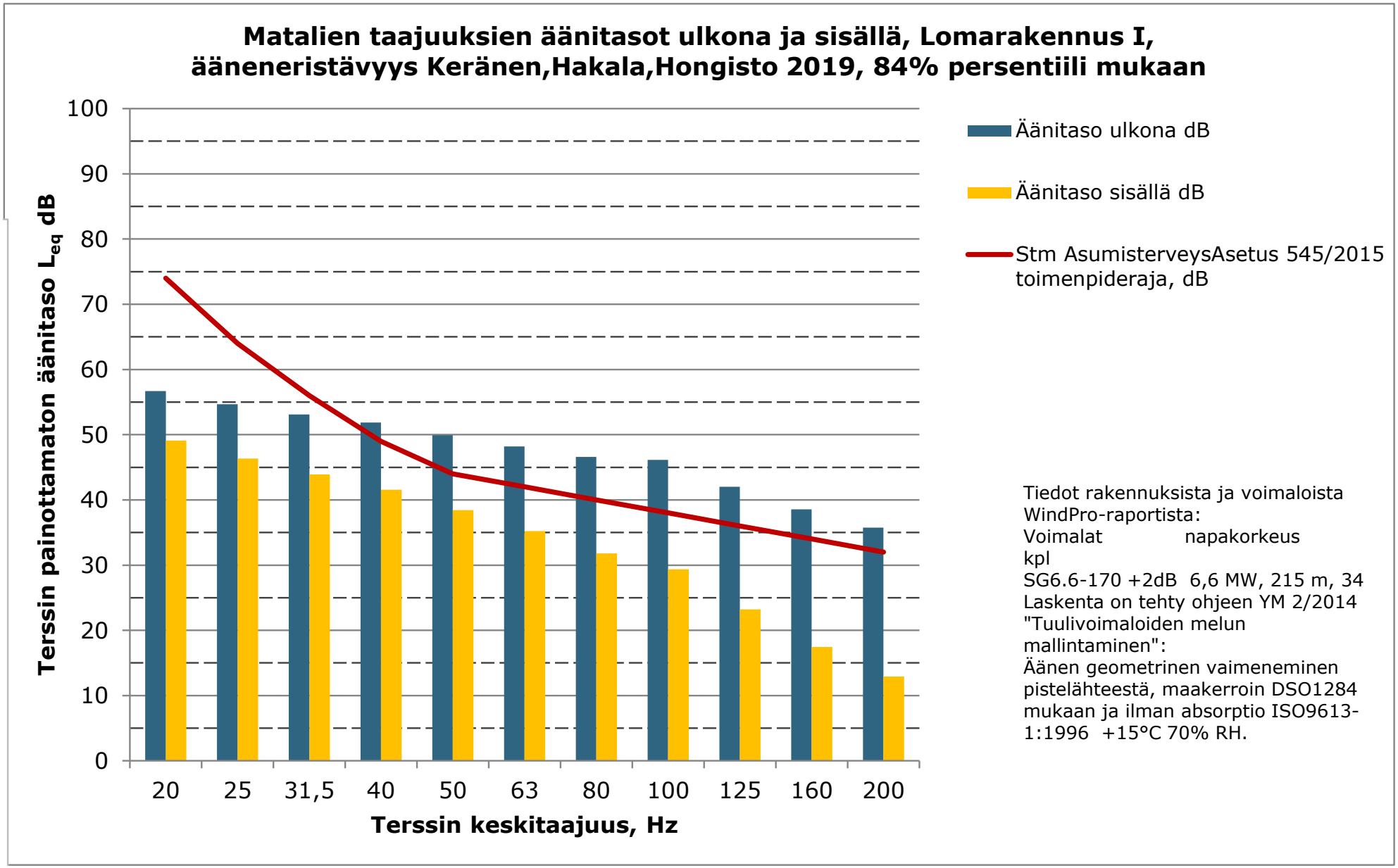


Äänitaso ulkona dB

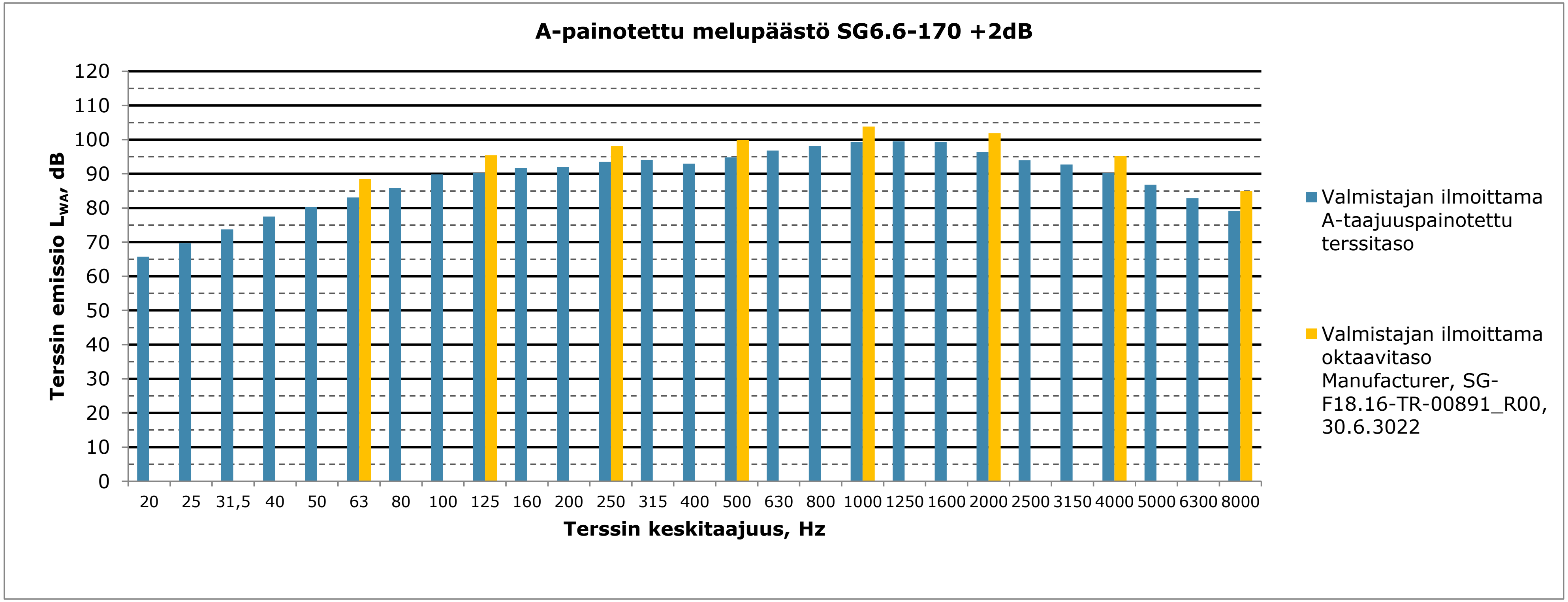
Äänitaso sisällä dB

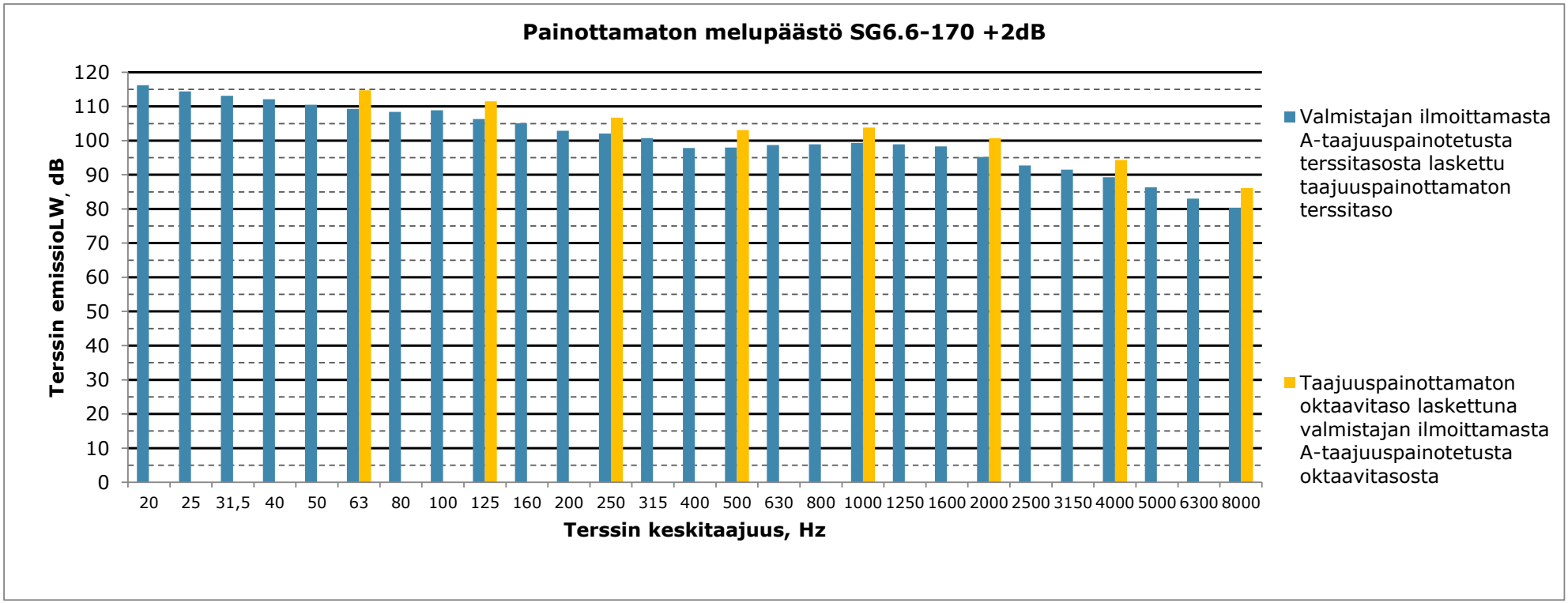
Stm AsumisterveysAsetus 545/2015 toimenpideraja, dB

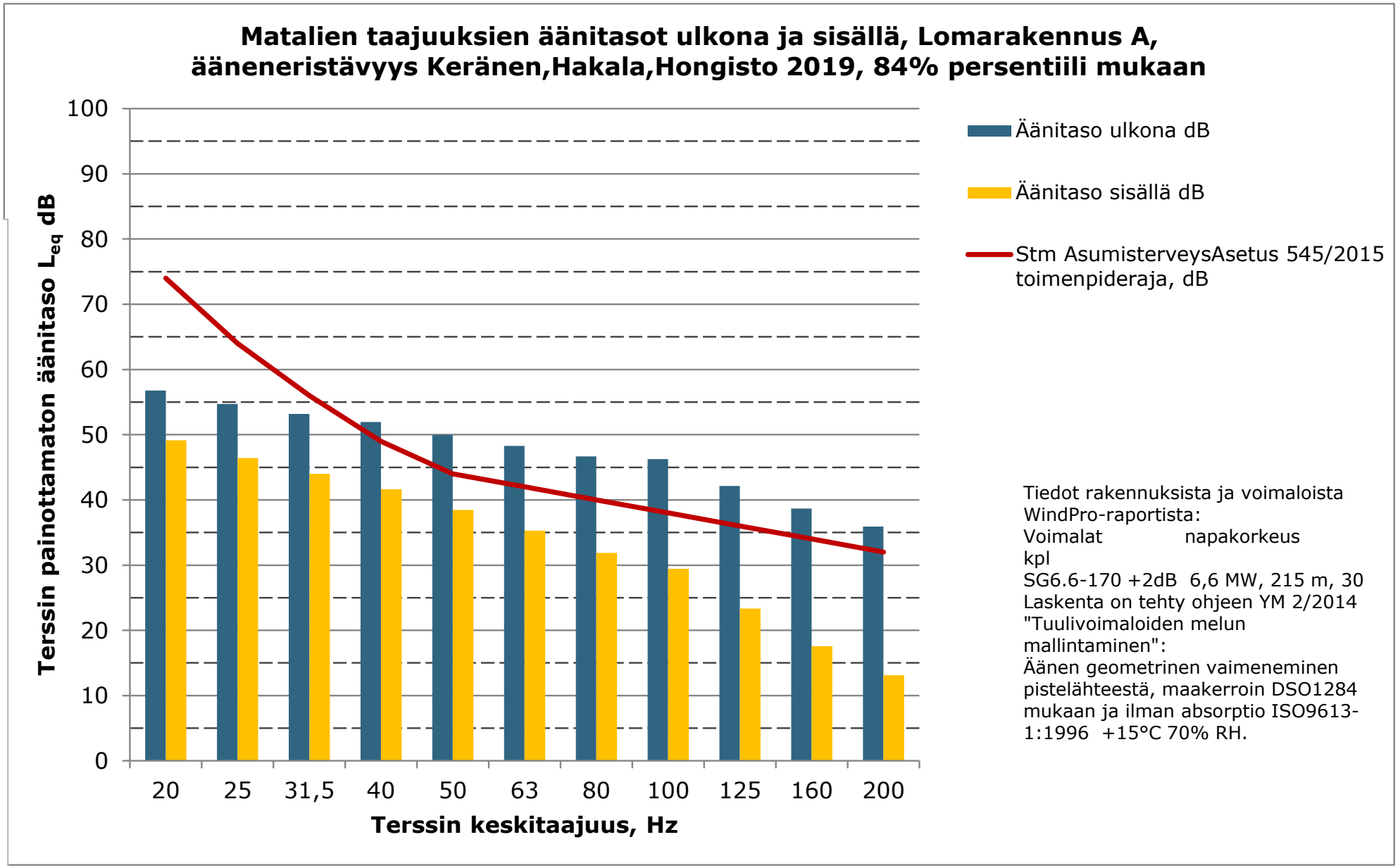
Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus kpl
SG6.6-170 +2dB 6,6 MW, 215 m, 34
Laskenta on tehty ohjeen YM 2/2014 "Tuulivoimaloiden melun mallintaminen":
Äänen geometrinen vaimeneminen pistelähteestä, maakerroin DSO1284 mukaan ja ilman absorptio ISO9613-1:1996 +15°C 70% RH.

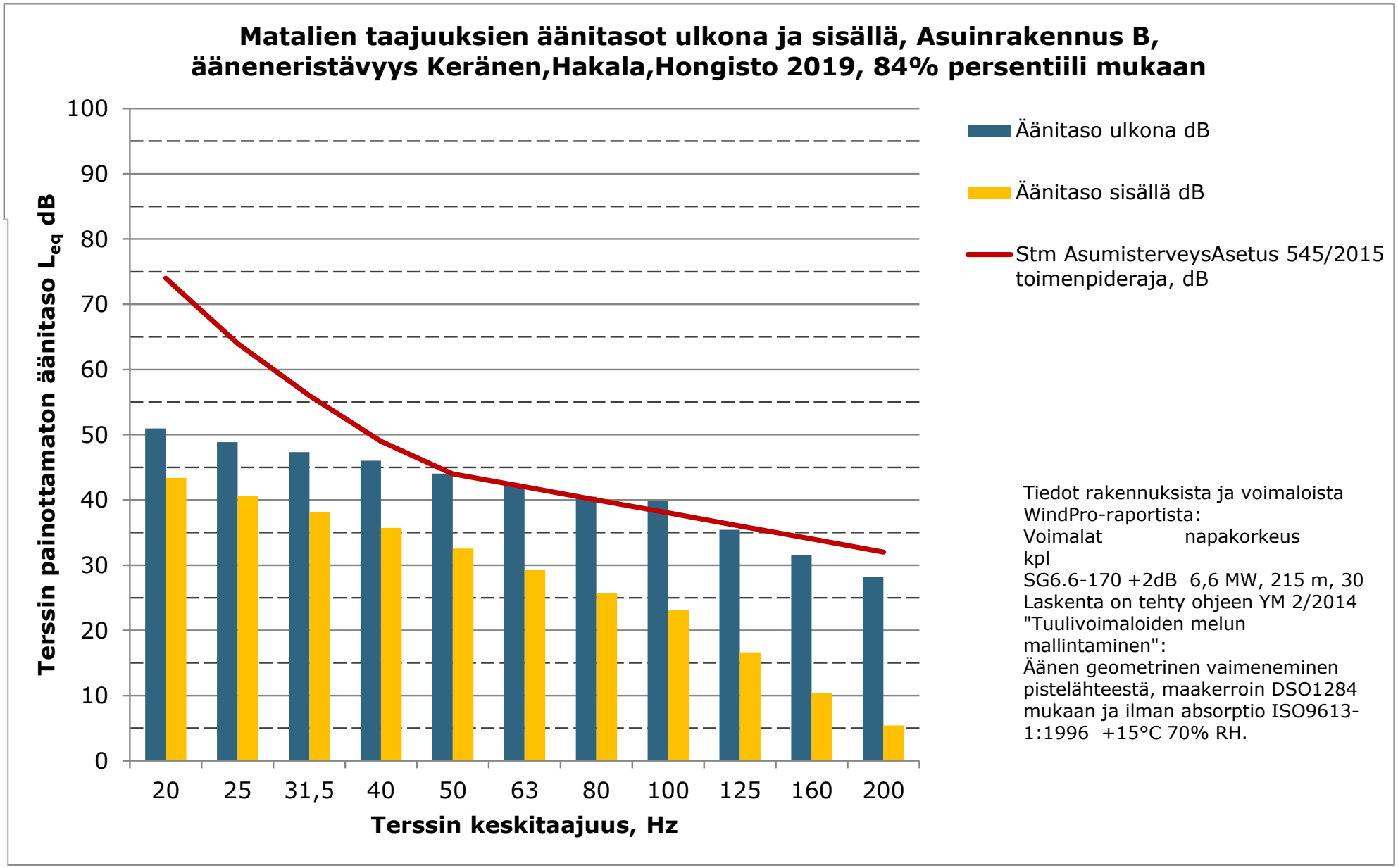

Matalien taajuuksien äänitasot ulkona ja sisällä, Lomarakennus I, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan
Terssin painottamaton äänitaso L_{eq} dB
100
90
80
70
60
50
40
30
20
10
0
20
25
31,5
40
50
63
80
100
125
160
200
Terssin keskitaajuus, Hz
Äänitaso ulkona dB
Äänitaso sisällä dB
Stm AsumisterveysAsetus 545/2015 toimenpideraja, dB
Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus kpl
SG6.6-170 +2dB 6,6 MW, 215 m, 34
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.

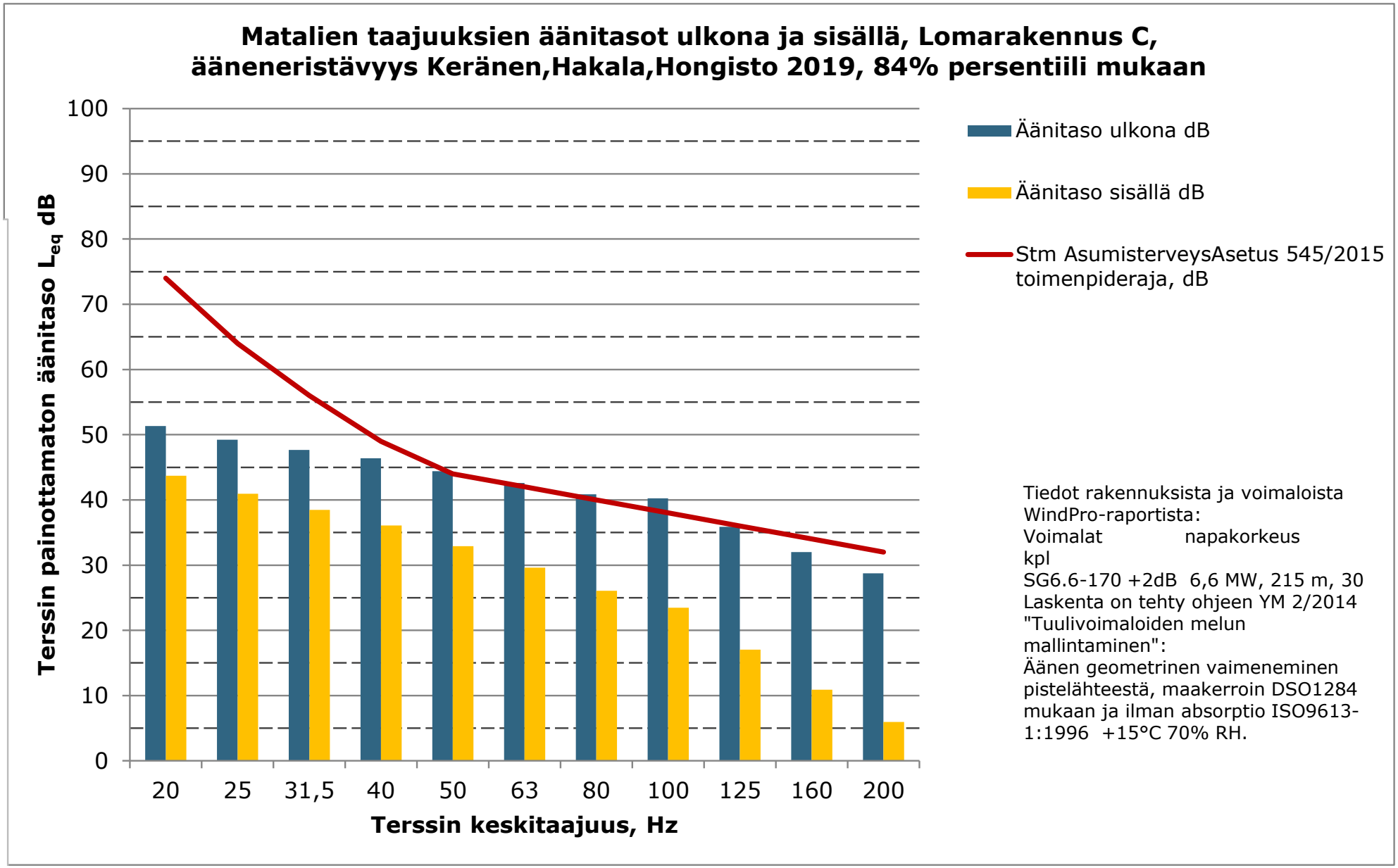
Liite 4: Matalataajuisen melun rakennuskohtaiset arvot vaihtoehdossa VE2.

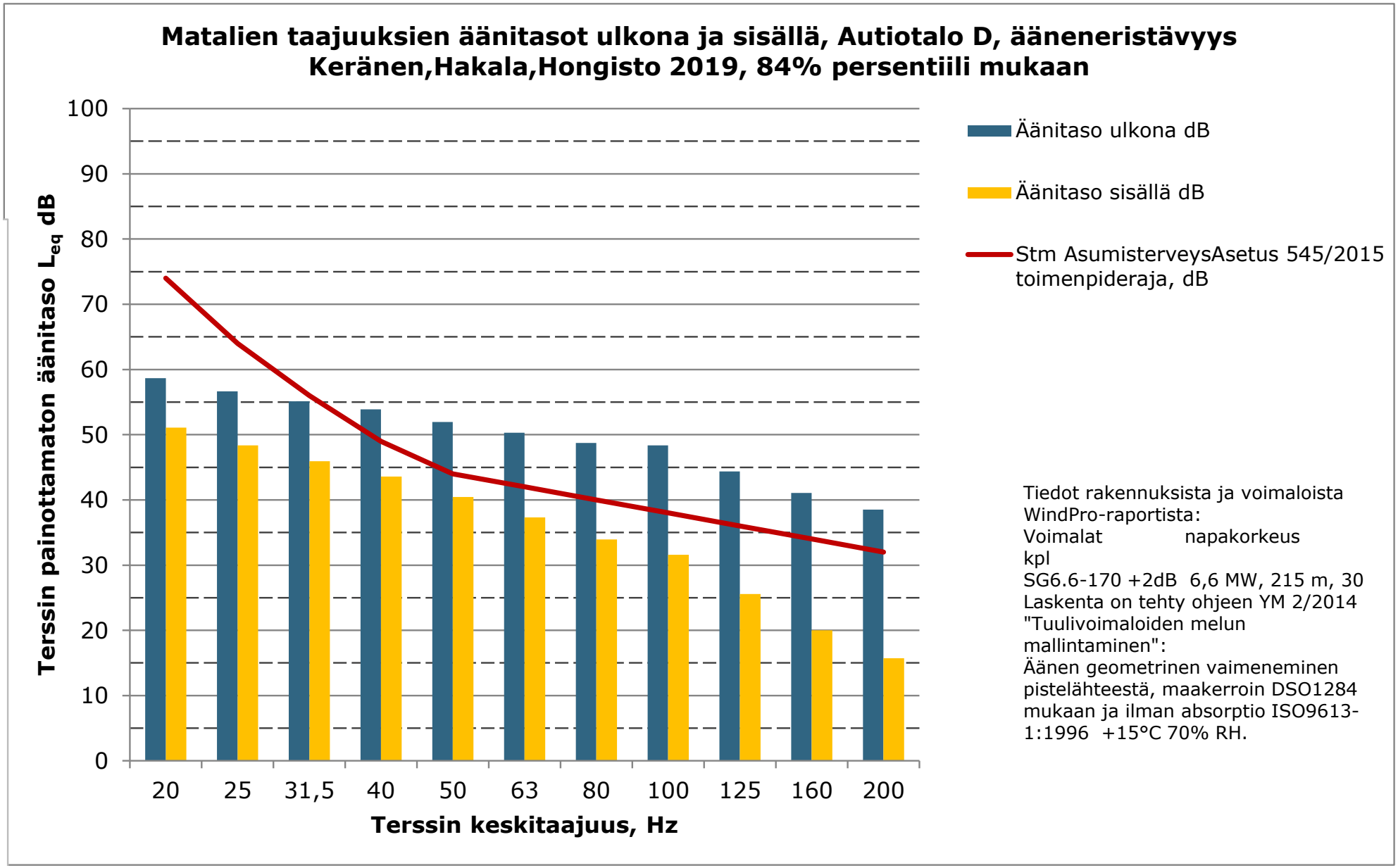

A-painotettu melupäästö SG6.6-170 +2dB
Terssin emissio L_WA, dB
120
110
100
90
80
70
60
50
40
30
20
10
0
20 25 31,5 40 50 63 80 100 125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000 5000 6300 8000
Terssin keskitaajuus, Hz
Valmistajan ilmoittama A-taajuuspainotettu terssitaso
Valmistajan ilmoittama oktaavitaso Manufacturer, SG-F18.16-TR-00891_R00, 30.6.3022

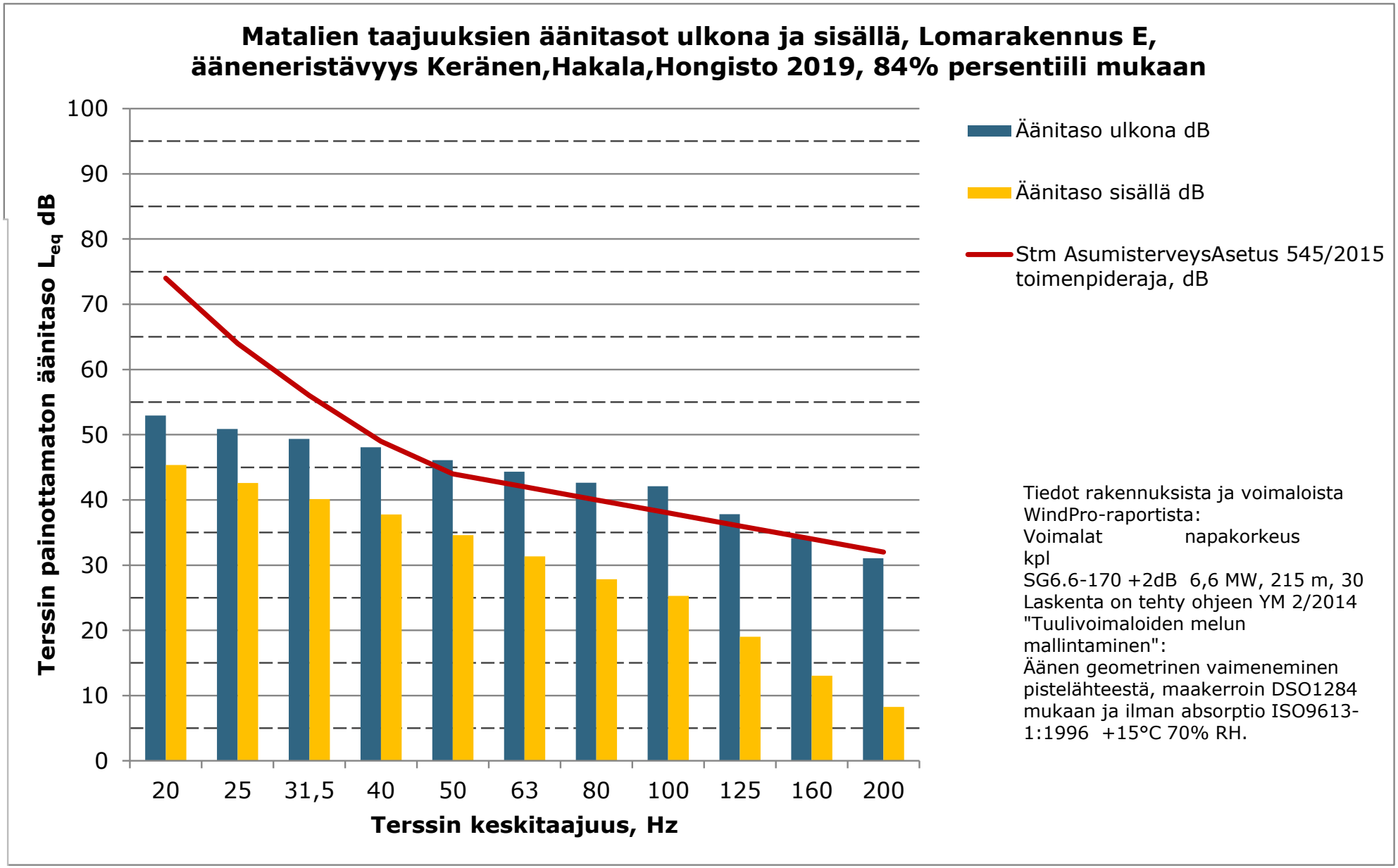

Painottamaton melupäästö SG6.6-170 +2dB
Terssin emissioLW, dB
120
110
100
90
80
70
60
50
40
30
20
10
0
20 25 31,5 40 50 63 80 100 125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000 5000 6300 8000
Terssin keskitaajuus, Hz
Valmistajan ilmoittamasta A-taajuuspainotetusta terssitasosta laskettu taajuuspainottamaton terssitaso
Taajuuspainottamaton oktaavitaso laskettuna valmistajan ilmoittamasta A-taajuuspainotetusta oktaavitasosta

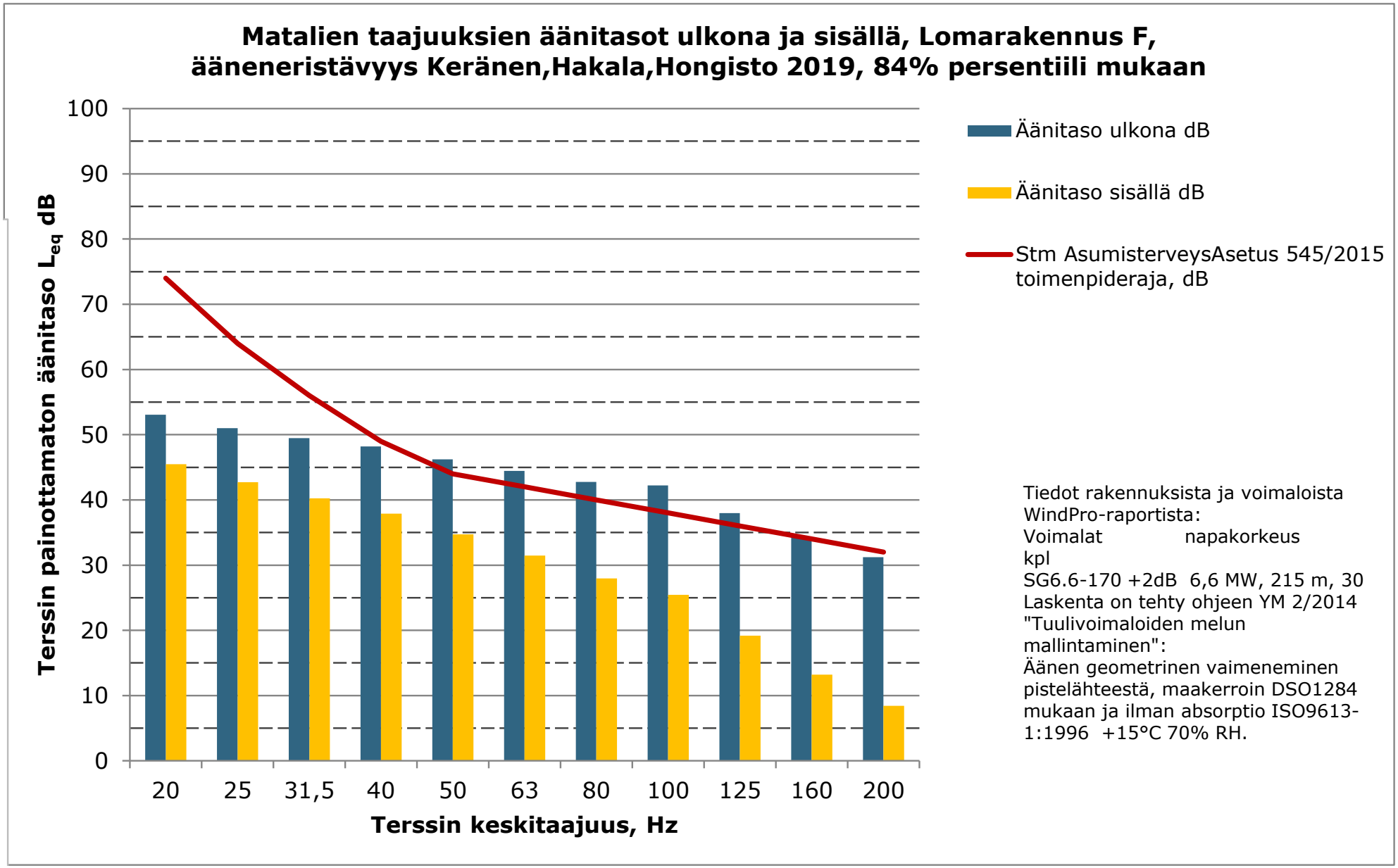

Matalien taajuuksien äänitasot ulkona ja sisällä, Lomarakennus A, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan
Terssin painottamaton äänitaso Leq dB
100
90
80
70
60
50
40
30
20
10
0
20
25
31,5
40
50
63
80
100
125
160
200
Terssin keskitaajuus, Hz
Äänitaso ulkona dB
Äänitaso sisällä dB
Stm AsumisterveysAsetus 545/2015 toimenpideraja, dB
Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus kpl
SG6.6-170 +2dB 6,6 MW, 215 m, 30
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, Asuinrakennus B, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan
Terssin painottamaton äänitaso Leq dB
100
90
80
70
60
50
40
30
20
10
0
20
25
31,5
40
50
63
80
100
125
160
200
Terssin keskitaajuus, Hz
Äänitaso ulkona dB
Äänitaso sisällä dB
Stm AsumisterveysAsetus 545/2015 toimenpideraja, dB
Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus kpl
SG6.6-170 +2dB 6,6 MW, 215 m, 30
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.

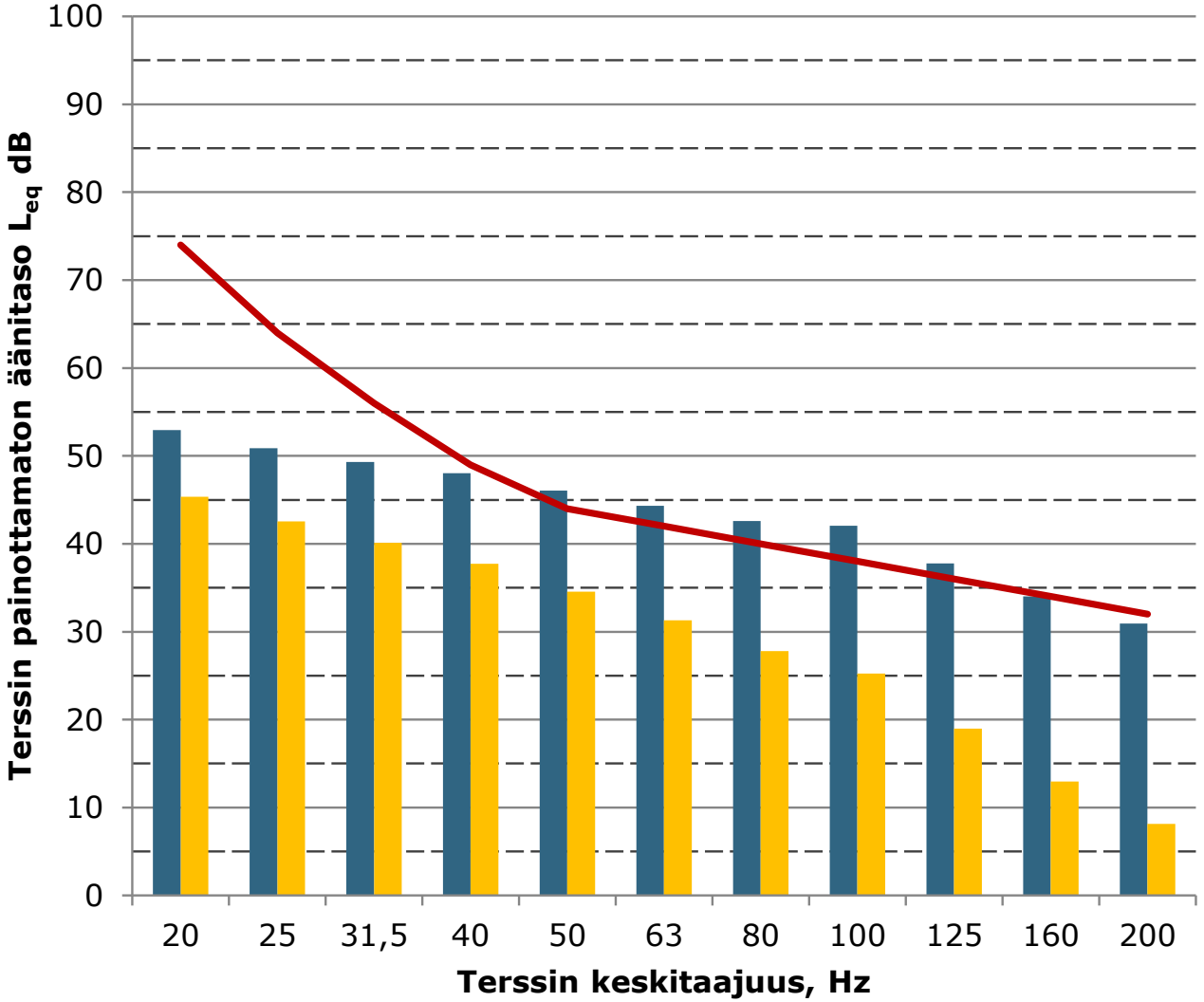

Matalien taajuuksien äänitasot ulkona ja sisällä, Lomarakennus C, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan
Terssin painottamaton äänitaso Leq dB
100
90
80
70
60
50
40
30
20
10
0
20
25
31,5
40
50
63
80
100
125
160
200
Terssin keskitaajuus, Hz
Äänitaso ulkona dB
Äänitaso sisällä dB
Stm AsumisterveysAsetus 545/2015 toimenpideraja, dB
Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus
kpl
SG6.6-170 +2dB 6,6 MW, 215 m, 30
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.

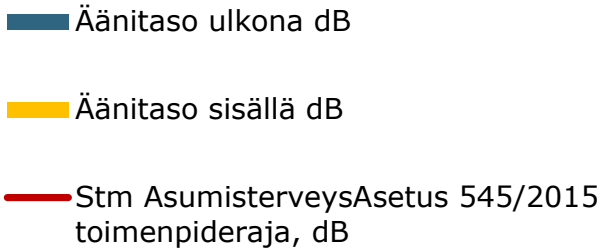

Matalien taajuuksien äänitasot ulkona ja sisällä, Autiotalo D, ääneneristävyys
Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan
Terssin painottamaton äänitaso Leq dB
100
90
80
70
60
50
40
30
20
10
0
20
25
31,5
40
50
63
80
100
125
160
200
Terssin keskitaajuus, Hz
Äänitaso ulkona dB
Äänitaso sisällä dB
Stm AsumisterveysAsetus 545/2015 toimenpideraja, dB
Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus
kpl
SG6.6-170 +2dB 6,6 MW, 215 m, 30
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, Lomarakennus E, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan
Terssin painottamaton äänitaso Leq dB
100
90
80
70
60
50
40
30
20
10
0
20
25
31,5
40
50
63
80
100
125
160
200
Terssin keskitaajuus, Hz
Äänitaso ulkona dB
Äänitaso sisällä dB
Stm AsumisterveysAsetus 545/2015 toimenpideraja, dB
Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus kpl
SG6.6-170 +2dB 6,6 MW, 215 m, 30
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.

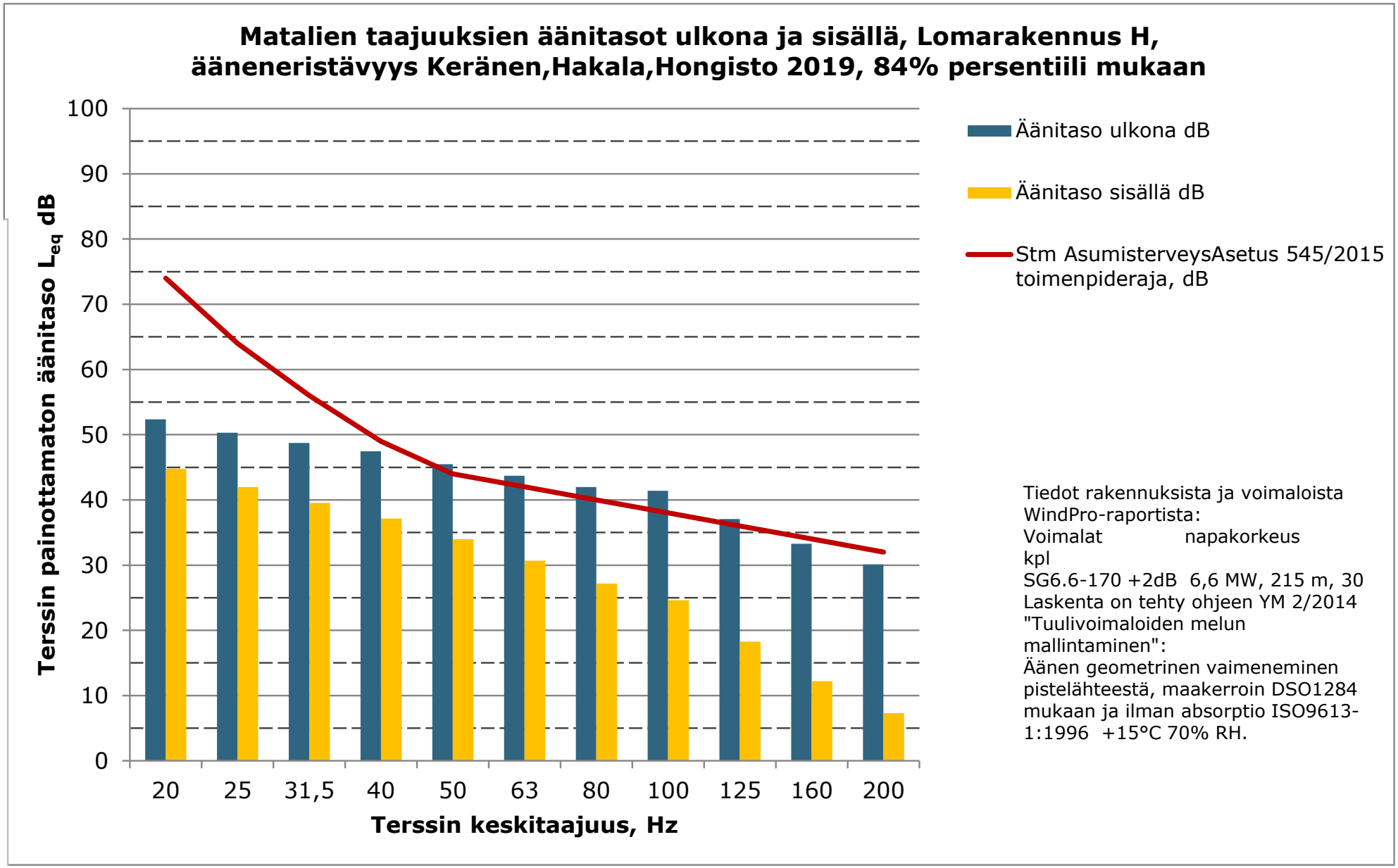

Matalien taajuuksien äänitasot ulkona ja sisällä, Lomarakennus F,
ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan
Terssin painottamaton äänitaso Leq dB
100
90
80
70
60
50
40
30
20
10
0
20
25
31,5
40
50
63
80
100
125
160
200
Terssin keskitaajuus, Hz
Äänitaso ulkona dB
Äänitaso sisällä dB
Stm AsumisterveysAsetus 545/2015 toimenpideraja, dB
Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus kpl
SG6.6-170 +2dB 6,6 MW, 215 m, 30
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.

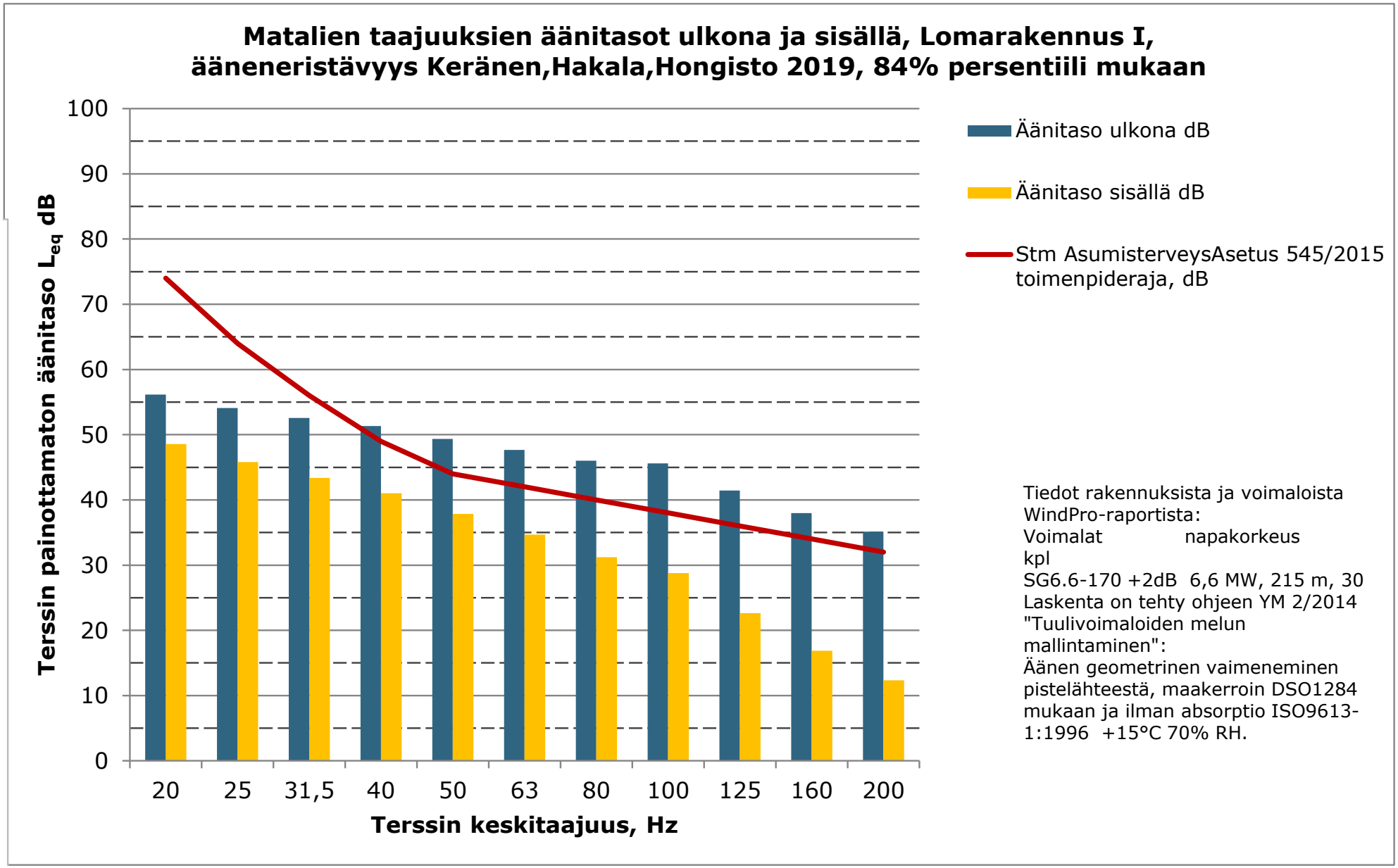
Matalien taajuuksien äänitasot ulkona ja sisällä, Asuinrakennus G, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan





Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus kpl
SG6.6-170 +2dB 6,6 MW, 215 m, 30
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, Lomarakennus H, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan
Terssin painottamaton äänitaso Leq dB
100
90
80
70
60
50
40
30
20
10
0
20
25
31,5
40
50
63
80
100
125
160
200
Terssin keskitaajuus, Hz
Äänitaso ulkona dB
Äänitaso sisällä dB
Stm AsumisterveysAsetus 545/2015 toimenpideraja, dB
Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus kpl
SG6.6-170 +2dB 6,6 MW, 215 m, 30
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, Lomarakennus I, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan
Terssin painottamaton äänitaso Leq dB
100
90
80
70
60
50
40
30
20
10
0
20
25
31,5
40
50
63
80
100
125
160
200
Terssin keskitaajuus, Hz
Äänitaso ulkona dB
Äänitaso sisällä dB
Stm AsumisterveysAsetus 545/2015 toimenpideraja, dB
Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus kpl
SG6.6-170 +2dB 6,6 MW, 215 m, 30
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.

Liite 5: Varjostusmallinnuksen tulokset ”real case, no forest” (VE1).

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Calculated:
24.1.2024 12.58/3.5.584

SHADOW - Main Result

Calculation: VE1_Generic_RD200m_HH200m_20240124

Assumptions for shadow calculations

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

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,77	2,46	4,19	6,93	8,81	9,87	9,13	6,84	4,43	2,23	0,93	0,26

Operational hours are calculated from WTGs in calculation and wind distribution:
MERRA-2_N64,00_E026,875 (8)

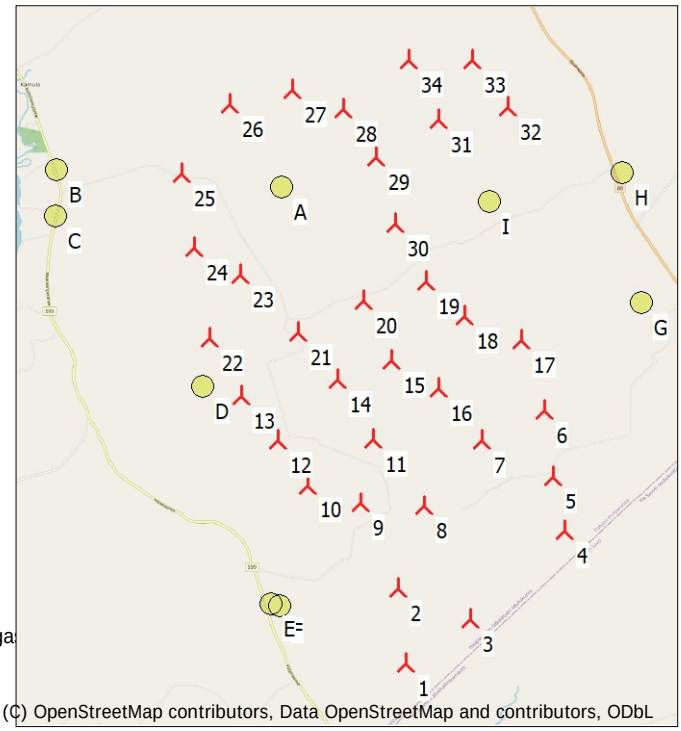
Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
474	404	400	458	605	893	1 104	1 088	885	783	712	656	8 462

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

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

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



Scale 1:125 000

New WTG Shadow receptor

WTGs

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	473 642	7 089 459	165,9	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
2	473 523	7 090 697	166,4	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
3	474 724	7 090 192	163,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
4	476 298	7 091 642	169,7	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
5	476 097	7 092 538	175,0	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
6	475 979	7 093 646	177,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
7	474 928	7 093 153	170,9	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
8	473 955	7 092 082	169,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
9	472 921	7 092 121	171,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
10	472 045	7 092 434	174,8	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
11	473 133	7 093 196	170,1	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
12	471 545	7 093 189	175,1	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
13	470 952	7 093 929	178,3	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
14	472 556	7 094 191	172,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
15	473 450	7 094 501	175,0	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
16	474 232	7 094 014	173,4	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
17	475 592	7 094 825	177,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
18	474 653	7 095 212	177,9	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
19	474 026	7 095 796	179,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
20	472 999	7 095 500	175,0	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
21	471 895	7 094 973	170,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
22	470 430	7 094 892	173,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
23	470 952	7 095 933	163,7	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
24	470 207	7 096 391	155,8	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
25	469 994	7 097 616	152,3	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
26	470 814	7 098 750	149,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
27	471 839	7 098 977	152,4	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
28	472 690	7 098 642	163,3	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
29	473 217	7 097 856	165,0	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
30	473 530	7 096 766	168,7	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4

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Calculated:
24.1.2024 12.58/3.5.584

SHADOW - Main Result

Calculation: VE1_Generic_RD200m_HH200m_20240124

...continued from previous page

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
31	474 257	7 098 465	167,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
32	475 413	7 098 667	166,8	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
33	474 833	7 099 446	158,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
34	473 764	7 099 462	155,4	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4

Shadow receptor-Input

No.	Name	East	North	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
A	Lomarakennus A	471 650	7 097 381	157,6	5,0	5,0	1,0	90,0	"Green house mode"	6,0
B	Asuinrakennus B	467 933	7 097 709	139,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
C	Lomarakennus C	467 899	7 096 936	139,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
D	Autiotalo D	470 313	7 094 090	168,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
E	Lomarakennus E	471 402	7 090 461	195,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
F	Lomarakennus F	471 557	7 090 435	188,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
G	Asuinrakennus G	477 593	7 095 429	191,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
H	Lomarakennus H	477 297	7 097 577	190,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
I	Lomarakennus I	475 097	7 097 098	176,3	5,0	5,0	1,0	90,0	"Green house mode"	6,0

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values Shadow hours per year [h/year]
A	Lomarakennus A	15:46
B	Asuinrakennus B	1:58
C	Lomarakennus C	0:00
D	Autiotalo D	29:44
E	Lomarakennus E	0:00
F	Lomarakennus F	2:16
G	Asuinrakennus G	0:00
H	Lomarakennus H	0:00
I	Lomarakennus I	9:45

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

No.	Name	Expected [h/year]
1	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (636)	0:00
2	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (639)	2:16
3	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (640)	0:00
4	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (642)	0:00
5	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (644)	0:00
6	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (645)	0:00
7	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (650)	0:00
8	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (643)	0:00
9	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (647)	0:00
10	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (649)	0:00
11	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (648)	0:00
12	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (638)	2:50
13	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (653)	21:26
14	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (637)	0:00
15	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (652)	0:00
16	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (646)	0:00
17	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (630)	0:00
18	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (651)	1:35
19	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (635)	2:16
20	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (634)	0:00
21	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (633)	5:22
22	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (654)	0:00

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SHADOW - Main Result

Calculation: VE1_Generic_RD200m_HH200m_20240124

...continued from previous page

No.	Name	Expected [h/year]
23	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (632)	2:22
24	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (641)	2:03
25	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (655)	5:40
26	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (662)	0:00
27	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (629)	0:00
28	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (661)	1:07
29	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (657)	7:28
30	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (631)	4:46
31	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (656)	0:00
32	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (659)	0:00
33	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (658)	0:00
34	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (660)	0:00

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

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

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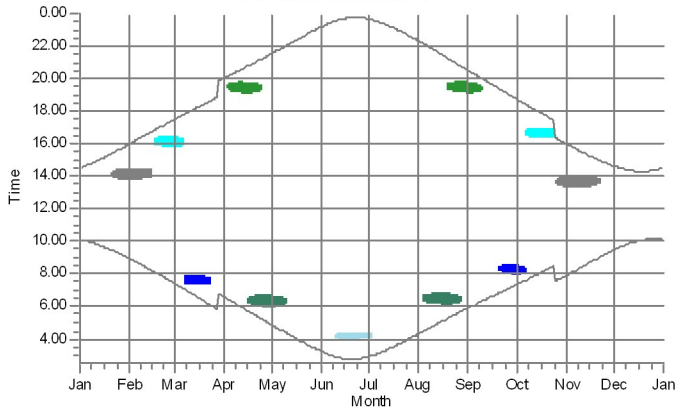
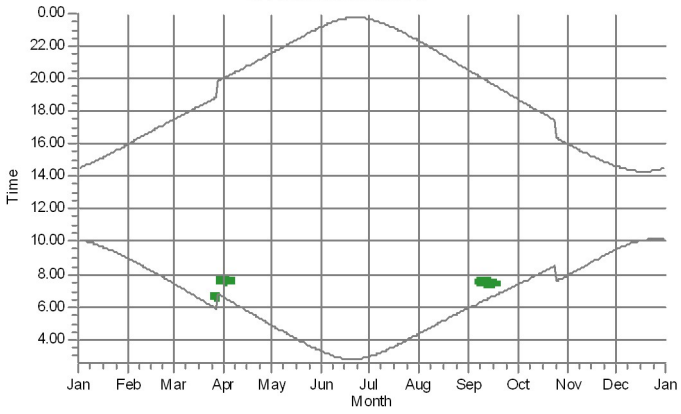
SHADOW - Calendar, graphical

Calculation: VE1_Generic_RD200m_HH200m_20240124

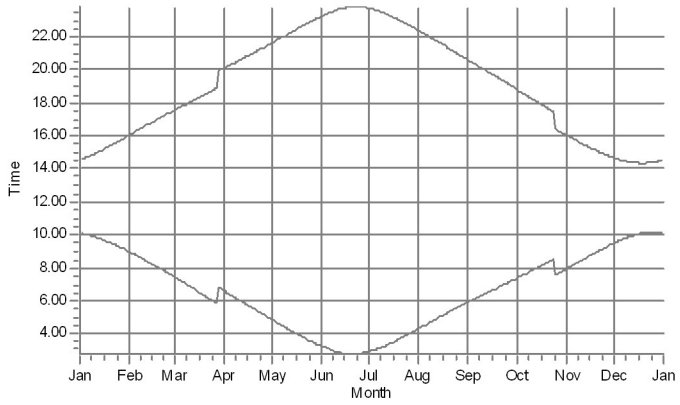
A: Lomarakennus A



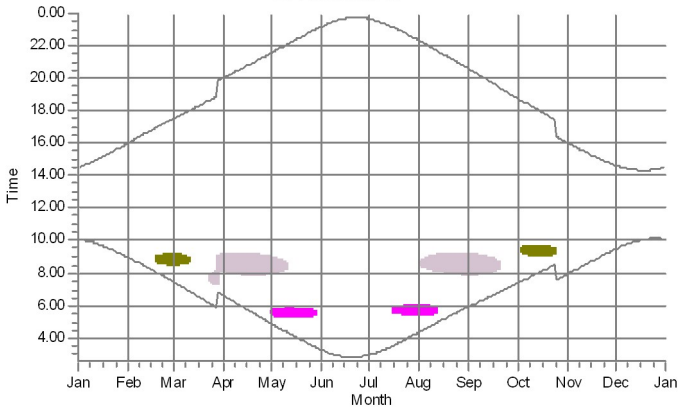
B: Asuinrakennus B



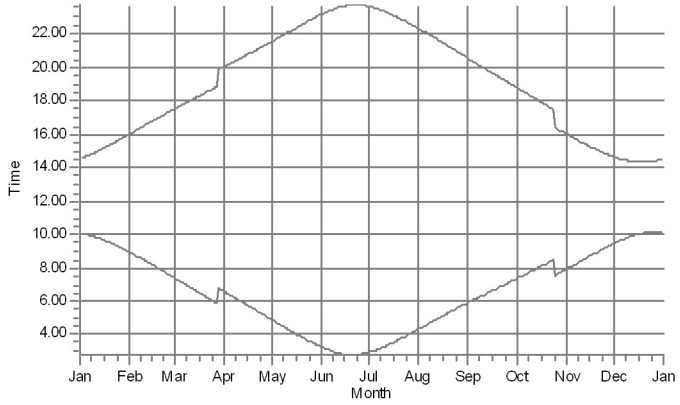
C: Lomarakennus C



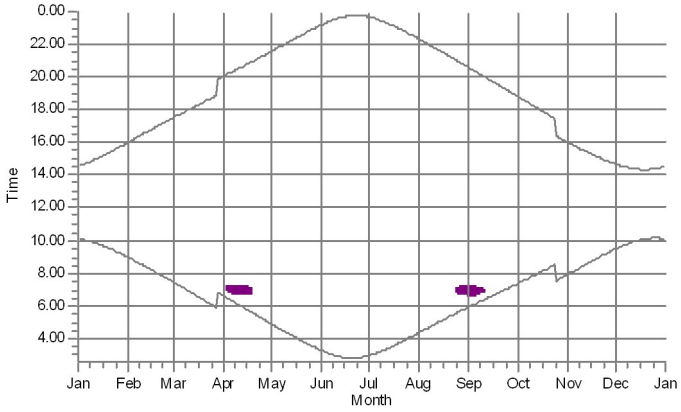
D: Autiotalo D



E: Lomarakennus E



F: Lomarakennus F



WTGs

30: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (631)
23: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (632)
21: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (633)
12: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (638)
2: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (639)
24: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (641)
13: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (653)
25: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (655)
29: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (657)
28: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (661)

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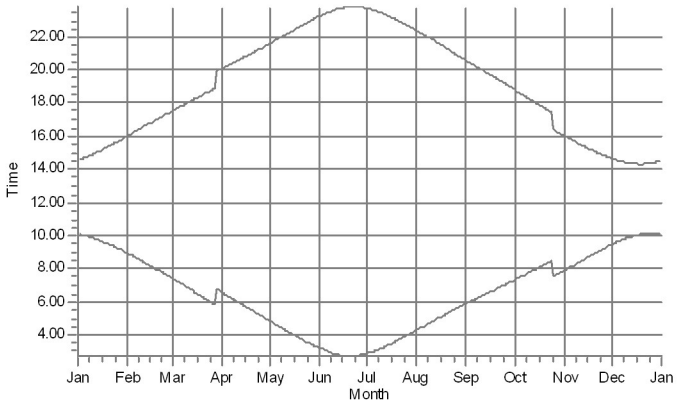
Calculated:
24.1.2024 12.58/3.5.584

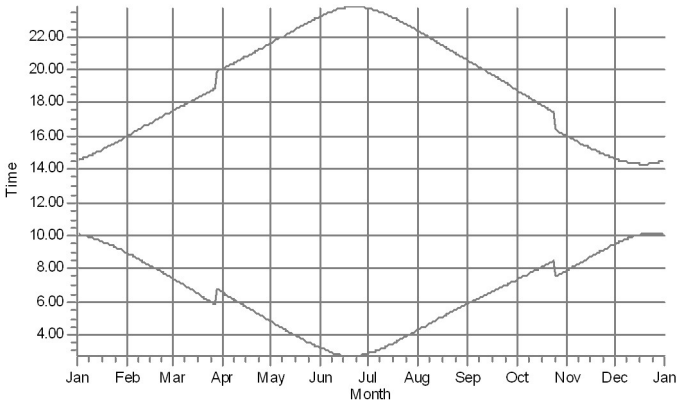
SHADOW - Calendar, graphical

Calculation: VE1_Generic_RD200m_HH200m_20240124

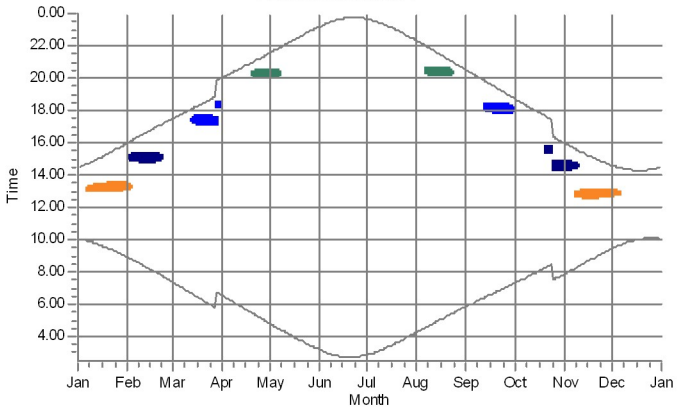
G: Asuinrakennus G



H: Lomarakennus H



I: Lomarakennus I



WTGs

30: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (631)
19: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (635)
18: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (651)
29: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (657)

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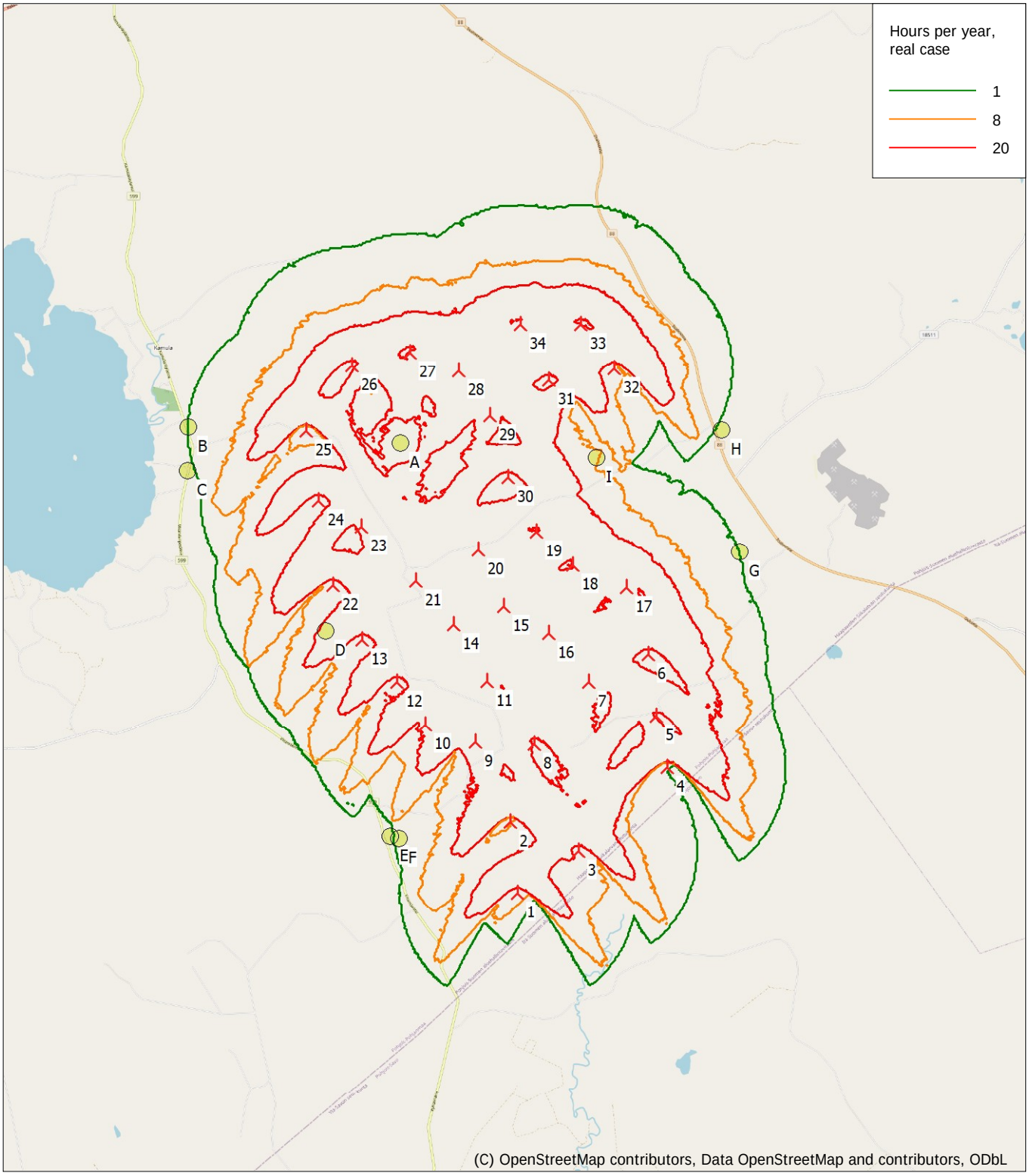
Calculated:
24.1.2024 12.58/3.5.584

SHADOW - Map

Calculation: VE1_Generic_RD200m_HH200m_20240124



Map: EMD OpenStreetMap , Print scale 1:100 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 473 700 North: 7 094 940

New WTG Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_Pyhäntä_Pilpankangas_0.wpo (1)

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

Liite 6. Varjostusmallinnuksen tulokset ”real case, no forest” (VE2).

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Calculated:
24.1.2024 13.26/3.5.584

SHADOW - Main Result

Calculation: VE2_Generic_RD200m_HH200m_202401

Assumptions for shadow calculations

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

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,77	2,46	4,19	6,93	8,81	9,87	9,13	6,84	4,43	2,23	0,93	0,26

Operational hours are calculated from WTGs in calculation and wind distribution:
MERRA-2_N64,00_E026,875 (8)

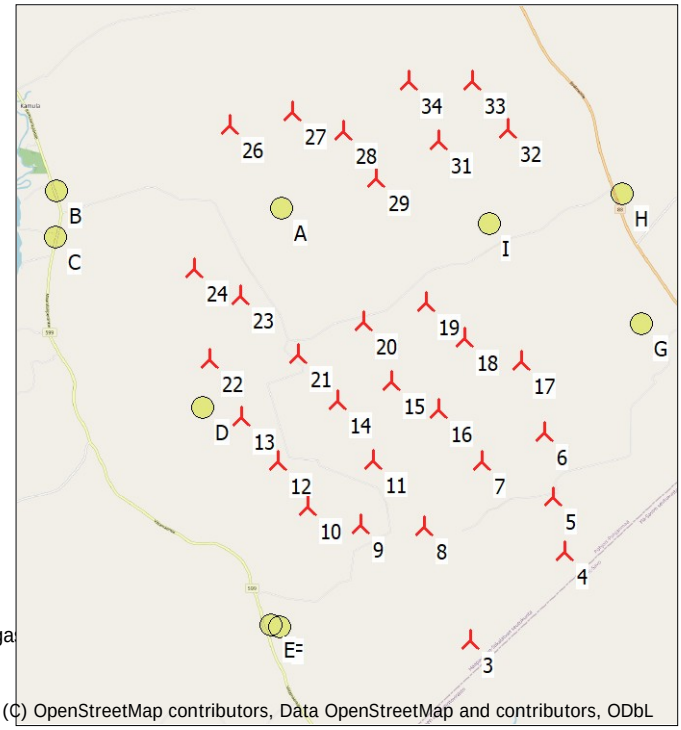
Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
474	404	400	458	605	893	1 104	1 088	885	783	712	656	8 462

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

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

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



Scale 1:125 000

New WTG Shadow receptor

WTGs

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
3	474 724	7 090 192	163,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
4	476 298	7 091 642	169,7	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
5	476 097	7 092 538	175,0	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
6	475 979	7 093 646	177,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
7	474 928	7 093 153	170,9	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
8	473 955	7 092 082	169,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
9	472 921	7 092 121	171,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
10	472 045	7 092 434	174,8	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
11	473 133	7 093 196	170,1	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
12	471 545	7 093 189	175,1	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
13	470 952	7 093 929	178,3	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
14	472 556	7 094 191	172,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
15	473 450	7 094 501	175,0	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
16	474 232	7 094 014	173,4	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
17	475 592	7 094 825	177,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
18	474 653	7 095 212	177,9	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
19	474 026	7 095 796	179,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
20	472 999	7 095 500	175,0	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
21	471 895	7 094 973	170,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
22	470 430	7 094 892	173,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
23	470 952	7 095 933	163,7	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
24	470 207	7 096 391	155,8	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
26	470 814	7 098 750	149,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
27	471 839	7 098 977	152,4	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
28	472 690	7 098 642	163,3	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
29	473 217	7 097 856	165,0	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
31	474 257	7 098 465	167,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
32	475 413	7 098 667	166,8	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
33	474 833	7 099 446	158,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
34	473 764	7 099 462	155,4	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4

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Calculated:
24.1.2024 13.26/3.5.584

SHADOW - Main Result

Calculation: VE2_Generic_RD200m_HH200m_202401

Shadow receptor-Input

No.	Name	East	North	Z [m]	Width [m]	Height [m]	Elevation a.g.l. [m]	Slope of window [°]	Direction mode	Eye height (ZVI) a.g.l. [m]
A	Lomarakennus A	471 650	7 097 381	157,6	5,0	5,0	1,0	90,0	"Green house mode"	6,0
B	Asuinrakennus B	467 933	7 097 709	139,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
C	Lomarakennus C	467 899	7 096 936	139,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
D	Autiotalo D	470 313	7 094 090	168,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
E	Lomarakennus E	471 402	7 090 461	195,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
F	Lomarakennus F	471 557	7 090 435	188,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
G	Asuinrakennus G	477 593	7 095 429	191,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
H	Lomarakennus H	477 297	7 097 577	190,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
I	Lomarakennus I	475 097	7 097 098	176,3	5,0	5,0	1,0	90,0	"Green house mode"	6,0

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values: Shadow hours per year [h/year]
A	Lomarakennus A	10:11
B	Asuinrakennus B	0:00
C	Lomarakennus C	0:00
D	Autiotalo D	29:44
E	Lomarakennus E	0:00
F	Lomarakennus F	0:00
G	Asuinrakennus G	0:00
H	Lomarakennus H	0:00
I	Lomarakennus I	6:48

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

No.	Name	Expected [h/year]
3	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (671)	0:00
4	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (673)	0:00
5	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (675)	0:00
6	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (676)	0:00
7	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (681)	0:00
8	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (674)	0:00
9	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (678)	0:00
10	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (680)	0:00
11	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (679)	0:00
12	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (670)	2:50
13	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (684)	21:26
14	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (669)	0:00
15	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (683)	0:00
16	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (677)	0:00
17	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (664)	0:00
18	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (682)	1:35
19	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (668)	2:16
20	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (667)	0:00
21	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (666)	5:22
22	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (685)	0:00
23	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (665)	2:22
24	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (672)	2:03
26	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (692)	0:00
27	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (663)	0:00
28	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (691)	1:07
29	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (687)	7:28
31	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (686)	0:00
32	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (689)	0:00
33	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (688)	0:00
34	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (690)	0:00

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

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

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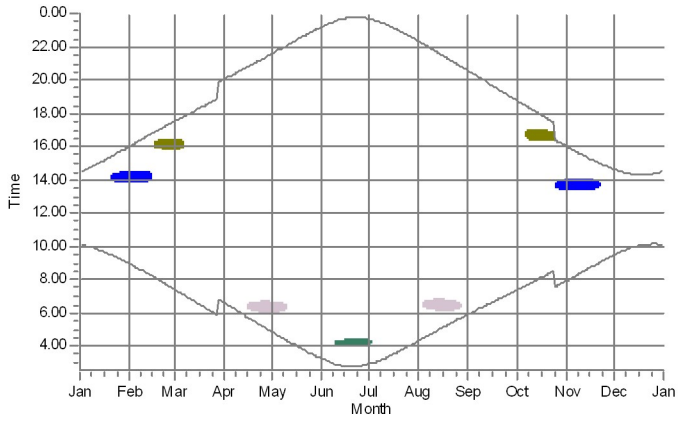
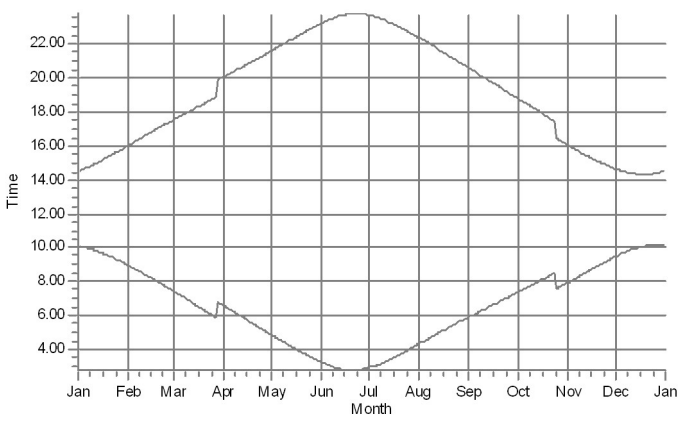
SHADOW - Calendar, graphical

Calculation: VE2_Generic_RD200m_HH200m_202401

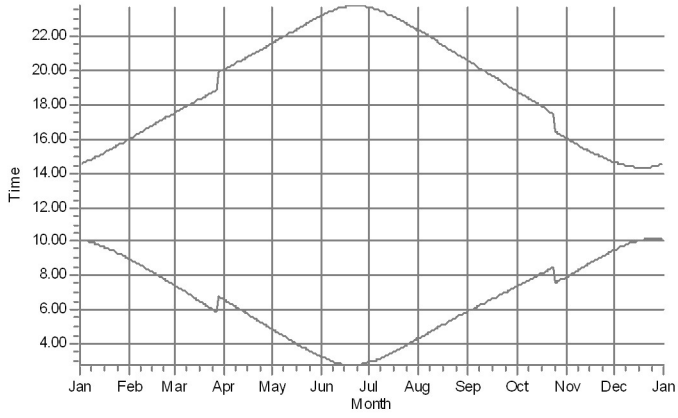
A: Lomarakennus A



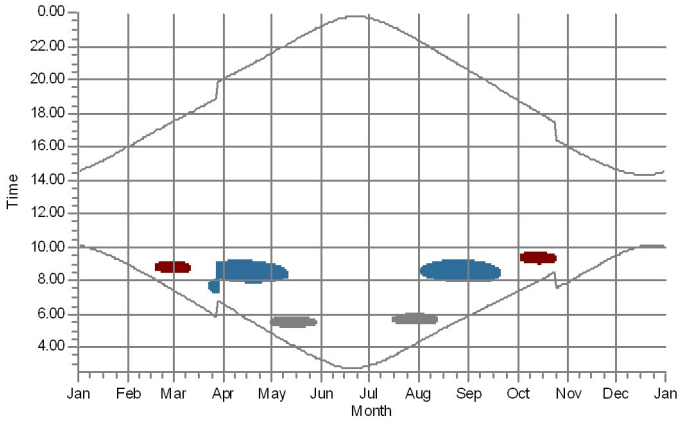
B: Asuinrakennus B



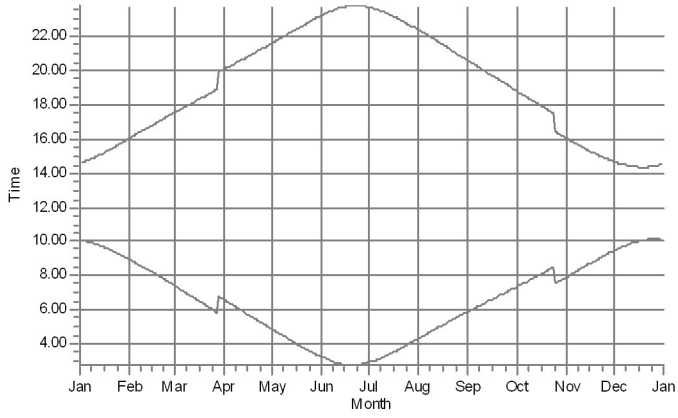
C: Lomarakennus C



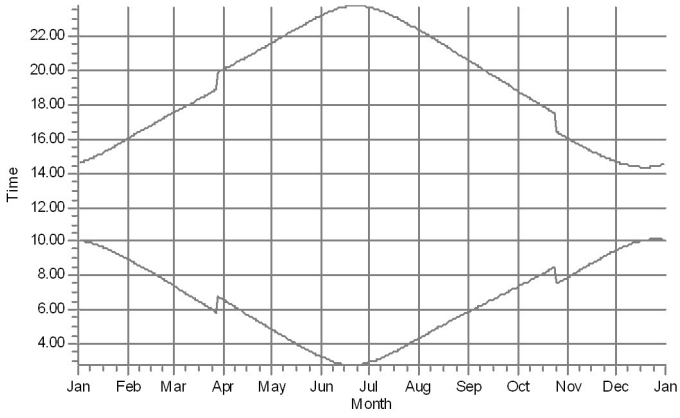
D: Autiotalo D



E: Lomarakennus E



F: Lomarakennus F



WTGs

23: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (665)
21: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (666)
12: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (670)
24: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (672)
13: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (684)
29: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (687)
28: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (691)

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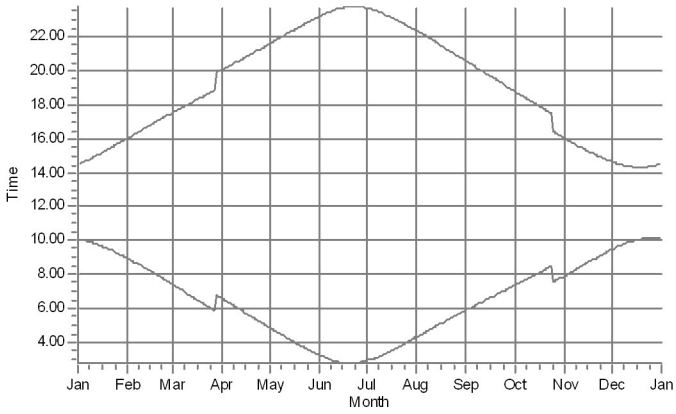
24.1.2024 13.26/3.5.584

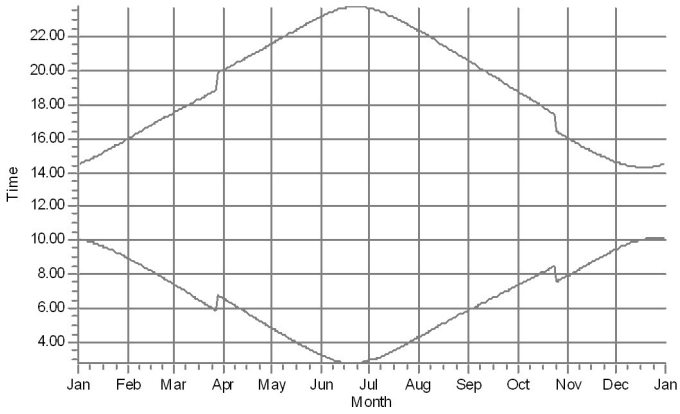
SHADOW - Calendar, graphical

Calculation: VE2_Generic_RD200m_HH200m_202401

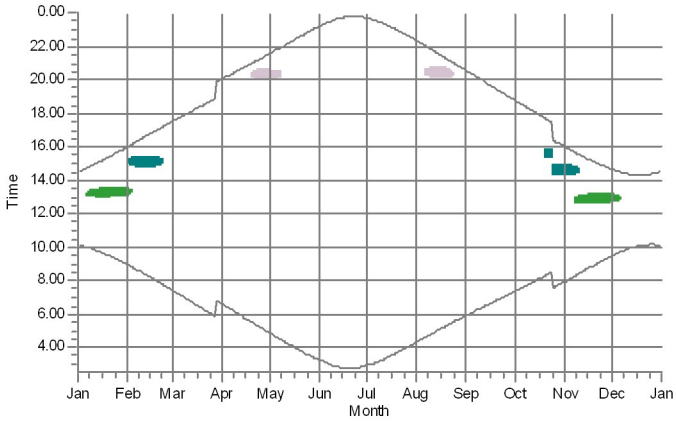
G: Asuinrakennus G



H: Lomarakennus H



I: Lomarakennus I



WTGs

19: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (668)

18: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (682)

29: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (687)

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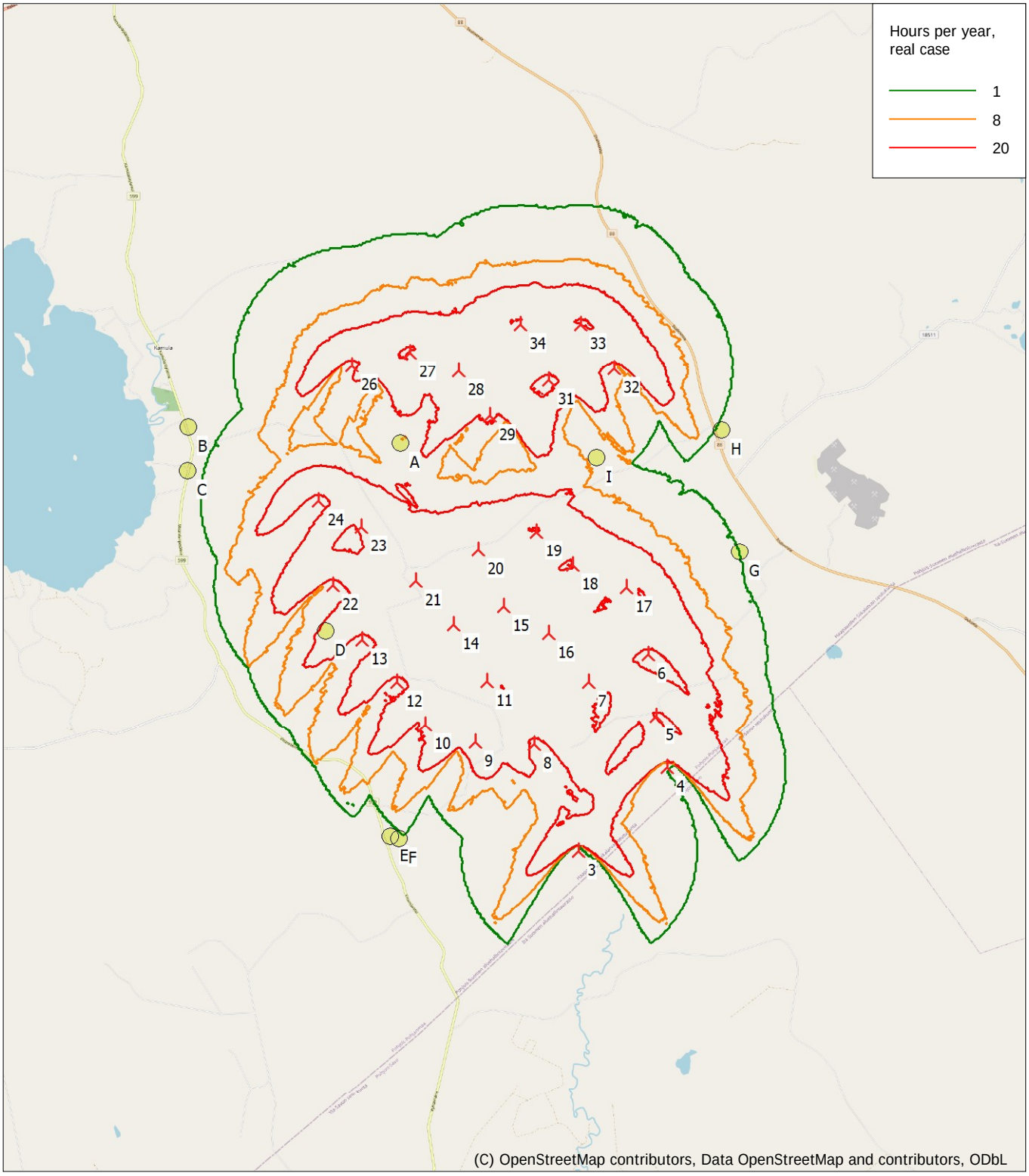
Calculated:
24.1.2024 13.26/3.5.584

SHADOW - Map

Calculation: VE2_Generic_RD200m_HH200m_202401



0 1 2 3 4 km

Map: EMD OpenStreetMap , Print scale 1:100 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 473 700 North: 7 094 940

New WTG Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_Pyhäntä_Pilpankangas_0.wpo (1)

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

Liite 7. Varjostusmallinnuksen tulokset ”real case, Lukeforest” (VE1).

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SHADOW - Main Result

Calculation: VE1_Generic_RD200m_HH200m_LUKE Forest_202401

Assumptions for shadow calculations

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

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,77	2,46	4,19	6,93	8,81	9,87	9,13	6,84	4,43	2,23	0,93	0,26

Operational hours are calculated from WTGs in calculation and wind distribution:
MERRA-2_N64,00_E026,875 (8)

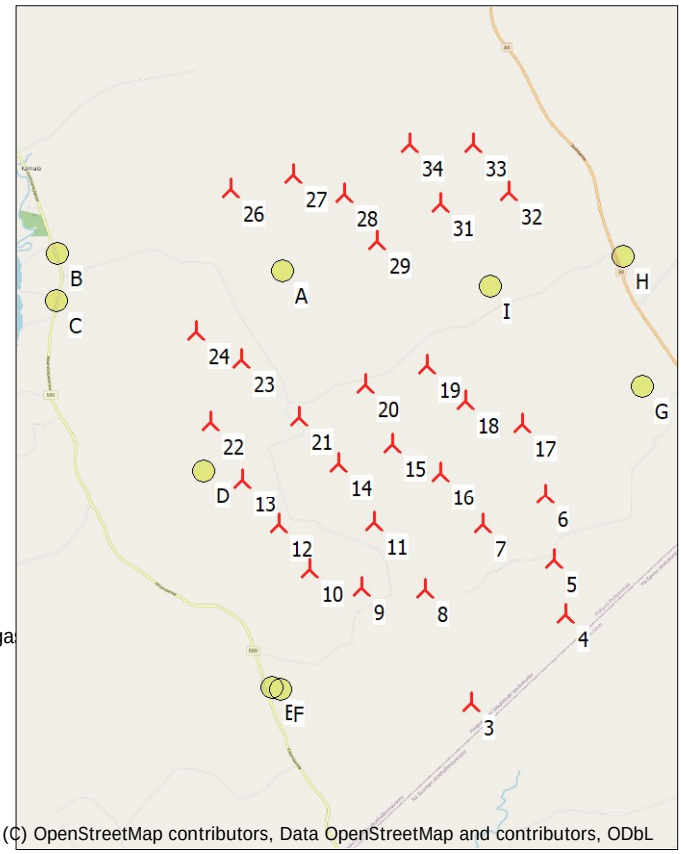
Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
474	404	400	458	605	893	1 104	1 088	885	783	712	656	8 462

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

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: CONTOURLINE_Pyhäntä_Pilpankanga
Area object(s) used in calculation:
Area object (NW): (1)
Area object (NE): (2)
Area object (SW): (3)
Area object (SE): (4)
Obstacles used in calculation
Receptor grid resolution: 1,0 m

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



Scale 1:125 000

New WTG Shadow receptor

WTGs

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
3	474 724	7 090 192	163,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
4	476 298	7 091 642	169,7	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
5	476 097	7 092 538	175,0	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
6	475 979	7 093 646	177,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
7	474 928	7 093 153	170,9	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
8	473 955	7 092 082	169,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
9	472 921	7 092 121	171,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
10	472 045	7 092 434	174,8	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
11	473 133	7 093 196	170,1	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
12	471 545	7 093 189	175,1	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
13	470 952	7 093 929	178,3	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
14	472 556	7 094 191	172,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
15	473 450	7 094 501	175,0	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
16	474 232	7 094 014	173,4	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
17	475 592	7 094 825	177,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
18	474 653	7 095 212	177,9	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
19	474 026	7 095 796	179,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
20	472 999	7 095 500	175,0	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
21	471 895	7 094 973	170,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
22	470 430	7 094 892	173,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
23	470 952	7 095 933	163,7	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
24	470 207	7 096 391	155,8	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
26	470 814	7 098 750	149,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
27	471 839	7 098 977	152,4	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
28	472 690	7 098 642	163,3	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4

To be continued on next page...

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Calculated:
24.1.2024 13.47/3.5.584

SHADOW - Main Result

Calculation: VE1_Generic_RD200m_HH200m_LUKE Forest_202401

...continued from previous page

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
29	473 217	7 097 856	165,0	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
31	474 257	7 098 465	167,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
32	475 413	7 098 667	166,8	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
33	474 833	7 099 446	158,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
34	473 764	7 099 462	155,4	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4

Shadow receptor-Input

No.	Name	East	North	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
A	Lomarakennus A	471 650	7 097 381	157,6	5,0	5,0	1,0	90,0	"Green house mode"	6,0
B	Asuinrakennus B	467 933	7 097 709	139,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
C	Lomarakennus C	467 899	7 096 936	139,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
D	Autiotalo D	470 313	7 094 090	168,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
E	Lomarakennus E	471 402	7 090 461	195,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
F	Lomarakennus F	471 557	7 090 435	188,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
G	Asuinrakennus G	477 593	7 095 429	191,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
H	Lomarakennus H	477 297	7 097 577	190,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
I	Lomarakennus I	475 097	7 097 098	176,3	5,0	5,0	1,0	90,0	"Green house mode"	6,0

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values Shadow hours per year [h/year]
A	Lomarakennus A	0:00
B	Asuinrakennus B	0:00
C	Lomarakennus C	0:00
D	Autiotalo D	29:44
E	Lomarakennus E	0:00
F	Lomarakennus F	0:00
G	Asuinrakennus G	0:00
H	Lomarakennus H	0:00
I	Lomarakennus I	0:00

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

No.	Name	Expected [h/year]
3	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (671)	0:00
4	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (673)	0:00
5	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (675)	0:00
6	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (676)	0:00
7	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (681)	0:00
8	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (674)	0:00
9	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (678)	0:00
10	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (680)	0:00
11	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (679)	0:00
12	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (670)	2:50
13	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (684)	21:26
14	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (669)	0:00
15	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (683)	0:00
16	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (677)	0:00
17	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (664)	0:00
18	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (682)	0:00
19	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (668)	0:00
20	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (667)	0:00
21	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (666)	5:22
22	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (685)	0:00
23	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (665)	0:00

To be continued on next page...

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Calculated:
24.1.2024 13.47/3.5.584

SHADOW - Main Result

Calculation: VE1_Generic_RD200m_HH200m_LUKE Forest_202401

...continued from previous page

No.	Name	Expected [h/year]
24	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (672)	0:00
26	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (692)	0:00
27	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (663)	0:00
28	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (691)	0:00
29	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (687)	0:00
31	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (686)	0:00
32	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (689)	0:00
33	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (688)	0:00
34	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (690)	0:00

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

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

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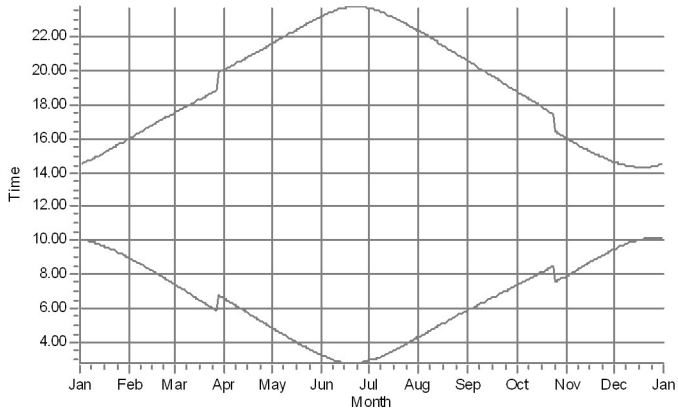
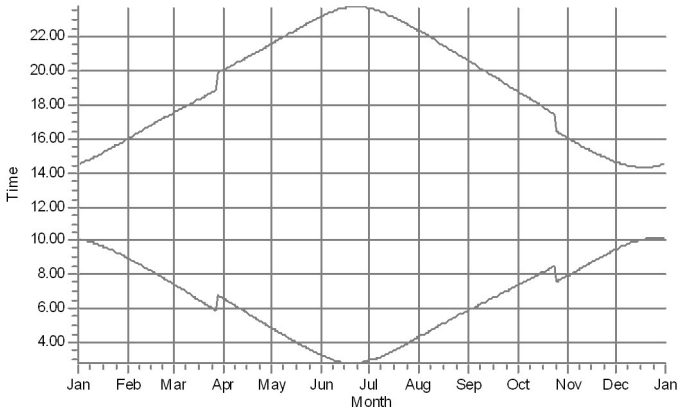
SHADOW - Calendar, graphical

Calculation: VE1_Generic_RD200m_HH200m_LUKE Forest_202401

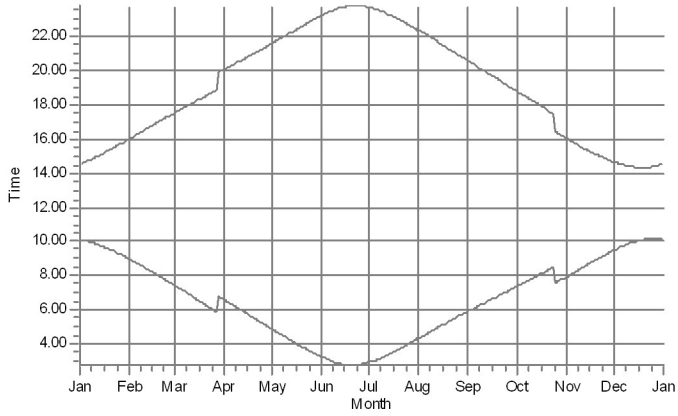
A: Lomarakennus A



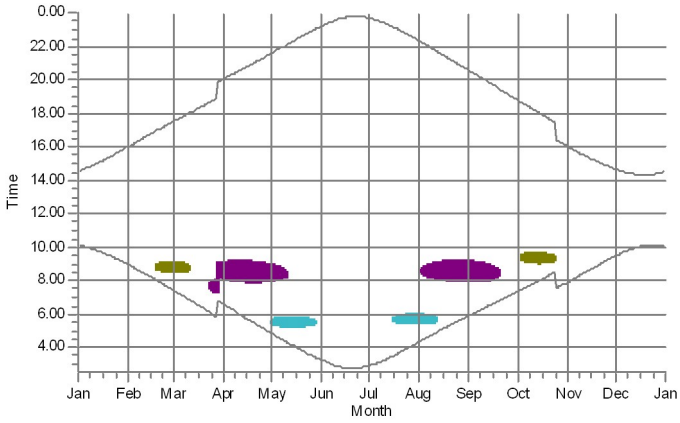
B: Asuinrakennus B



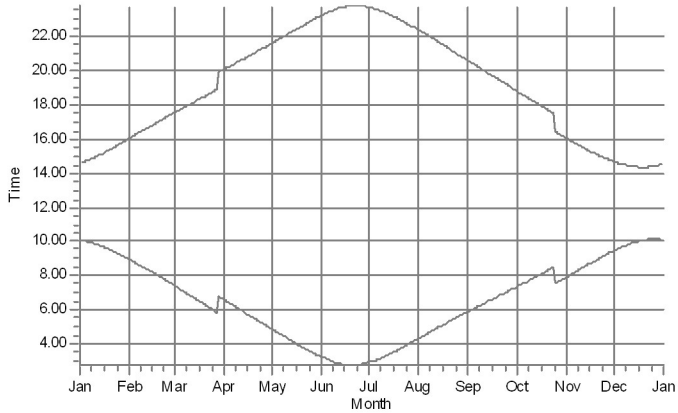
C: Lomarakennus C



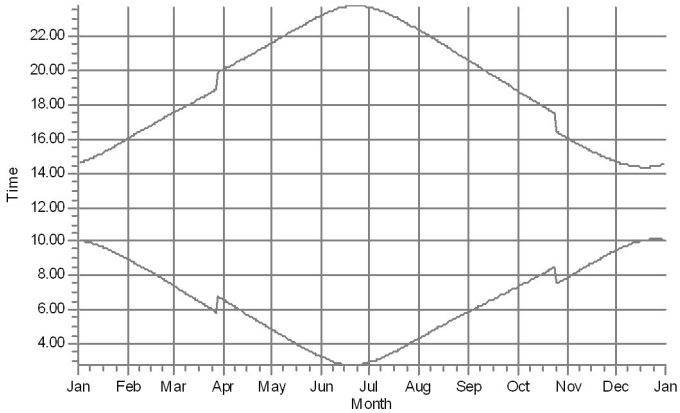
D: Autiotalo D



E: Lomarakennus E



F: Lomarakennus F



WTGs

12: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (670)
13: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (684)
21: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (666)

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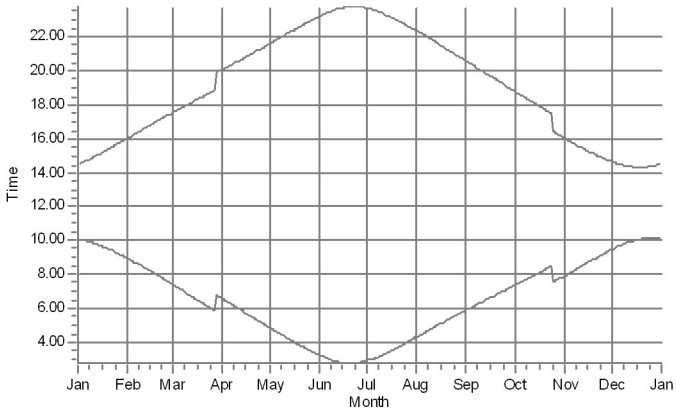
Calculated:
24.1.2024 13.47/3.5.584

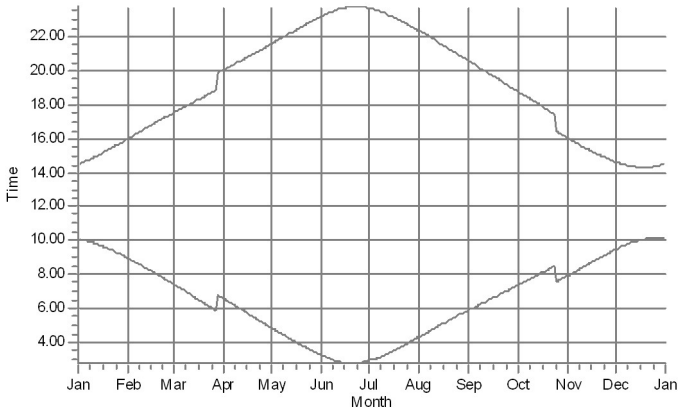
SHADOW - Calendar, graphical

Calculation: VE1_Generic_RD200m_HH200m_LUKE Forest_202401

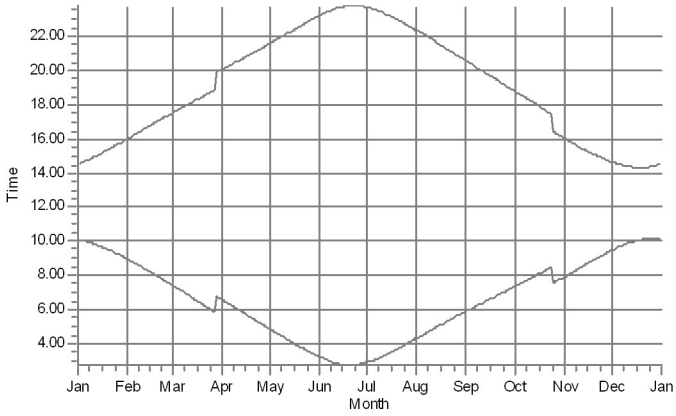
G: Asuinrakennus G



H: Lomarakennus H



I: Lomarakennus I



WTGs

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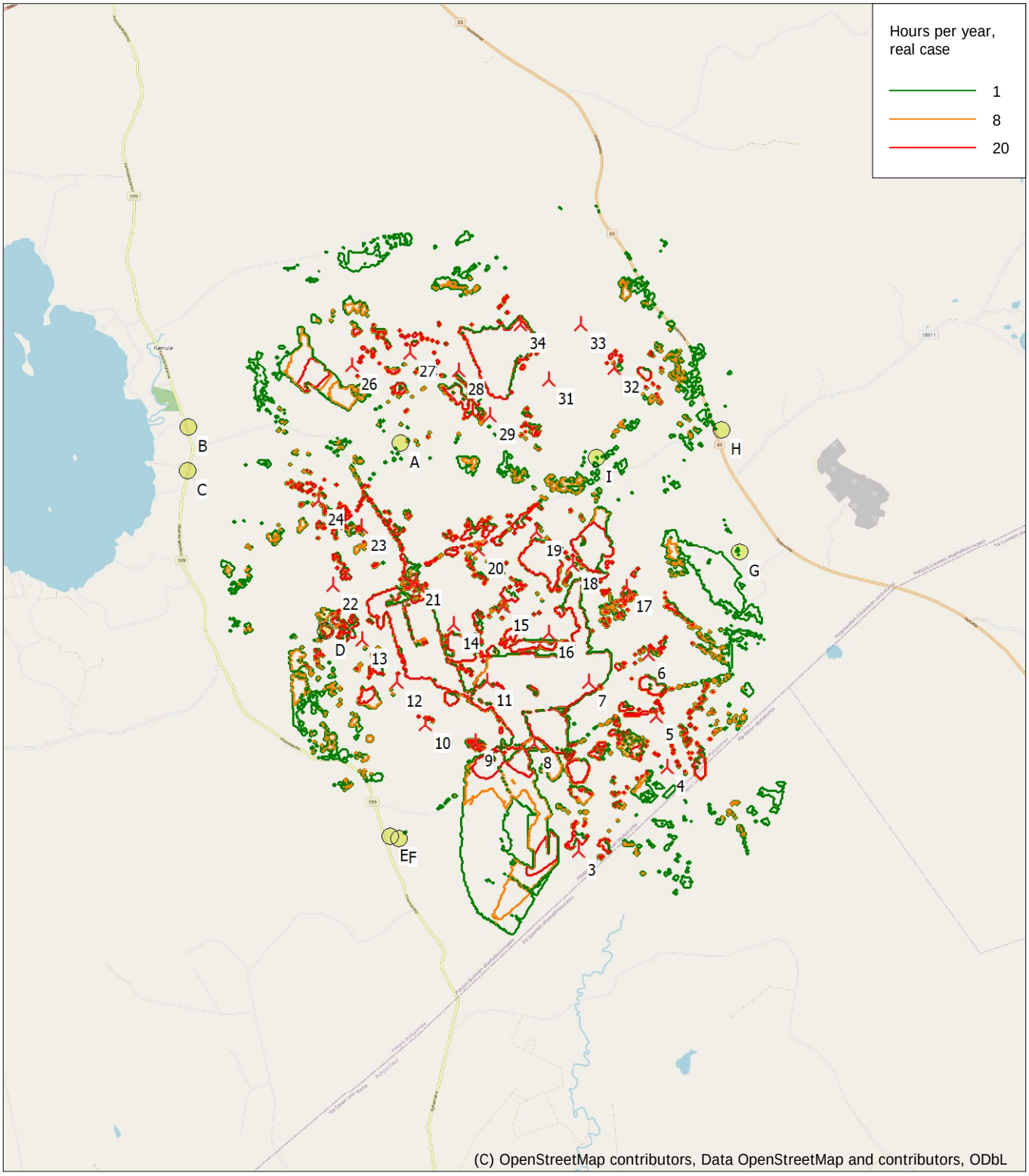
Calculated:
24.1.2024 13.47/3.5.584

SHADOW - Map

Calculation: VE1_Generic_RD200m_HH200m_LUKE Forest_202401



0 1 2 3 4 km

Map: EMD OpenStreetMap , Print scale 1:100 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 473 700 North: 7 094 940

New WTG Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_Pyhäntä_Pilpankangas_0.wpo (1)

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

Liite 8: Varjostusmallinnuksen tulokset ”real case, Lukeforest” (VE2).

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SHADOW - Main Result

Calculation: VE2_Generic_RD200m_HH200m_202401_LUKE_forest

Assumptions for shadow calculations

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

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,77	2,46	4,19	6,93	8,81	9,87	9,13	6,84	4,43	2,23	0,93	0,26

Operational hours are calculated from WTGs in calculation and wind distribution:
MERRA-2_N64,00_E026,875 (8)

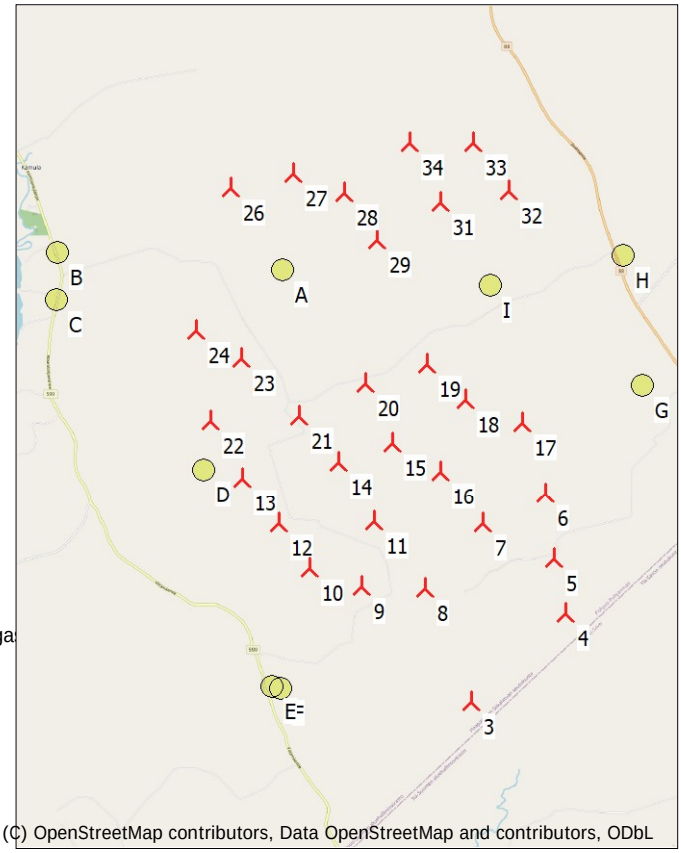
Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
474	404	400	458	605	893	1 104	1 088	885	783	712	656	8 462

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

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: CONTOURLINE_Pyhäntä_Pilpankanga
Area object(s) used in calculation:
Area object (NW): (1)
Area object (NE): (2)
Area object (SW): (3)
Area object (SE): (4)
Obstacles used in calculation
Receptor grid resolution: 1,0 m

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



Scale 1:125 000

New WTG Shadow receptor

WTGs

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
3	474 724	7 090 192	163,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
4	476 298	7 091 642	169,7	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
5	476 097	7 092 538	175,0	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
6	475 979	7 093 646	177,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
7	474 928	7 093 153	170,9	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
8	473 955	7 092 082	169,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
9	472 921	7 092 121	171,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
10	472 045	7 092 434	174,8	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
11	473 133	7 093 196	170,1	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
12	471 545	7 093 189	175,1	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
13	470 952	7 093 929	178,3	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
14	472 556	7 094 191	172,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
15	473 450	7 094 501	175,0	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
16	474 232	7 094 014	173,4	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
17	475 592	7 094 825	177,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
18	474 653	7 095 212	177,9	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
19	474 026	7 095 796	179,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
20	472 999	7 095 500	175,0	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
21	471 895	7 094 973	170,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
22	470 430	7 094 892	173,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
23	470 952	7 095 933	163,7	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
24	470 207	7 096 391	155,8	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
26	470 814	7 098 750	149,2	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
27	471 839	7 098 977	152,4	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
28	472 690	7 098 642	163,3	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4

To be continued on next page...

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Calculated:
24.1.2024 14.46/3.5.584

SHADOW - Main Result

Calculation: VE2_Generic_RD200m_HH200m_202401_LUKE_forest

...continued from previous page

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
29	473 217	7 097 856	165,0	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
31	474 257	7 098 465	167,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
32	475 413	7 098 667	166,8	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
33	474 833	7 099 446	158,5	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4
34	473 764	7 099 462	155,4	Generic RD200 HH200 7200 ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 075	10,4

Shadow receptor-Input

No.	Name	East	North	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
A	Lomarakennus A	471 650	7 097 381	157,6	5,0	5,0	1,0	90,0	"Green house mode"	6,0
B	Asuinrakennus B	467 933	7 097 709	139,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
C	Lomarakennus C	467 899	7 096 936	139,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
D	Autiotalo D	470 313	7 094 090	168,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
E	Lomarakennus E	471 402	7 090 461	195,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
F	Lomarakennus F	471 557	7 090 435	188,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
G	Asuinrakennus G	477 593	7 095 429	191,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
H	Lomarakennus H	477 297	7 097 577	190,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
I	Lomarakennus I	475 097	7 097 098	176,3	5,0	5,0	1,0	90,0	"Green house mode"	6,0

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values Shadow hours per year [h/year]
A	Lomarakennus A	0:00
B	Asuinrakennus B	0:00
C	Lomarakennus C	0:00
D	Autiotalo D	29:44
E	Lomarakennus E	0:00
F	Lomarakennus F	0:00
G	Asuinrakennus G	0:00
H	Lomarakennus H	0:00
I	Lomarakennus I	0:00

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

No.	Name	Expected [h/year]
3	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (671)	0:00
4	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (673)	0:00
5	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (675)	0:00
6	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (676)	0:00
7	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (681)	0:00
8	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (674)	0:00
9	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (678)	0:00
10	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (680)	0:00
11	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (679)	0:00
12	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (670)	2:50
13	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (684)	21:26
14	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (669)	0:00
15	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (683)	0:00
16	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (677)	0:00
17	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (664)	0:00
18	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (682)	0:00
19	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (668)	0:00
20	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (667)	0:00
21	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (666)	5:22
22	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (685)	0:00
23	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (665)	0:00

To be continued on next page...

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24.1.2024 14.46/3.5.584

SHADOW - Main Result

Calculation: VE2_Generic_RD200m_HH200m_202401_LUKE_forest

...continued from previous page

No.	Name	Expected [h/year]
24	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (672)	0:00
26	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (692)	0:00
27	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (663)	0:00
28	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (691)	0:00
29	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (687)	0:00
31	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (686)	0:00
32	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (689)	0:00
33	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (688)	0:00
34	Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (690)	0:00

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

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

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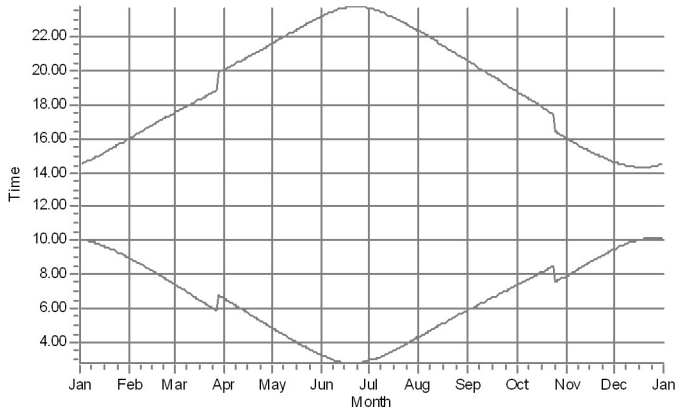
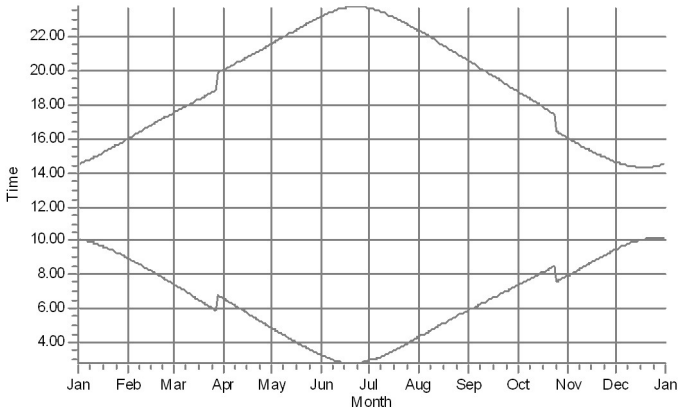
SHADOW - Calendar, graphical

Calculation: VE2_Generic_RD200m_HH200m_202401_LUKE_forest

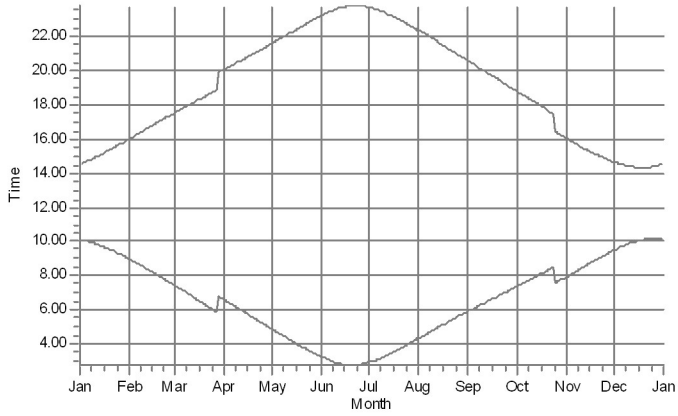
A: Lomarakennus A



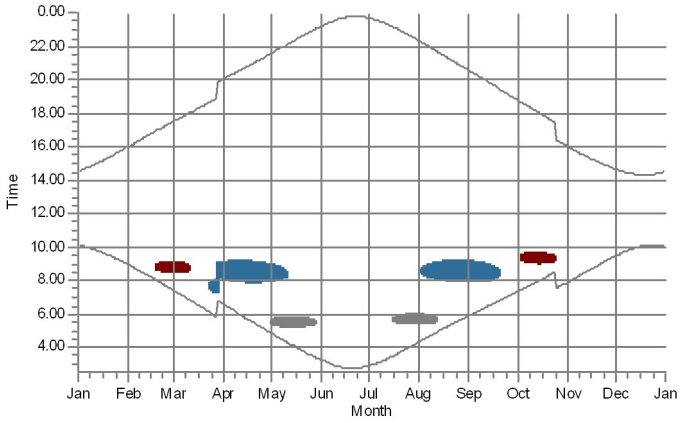
B: Asuinrakennus B



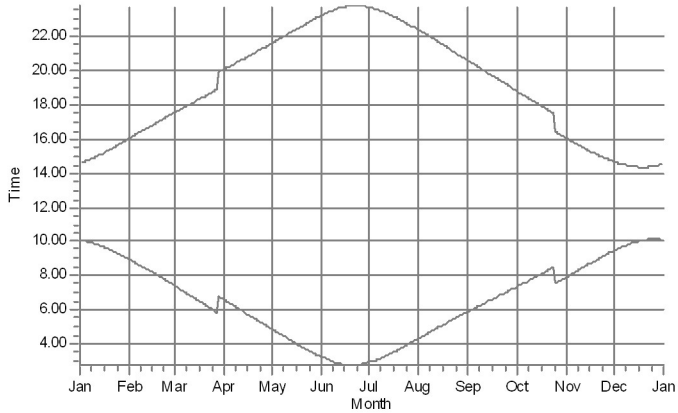
C: Lomarakennus C



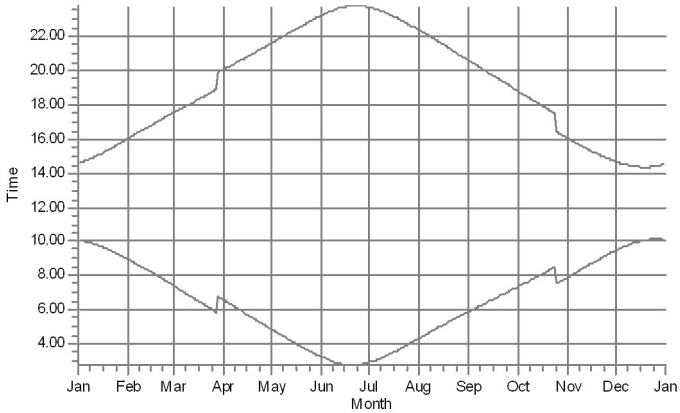
D: Autiotalo D



E: Lomarakennus E



F: Lomarakennus F



WTGs

21: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (666)

12: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (670)

13: Generic RD200 HH200 7200 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (684)

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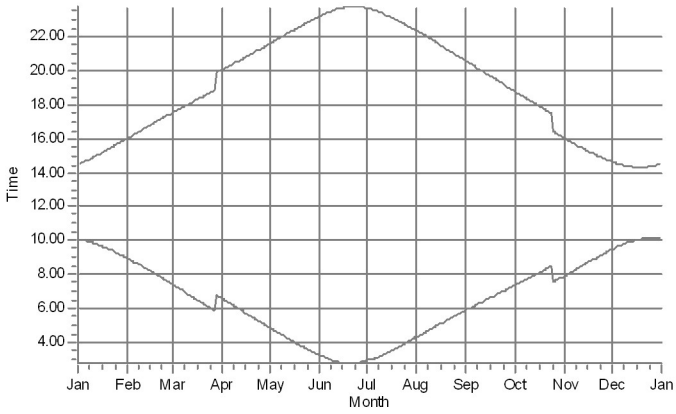
24.1.2024 14.46/3.5.584

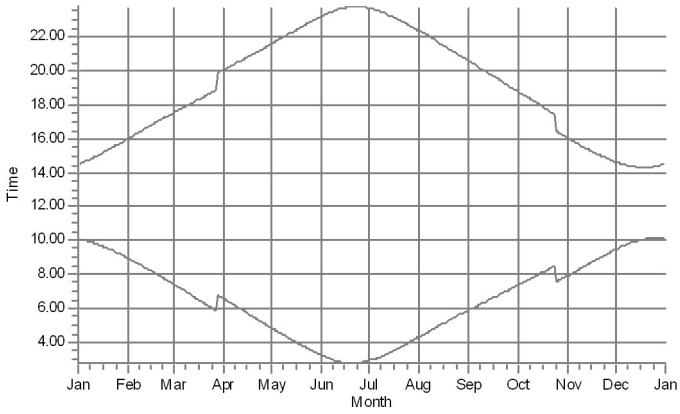
SHADOW - Calendar, graphical

Calculation: VE2_Generic_RD200m_HH200m_202401_LUKE_forest

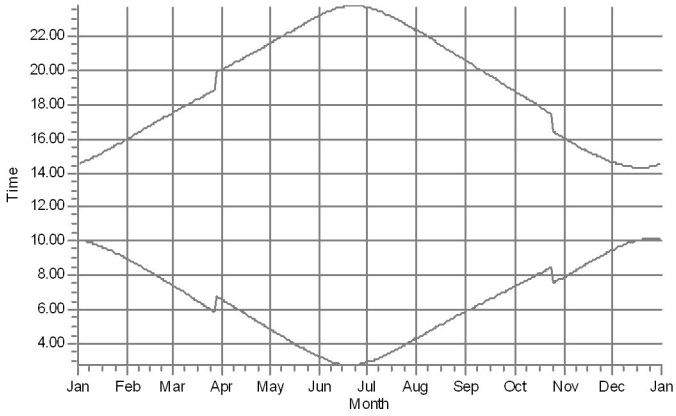
G: Asuinrakennus G



H: Lomarakennus H



I: Lomarakennus I



WTGs

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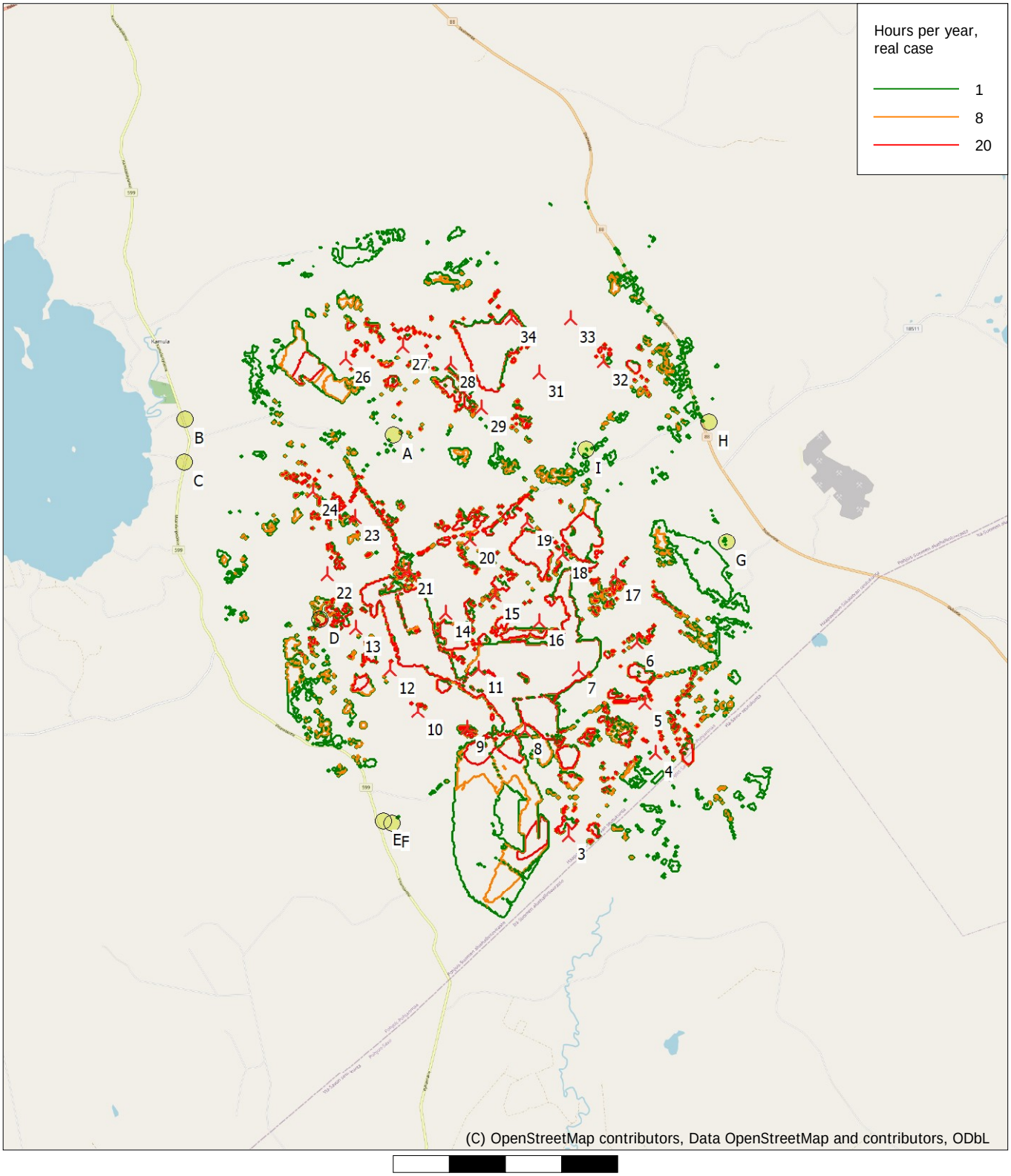
Calculated:
24.1.2024 14.46/3.5.584

SHADOW - Map

Calculation: VE2_Generic_RD200m_HH200m_202401_LUKE_forest



Map: EMD OpenStreetMap , Print scale 1:100 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 473 700 North: 7 094 940

New WTG Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_Pyhäntä_Pilpankangas_0.wpo (1)

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

Liite 9: Yhteismelun leviämismallinnuksen (ISO 9613-2, YM 2/2014) tulokset WindPro-raporttina Konnunsuon vaihtoehdossa VE1.

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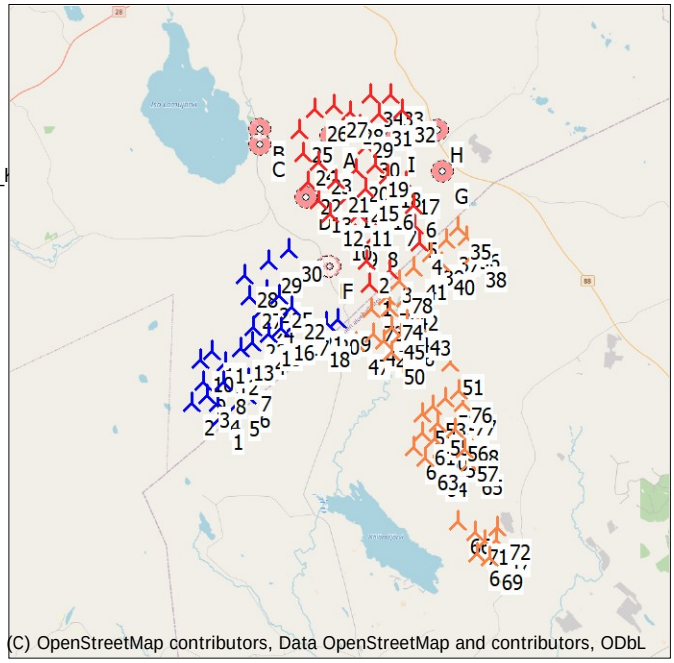
11.4.2024 13.49/3.6.377

DECIBEL - Main Result

Calculation: Yhteisvaikutus_VE1_34WTG_Konnunsuo_LapinsaloVE1_PilpankangasVE1

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

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



Scale 1:400 000
New WTG
Noise sensitive area

WTGs

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Noise data Creator	Name	Wind speed	LwA,ref
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]
1	473 642	7 089 459	165,9	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
1	465 686	7 082 467	165,4	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
2	473 523	7 090 697	166,4	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
2	464 106	7 083 255	147,6	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
3	474 724	7 090 192	163,2	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
3	464 951	7 083 636	154,2	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
4	476 298	7 091 642	169,7	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
4	465 561	7 083 192	163,3	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
5	466 536	7 083 117	165,1	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
5	476 097	7 092 538	175,0	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
6	467 111	7 083 592	159,6	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
6	475 979	7 093 646	177,2	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
7	474 928	7 093 153	170,9	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
7	467 136	7 084 492	159,4	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
8	473 955	7 092 082	169,2	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
8	465 786	7 084 367	164,6	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
9	472 921	7 092 121	171,2	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
9	464 736	7 084 392	152,2	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
10	464 636	7 085 517	155,2	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
10	472 045	7 092 434	174,8	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
11	473 133	7 093 196	170,1	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
11	465 236	7 085 992	159,1	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
12	465 936	7 085 367	160,8	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
12	471 545	7 093 189	175,1	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
13	466 761	7 086 117	170,0	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
13	470 952	7 093 929	178,3	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
14	472 556	7 094 191	172,5	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
14	467 386	7 086 467	159,7	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
15	473 450	7 094 501	175,0	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
15	468 261	7 086 867	156,9	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
16	468 936	7 087 192	156,2	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
16	474 232	7 094 014	173,4	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
17	469 711	7 087 392	157,4	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
17	475 592	7 094 825	177,5	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
18	474 653	7 095 212	177,9	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
18	470 821	7 086 831	160,6	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
19	474 026	7 095 796	179,2	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
19	471 948	7 087 636	182,5	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
20	471 311	7 087 492	168,0	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
20	472 999	7 095 500	175,0	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
21	470 411	7 087 617	162,5	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
21	471 895	7 094 973	170,5	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
22	469 511	7 088 317	160,5	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
22	470 430	7 094 892	173,5	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
23	470 952	7 095 933	163,7	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
23	467 436	7 087 242	169,3	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
24	470 207	7 096 391	155,8	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
24	467 861	7 088 142	165,0	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
25	469 994	7 097 616	152,3	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
25	468 861	7 088 892	163,0	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
26	470 814	7 098 750	149,2	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
26	468 133	7 089 218	165,0	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
27	467 261	7 088 867	167,0	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
27	471 839	7 098 977	152,4	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0

To be continued on next page...

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11.4.2024 13.49/3.6.377

DECIBEL - Main Result

Calculation: Yhteisvaikutus_VE1_34WTG_Konnunsuo_LapinsaloVE1_PilpankangasVE1

...continued from previous page

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Noise data Creator	Name	Wind speed	LwA,ref
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]
28	472 690	7 098 642	163,3	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
28	466 998	7 090 015	168,4	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
29	473 217	7 097 856	165,0	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
29	468 282	7 090 703	164,5	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
30	473 530	7 096 766	168,7	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
30	469 365	7 091 361	164,5	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
31	474 257	7 098 465	167,5	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
32	475 413	7 098 667	166,8	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
33	474 833	7 099 446	158,5	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
34	473 764	7 099 462	155,4	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
35	478 336	7 092 455	177,4	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
36	478 845	7 091 899	190,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
37	477 742	7 091 824	177,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
38	479 177	7 090 979	185,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
39	476 955	7 091 051	172,8	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
40	477 487	7 090 620	182,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
41	475 964	7 090 352	164,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
42	475 501	7 088 705	162,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
43	476 189	7 087 343	162,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
44	475 611	7 087 510	161,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
45	474 845	7 087 199	160,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
46	475 310	7 086 848	160,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
47	472 937	7 086 386	170,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
48	473 780	7 086 830	165,6	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
49	474 399	7 086 459	160,6	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
50	474 825	7 085 835	158,1	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
51	477 918	7 085 282	163,9	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
52	477 610	7 083 418	159,9	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
53	476 957	7 082 967	158,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
54	476 370	7 082 551	156,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
55	477 187	7 082 052	160,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
56	478 121	7 081 764	160,1	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
57	478 641	7 080 668	158,8	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
58	478 709	7 081 538	163,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
59	477 972	7 080 917	155,3	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
60	477 084	7 081 229	157,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
61	476 355	7 081 601	162,8	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
62	475 903	7 080 778	161,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
63	476 526	7 080 222	157,4	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
64	476 972	7 079 815	154,3	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
65	478 868	7 079 944	156,8	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
66	478 217	7 076 798	138,3	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
67	480 292	7 075 796	153,1	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
68	479 248	7 075 045	139,8	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
69	479 889	7 074 867	140,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
70	479 686	7 075 714	147,9	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
71	479 198	7 076 190	147,3	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
72	480 317	7 076 500	159,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
73	473 769	7 088 131	166,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
74	474 672	7 088 183	162,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
75	474 559	7 088 784	163,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
76	478 369	7 083 786	163,1	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
77	478 581	7 083 109	162,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
78	475 224	7 089 562	162,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9

Calculation Results

Sound level

Noise sensitive area						Demands	Sound level	
No.	Name	East	North	Z	Immission height	Noise	From WTGs	Distance to noise demand
				[m]	[m]	[dB(A)]	[dB(A)]	[m]
A	Lomarakennus A	471 650	7 097 381	157,6	4,0	40,0	38,7	531
B	Asuinrakennus B	467 933	7 097 709	139,1	4,0	40,0	31,7	1 372
C	Lomarakennus C	467 899	7 096 936	139,8	4,0	40,0	32,0	1 493
D	Autiotalo D	470 313	7 094 090	168,7	4,0	40,0	42,4	-327
E	Lomarakennus E	471 402	7 090 461	195,0	4,0	40,0	38,5	1 033
F	Lomarakennus F	471 557	7 090 435	188,1	4,0	40,0	38,6	887
G	Asuinrakennus G	477 593	7 095 429	191,1	4,0	40,0	34,2	1 297
H	Lomarakennus H	477 297	7 097 577	190,8	4,0	40,0	32,2	1 502
I	Lomarakennus I	475 097	7 097 098	176,3	4,0	40,0	37,8	617

Distances (m)

WTG	A	B	C	D	E	F	G	H	I
1	8169	10033	9428	5703	2454	2302	7160	8903	7777
1	16062	15406	14637	12510	9827	9897	17600	19055	17396
2	6941	8967	8400	4671	2134	1984	6241	7847	6591
2	16014	14952	14197	12487	10255	10348	18169	19471	17676
3	7819	10131	9595	5887	3333	3177	5971	7821	6916
3	15290	14385	13623	11749	9391	9480	17288	18622	16857
4	7385	10333	9928	6466	5036	4892	4003	6019	5587
4	15440	14709	13941	11888	9324	9402	17161	18564	16861
5	15152	14658	13886	11604	8809	8874	16548	18024	16393

To be continued on next page...

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11.4.2024 13.49/3.6.377

DECIBEL - Main Result

Calculation: Yhteisvaikutus_VE1_34WTG_Konnunsuo_LapinsaloVE1_PilpankangasVE1

...continued from previous page

WTG	A	B	C	D	E	F	G	H	I
5	6575	9664	9304	5989	5134	5003	3255	5180	4669
6	14516	14140	13367	10975	8099	8160	15810	17301	15690
6	5718	9014	8725	5684	5577	5465	2405	4146	3563
7	5349	8347	7982	4709	4436	4330	3505	5018	3948
7	13656	13240	12467	10110	7336	7406	15131	16566	14909
8	5779	8242	7761	4159	3024	2909	4943	6431	5144
8	14274	13513	12745	10725	8287	8373	16179	17521	15772
9	5411	7490	6957	3267	2250	2169	5725	6994	5432
9	14714	13695	12936	11187	9014	9112	16944	18210	16394
10	13782	12629	11875	10282	8379	8490	16313	17485	15606
10	4963	6689	6120	2397	2075	2058	6305	7351	5574
11	4440	6885	6433	2959	3237	3180	4987	6044	4368
11	13070	12023	11263	9557	7615	7726	15548	16723	14851
12	13303	12502	11734	9759	7471	7568	15398	16677	14884
12	4194	5786	5228	1526	2732	2754	6450	7235	5282
13	12279	11651	10878	8728	6356	6453	14284	15567	13786
13	3522	4837	4285	659	3497	3546	6809	7319	5218
14	3316	5809	5406	2245	3904	3886	5187	5826	3861
14	11717	11255	10481	8165	5663	5756	13583	14888	13132
15	3396	6382	6061	3164	4529	4485	4246	4926	3076
15	11046	10846	10075	7508	4773	4857	12664	14012	12304
16	10544	10564	9799	7034	4094	4169	11949	13332	11665
16	4243	7303	6975	3920	4543	4468	3646	4700	3203
17	10175	10469	9714	6724	3503	3559	11256	12699	11100
17	4698	8184	7977	5330	6049	5962	2091	3238	2326
18	3705	7169	6971	4483	5757	5692	2948	3548	1938
18	10582	11255	10519	7277	3676	3678	10945	12546	11122
19	2856	6386	6232	4086	5946	5902	3586	3724	1686
19	9749	10843	10143	6658	2877	2826	9623	11289	9972
20	9894	10761	10041	6673	2970	2953	10122	11727	10325
20	2315	5527	5299	3034	5286	5266	4594	4773	2637
21	9842	10391	9651	6473	3011	3042	10611	12108	10575
21	2420	4815	4452	1812	4539	4551	5716	5997	3843
22	9312	9523	8768	5828	2858	2944	10765	12098	10407
22	2772	3765	3254	810	4536	4597	7183	7373	5162
23	1607	3502	3213	1951	5491	5531	6660	6555	4306
23	10979	10478	9705	7427	5107	5213	13045	14284	12483
24	1750	2628	2371	2304	6050	6107	7449	7189	4941
24	9985	9567	8794	6433	4232	4349	12157	13343	11513
25	1672	2063	2203	3540	7292	7349	7907	7303	5129
25	8935	8865	8101	5396	2986	3106	10907	12107	10306
26	1605	3063	3433	4687	8310	8349	7549	6589	4591
26	8889	8494	7722	5338	3498	3634	11317	12404	10517
27	9578	8867	8094	6049	4437	4573	12239	13288	11364
27	1607	4107	4437	5120	8527	8546	6760	5635	3761
28	1635	4848	5086	5136	8282	8285	5862	4728	2859
28	8712	7751	6980	5253	4426	4578	11898	12777	10759
29	1637	5286	5397	4756	7615	7605	5004	4090	2028
29	7479	7014	6245	3949	3129	3286	10442	11337	9345
30	1978	5676	5634	4185	6654	6631	4277	3853	1602
30	6439	6507	5765	2889	2227	2379	9179	10077	8110
31	2824	6369	6539	5891	8498	8472	4511	3167	1605
32	3977	7541	7711	6853	9134	9090	3904	2177	1601
33	3794	7115	7375	7009	9618	9589	4874	3093	2363
34	2966	6089	6386	6385	9306	9293	5561	4005	2714
35	8305	11654	11358	8188	7215	7074	3065	5226	5661
36	9045	12362	12049	8809	7581	7434	3745	5885	6409
37	8246	11439	11091	7767	6485	6339	3608	5770	5900
38	9881	13104	12755	9394	7792	7639	4724	6861	7354
39	8259	11213	10800	7304	5584	5433	4424	6535	6326
40	8932	11897	11482	7970	6087	5933	4810	6960	6905
41	8247	10891	10411	6775	4563	4408	5332	7347	6801
42	9492	11762	11204	7478	4459	4307	7042	9052	8403
43	11016	13252	12679	8947	5713	5569	8207	10293	9816
44	10636	12766	12179	8448	5140	4999	8163	10207	9602
45	10672	12579	11961	8248	4743	4613	8677	10664	9902

To be continued on next page...

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11.4.2024 13.49/3.6.377

DECIBEL - Main Result

Calculation: Yhteisvaikutus_VE1_34WTG_Konnunsuo_LapinsaloVE1_PilpankangasVE1

...continued from previous page

WTG	A	B	C	D	E	F	G	H	I
46	11151	13129	12518	8799	5322	5192	8879	10911	10252
47	11071	12380	11692	8139	4355	4278	10172	12011	10928
48	10763	12350	11692	8045	4340	4235	9406	11307	10352
49	11263	12976	12329	8656	5000	4887	9522	11489	10662
50	11974	13729	13084	9407	5755	5642	9985	11999	11266
51	13627	15942	15369	11637	8324	8187	10153	12311	12148
52	15182	17259	16644	12928	9388	9267	12011	14162	13909
53	15360	17284	16648	12956	9328	9216	12478	14614	14253
54	15563	17348	16694	13032	9341	9237	12935	15054	14602
55	16298	18187	17544	13862	10207	10098	13383	15525	15190
56	16905	18922	18294	14591	10990	10875	13675	15834	15629
57	18116	20126	19495	15796	12178	12066	14798	16962	16808
58	17345	19433	18814	15101	11533	11415	13936	16101	15974
59	17636	19564	18923	15238	11587	11478	14517	16674	16434
60	17042	18850	18195	14535	10840	10738	14209	16349	15993
61	16467	18177	17512	13874	10150	10053	13884	16004	15548
62	17139	18713	18032	14438	10678	10590	14748	16857	16340
63	17839	19484	18809	15196	11450	11358	15245	17372	16937
64	18355	20048	19377	15752	12015	11921	15627	17765	17385
65	18871	20860	20224	16531	12897	12787	15537	17703	17563
66	21605	23303	22628	19013	15269	15177	18642	20800	20539
67	23251	25158	24505	20839	17150	17047	19818	21986	21927
68	23593	25332	24658	21037	17298	17205	20452	22617	22441
69	23974	25782	25116	21476	17754	17658	20690	22857	22742
70	23110	24939	24276	20629	16915	16817	19826	21994	21871
71	22495	24289	23623	19984	16261	16165	19306	21471	21306
72	22608	24560	23913	20236	16564	16460	19124	21292	21249
73	9489	11215	10582	6888	3321	3193	8239	10083	9064
74	9681	11668	11067	7341	3985	3843	7813	9754	8925
75	9075	11115	10526	6795	3574	3426	7305	9209	8331
76	15165	17400	16809	13080	9649	9519	11669	13833	13709
77	15866	18071	17473	13746	10276	10150	12360	14525	14417
78	8597	10933	10394	6680	3926	3769	6327	8279	7537

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DECIBEL - Assumptions for noise calculation

Calculation: Yhteisvaikutus_VE1_34WTG_Konnunsuo_LapinsaloVE1_PilpankangasVE1

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_Pyhäntä_Konnunsuo_0.w2r (5)
Area type with hard ground: jarvi_laatikko
Ground factor for hard ground: 0,0
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure tones penalty is added to total noise impact at receptors
Noise sensitive area
Height above ground level, when no value in NSA object:
4,0 m; Don't allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)
Octave data required
Frequency dependent air absorption

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

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89

WTG: Siemens Gamesa SG 6.6-170 6600 170.0 !O!
Noise: (AM 0, 6.6MW) - 106dB(A) + 2dB(A)

Source	Source/Date	Creator	Edited
SGRE	17.12.2021	USER	10.4.2024 8.54

Siemens Gamesa Renewable Energy and its affiliates reserve the right to change the above specifications without prior notice.

					Octave data							
Status	Hub height [m]	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones	63 [dB]	125 [dB]	250 [dB]	500 [dB]	1000 [dB]	2000 [dB]	4000 [dB]	8000 [dB]
From Windcat	215,0	8,0	108,0	No	88,5	95,4	98,1	99,9	103,8	101,9	95,3	85,0

WTG: NORDEX N163/6.X 6800 163.0 !O!
Noise: Nordex N163/6.X Third octave sound power levels, revision 02

Source	Source/Date	Creator	Edited
Nordex	8.11.2021	USER	20.3.2024 15.39

					Octave data							
Status	Hub height [m]	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones	63 [dB]	125 [dB]	250 [dB]	500 [dB]	1000 [dB]	2000 [dB]	4000 [dB]	8000 [dB]
From Windcat	200,0	8,0	109,9	No	93,8	98,6	101,7	103,2	104,8	103,0	91,5	71,3

WTG: Generic RD200 HH200 7200 200.0 !O!
Noise: V172 - 7,2 MW PO7200 STE + 2dB

Source	Source/Date	Creator	Edited
Vestas	30.6.2022	USER	9.4.2024 14.09

DMS no.: 0128-4336_00

					Octave data							
Status	Hub height [m]	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones	63 [dB]	125 [dB]	250 [dB]	500 [dB]	1000 [dB]	2000 [dB]	4000 [dB]	8000 [dB]
From Windcat	200,0	8,0	108,9	No	92,4	100,0	103,3	103,5	101,9	97,4	89,9	79,2

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Calculated:
11.4.2024 13.49/3.6.377

DECIBEL - Assumptions for noise calculation

Calculation: Yhteisvaikutus_VE1_34WTG_Konnunsuo_LapinsaloVE1_PilpankangasVE1

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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DECIBEL - Assumptions for noise calculation

Calculation: Yhteisvaikutus_VE1_34WTG_Konnunsuo_LapinsaloVE1_PilpankangasVE1

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

Noise sensitive area: I Lomarakennus I

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

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

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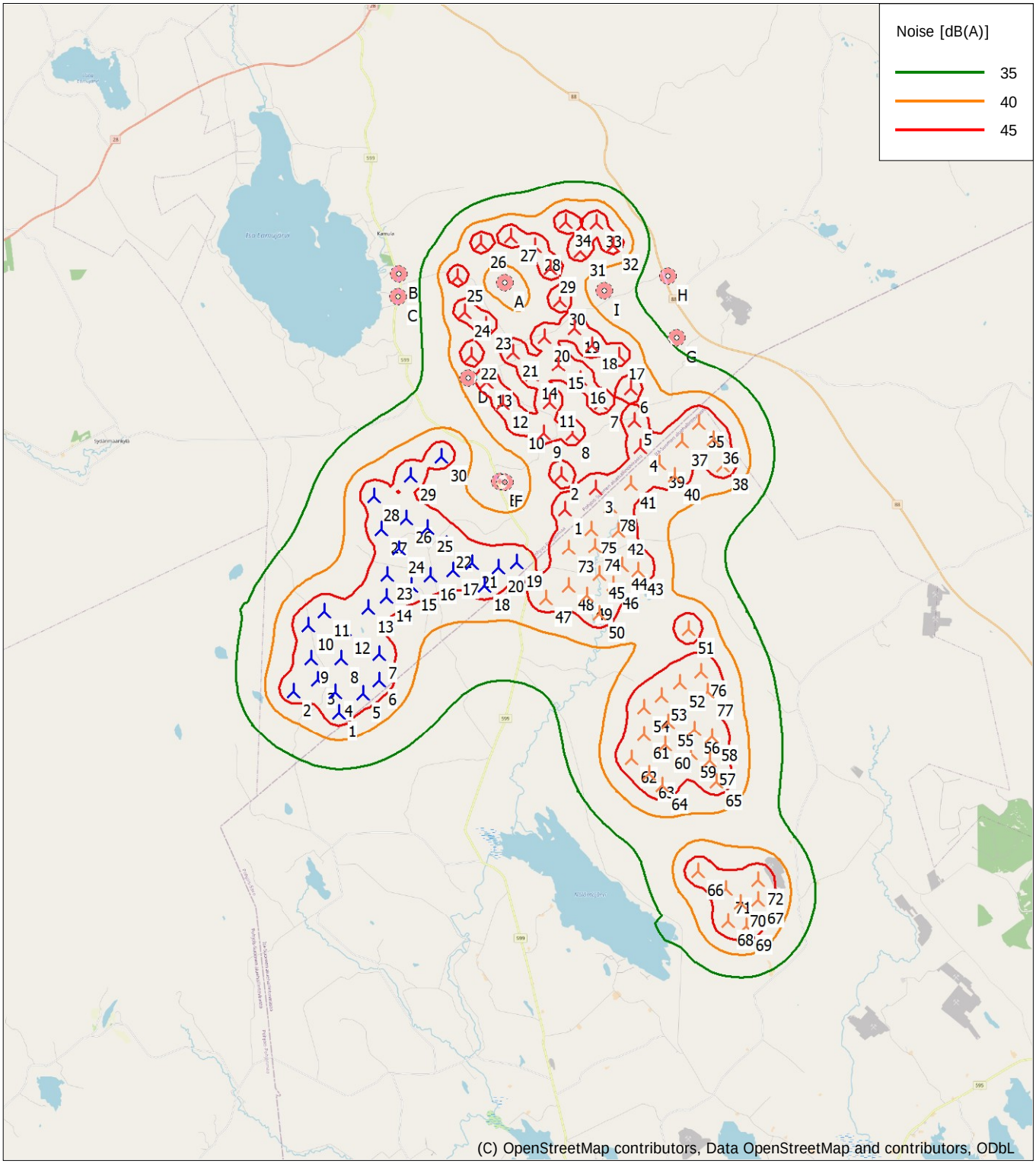
DECIBEL - Map 8,0 m/s

Calculation: Yhteisvaikutus_VE1_34WTG_Konnunsuo_LapinsaloVE1_PilpankangasVE1



Map: EMD OpenStreetMap , Print scale 1:200 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 472 212 North: 7 087 165

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 10: Yhteismelun leviämismallinnuksen (ISO 9613-2, YM 2/2014) tulokset WindPro-raporttina Konnunsuon vaihtoehdossa VE2.

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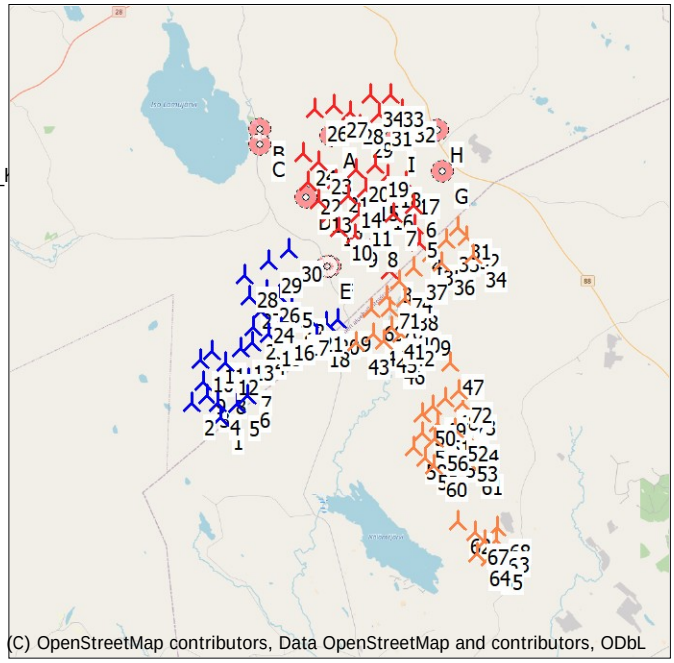
Calculated:
11.4.2024 14.18/3.6.377

DECIBEL - Main Result

Calculation: Yhteisvaikutus_VE2_30WTG_Konnunsuo_LapinsaloVE1_PilpankangasVE1

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

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



WTGs

	East	North	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]
1	465 686	7 082 467	165,4	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
2	464 106	7 083 255	147,6	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
3	474 724	7 090 192	163,2	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
3	464 951	7 083 636	154,2	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
4	465 561	7 083 192	163,3	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
4	476 298	7 091 642	169,7	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
5	466 536	7 083 117	165,1	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
5	476 097	7 092 538	175,0	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
6	467 111	7 083 592	159,6	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
6	475 979	7 093 646	177,2	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
7	467 136	7 084 492	159,4	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
7	474 928	7 093 153	170,9	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
8	465 786	7 084 367	164,6	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
8	473 955	7 092 082	169,2	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
9	472 921	7 092 121	171,2	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
9	464 736	7 084 392	152,2	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
10	464 636	7 085 517	155,2	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
10	472 045	7 092 434	174,8	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
11	465 236	7 085 992	159,1	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
11	473 133	7 093 196	170,1	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
12	471 545	7 093 189	175,1	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
12	465 936	7 085 367	160,8	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
13	470 952	7 093 929	178,3	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
13	466 761	7 086 117	170,0	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
14	472 556	7 094 191	172,5	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
14	467 386	7 086 467	159,7	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
15	473 450	7 094 501	175,0	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
15	468 261	7 086 867	156,9	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
16	468 936	7 087 192	156,2	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
16	474 232	7 094 014	173,4	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
17	475 592	7 094 825	177,5	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
17	469 711	7 087 392	157,4	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
18	474 653	7 095 212	177,9	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
18	470 821	7 086 831	160,6	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
19	474 026	7 095 796	179,2	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
19	471 948	7 087 636	182,5	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
20	472 999	7 095 500	175,0	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
20	471 311	7 087 492	168,0	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
21	470 411	7 087 617	162,5	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
21	471 895	7 094 973	170,5	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
22	470 430	7 094 892	173,5	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
22	469 511	7 088 317	160,5	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
23	470 952	7 095 933	163,7	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
23	467 436	7 087 242	169,3	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
24	467 861	7 088 142	165,0	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
24	470 207	7 096 391	155,8	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
25	468 861	7 088 892	163,0	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
26	468 133	7 089 218	165,0	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
26	470 814	7 098 750	149,2	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
27	467 261	7 088 867	167,0	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
27	471 839	7 098 977	152,4	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
28	466 998	7 090 015	168,4	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
28	472 690	7 098 642	163,3	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
29	468 282	7 090 703	164,5	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9

To be continued on next page...

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11.4.2024 14.18/3.6.377

DECIBEL - Main Result

Calculation: Yhteisvaikutus_VE2_30WTG_Konnunsuo_LapinsaloVE1_PilpankangasVE1

...continued from previous page

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Noise data Creator	Name	Wind speed	LwA,ref
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]
29	473 217	7 097 856	165,0	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
30	469 365	7 091 361	164,5	Siemens Gamesa SG 6.6-170 660...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	USER	V172 - 7,2 MW PO7200 STE + 2dB	8,0	108,9
31	478 336	7 092 455	177,4	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
31	474 257	7 098 465	167,5	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
32	478 845	7 091 899	190,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
32	475 413	7 098 667	166,8	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
33	474 833	7 099 446	158,5	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
33	477 742	7 091 824	177,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
34	473 764	7 099 462	155,4	Siemens Gamesa SG 6.6-170 660...	Yes	Siemens Gamesa	SG 6.6-170-6 600	6 600	170,0	215,0	USER	(AM 0, 6.6MW) - 106dB(A) + 2dB(A)	8,0	108,0
34	479 177	7 090 979	185,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
35	476 955	7 091 051	172,8	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
36	477 487	7 090 620	182,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
37	475 964	7 090 352	164,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
38	475 501	7 088 705	162,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
39	476 189	7 087 343	162,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
40	475 611	7 087 510	161,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
41	474 845	7 087 199	160,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
42	475 310	7 086 848	160,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
43	472 937	7 086 386	170,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
44	473 780	7 086 830	165,6	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
45	474 399	7 086 459	160,6	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
46	474 825	7 085 835	158,1	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
47	477 918	7 085 282	163,9	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
48	477 610	7 083 418	159,9	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
49	476 957	7 082 967	158,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
50	476 370	7 082 551	156,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
51	477 187	7 082 052	160,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
52	478 121	7 081 764	160,1	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
53	478 641	7 080 668	158,8	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
54	478 709	7 081 538	163,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
55	477 972	7 080 917	155,3	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
56	477 084	7 081 229	157,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
57	476 355	7 081 601	162,8	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
58	475 903	7 080 778	161,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
59	476 526	7 080 222	157,4	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
60	476 972	7 079 815	154,3	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
61	478 868	7 079 944	156,8	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
62	478 217	7 076 798	138,3	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
63	480 292	7 075 796	153,1	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
64	479 248	7 075 045	139,8	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
65	479 889	7 074 867	140,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
66	479 686	7 075 714	147,9	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
67	479 198	7 076 190	147,3	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
68	480 317	7 076 500	159,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
69	473 769	7 088 131	166,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
70	474 672	7 088 183	162,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
71	474 559	7 088 784	163,0	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
72	478 369	7 083 786	163,1	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
73	478 581	7 083 109	162,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9
74	475 224	7 089 562	162,5	NORDEX N163/6.X 6800 163.0 !O...	Yes	NORDEX	N163/6.X-6 800	6 800	163,0	200,0	USER	Nordex N163/6.X Third octave sound power levels, revision 02	8,0	109,9

Calculation Results

Sound level

Noise sensitive area No.	Name	East	North	Z [m]	Immission height [m]	Demands Noise [dB(A)]	Sound level From WTGs [dB(A)]	Distance to noise demand [m]
A	Lomarakennus A	471 650	7 097 381	157,6	4,0	40,0	38,0	617
B	Asuinrakennus B	467 933	7 097 709	139,1	4,0	40,0	30,4	1 959
C	Lomarakennus C	467 899	7 096 936	139,8	4,0	40,0	31,1	1 680
D	Autiotalo D	470 313	7 094 090	168,7	4,0	40,0	42,3	-319
E	Lomarakennus E	471 402	7 090 461	195,0	4,0	40,0	38,2	1 115
F	Lomarakennus F	471 557	7 090 435	188,1	4,0	40,0	38,1	1 080
G	Asuinrakennus G	477 593	7 095 429	191,1	4,0	40,0	34,1	1 303
H	Lomarakennus H	477 297	7 097 577	190,8	4,0	40,0	32,0	1 507
I	Lomarakennus I	475 097	7 097 098	176,3	4,0	40,0	37,2	731

Distances (m)

WTG	A	B	C	D	E	F	G	H	I
1	16062	15406	14637	12510	9827	9897	17600	19055	17396
2	16014	14952	14197	12487	10255	10348	18169	19471	17676
3	7819	10131	9595	5887	3333	3177	5971	7821	6916
3	15290	14385	13623	11749	9391	9480	17288	18622	16857
4	15440	14709	13941	11888	9324	9402	17161	18564	16861
4	7385	10333	9928	6466	5036	4892	4003	6019	5587
5	15152	14658	13886	11604	8809	8874	16548	18024	16393
5	6575	9664	9304	5989	5134	5003	3255	5180	4669
6	14516	14140	13367	10975	8099	8160	15810	17301	15690
6	5718	9014	8725	5684	5577	5465	2405	4146	3563
7	13656	13240	12467	10110	7336	7406	15131	16566	14909

To be continued on next page...

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11.4.2024 14.18/3.6.377

DECIBEL - Main Result

Calculation: Yhteisvaikutus_VE2_30WTG_Konnunsuo_LapinsaloVE1_PilpankangasVE1

...continued from previous page

WTG	A	B	C	D	E	F	G	H	I
7	5349	8347	7982	4709	4436	4330	3505	5018	3948
8	14274	13513	12745	10725	8287	8373	16179	17521	15772
8	5779	8242	7761	4159	3024	2909	4943	6431	5144
9	5411	7490	6957	3267	2250	2169	5725	6994	5432
9	14714	13695	12936	11187	9014	9112	16944	18210	16394
10	13782	12629	11875	10282	8379	8490	16313	17485	15606
10	4963	6689	6120	2397	2075	2058	6305	7351	5574
11	13070	12023	11263	9557	7615	7726	15548	16723	14851
11	4440	6885	6433	2959	3237	3180	4987	6044	4368
12	4194	5786	5228	1526	2732	2754	6450	7235	5282
12	13303	12502	11734	9759	7471	7568	15398	16677	14884
13	3522	4837	4285	659	3497	3546	6809	7319	5218
13	12279	11651	10878	8728	6356	6453	14284	15567	13786
14	3316	5809	5406	2245	3904	3886	5187	5826	3861
14	11717	11255	10481	8165	5663	5756	13583	14888	13132
15	3396	6382	6061	3164	4529	4485	4246	4926	3076
15	11046	10846	10075	7508	4773	4857	12664	14012	12304
16	10544	10564	9799	7034	4094	4169	11949	13332	11665
16	4243	7303	6975	3920	4543	4468	3646	4700	3203
17	4698	8184	7977	5330	6049	5962	2091	3238	2326
17	10175	10469	9714	6724	3503	3559	11256	12699	11100
18	3705	7169	6971	4483	5757	5692	2948	3548	1938
18	10582	11255	10519	7277	3676	3678	10945	12546	11122
19	2856	6386	6232	4086	5946	5902	3586	3724	1686
19	9749	10843	10143	6658	2877	2826	9623	11289	9972
20	2315	5527	5299	3034	5286	5266	4594	4773	2637
20	9894	10761	10041	6673	2970	2953	10122	11727	10325
21	9842	10391	9651	6473	3011	3042	10611	12108	10575
21	2420	4815	4452	1812	4539	4551	5716	5997	3843
22	2772	3765	3254	810	4536	4597	7183	7373	5162
22	9312	9523	8768	5828	2858	2944	10765	12098	10407
23	1607	3502	3213	1951	5491	5531	6660	6555	4306
23	10979	10478	9705	7427	5107	5213	13045	14284	12483
24	9985	9567	8794	6433	4232	4349	12157	13343	11513
24	1750	2628	2371	2304	6050	6107	7449	7189	4941
25	8935	8865	8101	5396	2986	3106	10907	12107	10306
26	8889	8494	7722	5338	3498	3634	11317	12404	10517
26	1605	3063	3433	4687	8310	8349	7549	6589	4591
27	9578	8867	8094	6049	4437	4573	12239	13288	11364
27	1607	4107	4437	5120	8527	8546	6760	5635	3761
28	8712	7751	6980	5253	4426	4578	11898	12777	10759
28	1635	4848	5086	5136	8282	8285	5862	4728	2859
29	7479	7014	6245	3949	3129	3286	10442	11337	9345
29	1637	5286	5397	4756	7615	7605	5004	4090	2028
30	6439	6507	5765	2889	2227	2379	9179	10077	8110
31	8305	11654	11358	8188	7215	7074	3065	5226	5661
31	2824	6369	6539	5891	8498	8472	4511	3167	1605
32	9045	12362	12049	8809	7581	7434	3745	5885	6409
32	3977	7541	7711	6853	9134	9090	3904	2177	1601
33	3794	7115	7375	7009	9618	9589	4874	3093	2363
33	8246	11439	11091	7767	6485	6339	3608	5770	5900
34	2966	6089	6386	6385	9306	9293	5561	4005	2714
34	9881	13104	12755	9394	7792	7639	4724	6861	7354
35	8259	11213	10800	7304	5584	5433	4424	6535	6326
36	8932	11897	11482	7970	6087	5933	4810	6960	6905
37	8247	10891	10411	6775	4563	4408	5332	7347	6801
38	9492	11762	11204	7478	4459	4307	7042	9052	8403
39	11016	13252	12679	8947	5713	5569	8207	10293	9816
40	10636	12766	12179	8448	5140	4999	8163	10207	9602
41	10672	12579	11961	8248	4743	4613	8677	10664	9902
42	11151	13129	12518	8799	5322	5192	8879	10911	10252
43	11071	12380	11692	8139	4355	4278	10172	12011	10928
44	10763	12350	11692	8045	4340	4235	9406	11307	10352
45	11263	12976	12329	8656	5000	4887	9522	11489	10662
46	11974	13729	13084	9407	5755	5642	9985	11999	11266
47	13627	15942	15369	11637	8324	8187	10153	12311	12148

To be continued on next page...

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DECIBEL - Main Result

Calculation: Yhteisvaikutus_VE2_30WTG_Konnunsuo_LapinsaloVE1_PilpankangasVE1

...continued from previous page

WTG	A	B	C	D	E	F	G	H	I
48	15182	17259	16644	12928	9388	9267	12011	14162	13909
49	15360	17284	16648	12956	9328	9216	12478	14614	14253
50	15563	17348	16694	13032	9341	9237	12935	15054	14602
51	16298	18187	17544	13862	10207	10098	13383	15525	15190
52	16905	18922	18294	14591	10990	10875	13675	15834	15629
53	18116	20126	19495	15796	12178	12066	14798	16962	16808
54	17345	19433	18814	15101	11533	11415	13936	16101	15974
55	17636	19564	18923	15238	11587	11478	14517	16674	16434
56	17042	18850	18195	14535	10840	10738	14209	16349	15993
57	16467	18177	17512	13874	10150	10053	13884	16004	15548
58	17139	18713	18032	14438	10678	10590	14748	16857	16340
59	17839	19484	18809	15196	11450	11358	15245	17372	16937
60	18355	20048	19377	15752	12015	11921	15627	17765	17385
61	18871	20860	20224	16531	12897	12787	15537	17703	17563
62	21605	23303	22628	19013	15269	15177	18642	20800	20539
63	23251	25158	24505	20839	17150	17047	19818	21986	21927
64	23593	25332	24658	21037	17298	17205	20452	22617	22441
65	23974	25782	25116	21476	17754	17658	20690	22857	22742
66	23110	24939	24276	20629	16915	16817	19826	21994	21871
67	22495	24289	23623	19984	16261	16165	19306	21471	21306
68	22608	24560	23913	20236	16564	16460	19124	21292	21249
69	9489	11215	10582	6888	3321	3193	8239	10083	9064
70	9681	11668	11067	7341	3985	3843	7813	9754	8925
71	9075	11115	10526	6795	3574	3426	7305	9209	8331
72	15165	17400	16809	13080	9649	9519	11669	13833	13709
73	15866	18071	17473	13746	10276	10150	12360	14525	14417
74	8597	10933	10394	6680	3926	3769	6327	8279	7537

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DECIBEL - Assumptions for noise calculation

Calculation: Yhteisvaikutus_VE2_30WTG_Konnunsuo_LapinsaloVE1_PilpankangasVE1

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_Pyhäntä_Konnunsuo_0.w2r (5)
Area type with hard ground: jarvi_laatikko
Ground factor for hard ground: 0,0
Meteorological coefficient, C0:
0,0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure tones penalty is added to total noise impact at receptors
Noise sensitive area
Height above ground level, when no value in NSA object:
4,0 m; Don't allow override of model height with height from NSA object
Uncertainty margin:
0,0 dB; Uncertainty margin in NSA has priority
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0,0 dB(A)
Octave data required
Frequency dependent air absorption

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

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89

WTG: Siemens Gamesa SG 6.6-170 6600 170.0 !O!
Noise: (AM 0, 6.6MW) - 106dB(A) + 2dB(A)

Source	Source/Date	Creator	Edited
SGRE	17.12.2021	USER	10.4.2024 8.54

Siemens Gamesa Renewable Energy and its affiliates reserve the right to change the above specifications without prior notice.

					Octave data							
Status	Hub height [m]	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones	63 [dB]	125 [dB]	250 [dB]	500 [dB]	1000 [dB]	2000 [dB]	4000 [dB]	8000 [dB]
From Windcat	215,0	8,0	108,0	No	88,5	95,4	98,1	99,9	103,8	101,9	95,3	85,0

WTG: NORDEX N163/6.X 6800 163.0 !O!
Noise: Nordex N163/6.X Third octave sound power levels, revision 02

Source	Source/Date	Creator	Edited
Nordex	8.11.2021	USER	20.3.2024 15.39

					Octave data							
Status	Hub height [m]	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones	63 [dB]	125 [dB]	250 [dB]	500 [dB]	1000 [dB]	2000 [dB]	4000 [dB]	8000 [dB]
From Windcat	200,0	8,0	109,9	No	93,8	98,6	101,7	103,2	104,8	103,0	91,5	71,3

WTG: Generic RD200 HH200 7200 200.0 !O!
Noise: V172 - 7,2 MW PO7200 STE + 2dB

Source	Source/Date	Creator	Edited
Vestas	30.6.2022	USER	9.4.2024 14.09

DMS no.: 0128-4336_00

					Octave data							
Status	Hub height [m]	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones	63 [dB]	125 [dB]	250 [dB]	500 [dB]	1000 [dB]	2000 [dB]	4000 [dB]	8000 [dB]
From Windcat	200,0	8,0	108,9	No	92,4	100,0	103,3	103,5	101,9	97,4	89,9	79,2

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DECIBEL - Assumptions for noise calculation

Calculation: Yhteisvaikutus_VE2_30WTG_Konnunsuo_LapinsaloVE1_PilpankangasVE1

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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DECIBEL - Assumptions for noise calculation

Calculation: Yhteisvaikutus_VE2_30WTG_Konnunsuo_LapinsaloVE1_PilpankangasVE1

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

Noise sensitive area: I Lomarakennus I

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

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

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Calculated:
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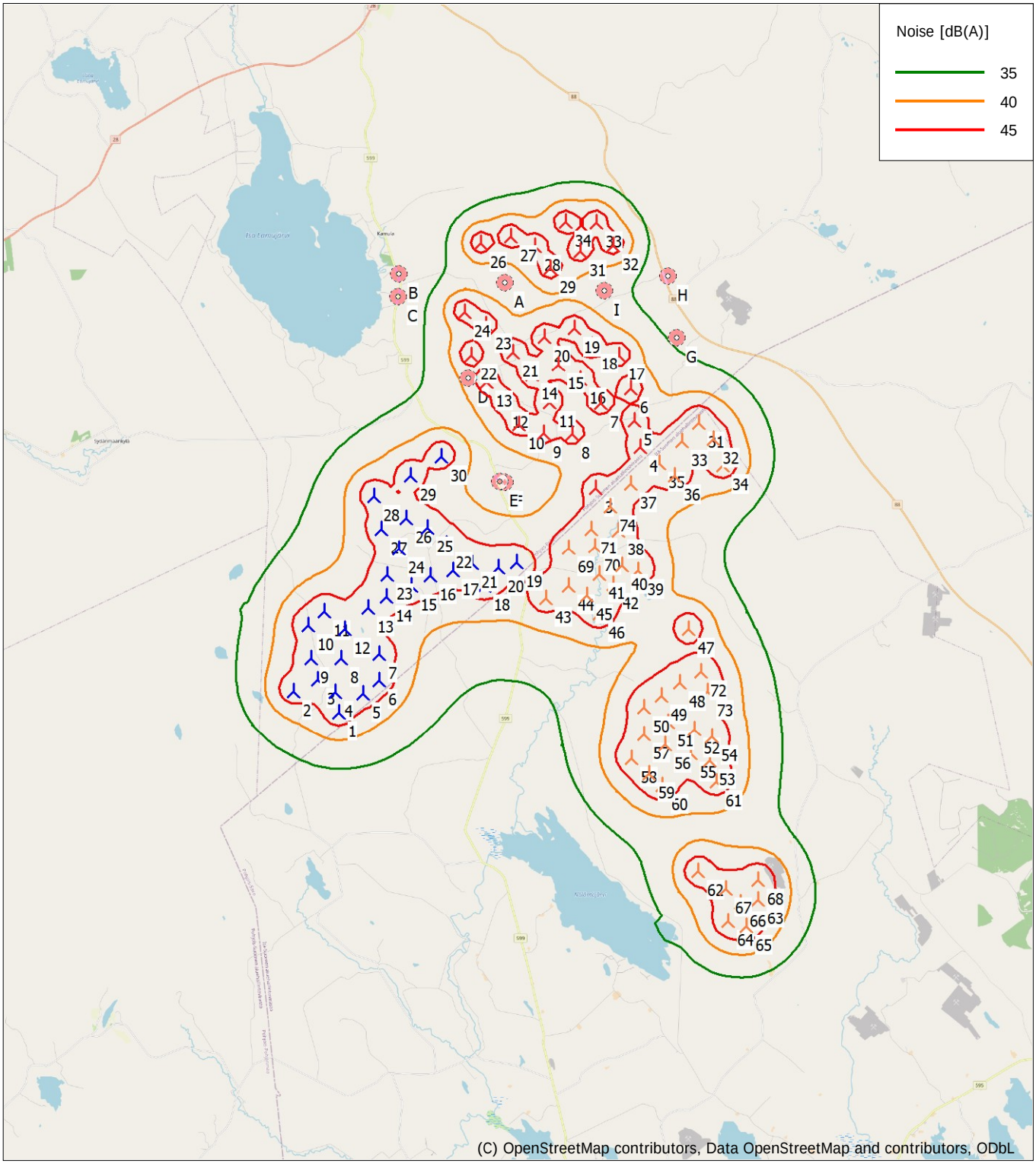
DECIBEL - Map 8,0 m/s

Calculation: Yhteisvaikutus_VE2_30WTG_Konnunsuo_LapinsaloVE1_PilpankangasVE1

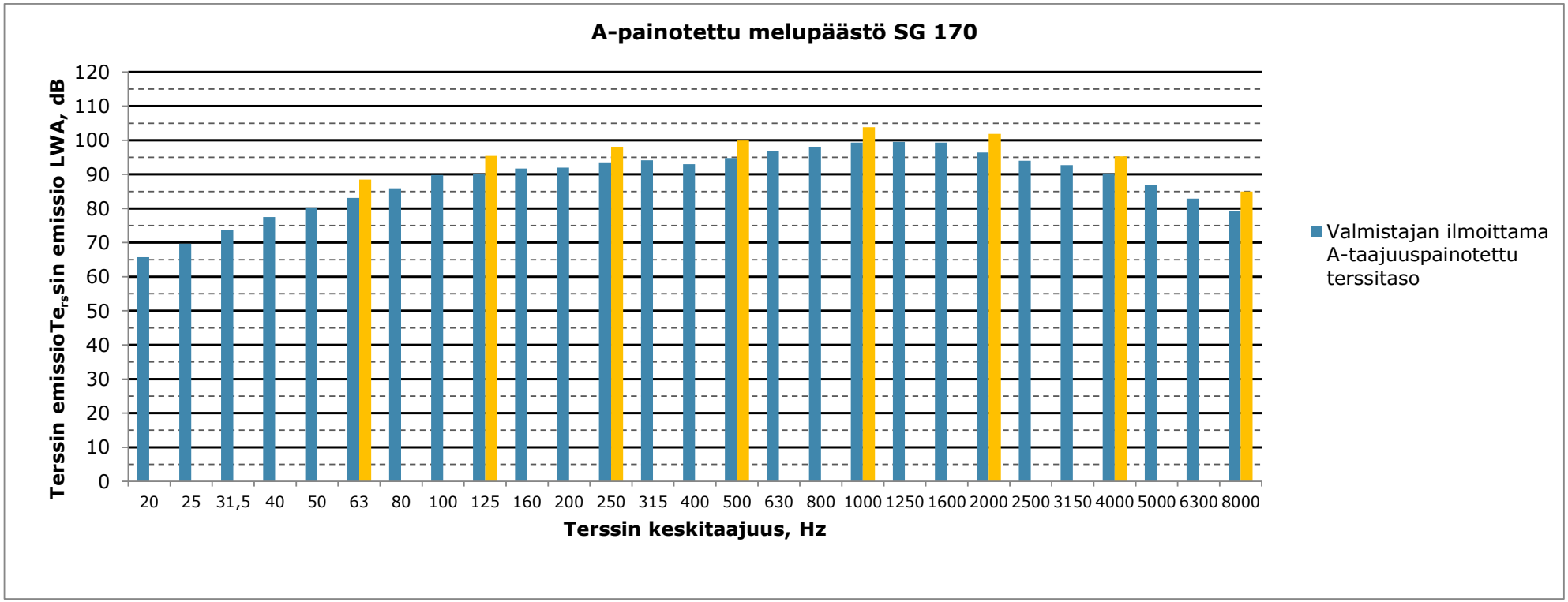


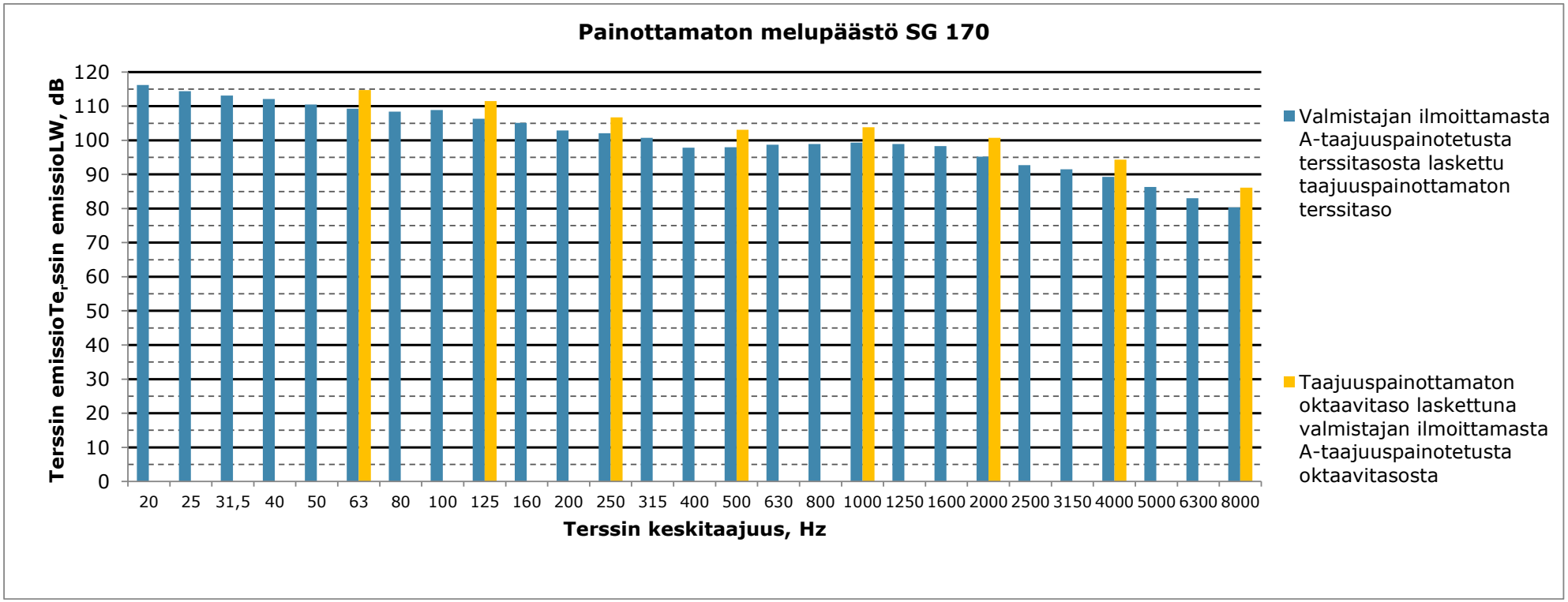
Map: EMD OpenStreetMap , Print scale 1:200 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 472 212 North: 7 087 165

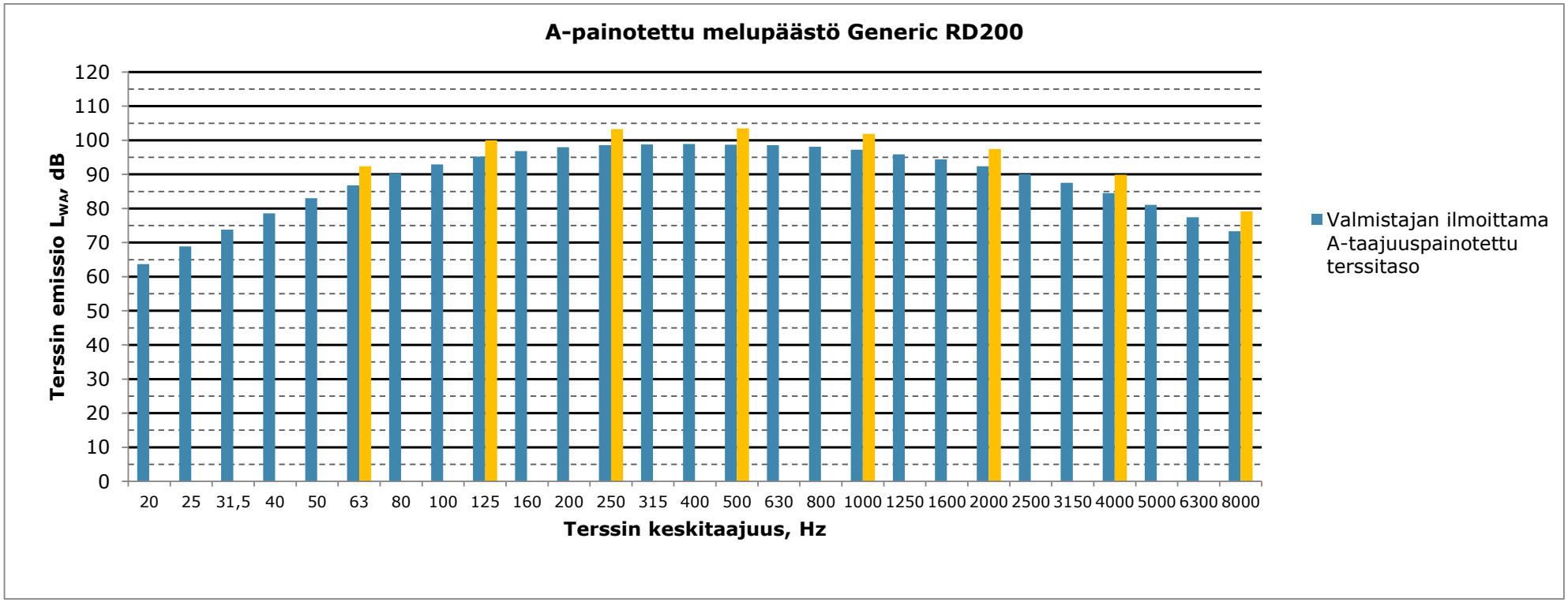
New WTG Noise sensitive area

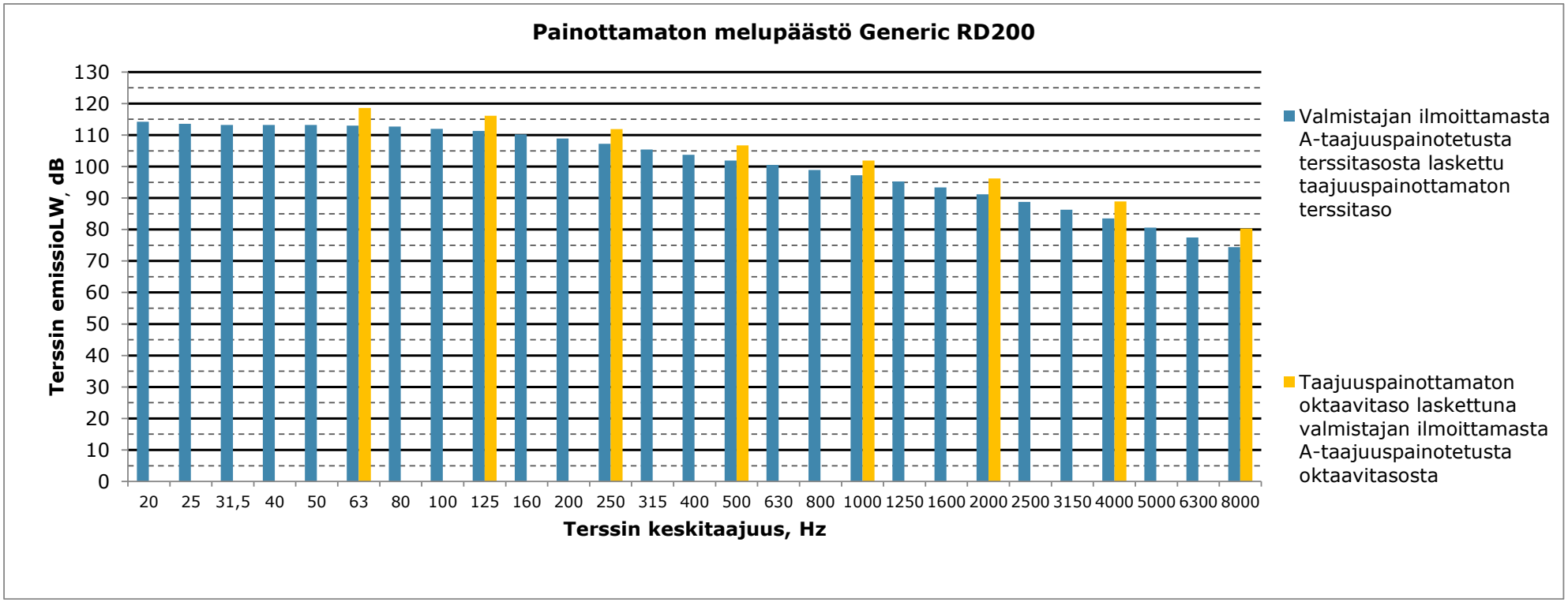
Noise calculation model: ISO 9613-2 General. Wind speed: 8,0 m/s
Height above sea level from active line object

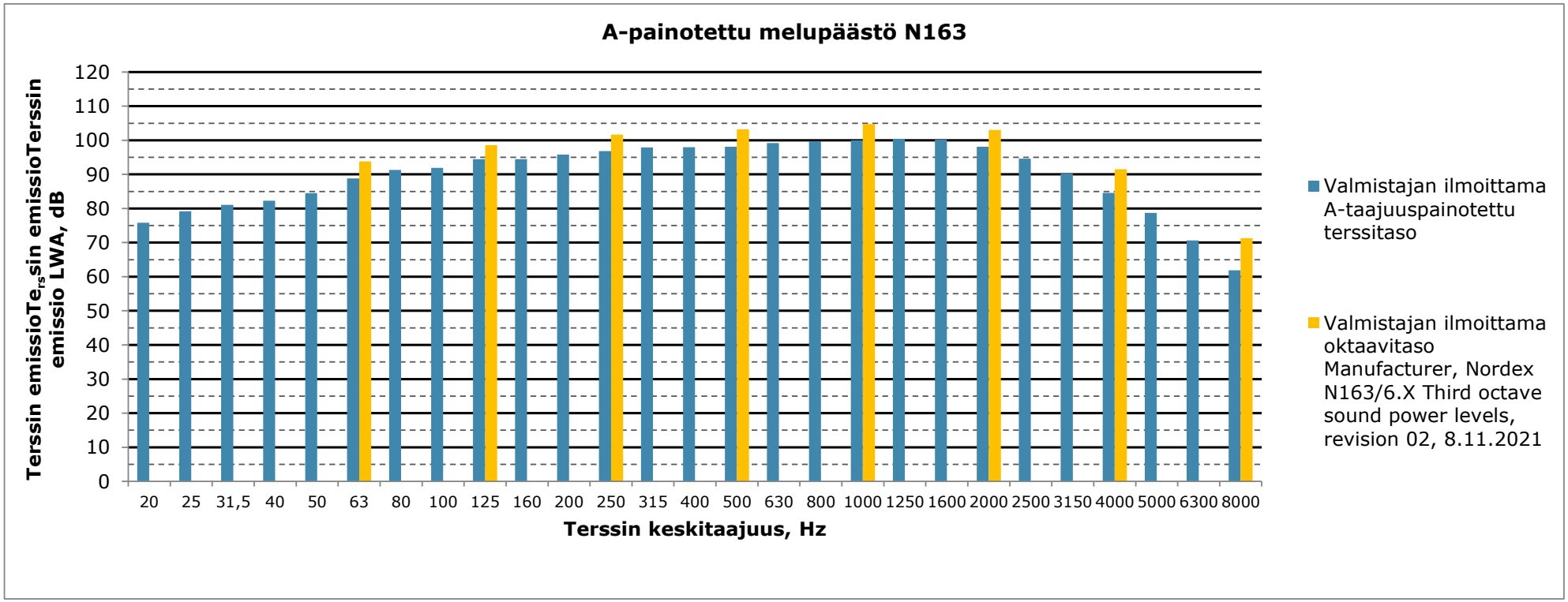
Liite 11: Matalataajuisen yhteismelun rakennuskohtaiset arvot Konnunsuon vaihtoehdossa VE1.

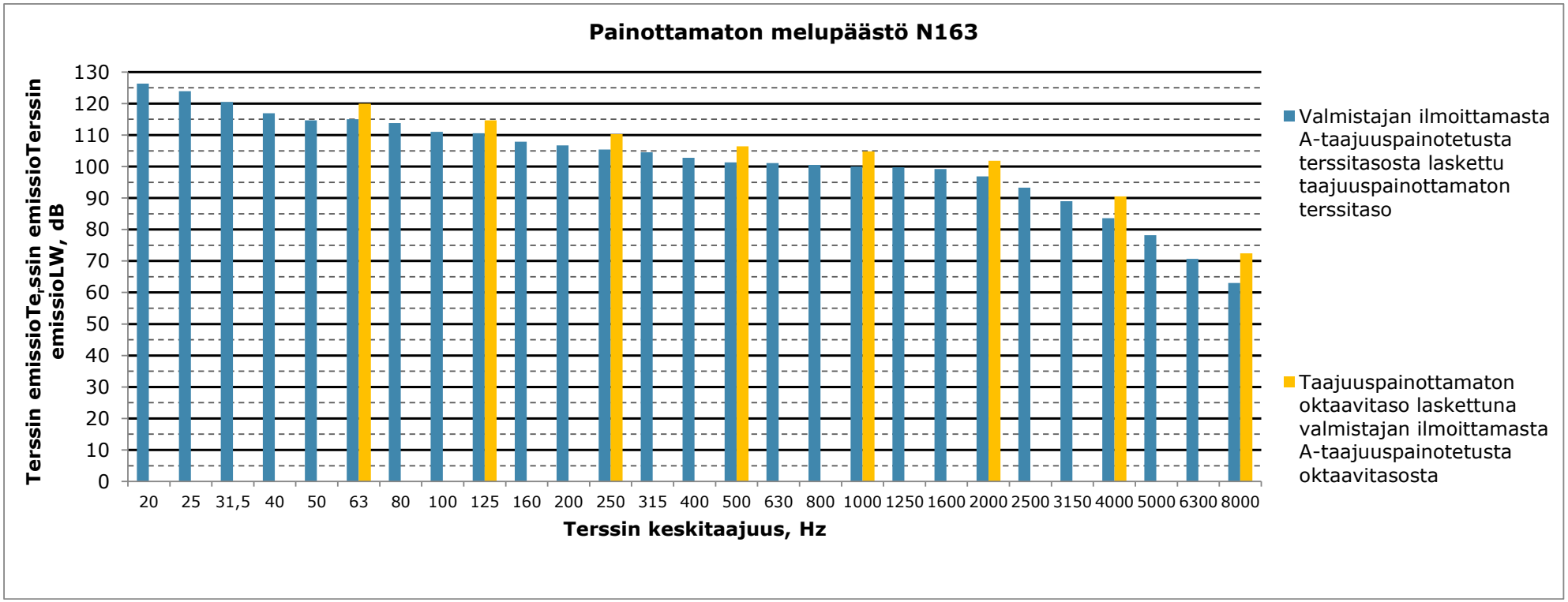

A-painotettu melupäästö SG 170
Terssin emissioTe$_{rs}$sin emissio LWA, dB
120
110
100
90
80
70
60
50
40
30
20
10
0
20 25 31,5 40 50 63 80 100 125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000 5000 6300 8000
Terssin keskitaajuus, Hz
Valmistajan ilmoittama A-taajuuspainotettu terssitaso

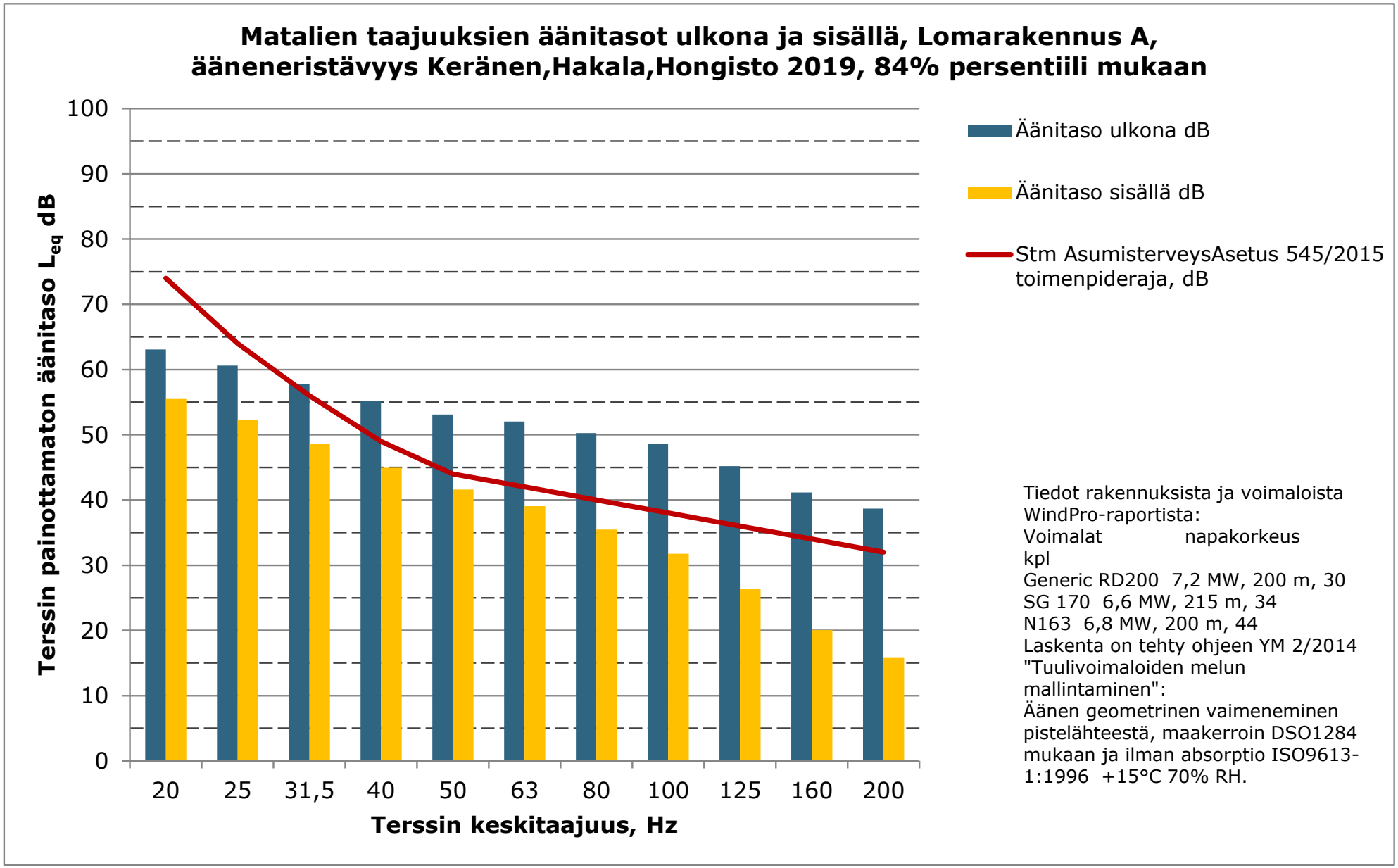

Painottamaton melupäästö SG 170
Terssin emissioTe,ssin emissioLW, dB
120
110
100
90
80
70
60
50
40
30
20
10
0
20 25 31,5 40 50 63 80 100 125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000 5000 6300 8000
Terssin keskitaajuus, Hz
Valmistajan ilmoittamasta A-taajuuspainotetusta terssitasosta laskettu taajuuspainottamaton terssitaso
Taajuuspainottamaton oktaavitaso laskettuna valmistajan ilmoittamasta A-taajuuspainotetusta oktaavitasosta


A-painotettu melupäästö Generic RD200
Terssin emissio L_{WA} dB
120
110
100
90
80
70
60
50
40
30
20
10
0
20 25 31,5 40 50 63 80 100 125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000 5000 6300 8000
Terssin keskitaajuus, Hz
Valmistajan ilmoittama A-taajuuspainotettu terssitaso

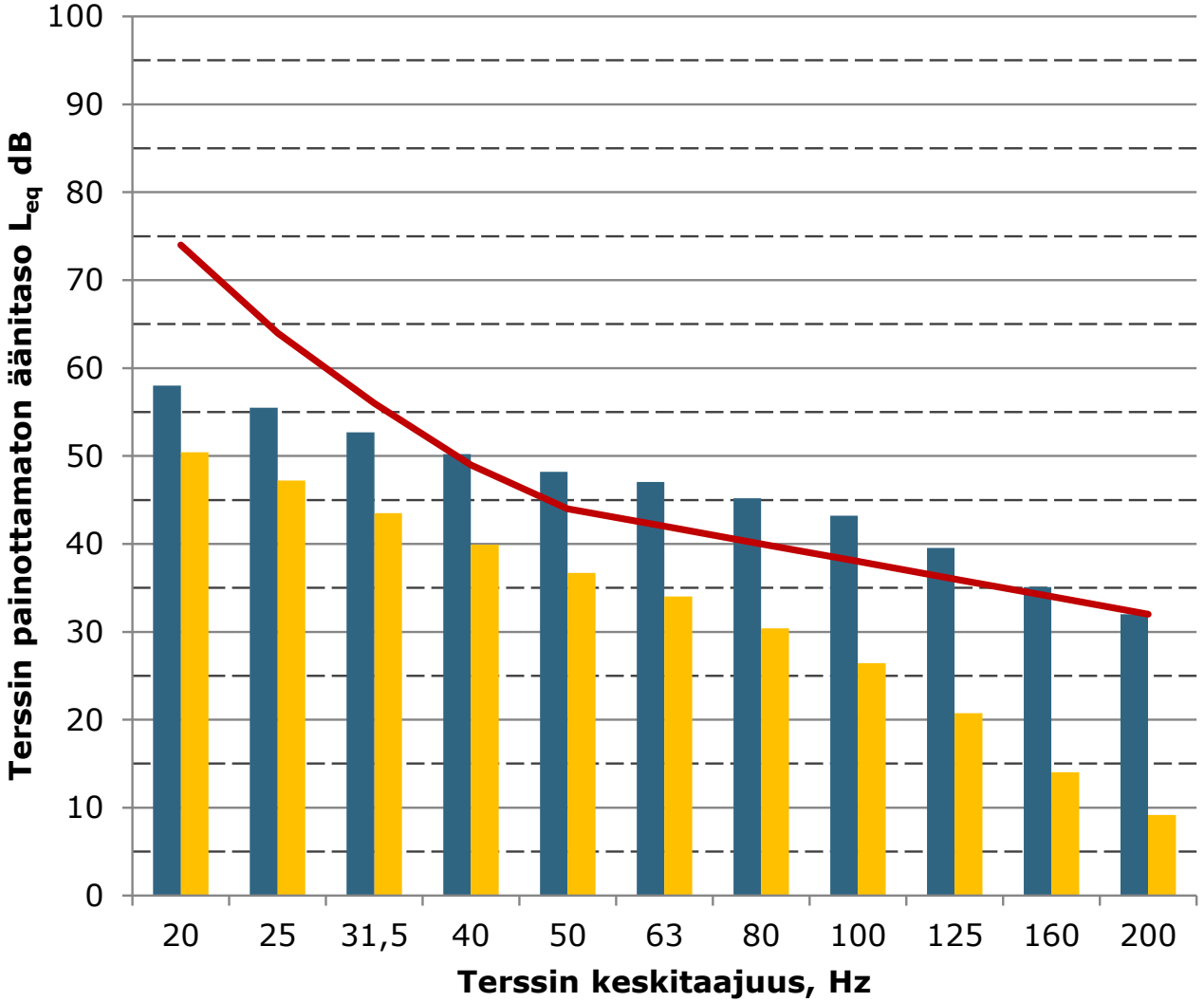

Painottamaton melupäästö Generic RD200
Terssin emissioLW, dB
130
120
110
100
90
80
70
60
50
40
30
20
10
0
20 25 31,5 40 50 63 80 100 125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000 5000 6300 8000
Terssin keskitaajuus, Hz
Valmistajan ilmoittamasta A-taajuuspainotetusta terssitasosta laskettu taajuuspainottamaton terssitaso
Taajuuspainottamaton oktaavitaso laskettuna valmistajan ilmoittamasta A-taajuuspainotetusta oktaavitasosta

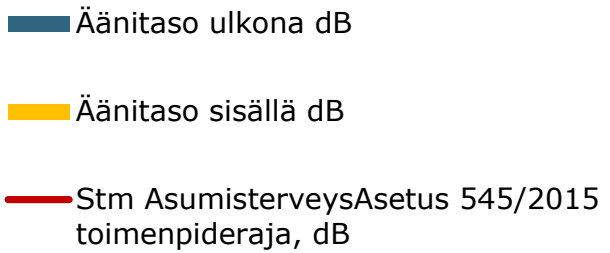

A-painotettu melupäästö N163
Terssin emissioTe$_{rs}$sin emissioTerssin emissio LWA, dB
120
110
100
90
80
70
60
50
40
30
20
10
0
20 25 31,5 40 50 63 80 100 125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000 5000 6300 8000
Terssin keskitaajuus, Hz
Valmistajan ilmoittama A-taajuuspainotettu terssitaso
Valmistajan ilmoittama oktaavitaso Manufacturer, Nordex N163/6.X Third octave sound power levels, revision 02, 8.11.2021


Painottamaton melupäästö N163
Terssin emissioTerssin emissioLW, dB
130
120
110
100
90
80
70
60
50
40
30
20
10
0
20 25 31,5 40 50 63 80 100 125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000 5000 6300 8000
Terssin keskitaajuus, Hz
Valmistajan ilmoittamasta A-taajuuspainotetusta terssitasosta laskettu taajuuspainottamaton terssitaso
Taajuuspainottamaton oktaavitaso laskettuna valmistajan ilmoittamasta A-taajuuspainotetusta oktaavitasosta


Matalien taajuuksien äänitasot ulkona ja sisällä, Lomarakennus A, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan
Terssin painottamaton äänitaso L_{eq} dB
100
90
80
70
60
50
40
30
20
10
0
20
25
31,5
40
50
63
80
100
125
160
200
Terssin keskitaajuus, Hz
Äänitaso ulkona dB
Äänitaso sisällä dB
Stm AsumisterveysAsetus 545/2015 toimenpideraja, dB
Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus
kpl
Generic RD200 7,2 MW, 200 m, 30
SG 170 6,6 MW, 215 m, 34
N163 6,8 MW, 200 m, 44
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, Asuinrakennus B, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan



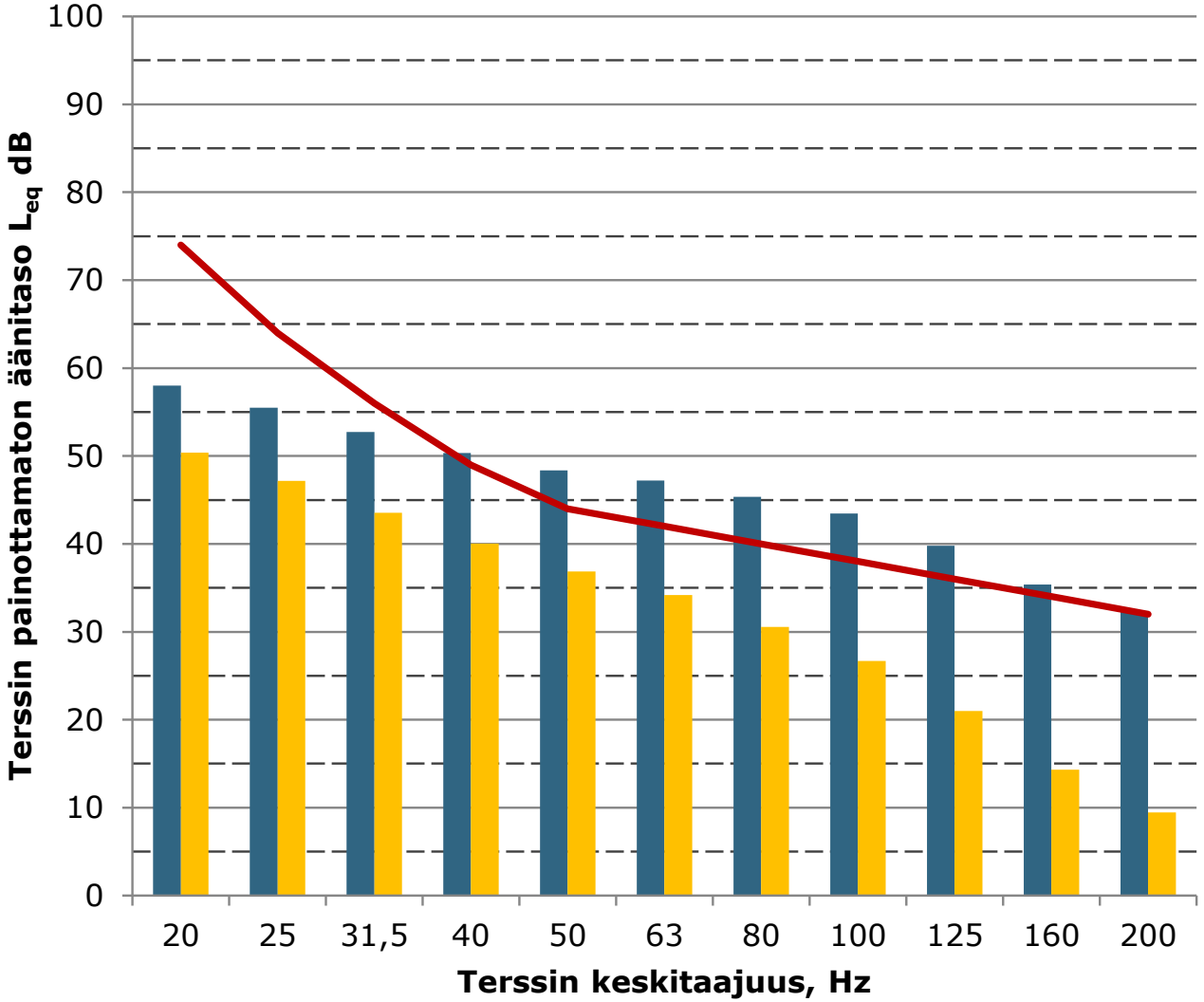


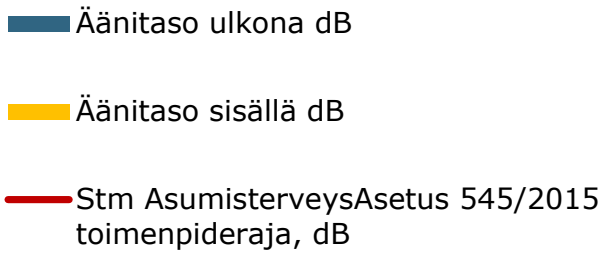
Tiedot rakennuksista ja voimaloista WindPro-raportista:

Voimalat	napakorkeus	kpl
Generic RD200	7,2 MW, 200 m,	30
SG 170	6,6 MW, 215 m,	34
N163	6,8 MW, 200 m,	44

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, Lomarakennus C, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan

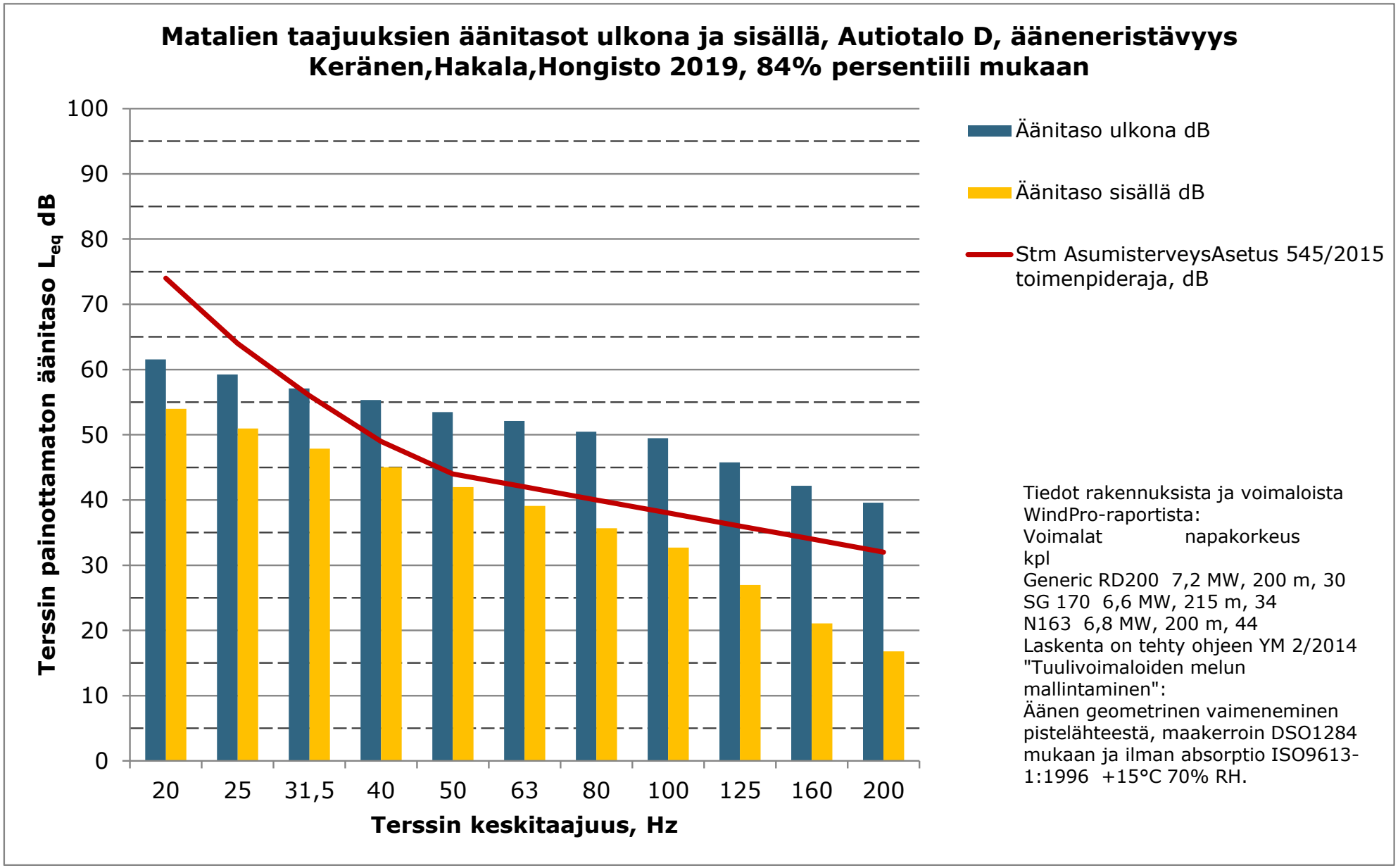




Tiedot rakennuksista ja voimaloista WindPro-raportista:

Voimalat	napakorkeus	kpl
Generic RD200	7,2 MW, 200 m,	30
SG 170	6,6 MW, 215 m,	34
N163	6,8 MW, 200 m,	44

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.

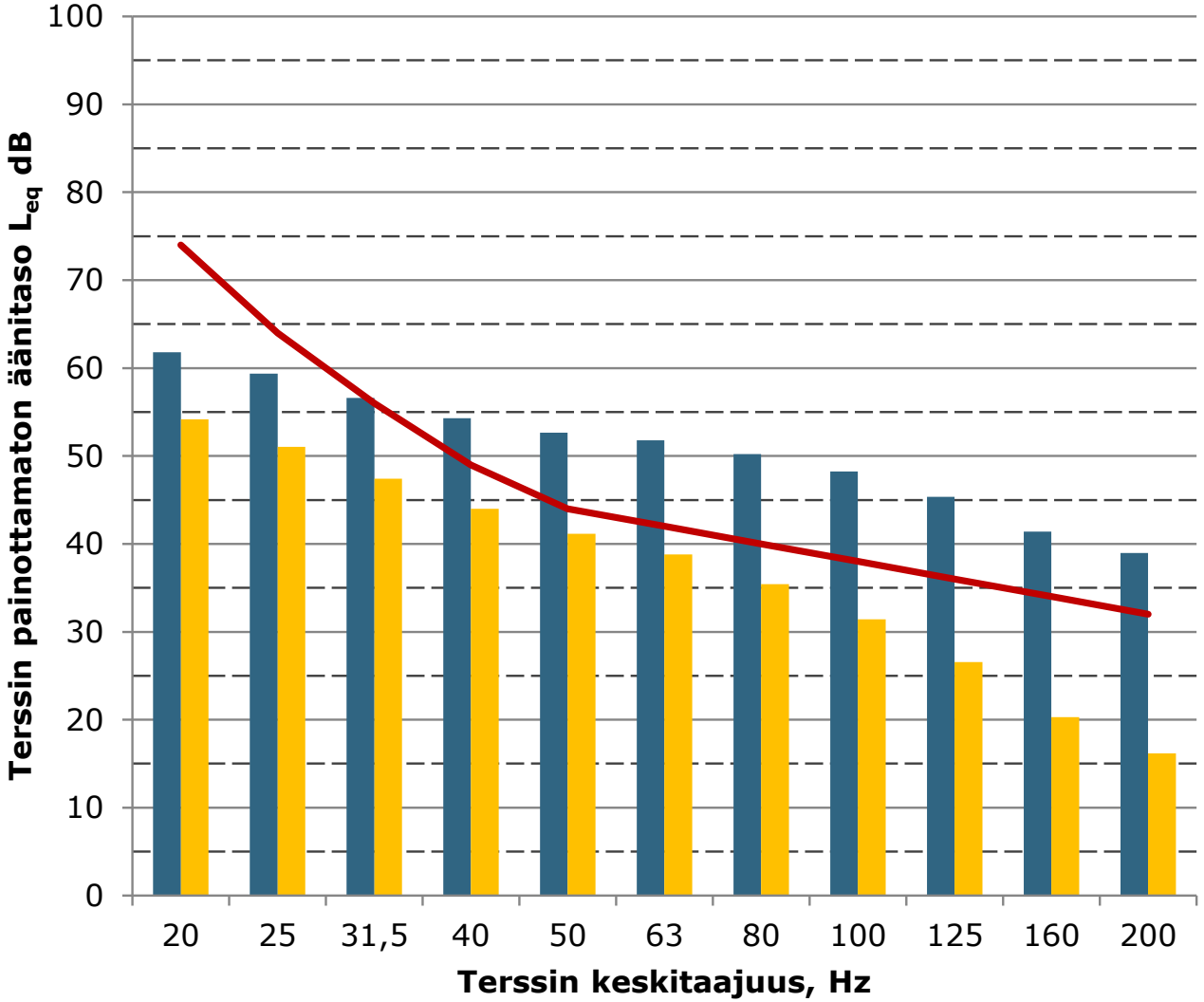


Tiedot rakennuksista ja voimaloista WindPro-raportista:

Voimalat	napakorkeus	kpl
Generic RD200	7,2 MW, 200 m,	30
SG 170	6,6 MW, 215 m,	34
N163	6,8 MW, 200 m,	44

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, Lomarakennus E, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan



Äänitaso ulkona dB

Äänitaso sisällä dB

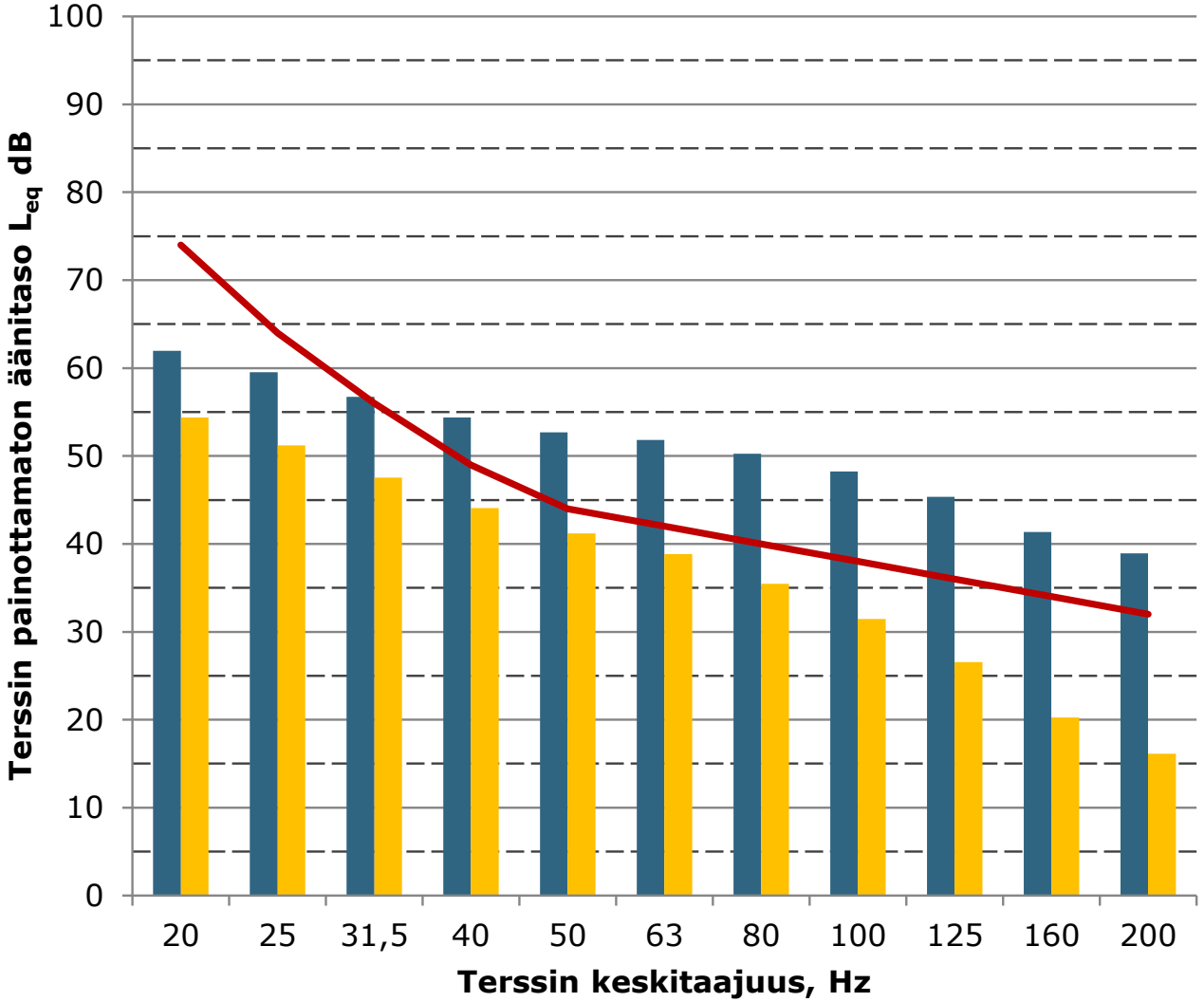
Stm AsumisterveysAsetus 545/2015 toimenpideraja, dB

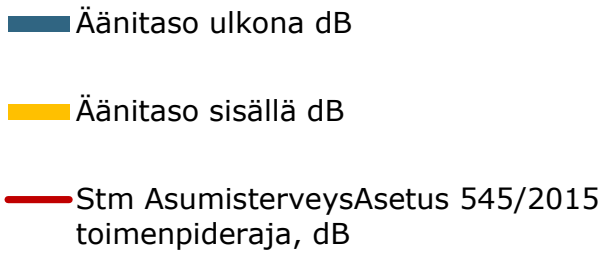
Tiedot rakennuksista ja voimaloista WindPro-raportista:

Voimalat	napakorkeus	kpl
Generic RD200	7,2 MW, 200 m,	30
SG 170	6,6 MW, 215 m,	34
N163	6,8 MW, 200 m,	44

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, Lomarakennus F, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan

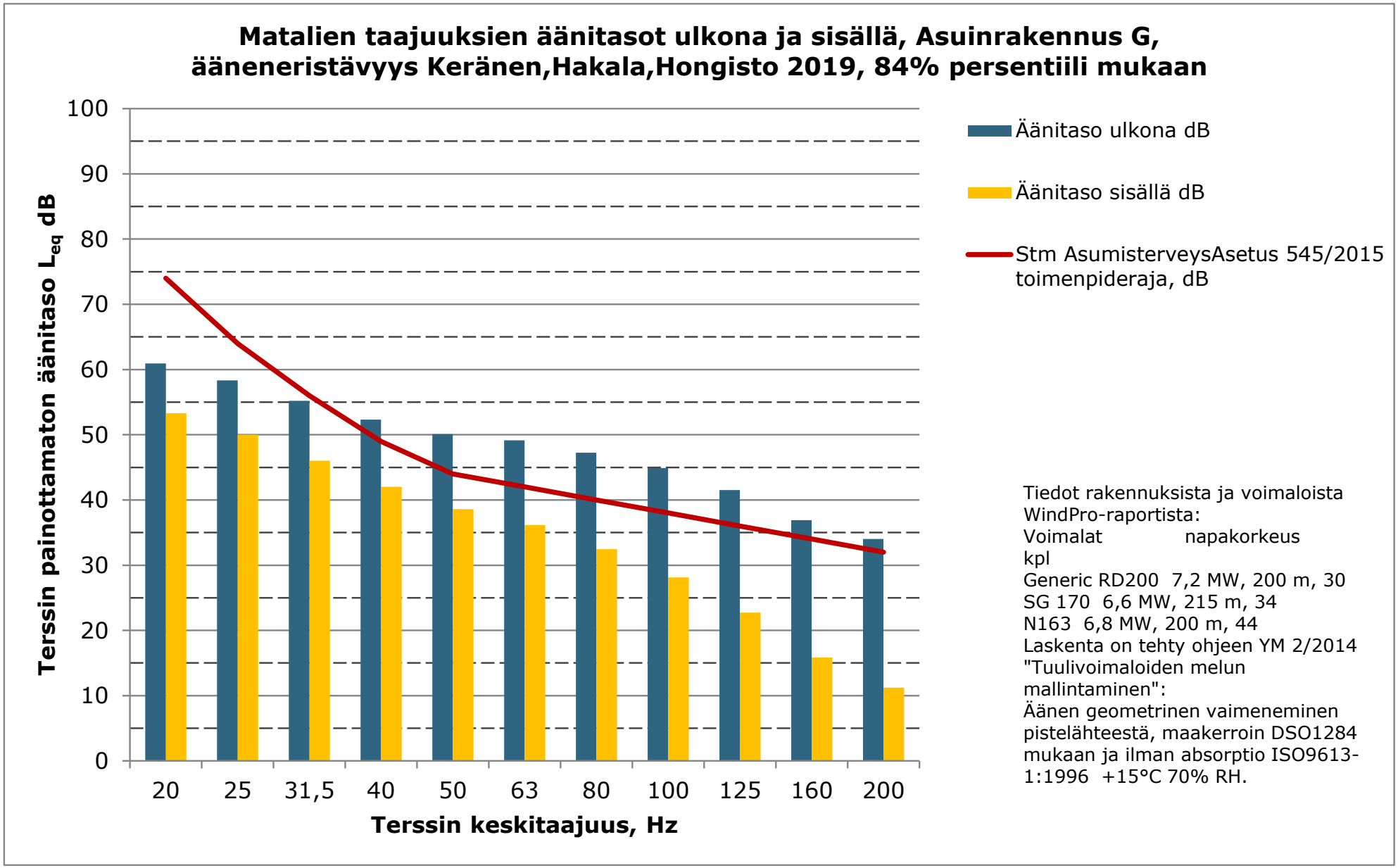


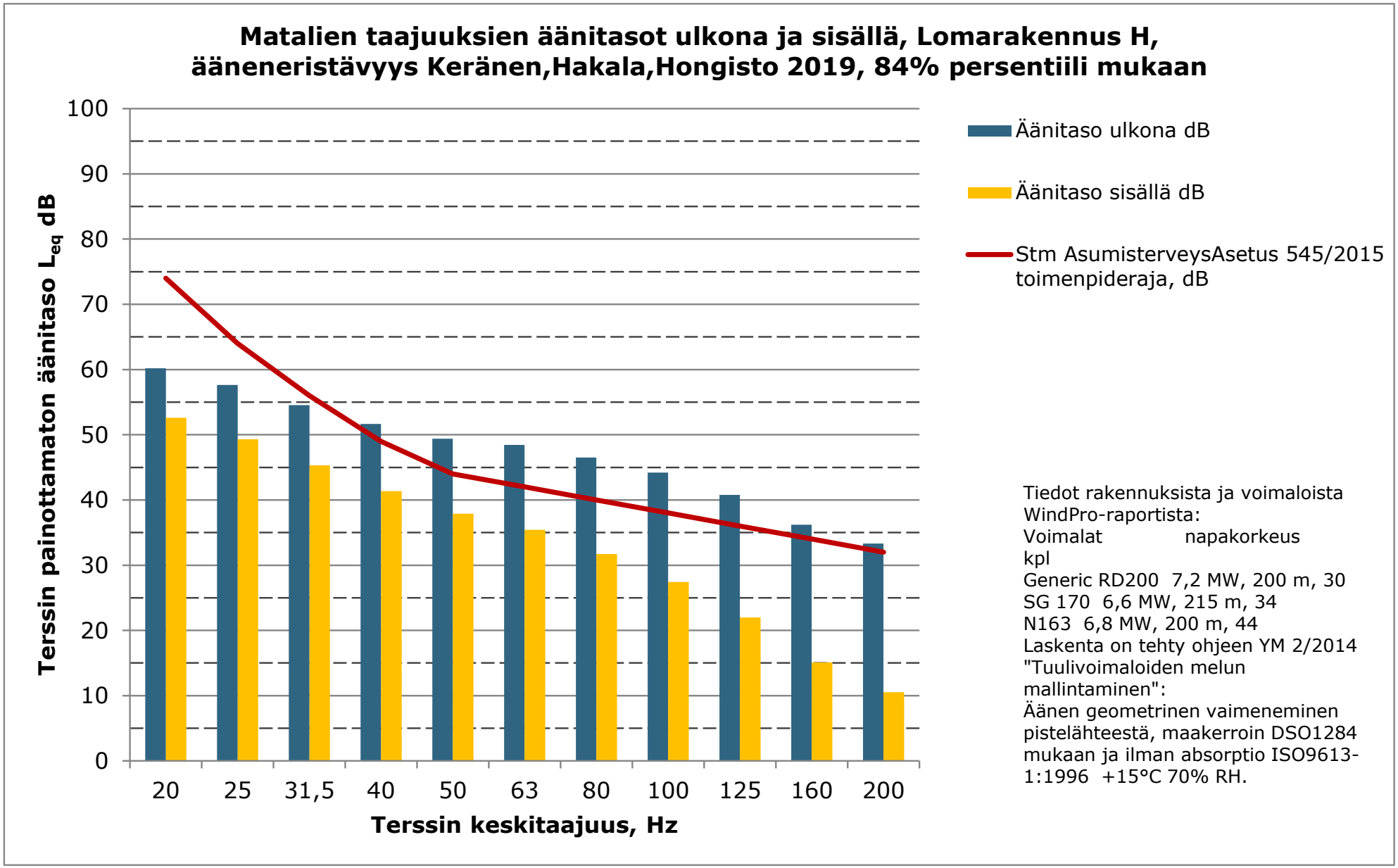


Tiedot rakennuksista ja voimaloista WindPro-raportista:

Voimalat	napakorkeus	kpl
Generic RD200	7,2 MW, 200 m,	30
SG 170	6,6 MW, 215 m,	34
N163	6,8 MW, 200 m,	44

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.

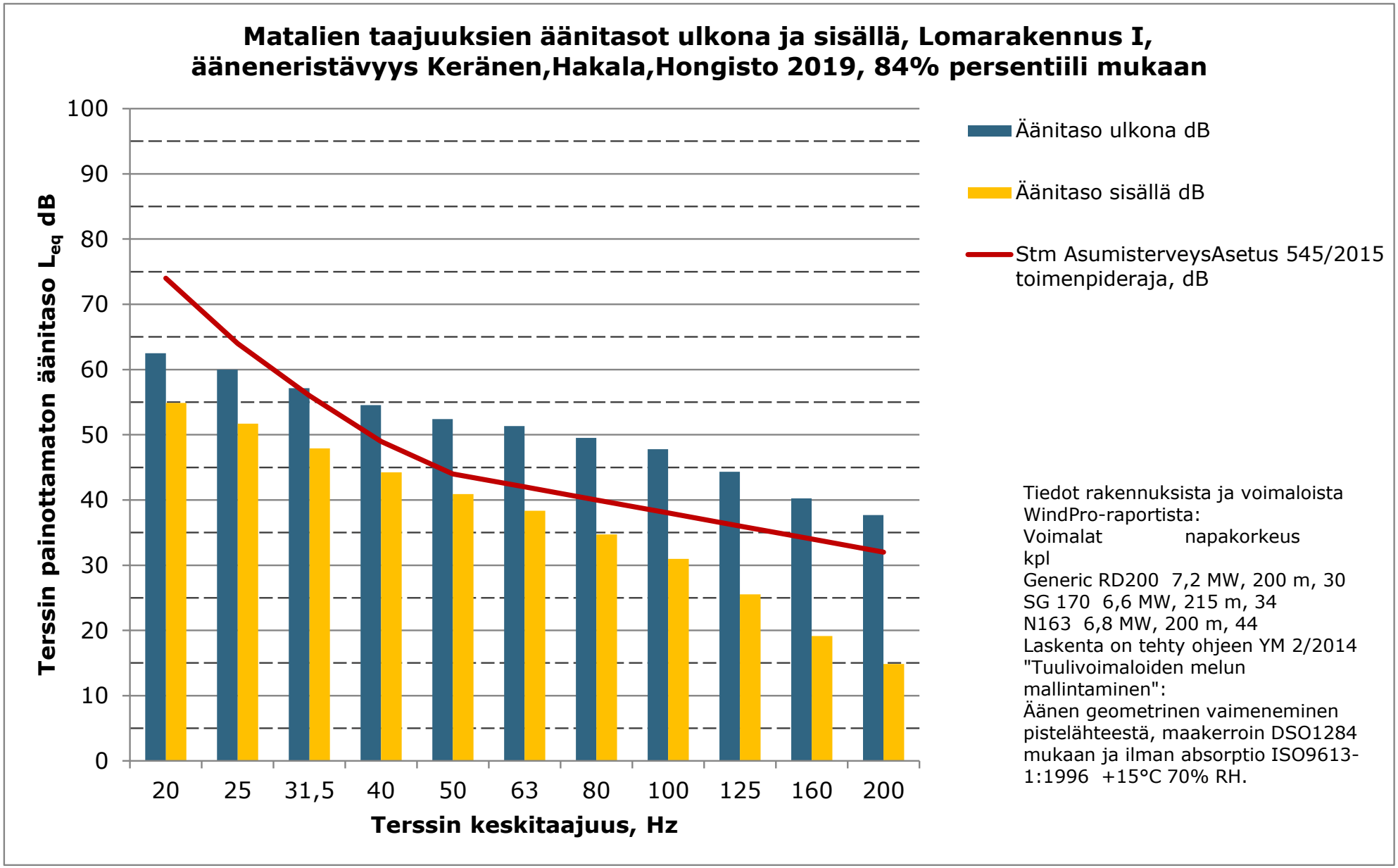

Matalien taajuuksien äänitasot ulkona ja sisällä, Asuinrakennus G, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan
Terssin painottamaton äänitaso L_{eq} dB
100
90
80
70
60
50
40
30
20
10
0
20
25
31,5
40
50
63
80
100
125
160
200
Terssin keskitaajuus, Hz
Äänitaso ulkona dB
Äänitaso sisällä dB
Stm AsumisterveysAsetus 545/2015 toimenpideraja, dB
Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus kpl
Generic RD200 7,2 MW, 200 m, 30
SG 170 6,6 MW, 215 m, 34
N163 6,8 MW, 200 m, 44
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.



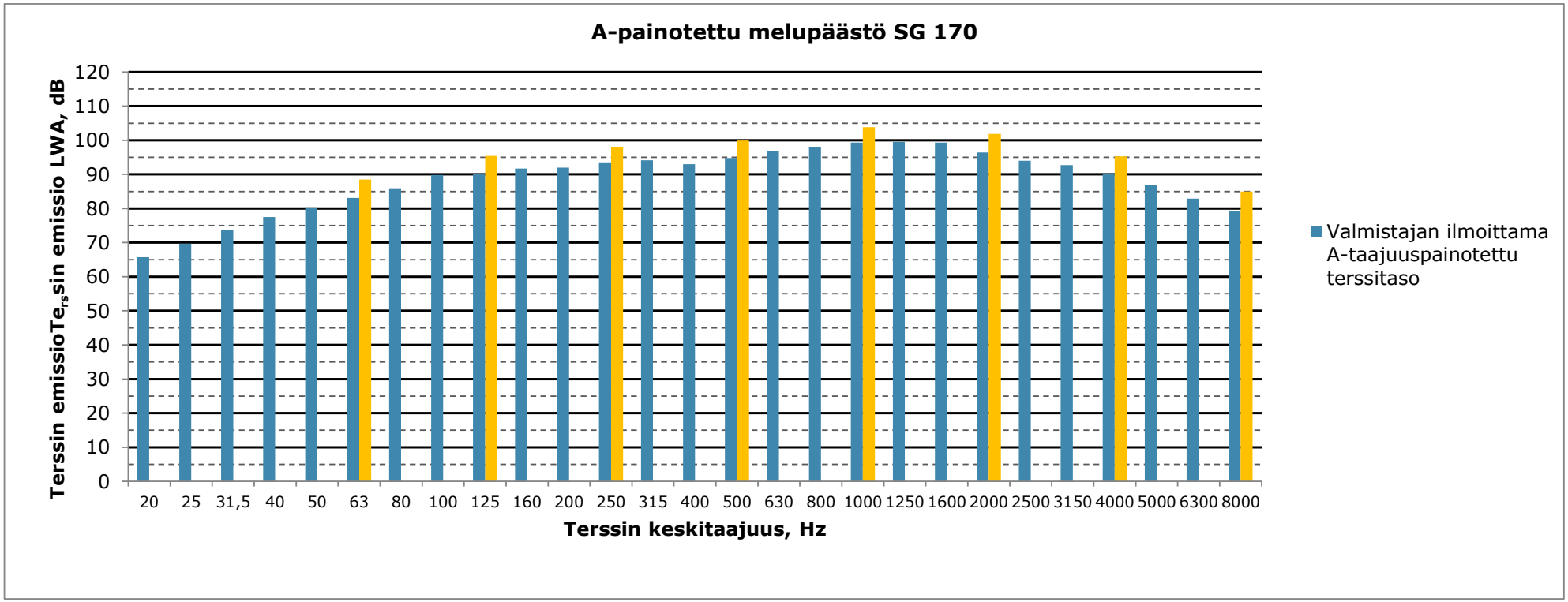
Tiedot rakennuksista ja voimaloista WindPro-raportista:

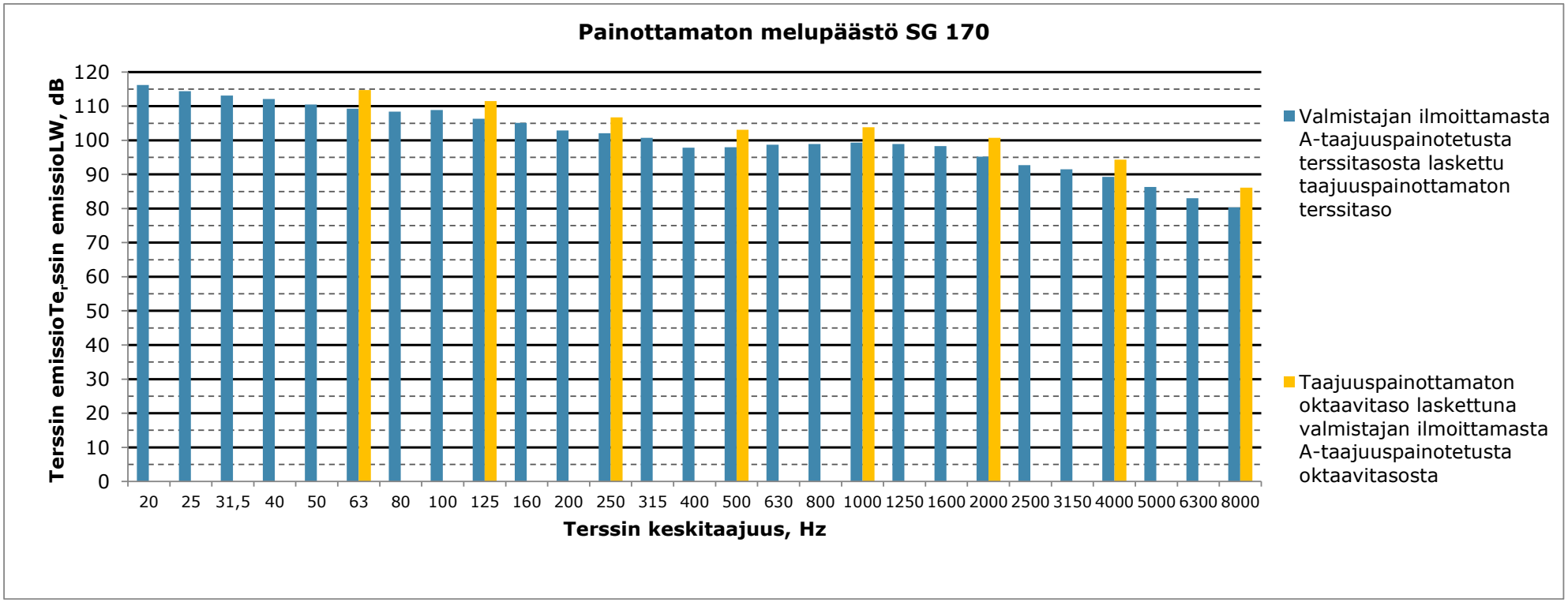
Voimalat	napakorkeus	kpl
Generic RD200	7,2 MW, 200 m,	30
SG 170	6,6 MW, 215 m,	34
N163	6,8 MW, 200 m,	44

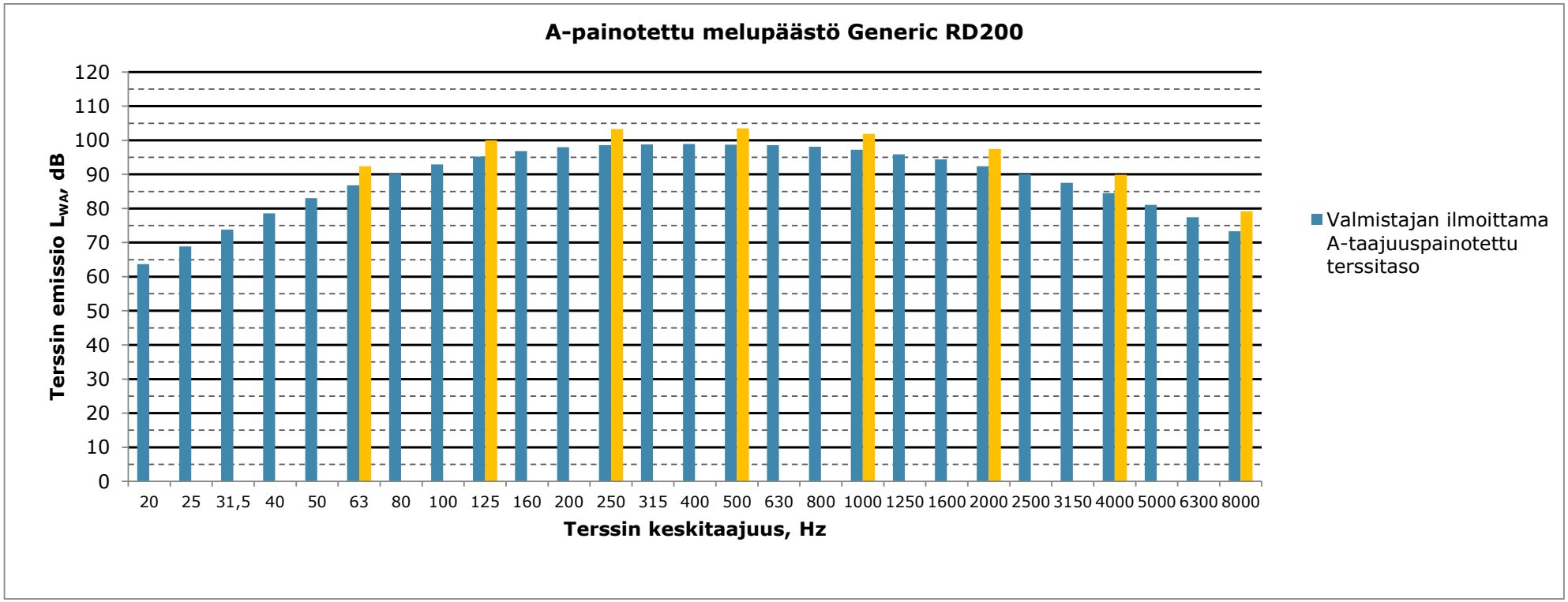
Laskenta on tehty ohjeen YM 2/2014 "Tuulivoimaloiden melun mallintaminen":
Äänen geometrinen vaimeneminen pistelähteestä, maakerroin DSO1284 mukaan ja ilman absorptio ISO9613-1:1996 +15°C 70% RH.

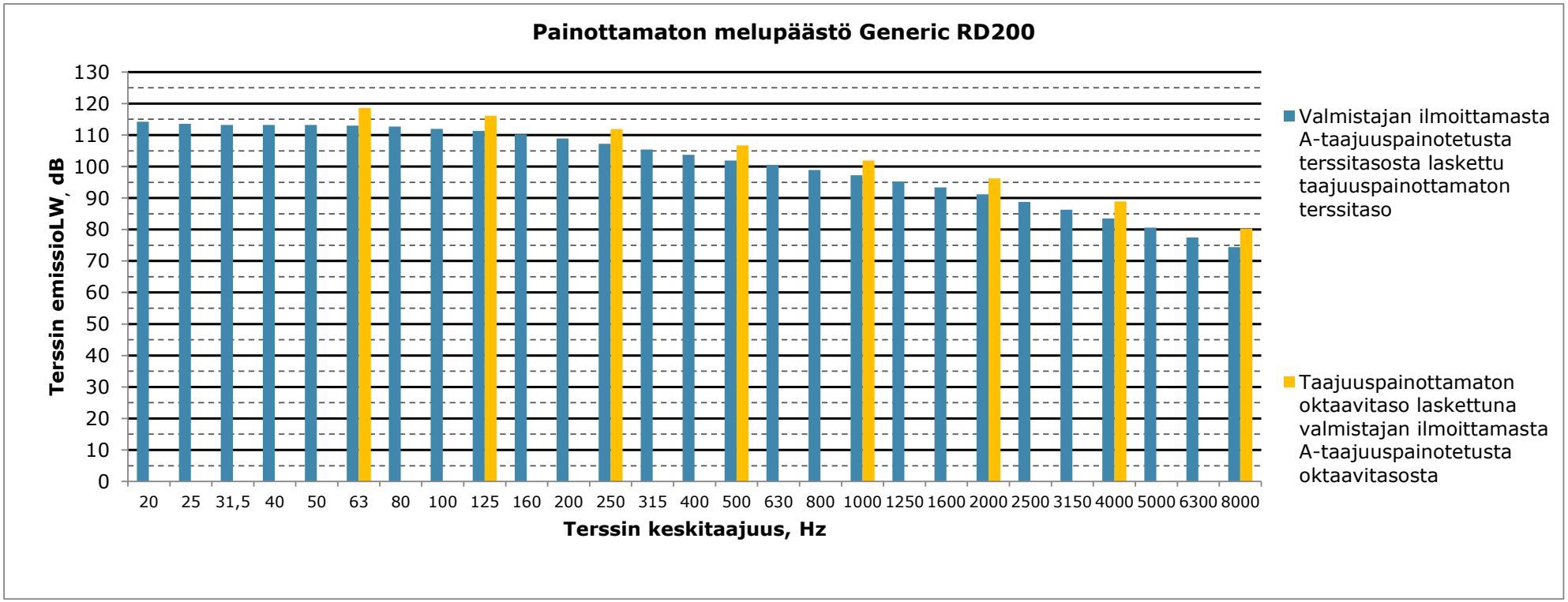

Matalien taajuuksien äänitasot ulkona ja sisällä, Lomarakennus I, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan
Terssin painottamaton äänitaso L_{eq} dB
100
90
80
70
60
50
40
30
20
10
0
20
25
31,5
40
50
63
80
100
125
160
200
Terssin keskitaajuus, Hz
Äänitaso ulkona dB
Äänitaso sisällä dB
Stm AsumisterveysAsetus 545/2015 toimenpideraja, dB
Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus
kpl
Generic RD200 7,2 MW, 200 m, 30
SG 170 6,6 MW, 215 m, 34
N163 6,8 MW, 200 m, 44
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.

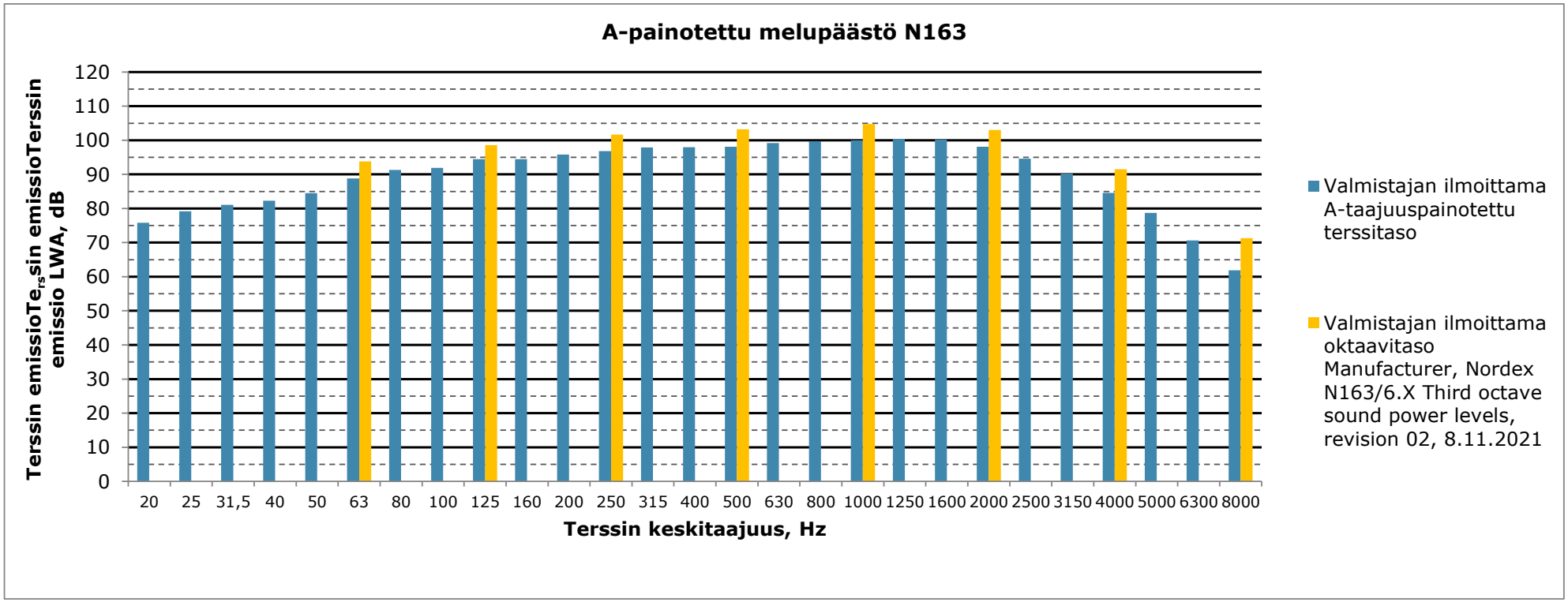
Liite 12: Matalataajuisen yhteismelun rakennuskohtaiset arvot Konnunsuon vaihtoehdossa VE2.

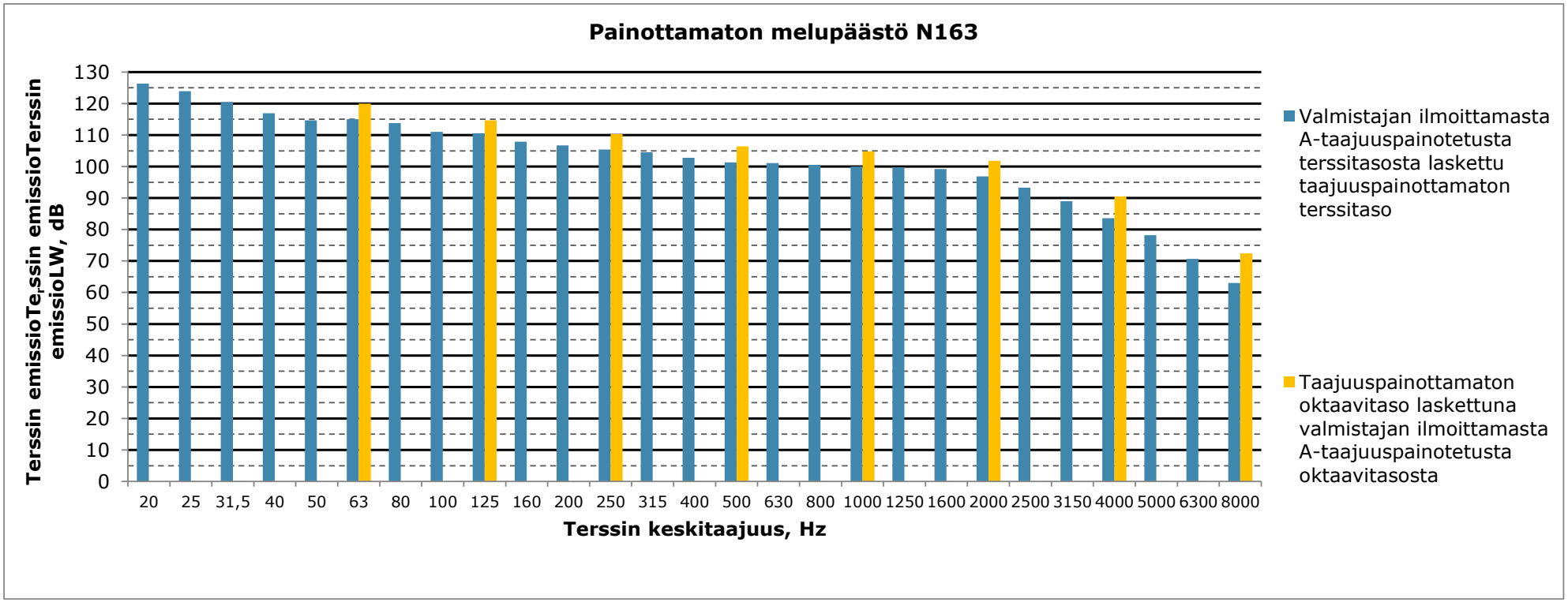

A-painotettu melupäästö SG 170
Terssin emissioTe$_{rs}$sin emissio LWA, dB
120
110
100
90
80
70
60
50
40
30
20
10
0
20 25 31,5 40 50 63 80 100 125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000 5000 6300 8000
Terssin keskitaajuus, Hz
Valmistajan ilmoittama A-taajuuspainotettu terssitaso

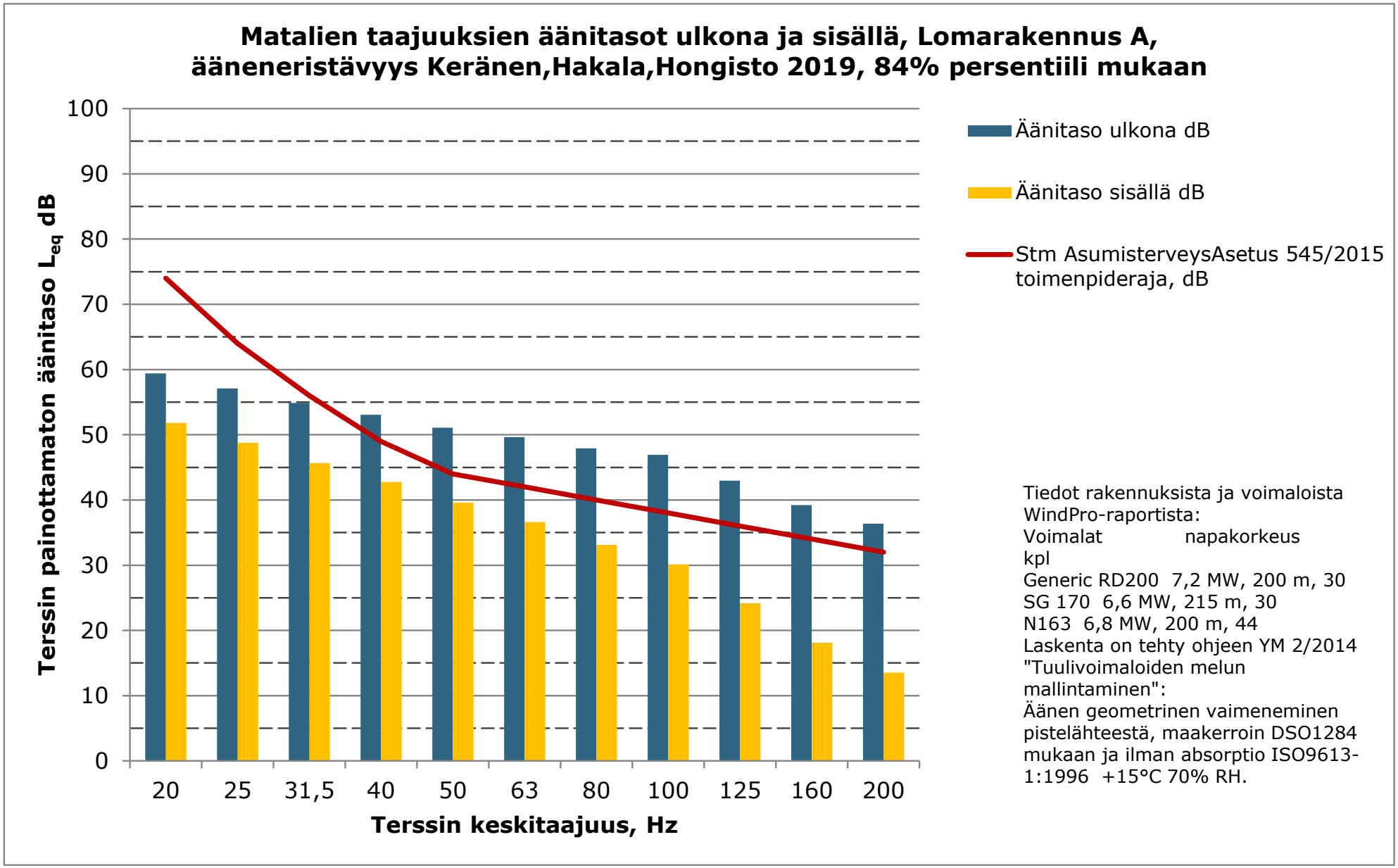

Painottamaton melupäästö SG 170
Terssin emissioTe,ssin emissioLW, dB
120
110
100
90
80
70
60
50
40
30
20
10
0
20 25 31,5 40 50 63 80 100 125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000 5000 6300 8000
Terssin keskitaajuus, Hz
Valmistajan ilmoittamasta A-taajuuspainotetusta terssitasosta laskettu taajuuspainottamaton terssitaso
Taajuuspainottamaton oktaavitaso laskettuna valmistajan ilmoittamasta A-taajuuspainotetusta oktaavitasosta


A-painotettu melupäästö Generic RD200
Terssin emissio L_{WA} dB
120
110
100
90
80
70
60
50
40
30
20
10
0
20 25 31,5 40 50 63 80 100 125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000 5000 6300 8000
Terssin keskitaajuus, Hz
Valmistajan ilmoittama A-taajuuspainotettu terssitaso

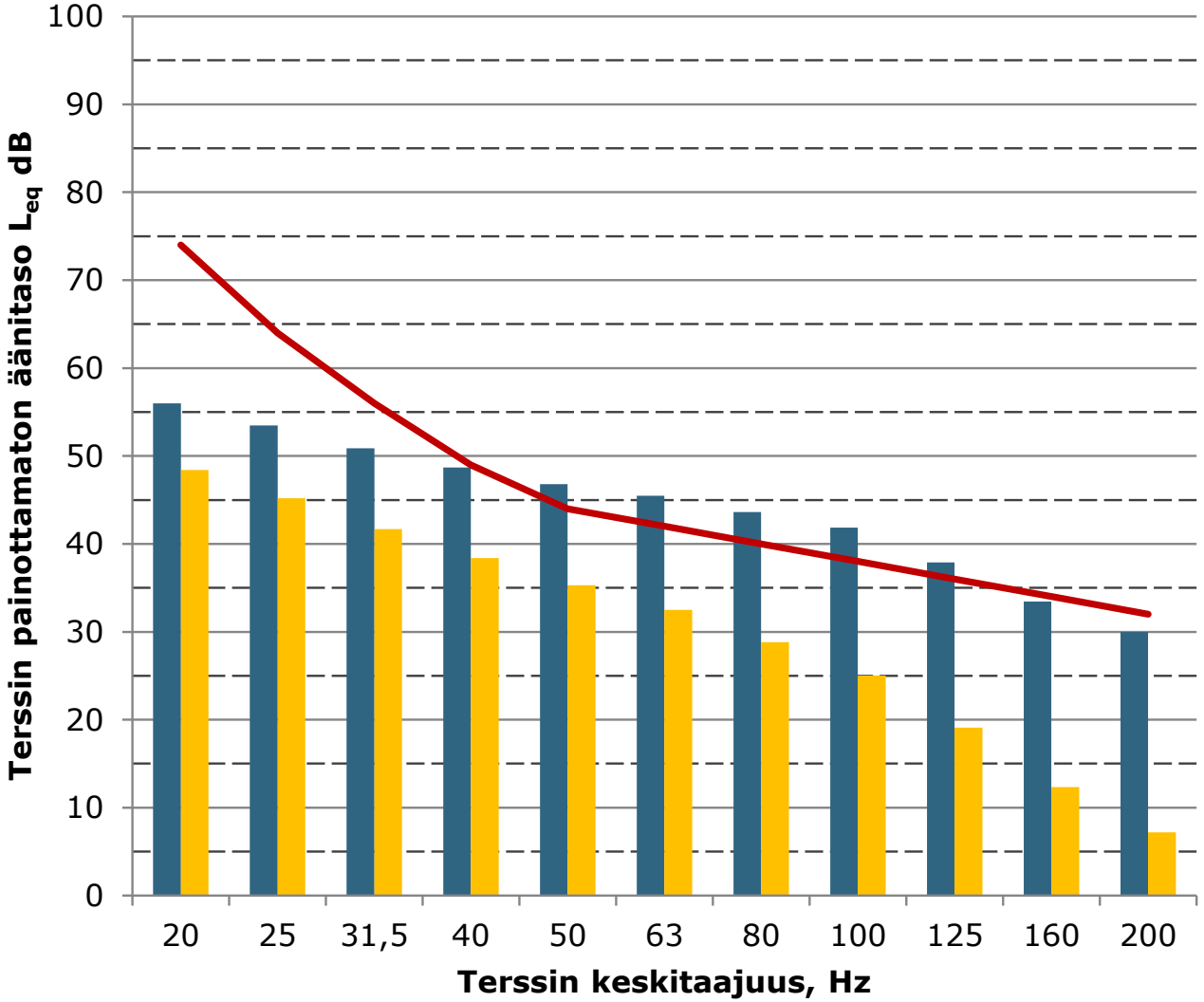

Painottamaton melupäästö Generic RD200
Terssin emissioLW, dB
130
120
110
100
90
80
70
60
50
40
30
20
10
0
20 25 31,5 40 50 63 80 100 125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000 5000 6300 8000
Terssin keskitaajuus, Hz
Valmistajan ilmoittamasta A-taajuuspainotetusta terssitasosta laskettu taajuuspainottamaton terssitaso
Taajuuspainottamaton oktaavitaso laskettuna valmistajan ilmoittamasta A-taajuuspainotetusta oktaavitasosta

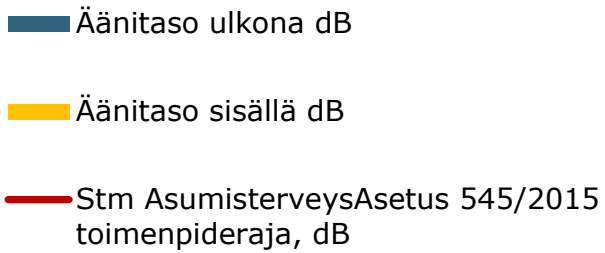

A-painotettu melupäästö N163
Terssin emissioTe$_{rs}$sin emissioTerssin emissio LWA, dB
120
110
100
90
80
70
60
50
40
30
20
10
0
20 25 31,5 40 50 63 80 100 125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000 5000 6300 8000
Terssin keskitaajuus, Hz
Valmistajan ilmoittama A-taajuuspainotettu terssitaso
Valmistajan ilmoittama oktaavitaso Manufacturer, Nordex N163/6.X Third octave sound power levels, revision 02, 8.11.2021


Painottamaton melupäästö N163
Terssin emissioTerssin emissioLW, dB
130
120
110
100
90
80
70
60
50
40
30
20
10
0
20 25 31,5 40 50 63 80 100 125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000 5000 6300 8000
Terssin keskitaajuus, Hz
Valmistajan ilmoittamasta A-taajuuspainotetusta terssitasosta laskettu taajuuspainottamaton terssitaso
Taajuuspainottamaton oktaavitaso laskettuna valmistajan ilmoittamasta A-taajuuspainotetusta oktaavitasosta


Matalien taajuuksien äänitasot ulkona ja sisällä, Lomarakennus A, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan
Terssin painottamaton äänitaso L_{eq} dB
100
90
80
70
60
50
40
30
20
10
0
20
25
31,5
40
50
63
80
100
125
160
200
Terssin keskitaajuus, Hz
Äänitaso ulkona dB
Äänitaso sisällä dB
Stm AsumisterveysAsetus 545/2015 toimenpideraja, dB
Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus
kpl
Generic RD200 7,2 MW, 200 m, 30
SG 170 6,6 MW, 215 m, 30
N163 6,8 MW, 200 m, 44
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, Asuinrakennus B, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan

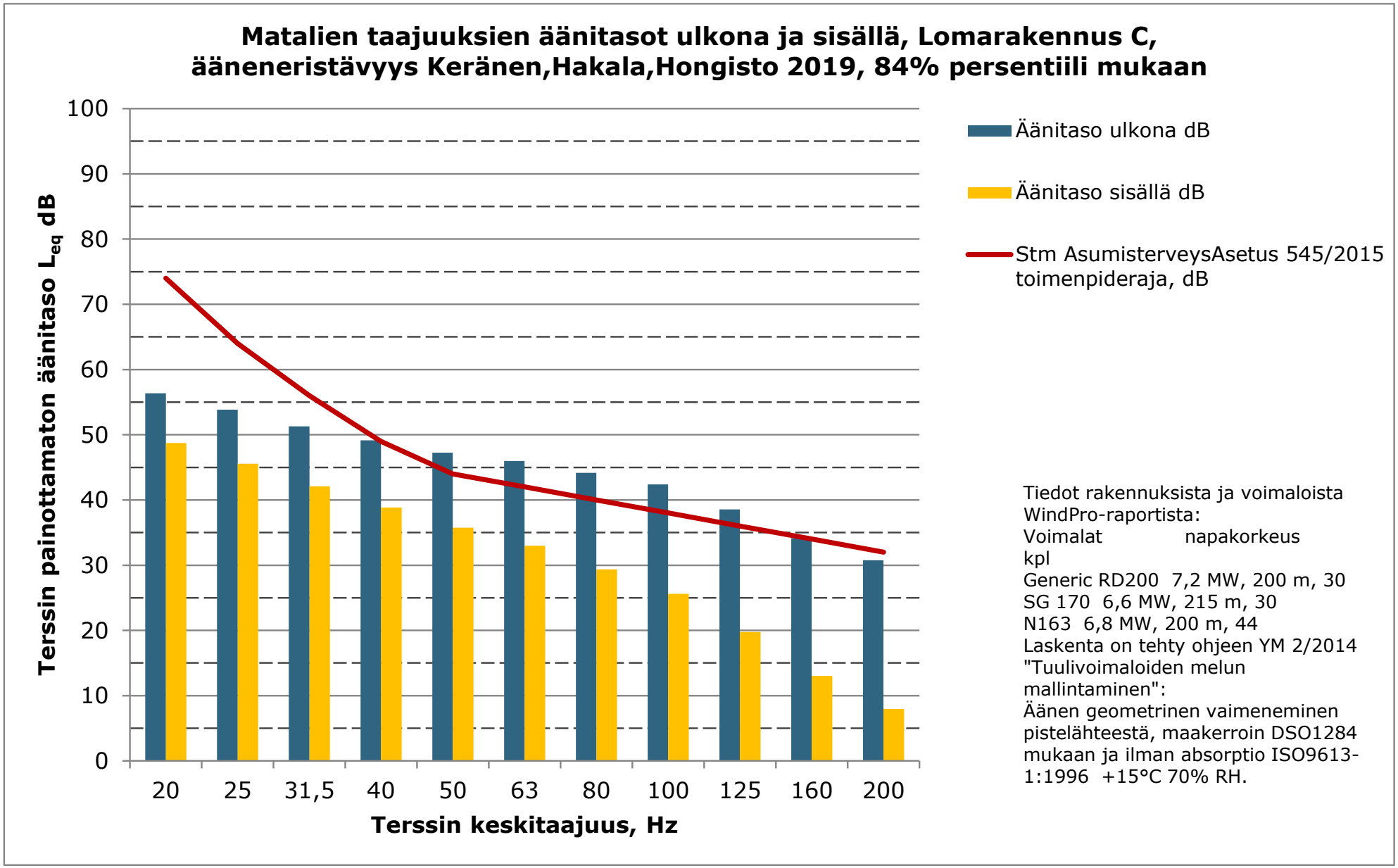


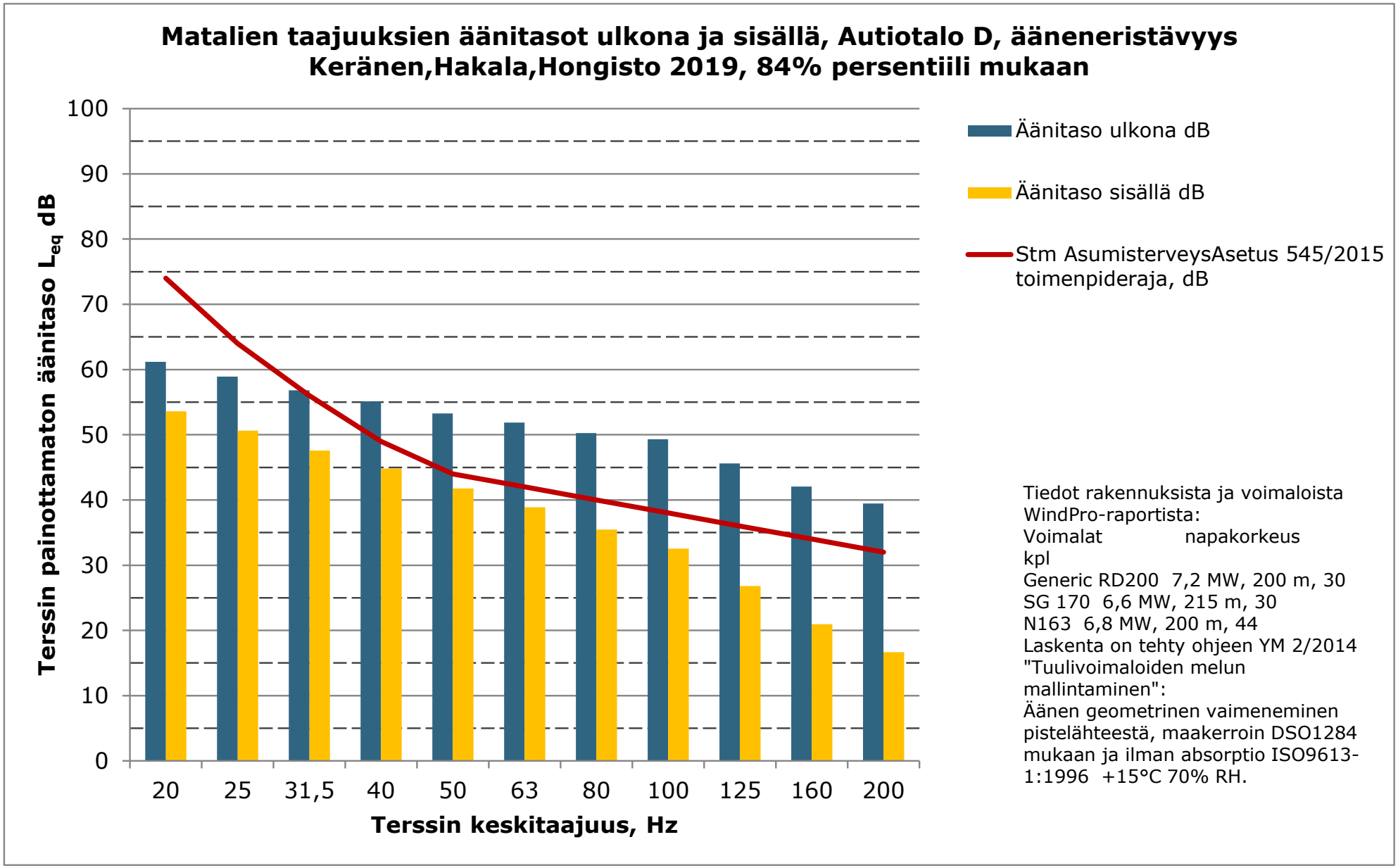


Tiedot rakennuksista ja voimaloista WindPro-raportista:

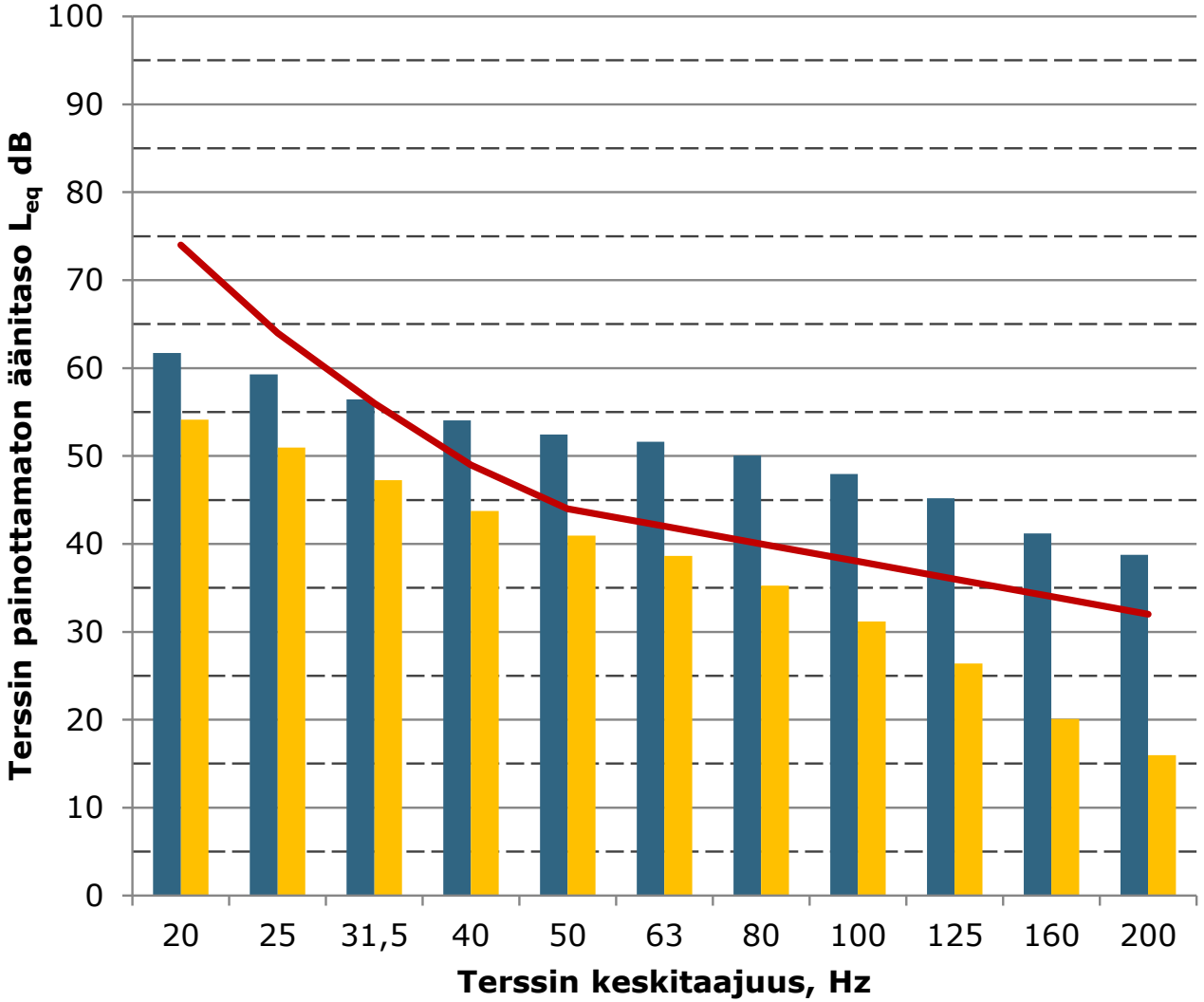
Voimalat	napakorkeus	kpl
Generic RD200	7,2 MW, 200 m,	30
SG 170	6,6 MW, 215 m,	30
N163	6,8 MW, 200 m,	44

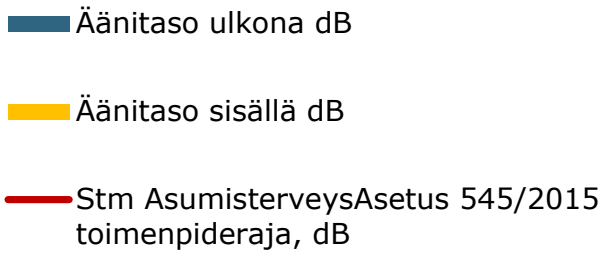
Laskenta on tehty ohjeen YM 2/2014 "Tuulivoimaloiden melun mallintaminen":
Äänen geometrinen vaimeneminen pistelähteestä, maakerroin DSO1284 mukaan ja ilman absorptio ISO9613-1:1996 +15°C 70% RH.


Matalien taajuuksien äänitasot ulkona ja sisällä, Lomarakennus C, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan
Terssin painottamaton äänitaso Leq dB
100
90
80
70
60
50
40
30
20
10
0
20
25
31,5
40
50
63
80
100
125
160
200
Terssin keskitaajuus, Hz
Äänitaso ulkona dB
Äänitaso sisällä dB
Stm AsumisterveysAsetus 545/2015 toimenpideraja, dB
Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus kpl
Generic RD200 7,2 MW, 200 m, 30
SG 170 6,6 MW, 215 m, 30
N163 6,8 MW, 200 m, 44
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.

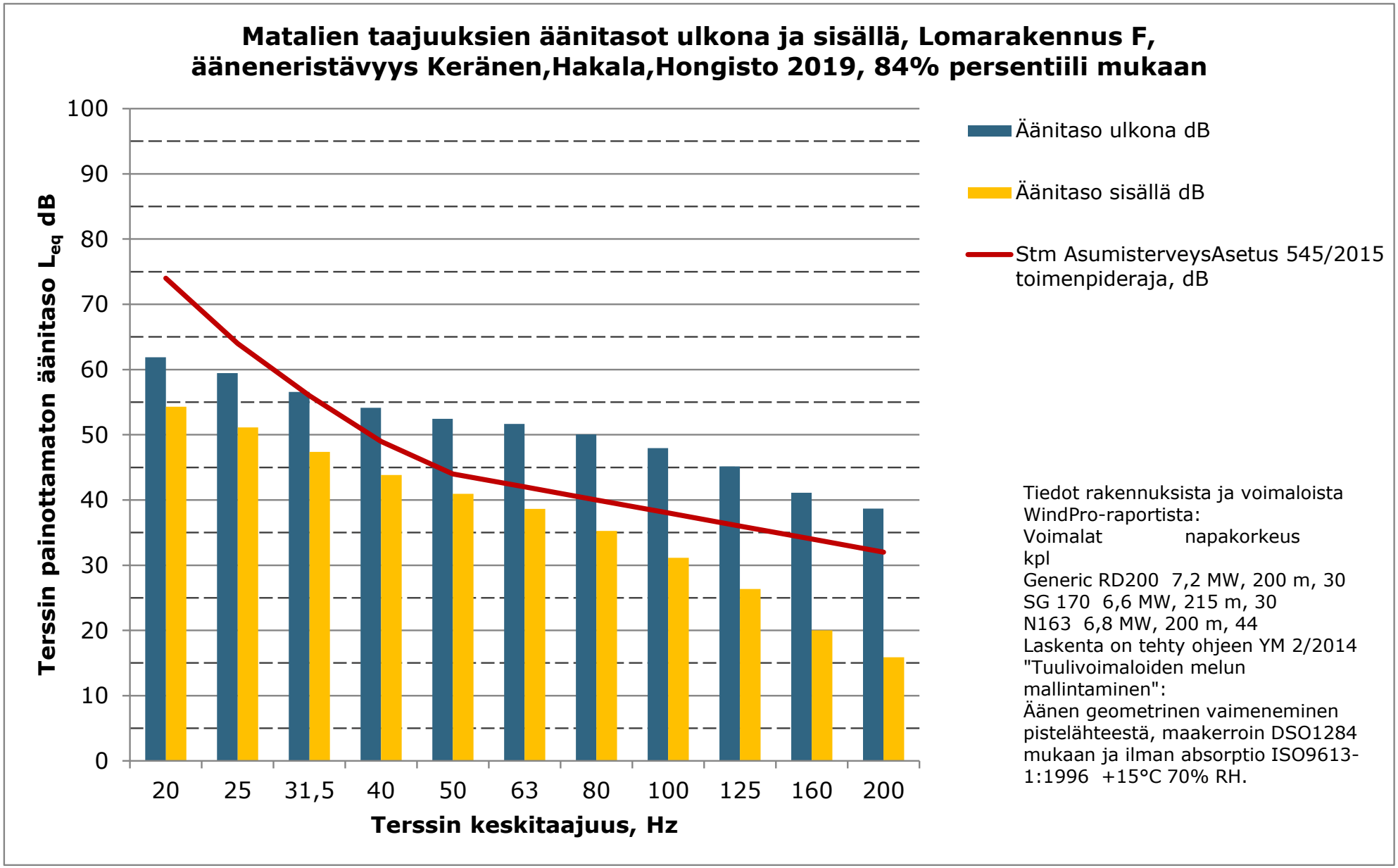

Matalien taajuuksien äänitasot ulkona ja sisällä, Autiotalo D, ääneneristävyys
Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan
Terssin painottamaton äänitaso L_{eq} dB
100
90
80
70
60
50
40
30
20
10
0
20
25
31,5
40
50
63
80
100
125
160
200
Terssin keskitaajuus, Hz
Äänitaso ulkona dB
Äänitaso sisällä dB
Stm AsumisterveysAsetus 545/2015 toimenpideraja, dB
Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus kpl
Generic RD200 7,2 MW, 200 m, 30
SG 170 6,6 MW, 215 m, 30
N163 6,8 MW, 200 m, 44
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, Lomarakennus E, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan

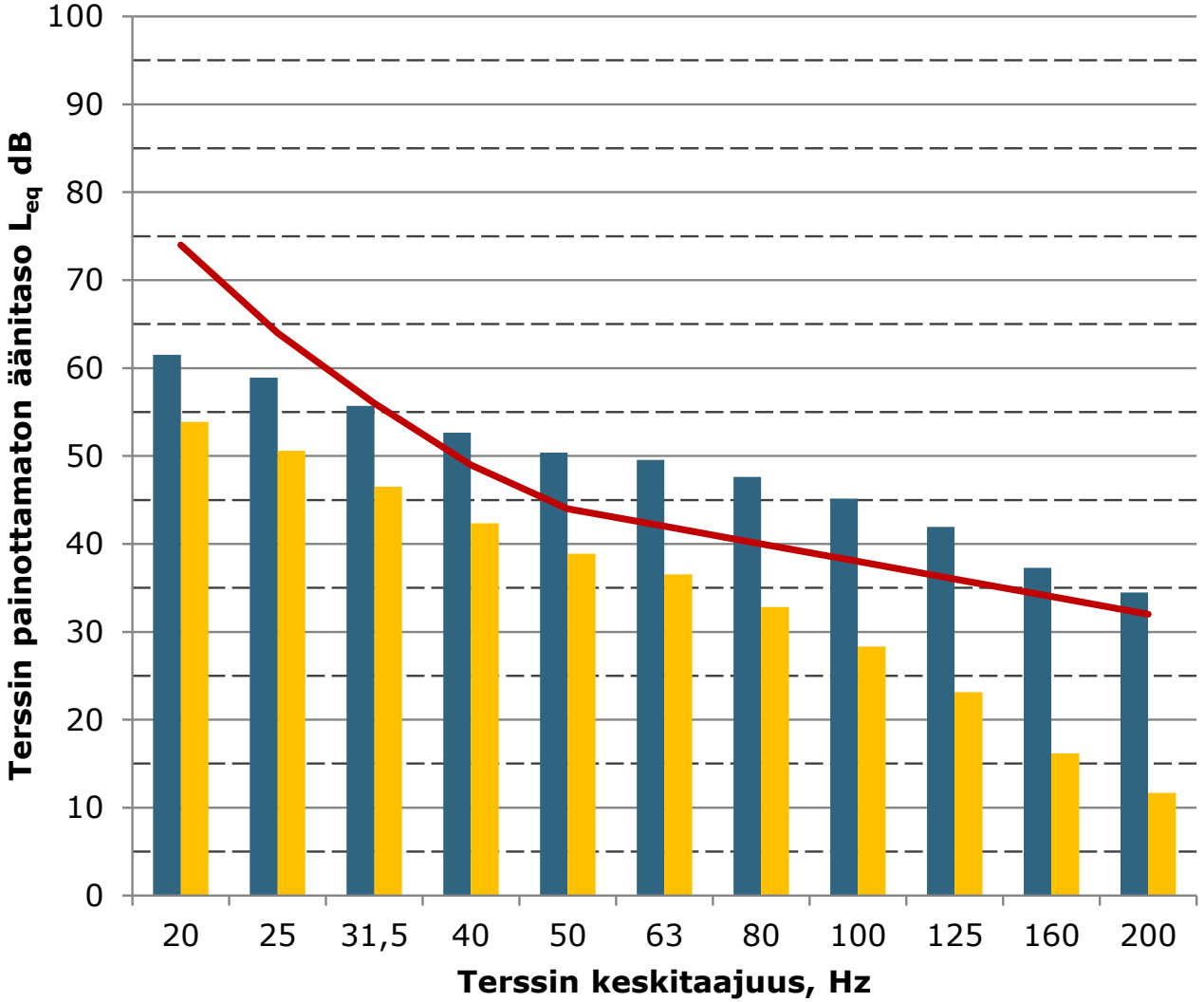


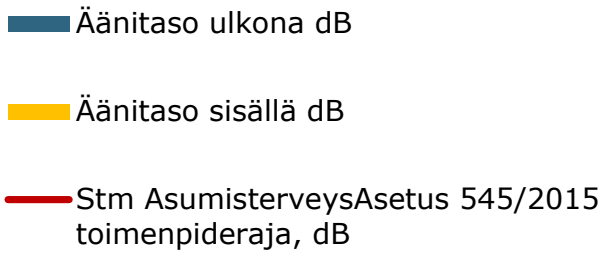


Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus kpl
Generic RD200 7,2 MW, 200 m, 30
SG 170 6,6 MW, 215 m, 30
N163 6,8 MW, 200 m, 44
Laskenta on tehty ohjeen YM 2/2014 "Tuulivoimaloiden melun mallintaminen":
Äänen geometrinen vaimeneminen pistelähteestä, maakerroin DSO1284 mukaan ja ilman absorptio ISO9613-1:1996 +15°C 70% RH.


Matalien taajuuksien äänitasot ulkona ja sisällä, Lomarakennus F,
ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan
Terssin painottamaton äänitaso Leq dB
100
90
80
70
60
50
40
30
20
10
0
20
25
31,5
40
50
63
80
100
125
160
200
Terssin keskitaajuus, Hz
Äänitaso ulkona dB
Äänitaso sisällä dB
Stm AsumisterveysAsetus 545/2015 toimenpideraja, dB
Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus
kpl
Generic RD200 7,2 MW, 200 m, 30
SG 170 6,6 MW, 215 m, 30
N163 6,8 MW, 200 m, 44
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.

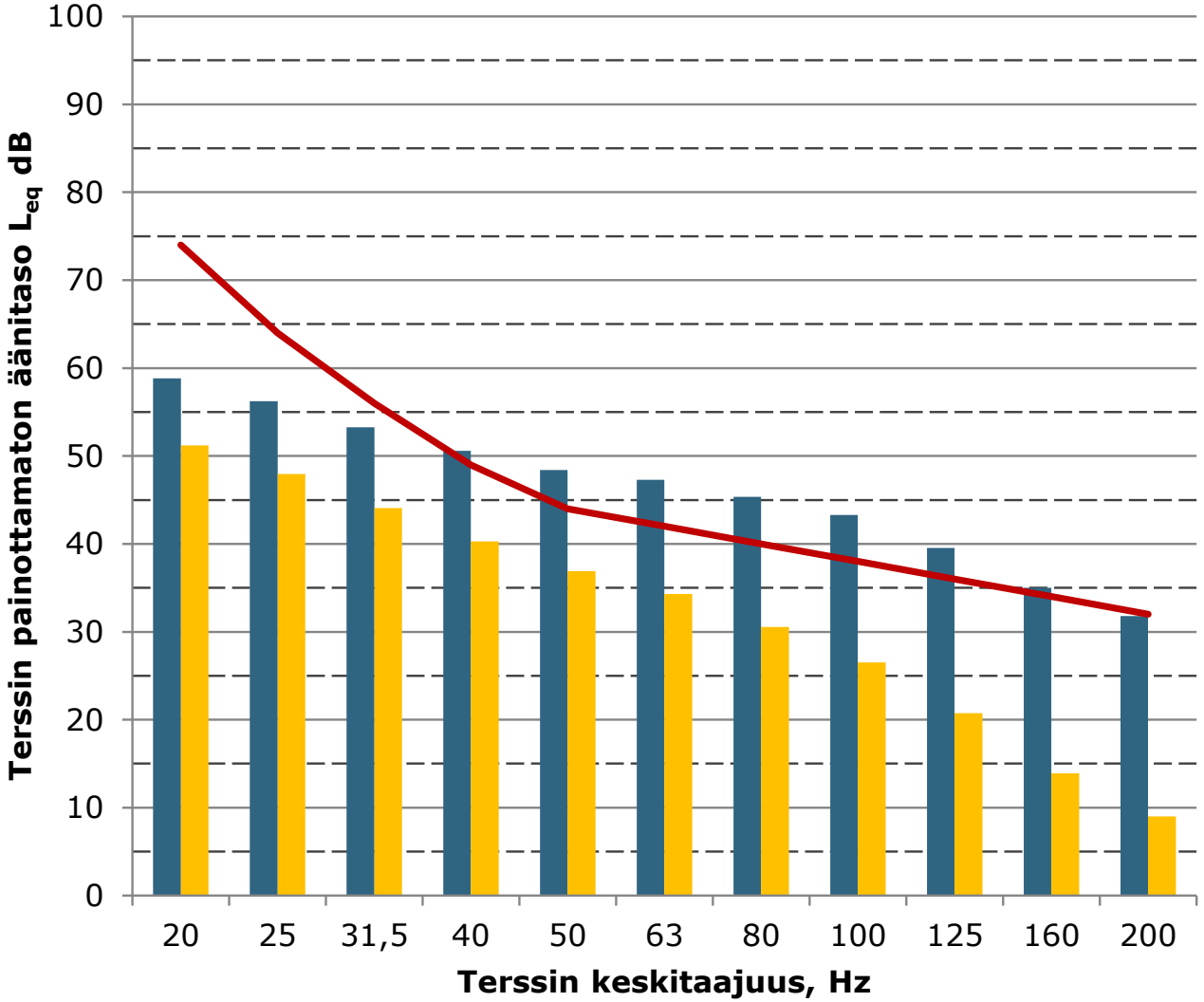
Matalien taajuuksien äänitasot ulkona ja sisällä, Asuinrakennus G, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan

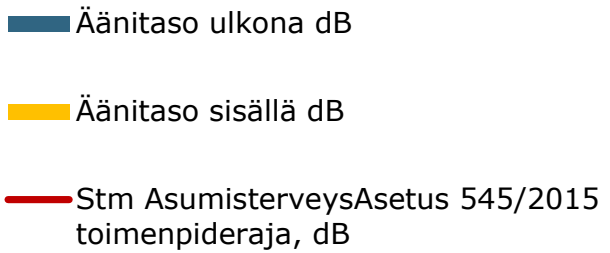




Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus
kpl
Generic RD200 7,2 MW, 200 m, 30
SG 170 6,6 MW, 215 m, 30
N163 6,8 MW, 200 m, 44
Laskenta on tehty ohjeen YM 2/2014 "Tuulivoimaloiden melun mallintaminen":
Äänen geometrinen vaimeneminen pistelähteestä, maakerroin DSO1284 mukaan ja ilman absorptio ISO9613-1:1996 +15°C 70% RH.

Matalien taajuuksien äänitasot ulkona ja sisällä, Lomarakennus H, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan

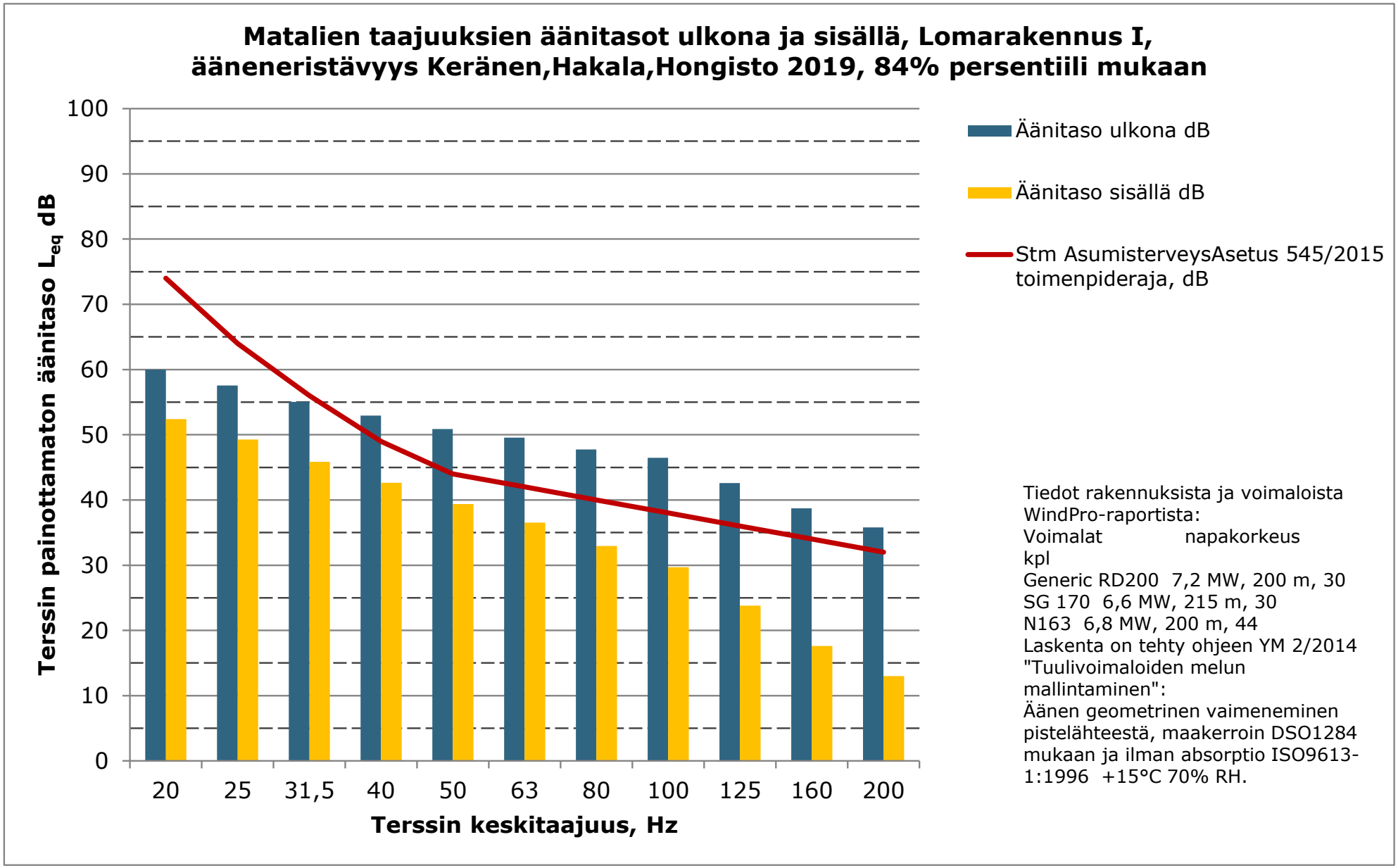




Tiedot rakennuksista ja voimaloista WindPro-raportista:

Voimalat	napakorkeus	kpl
Generic RD200	7,2 MW, 200 m,	30
SG 170	6,6 MW, 215 m,	30
N163	6,8 MW, 200 m,	44

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, Lomarakennus I, ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili mukaan
Terssin painottamaton äänitaso L_{eq} dB
100
90
80
70
60
50
40
30
20
10
0
20
25
31,5
40
50
63
80
100
125
160
200
Terssin keskitaajuus, Hz
Äänitaso ulkona dB
Äänitaso sisällä dB
Stm AsumisterveysAsetus 545/2015 toimenpideraja, dB
Tiedot rakennuksista ja voimaloista WindPro-raportista:
Voimalat napakorkeus kpl
Generic RD200 7,2 MW, 200 m, 30
SG 170 6,6 MW, 215 m, 30
N163 6,8 MW, 200 m, 44
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.

Liite 13: Varjostuksen yhteismallinnuksen tulokset ”real case, no forest” (Konnunsuon VE1).

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Calculated:
11.4.2024 14.58/3.6.377

SHADOW - Main Result

Calculation: VE1_Yhteisvaikutus_Generic_RD200m_HH200m_20240410

Assumptions for shadow calculations

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

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,77	2,46	4,19	6,93	8,81	9,87	9,13	6,84	4,43	2,23	0,93	0,26

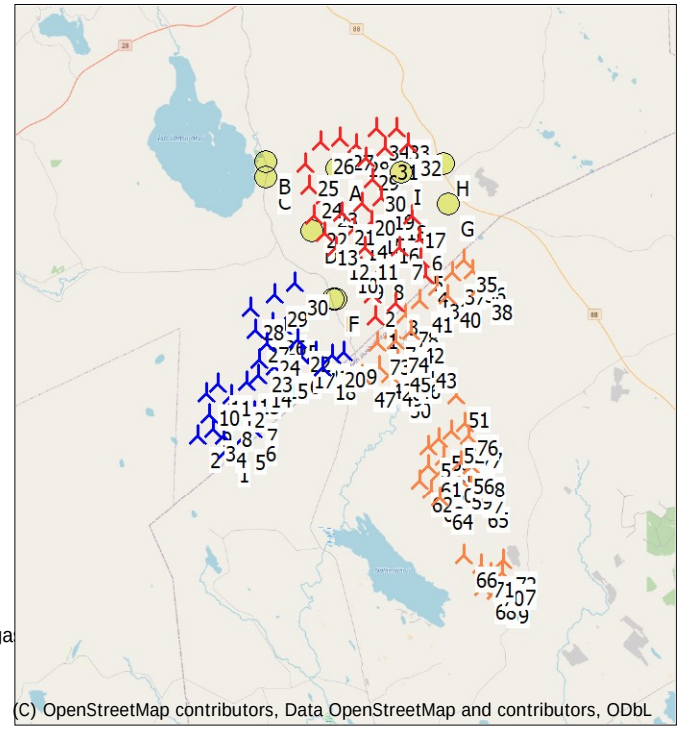
Operational hours are calculated from WTGs in calculation and wind distribution:
MERRA-2_N64,00_E026,875 (8)

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
474	404	401	459	606	894	1 106	1 090	887	784	713	657	8 474

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

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



Scale 1:400 000
New WTG
Shadow receptor

WTGs

	East	North	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data Calculation distance [m]	RPM [RPM]
1	465 686	7 082 467	165,4	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
1	473 642	7 089 459	165,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
2	464 106	7 083 255	147,6	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
2	473 523	7 090 697	166,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
3	464 951	7 083 636	154,2	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
3	474 724	7 090 192	163,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
4	465 561	7 083 192	163,3	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
4	476 298	7 091 642	169,7	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
5	466 536	7 083 117	165,1	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
5	476 097	7 092 538	175,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
6	467 111	7 083 592	159,6	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
6	475 979	7 093 646	177,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
7	474 928	7 093 153	170,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
7	467 136	7 084 492	159,4	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
8	465 786	7 084 367	164,6	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
8	473 955	7 092 082	169,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
9	464 736	7 084 392	152,2	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
9	472 921	7 092 121	171,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
10	464 636	7 085 517	155,2	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
10	472 045	7 092 434	174,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
11	465 236	7 085 992	159,1	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
11	473 133	7 093 196	170,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
12	465 936	7 085 367	160,8	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
12	471 545	7 093 189	175,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
13	466 761	7 086 117	170,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
13	470 952	7 093 929	178,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
14	472 556	7 094 191	172,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
14	467 386	7 086 467	159,7	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
15	468 261	7 086 867	156,9	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
15	473 450	7 094 501	175,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
16	468 936	7 087 192	156,2	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4

To be continued on next page...

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Calculated:
11.4.2024 14.58/3.6.377

SHADOW - Main Result

Calculation: VE1_Yhteisvaikutus_Generic_RD200m_HH200m_20240410

...continued from previous page

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
16	474 232	7 094 014	173,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
17	469 711	7 087 392	157,4	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
17	475 592	7 094 825	177,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
18	470 821	7 086 831	160,6	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
18	474 653	7 095 212	177,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
19	471 948	7 087 636	182,5	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
19	474 026	7 095 796	179,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
20	471 311	7 087 492	168,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
20	472 999	7 095 500	175,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
21	471 895	7 094 973	170,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
21	470 411	7 087 617	162,5	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
22	469 511	7 088 317	160,5	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
22	470 430	7 094 892	173,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
23	467 436	7 087 242	169,3	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
23	470 952	7 095 933	163,7	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
24	467 861	7 088 142	165,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
24	470 207	7 096 391	155,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
25	468 861	7 088 892	163,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
25	469 994	7 097 616	152,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
26	468 133	7 089 218	165,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
26	470 814	7 098 750	149,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
27	471 839	7 098 977	152,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
27	467 261	7 088 867	167,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
28	466 998	7 090 015	168,4	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
28	472 690	7 098 642	163,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
29	468 282	7 090 703	164,5	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
29	473 217	7 097 856	165,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
30	469 365	7 091 361	164,5	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
30	473 530	7 096 766	168,7	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
31	474 257	7 098 465	167,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
32	475 413	7 098 667	166,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
33	474 833	7 099 446	158,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
34	473 764	7 099 462	155,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
35	478 336	7 092 455	177,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
36	478 845	7 091 899	190,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
37	477 742	7 091 824	177,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
38	479 177	7 090 979	185,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
39	476 955	7 091 051	172,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
40	477 487	7 090 620	182,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
41	475 964	7 090 352	164,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
42	475 501	7 088 705	162,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
43	476 189	7 087 343	162,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
44	475 611	7 087 510	161,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
45	474 845	7 087 199	160,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
46	475 310	7 086 848	160,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
47	472 937	7 086 386	170,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
48	473 780	7 086 830	165,6	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
49	474 399	7 086 459	160,6	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
50	474 825	7 085 835	158,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
51	477 918	7 085 282	163,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
52	477 610	7 083 418	159,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
53	476 957	7 082 967	158,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
54	476 370	7 082 551	156,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
55	477 187	7 082 052	160,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
56	478 121	7 081 764	160,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
57	478 641	7 080 668	158,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
58	478 709	7 081 538	163,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
59	477 972	7 080 917	155,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
60	477 084	7 081 229	157,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
61	476 355	7 081 601	162,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
62	475 903	7 080 778	161,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
63	476 526	7 080 222	157,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
64	476 972	7 079 815	154,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4

To be continued on next page...

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SHADOW - Main Result

Calculation: VE1_Yhteisvaikutus_Generic_RD200m_HH200m_20240410

...continued from previous page

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
65	478 868	7 079 944	156,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
66	478 217	7 076 798	138,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
67	480 292	7 075 796	153,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
68	479 248	7 075 045	139,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
69	479 889	7 074 867	140,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
70	479 686	7 075 714	147,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
71	479 198	7 076 190	147,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
72	480 317	7 076 500	159,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
73	473 769	7 088 131	166,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
74	474 672	7 088 183	162,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
75	474 559	7 088 784	163,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
76	478 369	7 083 786	163,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
77	478 581	7 083 109	162,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
78	475 224	7 089 562	162,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4

Shadow receptor-Input

No.	Name	East	North	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
A	Lomarakennus A	471 650	7 097 381	157,6	5,0	5,0	1,0	90,0	"Green house mode"	6,0
B	Asuinrakennus B	467 933	7 097 709	139,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
C	Lomarakennus C	467 899	7 096 936	139,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
D	Autiotalo D	470 313	7 094 090	168,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
E	Lomarakennus E	471 402	7 090 461	195,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
F	Lomarakennus F	471 557	7 090 435	188,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
G	Asuinrakennus G	477 593	7 095 429	191,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
H	Lomarakennus H	477 297	7 097 577	190,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
I	Lomarakennus I	475 097	7 097 098	176,3	5,0	5,0	1,0	90,0	"Green house mode"	6,0

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values Shadow hours per year [h/year]
A	Lomarakennus A	15:47
B	Asuinrakennus B	1:58
C	Lomarakennus C	0:00
D	Autiotalo D	29:46
E	Lomarakennus E	0:00
F	Lomarakennus F	2:16
G	Asuinrakennus G	0:00
H	Lomarakennus H	0:00
I	Lomarakennus I	9:46

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

No.	Name	Expected [h/year]
1	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
1	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (636)	0:00
2	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
2	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (639)	2:16
3	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
3	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (640)	0:00
4	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
4	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (642)	0:00
5	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
5	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (644)	0:00
6	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
6	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (645)	0:00

To be continued on next page...

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SHADOW - Main Result

Calculation: VE1_Yhteisvaikutus_Generic_RD200m_HH200m_20240410

...continued from previous page

No.	Name	Expected [h/year]
7	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (650)	0:00
7	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
8	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
8	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (643)	0:00
9	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
9	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (647)	0:00
10	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
10	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (649)	0:00
11	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
11	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (648)	0:00
12	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
12	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (638)	2:51
13	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
13	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (653)	21:28
14	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (637)	0:00
14	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
15	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
15	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (652)	0:00
16	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
16	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (646)	0:00
17	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
17	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (630)	0:00
18	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
18	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (651)	1:35
19	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
19	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (635)	2:16
20	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
20	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (634)	0:00
21	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (633)	5:22
21	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
22	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
22	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (654)	0:00
23	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
23	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (632)	2:22
24	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
24	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (641)	2:03
25	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
25	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (655)	5:41
26	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
26	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (662)	0:00
27	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (629)	0:00
27	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
28	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
28	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (661)	1:08
29	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
29	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (657)	7:28
30	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
30	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (631)	4:46
31	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (656)	0:00
32	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (659)	0:00
33	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (658)	0:00
34	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (660)	0:00
35	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (914)	0:00
36	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (915)	0:00
37	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (916)	0:00
38	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (917)	0:00
39	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (918)	0:00
40	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (919)	0:00
41	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (920)	0:00
42	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (921)	0:00
43	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (922)	0:00
44	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (923)	0:00
45	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (924)	0:00
46	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (925)	0:00
47	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (926)	0:00

To be continued on next page...

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SHADOW - Main Result

Calculation: VE1_Yhteisvaikutus_Generic_RD200m_HH200m_20240410

...continued from previous page

No.	Name	Expected [h/year]
48	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (927)	0:00
49	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (928)	0:00
50	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (929)	0:00
51	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (930)	0:00
52	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (931)	0:00
53	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (932)	0:00
54	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (933)	0:00
55	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (934)	0:00
56	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (935)	0:00
57	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (936)	0:00
58	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (937)	0:00
59	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (938)	0:00
60	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (939)	0:00
61	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (940)	0:00
62	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (941)	0:00
63	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (942)	0:00
64	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (943)	0:00
65	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (944)	0:00
66	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (945)	0:00
67	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (946)	0:00
68	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (947)	0:00
69	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (948)	0:00
70	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (949)	0:00
71	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (950)	0:00
72	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (951)	0:00
73	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (952)	0:00
74	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (953)	0:00
75	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (954)	0:00
76	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (955)	0:00
77	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (956)	0:00
78	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (957)	0:00

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

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

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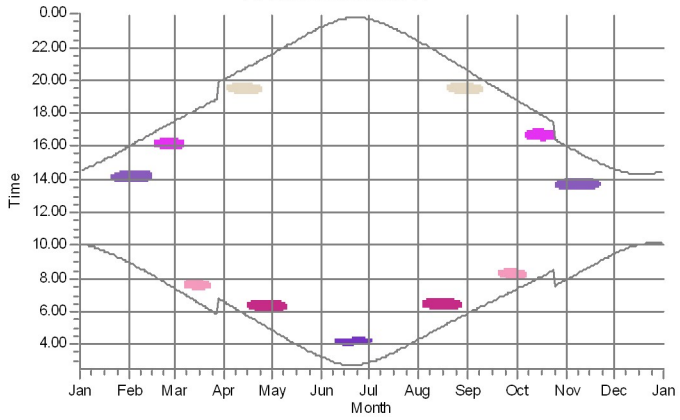
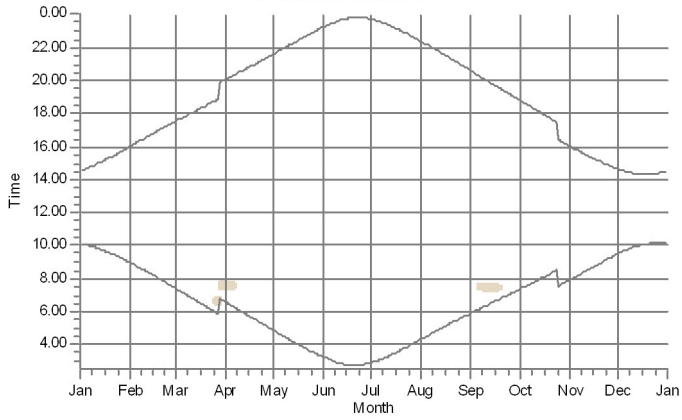
SHADOW - Calendar, graphical

Calculation: VE1_Yhteisvaikutus_Generic_RD200m_HH200m_20240410

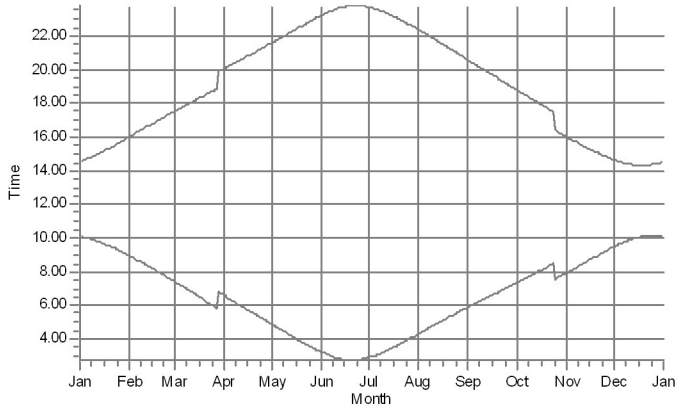
A: Lomarakennus A



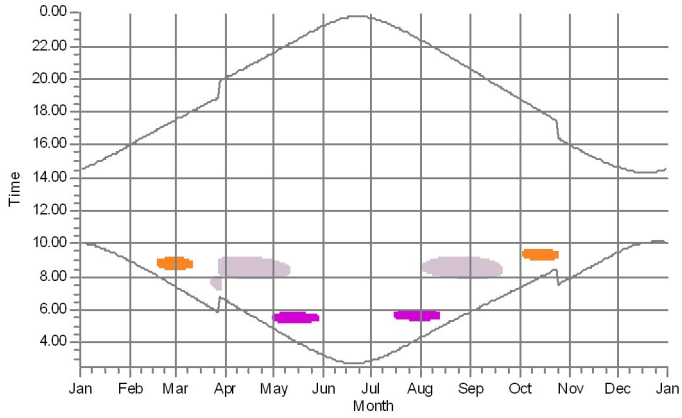
B: Asuinrakennus B



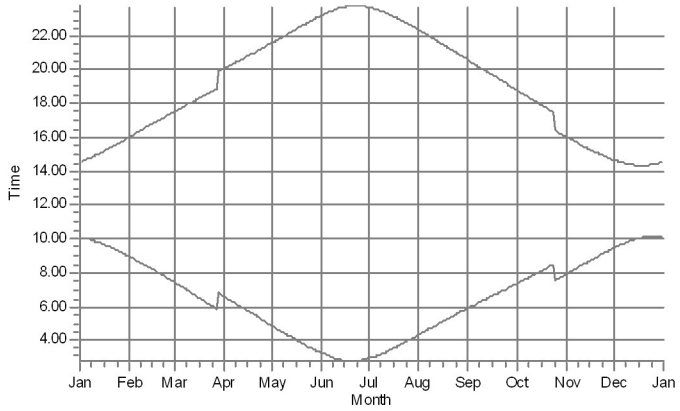
C: Lomarakennus C



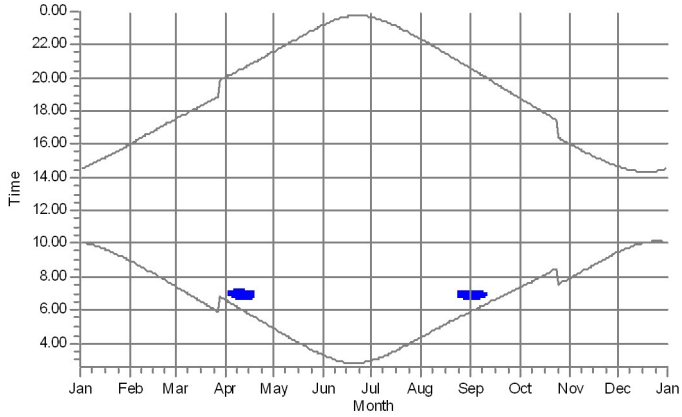
D: Autiotalo D



E: Lomarakennus E



F: Lomarakennus F



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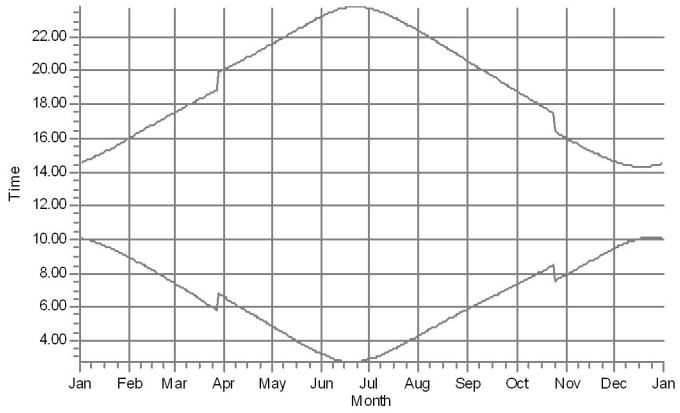
Calculated:
11.4.2024 14.58/3.6.377

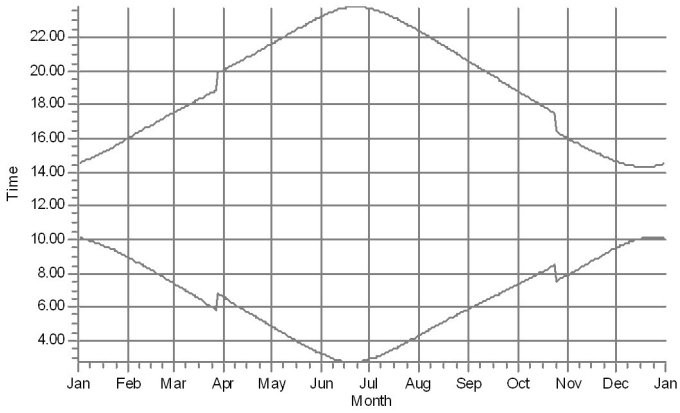
SHADOW - Calendar, graphical

Calculation: VE1_Yhteisvaikutus_Generic_RD200m_HH200m_20240410

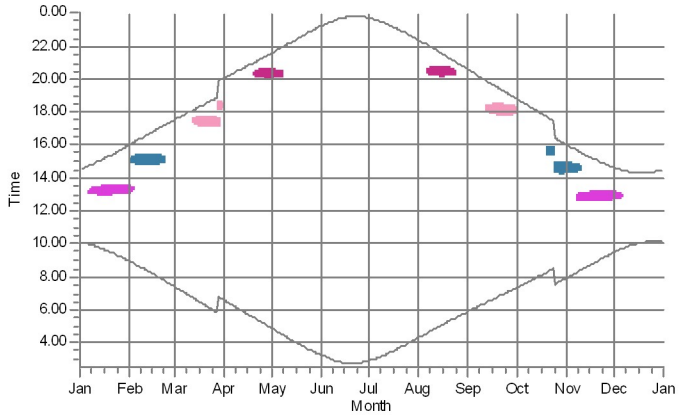
G: Asuinrakennus G



H: Lomarakennus H



I: Lomarakennus I



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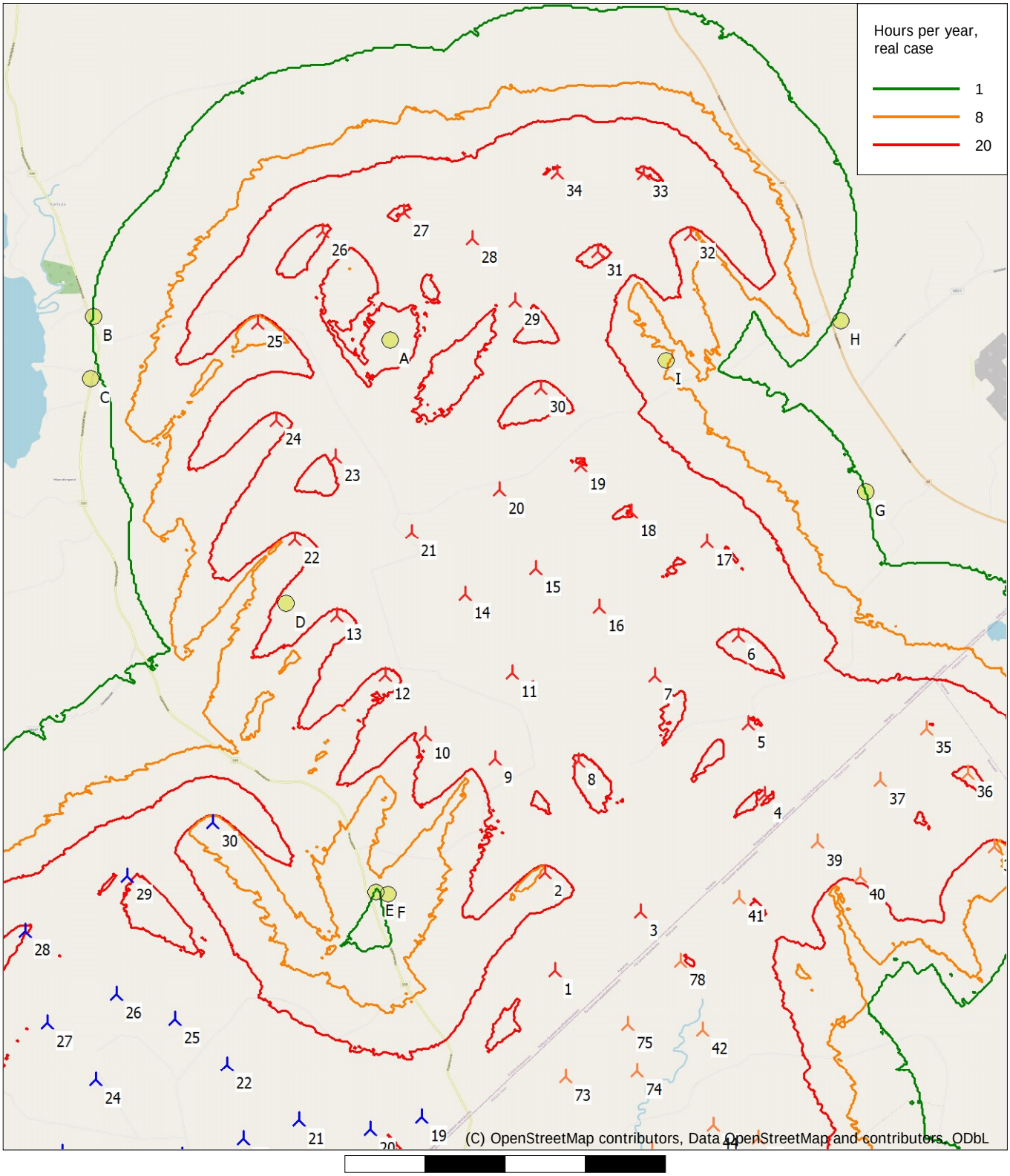
SHADOW - Map

Calculation: VE1_Yhteisvaikutus_Generic_RD200m_HH200m_20240410



Map: EMD OpenStreetMap , Print scale 1:70 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 473 103 North: 7 094 482

New WTG Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_Pyhäntä_Pilpankangas_0.wpo (1)

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

Liite 14. Varjostuksen yhteismallinnuksen tulokset ”real case, no forest” (Konnunsuon VE2).

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Calculated:
11.4.2024 15.17/3.6.377

SHADOW - Main Result

Calculation: VE2_Yhteisvaikutus_Generic_RD200m_HH200m_20240410

Assumptions for shadow calculations

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

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

Sunshine probability S (Average daily sunshine hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,77	2,46	4,19	6,93	8,81	9,87	9,13	6,84	4,43	2,23	0,93	0,26

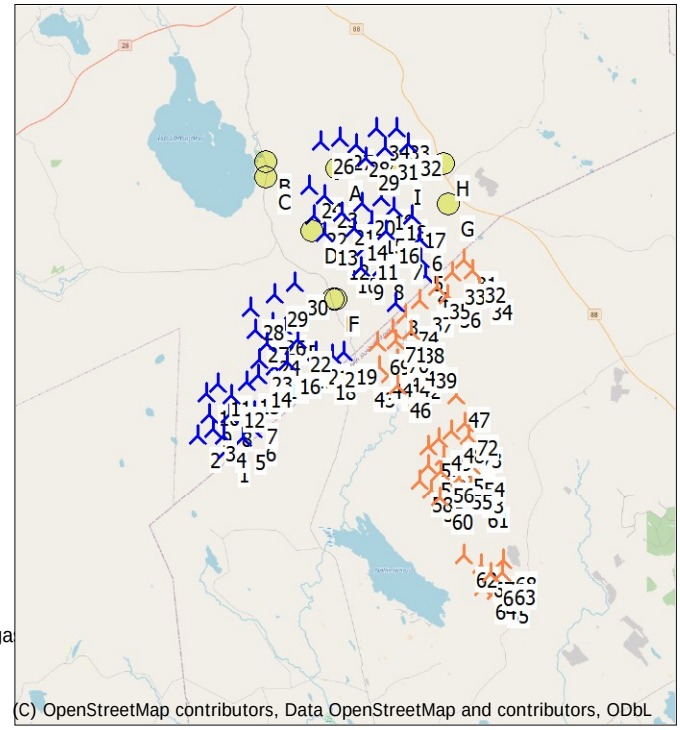
Operational hours are calculated from WTGs in calculation and wind distribution:
MERRA-2_N64,00_E026,875 (8)

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
474	404	401	459	606	894	1 106	1 090	887	784	713	657	8 474

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

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



WTGs

	East	North	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Shadow data Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM [RPM]
1	465 686	7 082 467	165,4	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
2	464 106	7 083 255	147,6	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
3	464 951	7 083 636	154,2	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
3	474 724	7 090 192	163,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
4	465 561	7 083 192	163,3	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
4	476 298	7 091 642	169,7	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
5	466 536	7 083 117	165,1	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
5	476 097	7 092 538	175,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
6	467 111	7 083 592	159,6	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
6	475 979	7 093 646	177,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
7	467 136	7 084 492	159,4	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
7	474 928	7 093 153	170,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
8	465 786	7 084 367	164,6	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
8	473 955	7 092 082	169,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
9	464 736	7 084 392	152,2	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
9	472 921	7 092 121	171,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
10	464 636	7 085 517	155,2	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
10	472 045	7 092 434	174,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
11	465 236	7 085 992	159,1	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
11	473 133	7 093 196	170,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
12	465 936	7 085 367	160,8	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
12	471 545	7 093 189	175,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
13	466 761	7 086 117	170,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
13	470 952	7 093 929	178,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
14	472 556	7 094 191	172,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
14	467 386	7 086 467	159,7	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
15	468 261	7 086 867	156,9	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
15	473 450	7 094 501	175,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
16	468 936	7 087 192	156,2	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
16	474 232	7 094 014	173,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
17	469 711	7 087 392	157,4	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4

To be continued on next page...

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11.4.2024 15.17/3.6.377

SHADOW - Main Result

Calculation: VE2_Yhteisvaikutus_Generic_RD200m_HH200m_20240410

...continued from previous page

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
17	475 592	7 094 825	177,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
18	470 821	7 086 831	160,6	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
18	474 653	7 095 212	177,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
19	471 948	7 087 636	182,5	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
19	474 026	7 095 796	179,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
20	471 311	7 087 492	168,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
20	472 999	7 095 500	175,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
21	470 411	7 087 617	162,5	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
21	471 895	7 094 973	170,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
22	469 511	7 088 317	160,5	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
22	470 430	7 094 892	173,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
23	467 436	7 087 242	169,3	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
23	470 952	7 095 933	163,7	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
24	467 861	7 088 142	165,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
24	470 207	7 096 391	155,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
25	468 861	7 088 892	163,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
26	468 133	7 089 218	165,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
26	470 814	7 098 750	149,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
27	467 261	7 088 867	167,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
27	471 839	7 098 977	152,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
28	472 690	7 098 642	163,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
28	466 998	7 090 015	168,4	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
29	468 282	7 090 703	164,5	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
29	473 217	7 097 856	165,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
30	469 365	7 091 361	164,5	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
31	478 336	7 092 455	177,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
31	474 257	7 098 465	167,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
32	478 845	7 091 899	190,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
32	475 413	7 098 667	166,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
33	477 742	7 091 824	177,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
33	474 833	7 099 446	158,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
34	479 177	7 090 979	185,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
34	473 764	7 099 462	155,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
35	476 955	7 091 051	172,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
36	477 487	7 090 620	182,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
37	475 964	7 090 352	164,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
38	475 501	7 088 705	162,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
39	476 189	7 087 343	162,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
40	475 611	7 087 510	161,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
41	474 845	7 087 199	160,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
42	475 310	7 086 848	160,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
43	472 937	7 086 386	170,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
44	473 780	7 086 830	165,6	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
45	474 399	7 086 459	160,6	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
46	474 825	7 085 835	158,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
47	477 918	7 085 282	163,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
48	477 610	7 083 418	159,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
49	476 957	7 082 967	158,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
50	476 370	7 082 551	156,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
51	477 187	7 082 052	160,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
52	478 121	7 081 764	160,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
53	478 641	7 080 668	158,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
54	478 709	7 081 538	163,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
55	477 972	7 080 917	155,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
56	477 084	7 081 229	157,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
57	476 355	7 081 601	162,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
58	475 903	7 080 778	161,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
59	476 526	7 080 222	157,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
60	476 972	7 079 815	154,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
61	478 868	7 079 944	156,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
62	478 217	7 076 798	138,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
63	480 292	7 075 796	153,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
64	479 248	7 075 045	139,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4

To be continued on next page...

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SHADOW - Main Result

Calculation: VE2_Yhteisvaikutus_Generic_RD200m_HH200m_20240410

...continued from previous page

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
65	479 889	7 074 867	140,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
66	479 686	7 075 714	147,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
67	479 198	7 076 190	147,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
68	480 317	7 076 500	159,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
69	473 769	7 088 131	166,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
70	474 672	7 088 183	162,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
71	474 559	7 088 784	163,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
72	478 369	7 083 786	163,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
73	478 581	7 083 109	162,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
74	475 224	7 089 562	162,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4

Shadow receptor-Input

No.	Name	East	North	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
A	Lomarakennus A	471 650	7 097 381	157,6	5,0	5,0	1,0	90,0	"Green house mode"	6,0
B	Asuinrakennus B	467 933	7 097 709	139,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
C	Lomarakennus C	467 899	7 096 936	139,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
D	Autiotalo D	470 313	7 094 090	168,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
E	Lomarakennus E	471 402	7 090 461	195,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
F	Lomarakennus F	471 557	7 090 435	188,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
G	Asuinrakennus G	477 593	7 095 429	191,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
H	Lomarakennus H	477 297	7 097 577	190,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
I	Lomarakennus I	475 097	7 097 098	176,3	5,0	5,0	1,0	90,0	"Green house mode"	6,0

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values Shadow hours per year [h/year]
A	Lomarakennus A	10:12
B	Asuinrakennus B	0:00
C	Lomarakennus C	0:00
D	Autiotalo D	29:46
E	Lomarakennus E	0:00
F	Lomarakennus F	0:00
G	Asuinrakennus G	0:00
H	Lomarakennus H	0:00
I	Lomarakennus I	6:49

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

No.	Name	Expected [h/year]
1	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
2	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
3	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
3	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (671)	0:00
4	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
4	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (673)	0:00
5	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
5	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (675)	0:00
6	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
6	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (676)	0:00
7	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
7	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (681)	0:00
8	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
8	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (674)	0:00
9	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
9	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (678)	0:00

To be continued on next page...

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11.4.2024 15.17/3.6.377

SHADOW - Main Result

Calculation: VE2_Yhteisvaikutus_Generic_RD200m_HH200m_20240410

...continued from previous page

No.	Name	Expected [h/year]
10	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
10	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (680)	0:00
11	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
11	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (679)	0:00
12	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
12	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (670)	2:51
13	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
13	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (684)	21:28
14	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (669)	0:00
14	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
15	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
15	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (683)	0:00
16	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
16	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (677)	0:00
17	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
17	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (664)	0:00
18	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
18	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (682)	1:35
19	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
19	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (668)	2:16
20	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
20	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (667)	0:00
21	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
21	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (666)	5:22
22	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
22	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (685)	0:00
23	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
23	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (665)	2:22
24	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
24	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (672)	2:03
25	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
26	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
26	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (692)	0:00
27	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
27	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (663)	0:00
28	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (691)	1:08
28	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
29	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
29	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (687)	7:28
30	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
31	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (914)	0:00
31	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (686)	0:00
32	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (915)	0:00
32	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (689)	0:00
33	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (916)	0:00
33	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (688)	0:00
34	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (917)	0:00
34	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (690)	0:00
35	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (918)	0:00
36	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (919)	0:00
37	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (920)	0:00
38	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (921)	0:00
39	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (922)	0:00
40	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (923)	0:00
41	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (924)	0:00
42	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (925)	0:00
43	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (926)	0:00
44	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (927)	0:00
45	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (928)	0:00
46	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (929)	0:00
47	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (930)	0:00
48	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (931)	0:00
49	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (932)	0:00
50	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (933)	0:00
51	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (934)	0:00

To be continued on next page...

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SHADOW - Main Result

Calculation: VE2_Yhteisvaikutus_Generic_RD200m_HH200m_20240410

...continued from previous page

No.	Name	Expected [h/year]
52	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (935)	0:00
53	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (936)	0:00
54	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (937)	0:00
55	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (938)	0:00
56	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (939)	0:00
57	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (940)	0:00
58	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (941)	0:00
59	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (942)	0:00
60	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (943)	0:00
61	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (944)	0:00
62	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (945)	0:00
63	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (946)	0:00
64	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (947)	0:00
65	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (948)	0:00
66	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (949)	0:00
67	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (950)	0:00
68	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (951)	0:00
69	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (952)	0:00
70	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (953)	0:00
71	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (954)	0:00
72	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (955)	0:00
73	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (956)	0:00
74	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (957)	0:00

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

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

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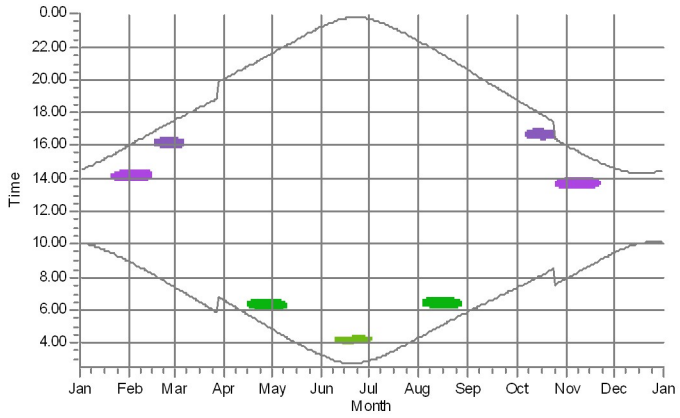
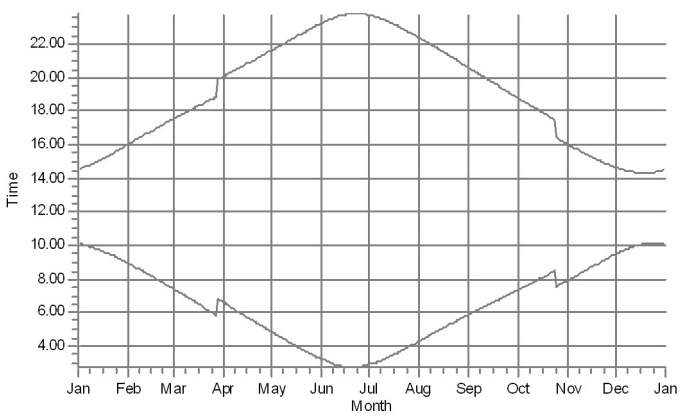
SHADOW - Calendar, graphical

Calculation: VE2_Yhteisvaikutus_Generic_RD200m_HH200m_20240410

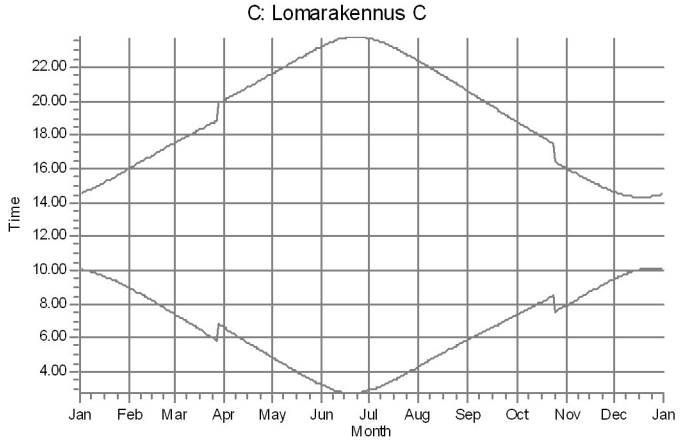
A: Lomarakennus A



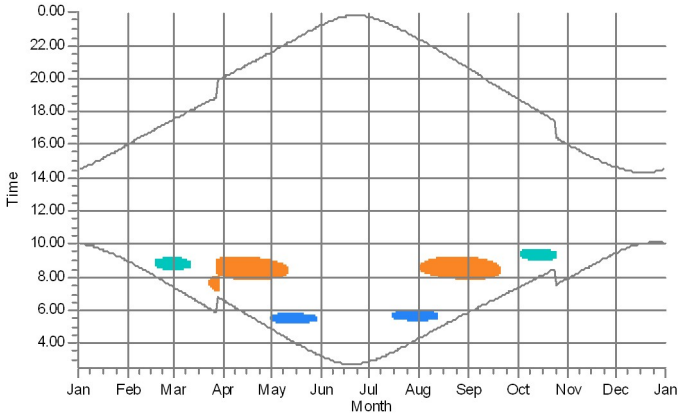
B: Asuinrakennus B



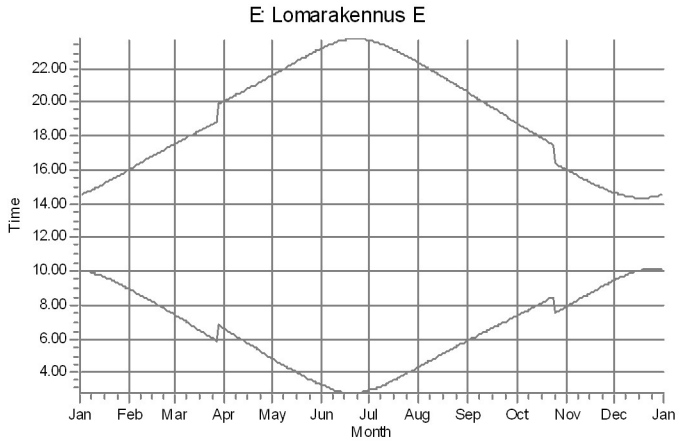
C: Lomarakennus C



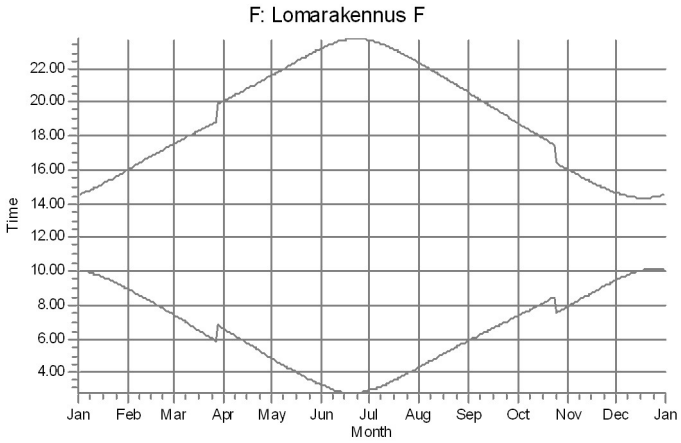
D: Autiotalo D



E: Lomarakennus E



F: Lomarakennus F



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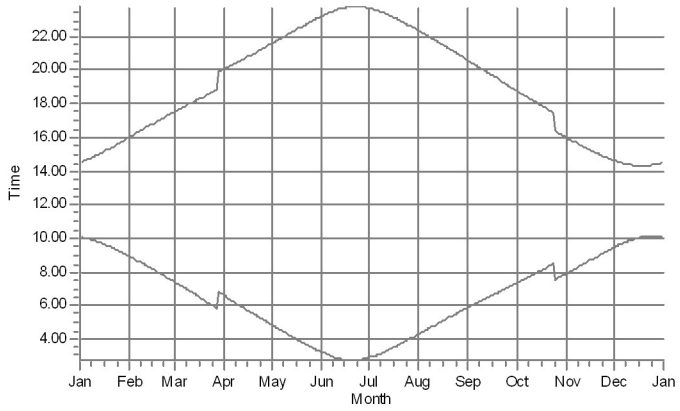
Calculated:
11.4.2024 15.17/3.6.377

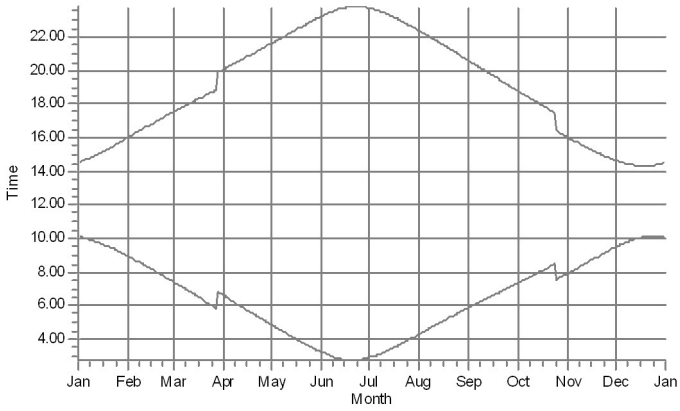
SHADOW - Calendar, graphical

Calculation: VE2_Yhteisvaikutus_Generic_RD200m_HH200m_20240410

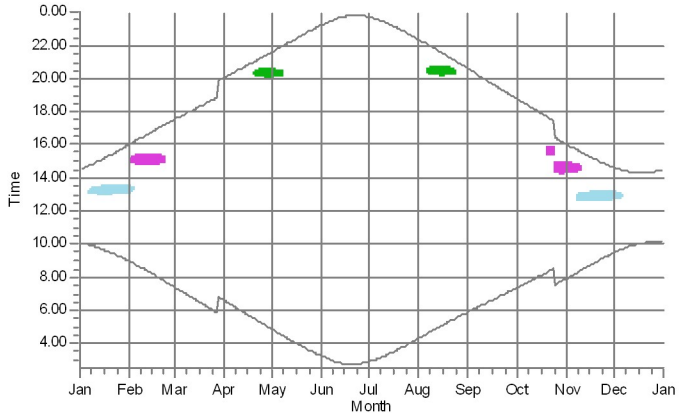
G: Asuinrakennus G



H: Lomarakennus H



I: Lomarakennus I



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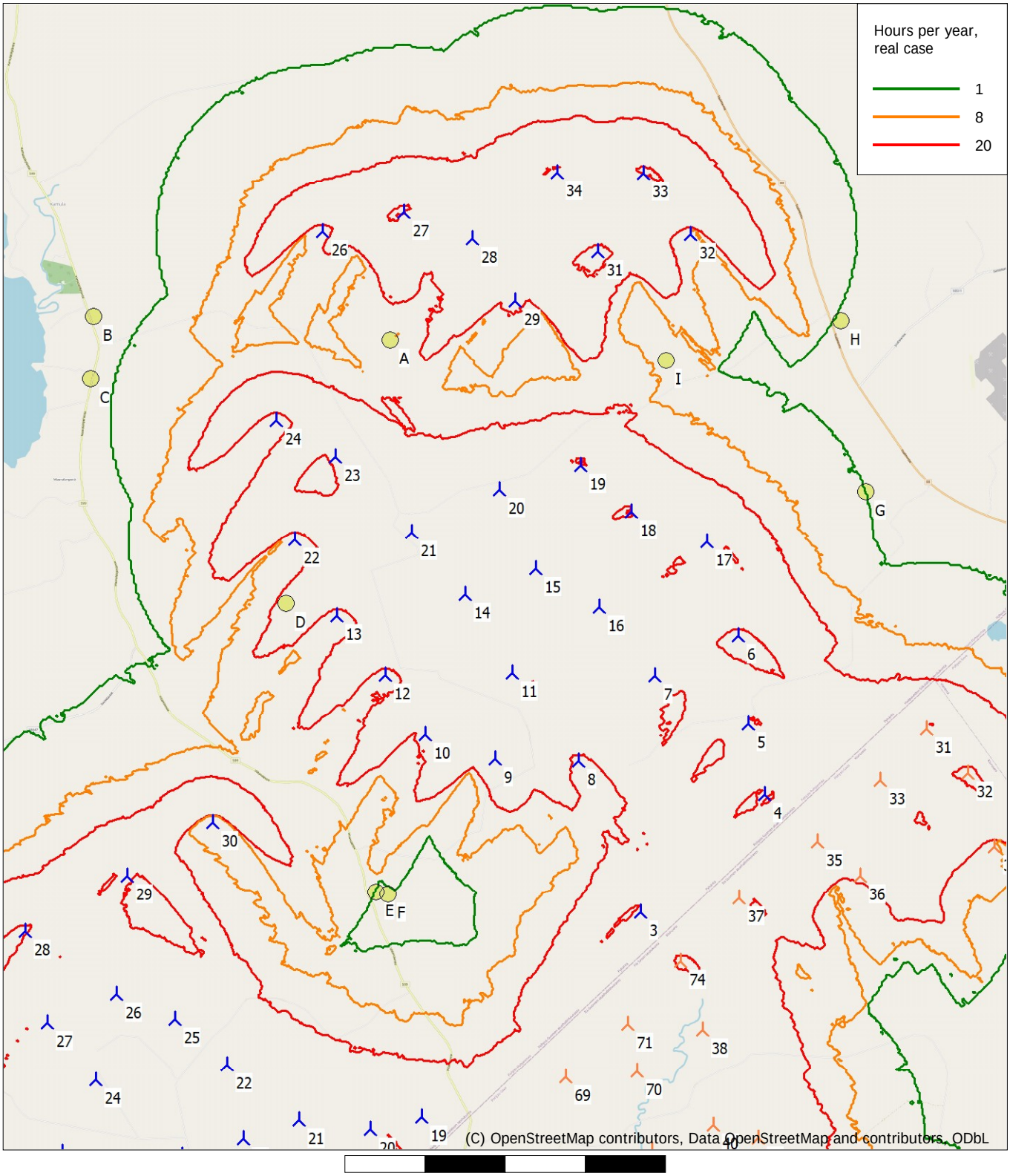
SHADOW - Map

Calculation: VE2_Yhteisvaikutus_Generic_RD200m_HH200m_20240410



Map: EMD OpenStreetMap , Print scale 1:70 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 473 103 North: 7 094 482

New WTG Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_Pyhäntä_Pilpankangas_0.wpo (1)

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

Liite 15. Varjostuksen yhteismallinnuksen tulokset ”real case, Forest” (Konnunsuon VE1).

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SHADOW - Main Result

Calculation: VE1_Yhteisvaikutus_Generic_RD200m_HH200m_20240410_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
0,77	2,46	4,19	6,93	8,81	9,87	9,13	6,84	4,43	2,23	0,93	0,26

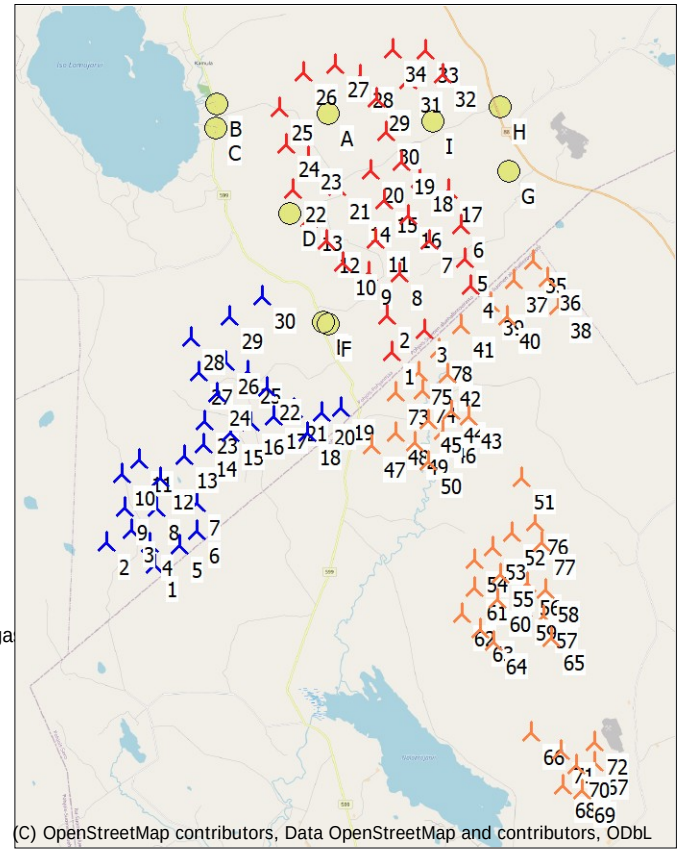
Operational hours are calculated from WTGs in calculation and wind distribution:
MERRA-2_N64,00_E026,875 (8)

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
474	404	401	459	606	894	1 106	1 090	887	784	713	657	8 474

Idle start wind speed: Cut in wind speed from power curve
A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: CONTOURLINE_Pyhäntä_Pilpankanga
Area object(s) used in calculation:
Area object (NW): (1)
Area object (NE): (2)
Area object (SW): (3)
Area object (SE): (4)
Obstacles used in calculation
Receptor grid resolution: 1,0 m

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



Scale 1:250 000

New WTG Shadow receptor

WTGs

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	465 686	7 082 467	165,4	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
1	473 642	7 089 459	165,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
2	464 106	7 083 255	147,6	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
2	473 523	7 090 697	166,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
3	464 951	7 083 636	154,2	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
3	474 724	7 090 192	163,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
4	465 561	7 083 192	163,3	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
4	476 298	7 091 642	169,7	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
5	466 536	7 083 117	165,1	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
5	476 097	7 092 538	175,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
6	467 111	7 083 592	159,6	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
6	475 979	7 093 646	177,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
7	474 928	7 093 153	170,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
7	467 136	7 084 492	159,4	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
8	465 786	7 084 367	164,6	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
8	473 955	7 092 082	169,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
9	464 736	7 084 392	152,2	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
9	472 921	7 092 121	171,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
10	464 636	7 085 517	155,2	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
10	472 045	7 092 434	174,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
11	465 236	7 085 992	159,1	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
11	473 133	7 093 196	170,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
12	465 936	7 085 367	160,8	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
12	471 545	7 093 189	175,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
13	466 761	7 086 117	170,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
13	470 952	7 093 929	178,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4

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11.4.2024 16.29/3.6.377

SHADOW - Main Result

Calculation: VE1_Yhteisvaikutus_Generic_RD200m_HH200m_20240410_forest

...continued from previous page

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
14	472 556	7 094 191	172,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
14	467 386	7 086 467	159,7	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
15	468 261	7 086 867	156,9	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
15	473 450	7 094 501	175,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
16	468 936	7 087 192	156,2	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
16	474 232	7 094 014	173,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
17	469 711	7 087 392	157,4	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
17	475 592	7 094 825	177,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
18	470 821	7 086 831	160,6	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
18	474 653	7 095 212	177,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
19	471 948	7 087 636	182,5	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
19	474 026	7 095 796	179,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
20	471 311	7 087 492	168,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
20	472 999	7 095 500	175,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
21	471 895	7 094 973	170,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
21	470 411	7 087 617	162,5	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
22	469 511	7 088 317	160,5	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
22	470 430	7 094 892	173,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
23	467 436	7 087 242	169,3	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
23	470 952	7 095 933	163,7	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
24	467 861	7 088 142	165,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
24	470 207	7 096 391	155,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
25	468 861	7 088 892	163,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
25	469 994	7 097 616	152,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
26	468 133	7 089 218	165,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
26	470 814	7 098 750	149,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
27	471 839	7 098 977	152,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
27	467 261	7 088 867	167,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
28	466 998	7 090 015	168,4	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
28	472 690	7 098 642	163,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
29	468 282	7 090 703	164,5	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
29	473 217	7 097 856	165,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
30	469 365	7 091 361	164,5	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
30	473 530	7 096 766	168,7	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
31	474 257	7 098 465	167,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
32	475 413	7 098 667	166,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
33	474 833	7 099 446	158,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
34	473 764	7 099 462	155,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
35	478 336	7 092 455	177,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
36	478 845	7 091 899	190,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
37	477 742	7 091 824	177,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
38	479 177	7 090 979	185,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
39	476 955	7 091 051	172,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
40	477 487	7 090 620	182,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
41	475 964	7 090 352	164,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
42	475 501	7 088 705	162,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
43	476 189	7 087 343	162,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
44	475 611	7 087 510	161,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
45	474 845	7 087 199	160,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
46	475 310	7 086 848	160,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
47	472 937	7 086 386	170,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
48	473 780	7 086 830	165,6	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
49	474 399	7 086 459	160,6	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
50	474 825	7 085 835	158,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
51	477 918	7 085 282	163,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
52	477 610	7 083 418	159,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
53	476 957	7 082 967	158,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
54	476 370	7 082 551	156,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
55	477 187	7 082 052	160,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
56	478 121	7 081 764	160,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
57	478 641	7 080 668	158,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
58	478 709	7 081 538	163,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
59	477 972	7 080 917	155,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4

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SHADOW - Main Result

Calculation: VE1_Yhteisvaikutus_Generic_RD200m_HH200m_20240410_forest

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	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
60	477 084	7 081 229	157,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
61	476 355	7 081 601	162,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
62	475 903	7 080 778	161,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
63	476 526	7 080 222	157,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
64	476 972	7 079 815	154,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
65	478 868	7 079 944	156,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
66	478 217	7 076 798	138,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
67	480 292	7 075 796	153,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
68	479 248	7 075 045	139,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
69	479 889	7 074 867	140,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
70	479 686	7 075 714	147,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
71	479 198	7 076 190	147,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
72	480 317	7 076 500	159,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
73	473 769	7 088 131	166,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
74	474 672	7 088 183	162,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
75	474 559	7 088 784	163,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
76	478 369	7 083 786	163,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
77	478 581	7 083 109	162,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
78	475 224	7 089 562	162,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4

Shadow receptor-Input

No.	Name	East	North	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
A	Lomarakennus A	471 650	7 097 381	157,6	5,0	5,0	1,0	90,0	"Green house mode"	6,0
B	Asuinrakennus B	467 933	7 097 709	139,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
C	Lomarakennus C	467 899	7 096 936	139,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
D	Autiotalo D	470 313	7 094 090	168,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
E	Lomarakennus E	471 402	7 090 461	195,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
F	Lomarakennus F	471 557	7 090 435	188,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
G	Asuinrakennus G	477 593	7 095 429	191,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
H	Lomarakennus H	477 297	7 097 577	190,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
I	Lomarakennus I	475 097	7 097 098	176,3	5,0	5,0	1,0	90,0	"Green house mode"	6,0

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values Shadow hours per year [h/year]
A	Lomarakennus A	0:00
B	Asuinrakennus B	1:58
C	Lomarakennus C	0:00
D	Autiotalo D	29:46
E	Lomarakennus E	0:00
F	Lomarakennus F	2:16
G	Asuinrakennus G	0:00
H	Lomarakennus H	0:00
I	Lomarakennus I	0:00

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

No.	Name	Expected [h/year]
1	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
1	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (636)	0:00
2	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
2	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (639)	2:16
3	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
3	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (640)	0:00
4	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00

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SHADOW - Main Result

Calculation: VE1_Yhteisvaikutus_Generic_RD200m_HH200m_20240410_forest

...continued from previous page

No.	Name	Expected [h/year]
4	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (642)	0:00
5	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
5	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (644)	0:00
6	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
6	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (645)	0:00
7	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (650)	0:00
7	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
8	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
8	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (643)	0:00
9	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
9	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (647)	0:00
10	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
10	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (649)	0:00
11	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
11	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (648)	0:00
12	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
12	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (638)	2:51
13	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
13	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (653)	21:28
14	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (637)	0:00
14	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
15	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
15	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (652)	0:00
16	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
16	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (646)	0:00
17	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
17	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (630)	0:00
18	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
18	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (651)	0:00
19	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
19	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (635)	0:00
20	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
20	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (634)	0:00
21	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (633)	5:22
21	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
22	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
22	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (654)	0:00
23	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
23	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (632)	0:00
24	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
24	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (641)	0:00
25	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
25	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (655)	1:58
26	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
26	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (662)	0:00
27	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (629)	0:00
27	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
28	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
28	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (661)	0:00
29	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
29	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (657)	0:00
30	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
30	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (631)	0:00
31	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (656)	0:00
32	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (659)	0:00
33	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (658)	0:00
34	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (660)	0:00
35	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (914)	0:00
36	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (915)	0:00
37	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (916)	0:00
38	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (917)	0:00
39	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (918)	0:00
40	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (919)	0:00
41	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (920)	0:00
42	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (921)	0:00

To be continued on next page...

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11.4.2024 16.29/3.6.377

SHADOW - Main Result

Calculation: VE1_Yhteisvaikutus_Generic_RD200m_HH200m_20240410_forest

...continued from previous page

No.	Name	Expected [h/year]
43	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (922)	0:00
44	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (923)	0:00
45	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (924)	0:00
46	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (925)	0:00
47	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (926)	0:00
48	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (927)	0:00
49	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (928)	0:00
50	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (929)	0:00
51	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (930)	0:00
52	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (931)	0:00
53	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (932)	0:00
54	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (933)	0:00
55	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (934)	0:00
56	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (935)	0:00
57	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (936)	0:00
58	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (937)	0:00
59	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (938)	0:00
60	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (939)	0:00
61	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (940)	0:00
62	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (941)	0:00
63	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (942)	0:00
64	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (943)	0:00
65	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (944)	0:00
66	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (945)	0:00
67	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (946)	0:00
68	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (947)	0:00
69	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (948)	0:00
70	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (949)	0:00
71	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (950)	0:00
72	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (951)	0:00
73	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (952)	0:00
74	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (953)	0:00
75	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (954)	0:00
76	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (955)	0:00
77	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (956)	0:00
78	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (957)	0:00

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

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

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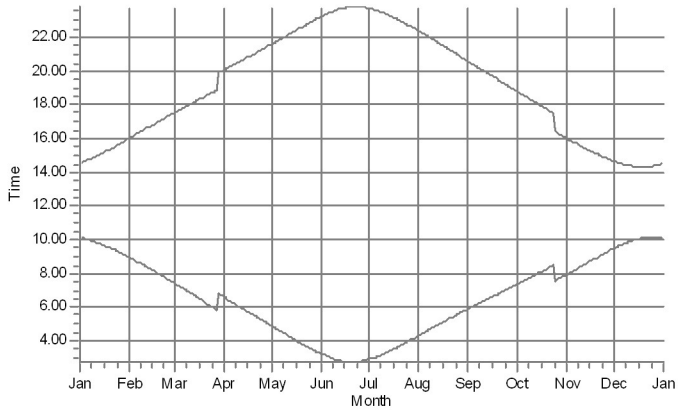
11.4.2024 16.29/3.6.377

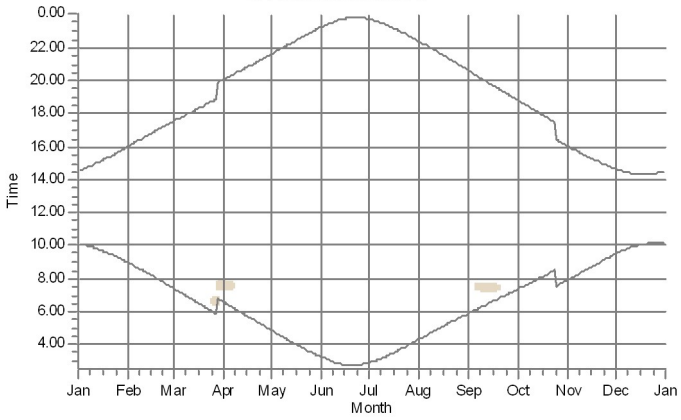
SHADOW - Calendar, graphical

Calculation: VE1_Yhteisvaikutus_Generic_RD200m_HH200m_20240410_forest

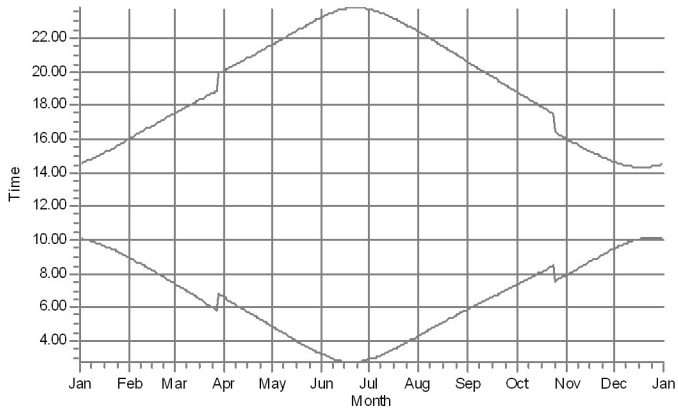
A: Lomarakennus A



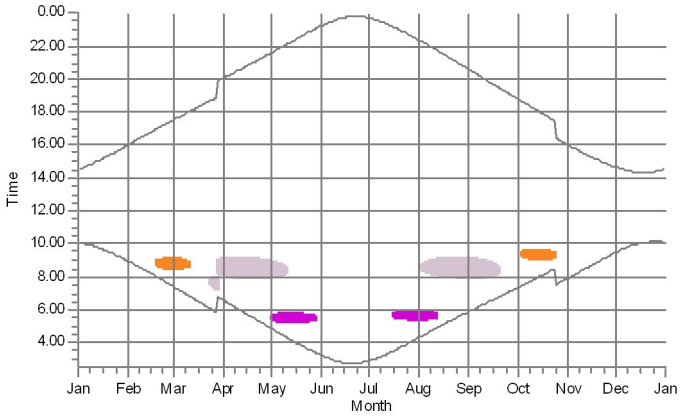
B: Asuinrakennus B



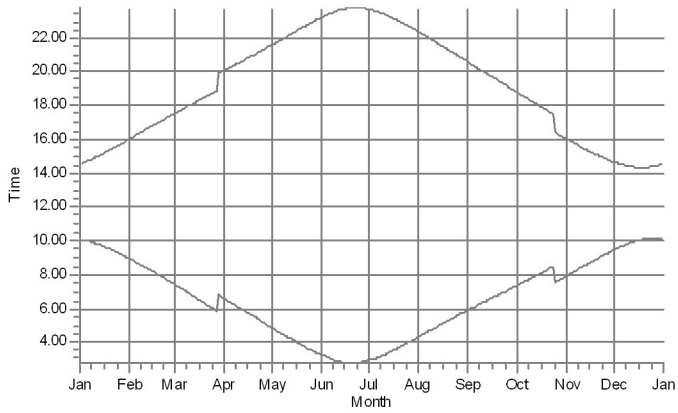
C: Lomarakennus C



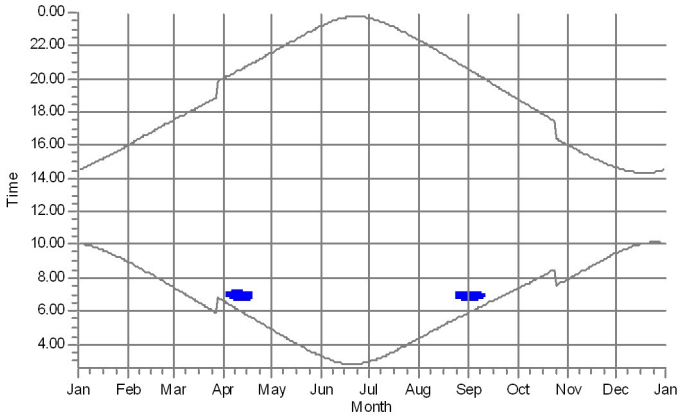
D: Autiotalo D



E: Lomarakennus E



F: Lomarakennus F



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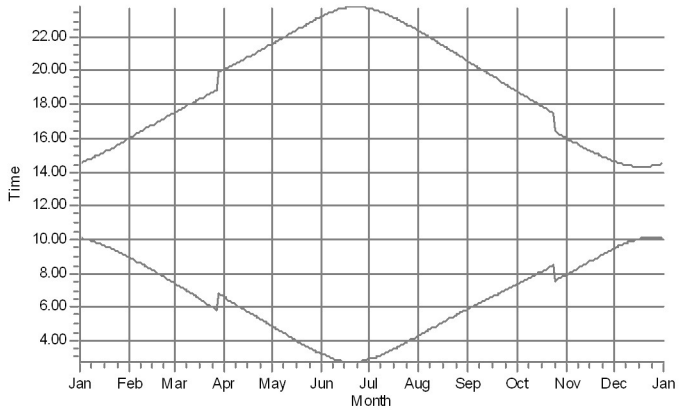
Calculated:
11.4.2024 16.29/3.6.377

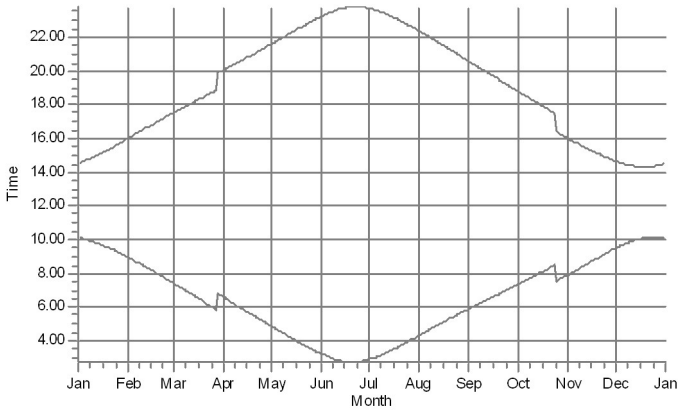
SHADOW - Calendar, graphical

Calculation: VE1_Yhteisvaikutus_Generic_RD200m_HH200m_20240410_forest

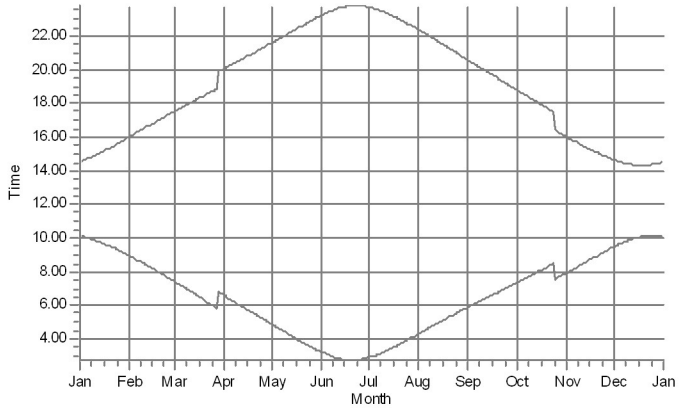
G: Asuinrakennus G



H: Lomarakennus H



I: Lomarakennus I



WTGs

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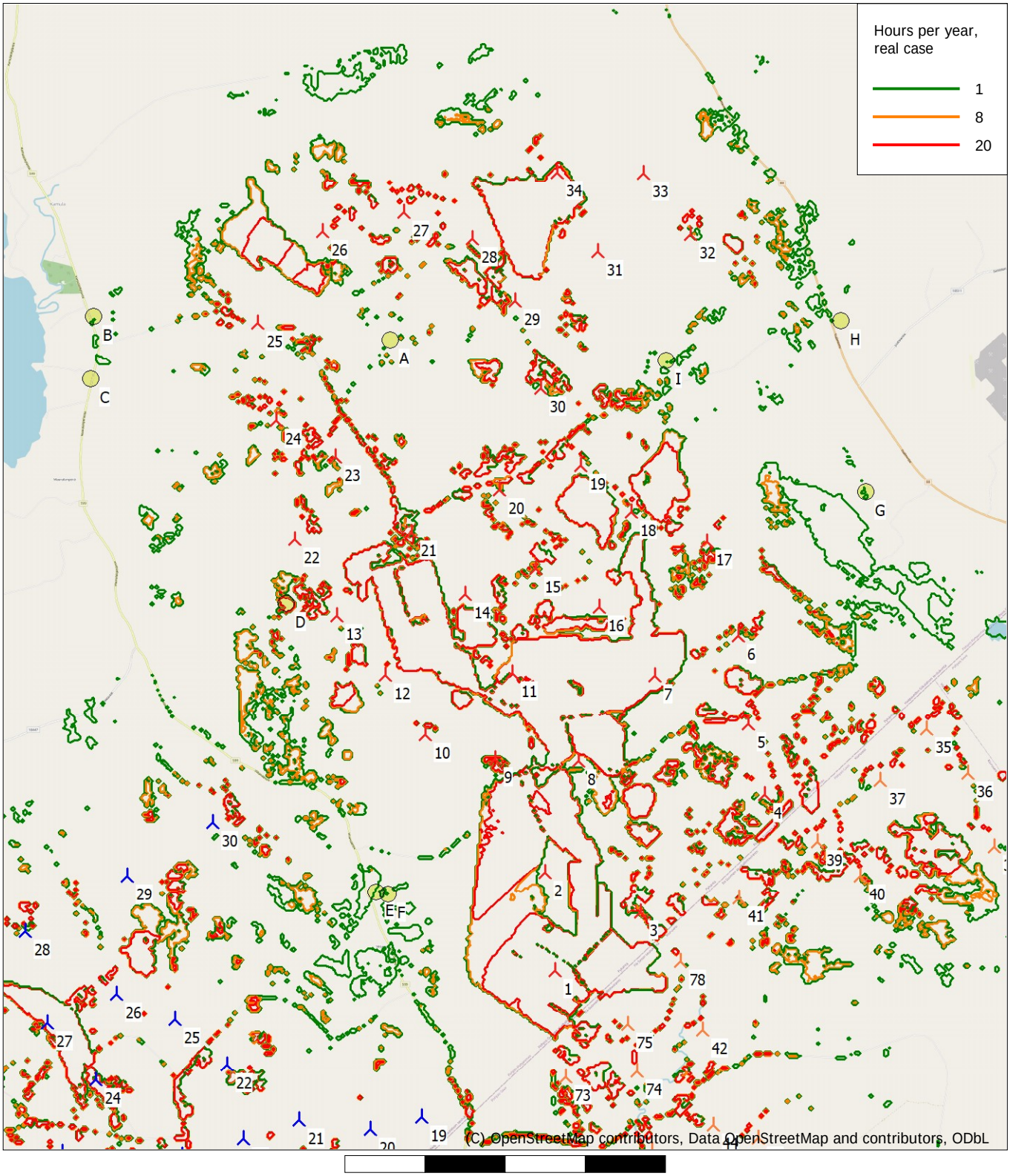
Calculated:
11.4.2024 16.29/3.6.377

SHADOW - Map

Calculation: VE1_Yhteisvaikutus_Generic_RD200m_HH200m_20240410_forest



Map: EMD OpenStreetMap , Print scale 1:70 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 473 103 North: 7 094 482

New WTG Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_Pyhäntä_Pilpankangas_0.wpo (1)

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

Liite 16: Varjostuksen yhteismallinnuksen tulokset ”real case, Forest” (Konnunsuon VE2).

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Calculated:
12.4.2024 10.40/3.6.377

SHADOW - Main Result

Calculation: VE2_Yhteisvaikutus_Generic_RD200m_HH200m_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
0,77	2,46	4,19	6,93	8,81	9,87	9,13	6,84	4,43	2,23	0,93	0,26

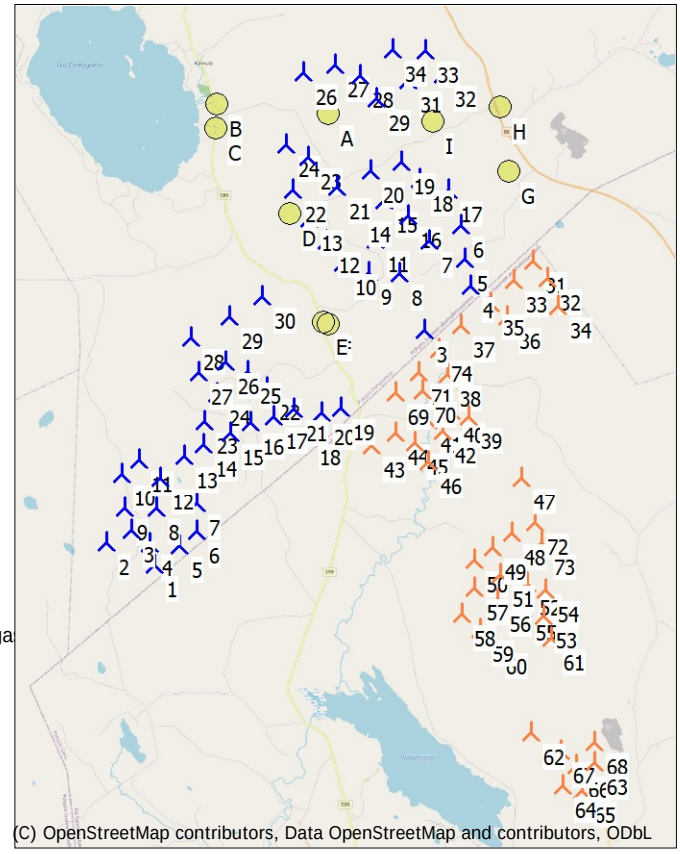
Operational hours are calculated from WTGs in calculation and wind distribution:
MERRA-2_N64,00_E026,875 (8)

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
474	404	401	459	606	894	1 106	1 090	887	784	713	657	8 474

Idle start wind speed: Cut in wind speed from power curve
A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: CONTOURLINE_Pyhäntä_Pilpankanga
Area object(s) used in calculation:
Area object (NW): (1)
Area object (NE): (2)
Area object (SW): (3)
Area object (SE): (4)
Obstacles used in calculation
Receptor grid resolution: 1,0 m

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



Scale 1:250 000

New WTG Shadow receptor

WTGs

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	465 686	7 082 467	165,4	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
2	464 106	7 083 255	147,6	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
3	464 951	7 083 636	154,2	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
3	474 724	7 090 192	163,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
4	465 561	7 083 192	163,3	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
4	476 298	7 091 642	169,7	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
5	466 536	7 083 117	165,1	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
5	476 097	7 092 538	175,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
6	467 111	7 083 592	159,6	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
6	475 979	7 093 646	177,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
7	467 136	7 084 492	159,4	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
7	474 928	7 093 153	170,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
8	465 786	7 084 367	164,6	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
8	473 955	7 092 082	169,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
9	464 736	7 084 392	152,2	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
9	472 921	7 092 121	171,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
10	464 636	7 085 517	155,2	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
10	472 045	7 092 434	174,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
11	465 236	7 085 992	159,1	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
11	473 133	7 093 196	170,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
12	465 936	7 085 367	160,8	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
12	471 545	7 093 189	175,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
13	466 761	7 086 117	170,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
13	470 952	7 093 929	178,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
14	472 556	7 094 191	172,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
14	467 386	7 086 467	159,7	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4

To be continued on next page...

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12.4.2024 10.40/3.6.377

SHADOW - Main Result

Calculation: VE2_Yhteisvaikutus_Generic_RD200m_HH200m_Forest

...continued from previous page

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
15	468 261	7 086 867	156,9	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
15	473 450	7 094 501	175,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
16	468 936	7 087 192	156,2	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
16	474 232	7 094 014	173,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
17	469 711	7 087 392	157,4	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
17	475 592	7 094 825	177,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
18	470 821	7 086 831	160,6	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
18	474 653	7 095 212	177,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
19	471 948	7 087 636	182,5	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
19	474 026	7 095 796	179,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
20	471 311	7 087 492	168,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
20	472 999	7 095 500	175,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
21	470 411	7 087 617	162,5	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
21	471 895	7 094 973	170,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
22	469 511	7 088 317	160,5	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
22	470 430	7 094 892	173,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
23	467 436	7 087 242	169,3	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
23	470 952	7 095 933	163,7	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
24	467 861	7 088 142	165,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
24	470 207	7 096 391	155,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
25	468 861	7 088 892	163,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
26	468 133	7 089 218	165,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
26	470 814	7 098 750	149,2	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
27	467 261	7 088 867	167,0	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
27	471 839	7 098 977	152,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
28	472 690	7 098 642	163,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
28	466 998	7 090 015	168,4	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
29	468 282	7 090 703	164,5	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
29	473 217	7 097 856	165,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
30	469 365	7 091 361	164,5	Siemens Gamesa SG ...	Yes	Generic	RD200 HH200-7 200	7 200	200,0	200,0	2 216	10,4
31	478 336	7 092 455	177,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
31	474 257	7 098 465	167,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
32	478 845	7 091 899	190,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
32	475 413	7 098 667	166,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
33	477 742	7 091 824	177,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
33	474 833	7 099 446	158,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
34	479 177	7 090 979	185,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
34	473 764	7 099 462	155,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
35	476 955	7 091 051	172,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
36	477 487	7 090 620	182,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
37	475 964	7 090 352	164,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
38	475 501	7 088 705	162,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
39	476 189	7 087 343	162,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
40	475 611	7 087 510	161,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
41	474 845	7 087 199	160,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
42	475 310	7 086 848	160,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
43	472 937	7 086 386	170,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
44	473 780	7 086 830	165,6	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
45	474 399	7 086 459	160,6	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
46	474 825	7 085 835	158,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
47	477 918	7 085 282	163,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
48	477 610	7 083 418	159,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
49	476 957	7 082 967	158,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
50	476 370	7 082 551	156,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
51	477 187	7 082 052	160,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
52	478 121	7 081 764	160,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
53	478 641	7 080 668	158,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
54	478 709	7 081 538	163,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
55	477 972	7 080 917	155,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
56	477 084	7 081 229	157,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
57	476 355	7 081 601	162,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
58	475 903	7 080 778	161,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
59	476 526	7 080 222	157,4	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4

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SHADOW - Main Result

Calculation: VE2_Yhteisvaikutus_Generic_RD200m_HH200m_Forest

...continued from previous page

	East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
60	476 972	7 079 815	154,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
61	478 868	7 079 944	156,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
62	478 217	7 076 798	138,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
63	480 292	7 075 796	153,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
64	479 248	7 075 045	139,8	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
65	479 889	7 074 867	140,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
66	479 686	7 075 714	147,9	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
67	479 198	7 076 190	147,3	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
68	480 317	7 076 500	159,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
69	473 769	7 088 131	166,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
70	474 672	7 088 183	162,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
71	474 559	7 088 784	163,0	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
72	478 369	7 083 786	163,1	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
73	478 581	7 083 109	162,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4
74	475 224	7 089 562	162,5	Generic RD200 HH20...	Yes	Generic	RD200 HH200 BW4,71-6 800	6 800	200,0	200,0	2 086	10,4

Shadow receptor-Input

No.	Name	East	North	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
A	Lomarakennus A	471 650	7 097 381	157,6	5,0	5,0	1,0	90,0	"Green house mode"	6,0
B	Asuinrakennus B	467 933	7 097 709	139,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
C	Lomarakennus C	467 899	7 096 936	139,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
D	Autiotalo D	470 313	7 094 090	168,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
E	Lomarakennus E	471 402	7 090 461	195,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
F	Lomarakennus F	471 557	7 090 435	188,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
G	Asuinrakennus G	477 593	7 095 429	191,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
H	Lomarakennus H	477 297	7 097 577	190,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
I	Lomarakennus I	475 097	7 097 098	176,3	5,0	5,0	1,0	90,0	"Green house mode"	6,0

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values Shadow hours per year [h/year]
A	Lomarakennus A	0:00
B	Asuinrakennus B	0:00
C	Lomarakennus C	0:00
D	Autiotalo D	29:46
E	Lomarakennus E	0:00
F	Lomarakennus F	0:00
G	Asuinrakennus G	0:00
H	Lomarakennus H	0:00
I	Lomarakennus I	0:00

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

No.	Name	Expected [h/year]
1	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
2	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
3	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
3	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (671)	0:00
4	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
4	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (673)	0:00
5	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
5	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (675)	0:00
6	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
6	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (676)	0:00
7	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00

To be continued on next page...

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12.4.2024 10.40/3.6.377

SHADOW - Main Result

Calculation: VE2_Yhteisvaikutus_Generic_RD200m_HH200m_Forest

...continued from previous page

No.	Name	Expected [h/year]
7	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (681)	0:00
8	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
8	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (674)	0:00
9	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
9	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (678)	0:00
10	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
10	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (680)	0:00
11	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
11	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (679)	0:00
12	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
12	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (670)	2:51
13	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
13	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (684)	21:28
14	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (669)	0:00
14	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
15	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
15	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (683)	0:00
16	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
16	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (677)	0:00
17	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
17	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (664)	0:00
18	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
18	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (682)	0:00
19	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
19	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (668)	0:00
20	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
20	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (667)	0:00
21	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
21	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (666)	5:22
22	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
22	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (685)	0:00
23	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
23	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (665)	0:00
24	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
24	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (672)	0:00
25	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
26	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
26	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (692)	0:00
27	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
27	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (663)	0:00
28	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (691)	0:00
28	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
29	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
29	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (687)	0:00
30	Siemens Gamesa SG 6.6-170 6600 170.0 !O! hub: 165.0 m (TOT: 250.	0:00
31	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (914)	0:00
31	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (686)	0:00
32	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (915)	0:00
32	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (689)	0:00
33	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (916)	0:00
33	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (688)	0:00
34	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (917)	0:00
34	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (690)	0:00
35	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (918)	0:00
36	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (919)	0:00
37	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (920)	0:00
38	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (921)	0:00
39	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (922)	0:00
40	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (923)	0:00
41	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (924)	0:00
42	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (925)	0:00
43	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (926)	0:00
44	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (927)	0:00
45	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (928)	0:00
46	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (929)	0:00

To be continued on next page...

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12.4.2024 10.40/3.6.377

SHADOW - Main Result

Calculation: VE2_Yhteisvaikutus_Generic_RD200m_HH200m_Forest

...continued from previous page

No.	Name	Expected [h/year]
47	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (930)	0:00
48	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (931)	0:00
49	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (932)	0:00
50	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (933)	0:00
51	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (934)	0:00
52	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (935)	0:00
53	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (936)	0:00
54	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (937)	0:00
55	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (938)	0:00
56	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (939)	0:00
57	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (940)	0:00
58	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (941)	0:00
59	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (942)	0:00
60	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (943)	0:00
61	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (944)	0:00
62	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (945)	0:00
63	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (946)	0:00
64	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (947)	0:00
65	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (948)	0:00
66	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (949)	0:00
67	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (950)	0:00
68	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (951)	0:00
69	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (952)	0:00
70	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (953)	0:00
71	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (954)	0:00
72	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (955)	0:00
73	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (956)	0:00
74	Generic RD200 HH200 BW4,71 6800 200.0 !O! hub: 200,0 m (TOT: 300,0 m) (957)	0:00

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

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

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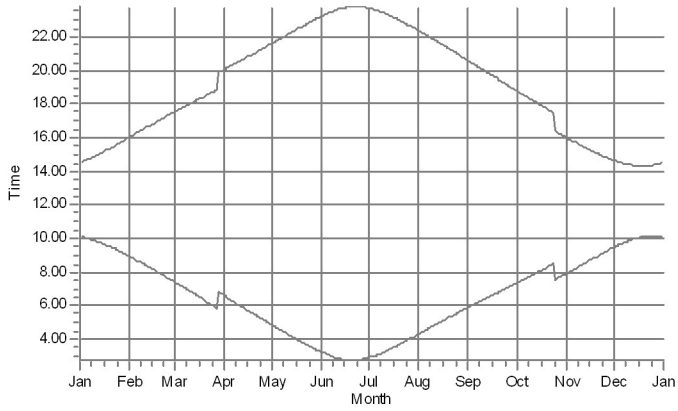
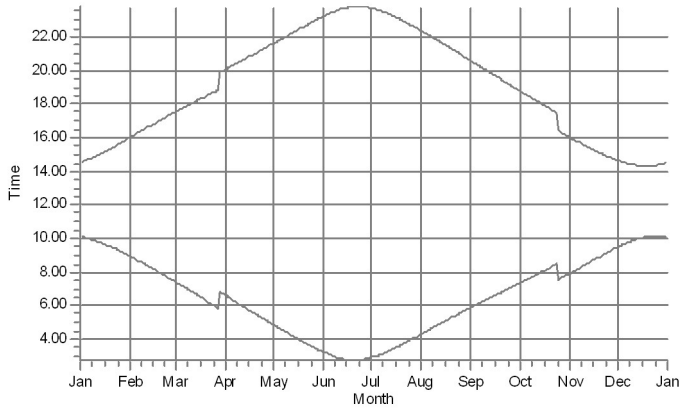
SHADOW - Calendar, graphical

Calculation: VE2_Yhteisvaikutus_Generic_RD200m_HH200m_Forest

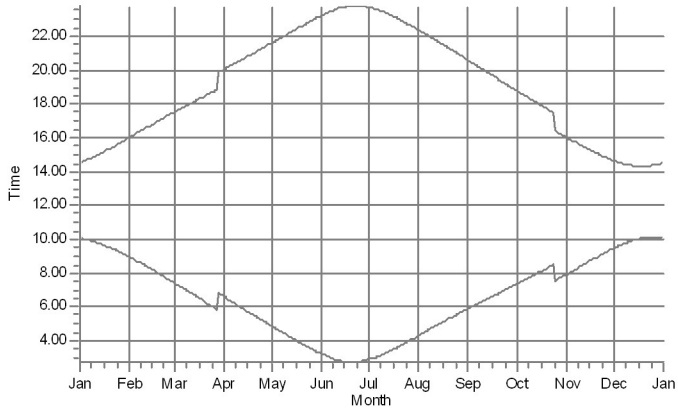
A: Lomarakennus A



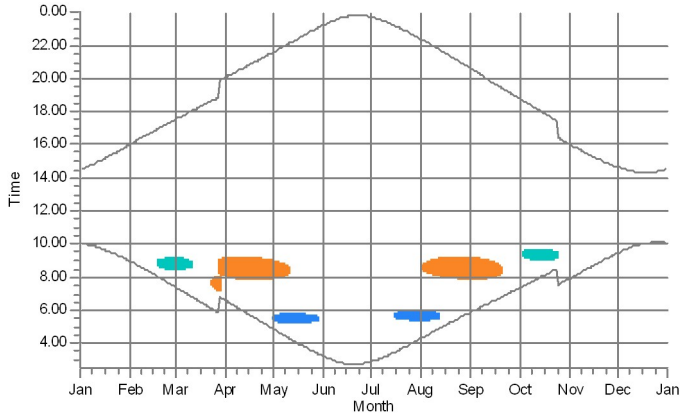
B: Asuinrakennus B



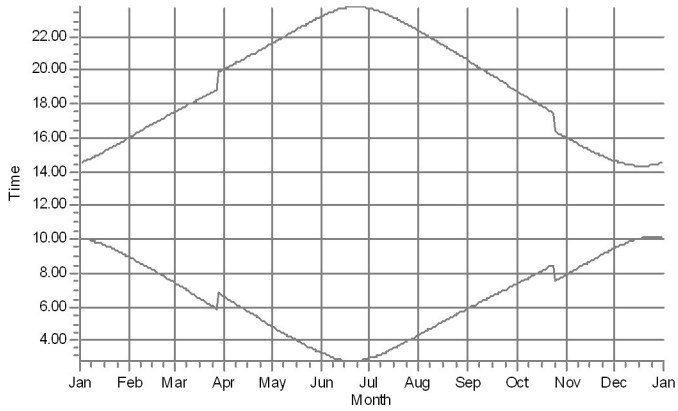
C: Lomarakennus C



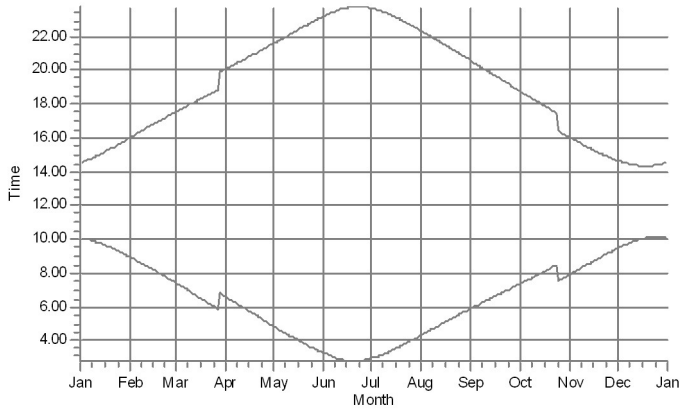
D: Autiotalo D



E: Lomarakennus E



F: Lomarakennus F



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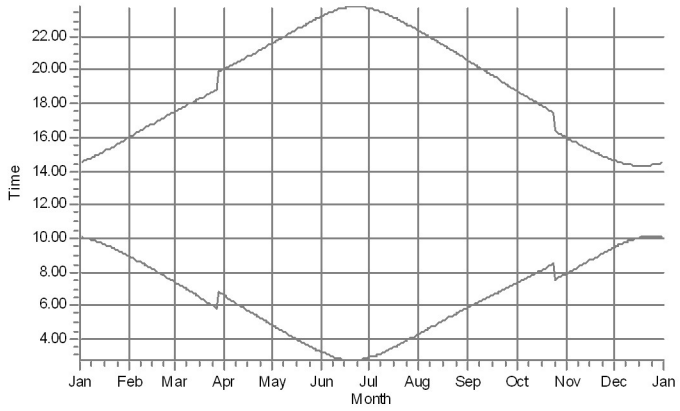
Calculated:
12.4.2024 10.40/3.6.377

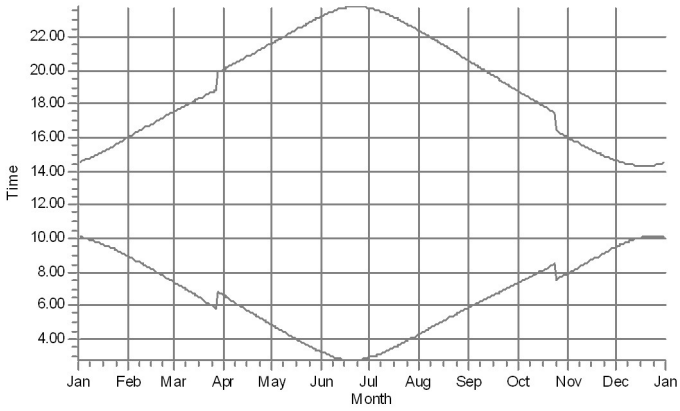
SHADOW - Calendar, graphical

Calculation: VE2_Yhteisvaikutus_Generic_RD200m_HH200m_Forest

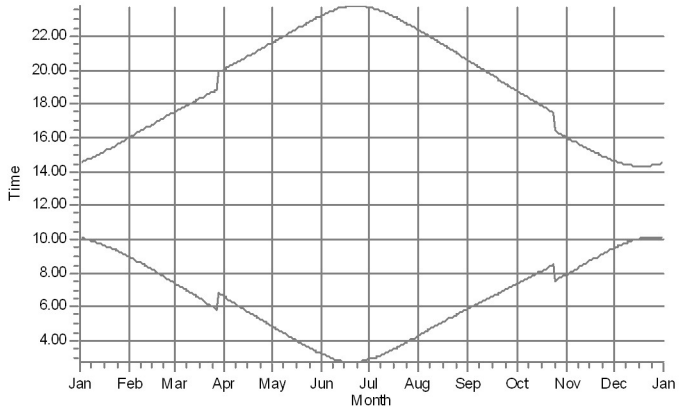
G: Asuinrakennus G



H: Lomarakennus H



I: Lomarakennus I



WTGs

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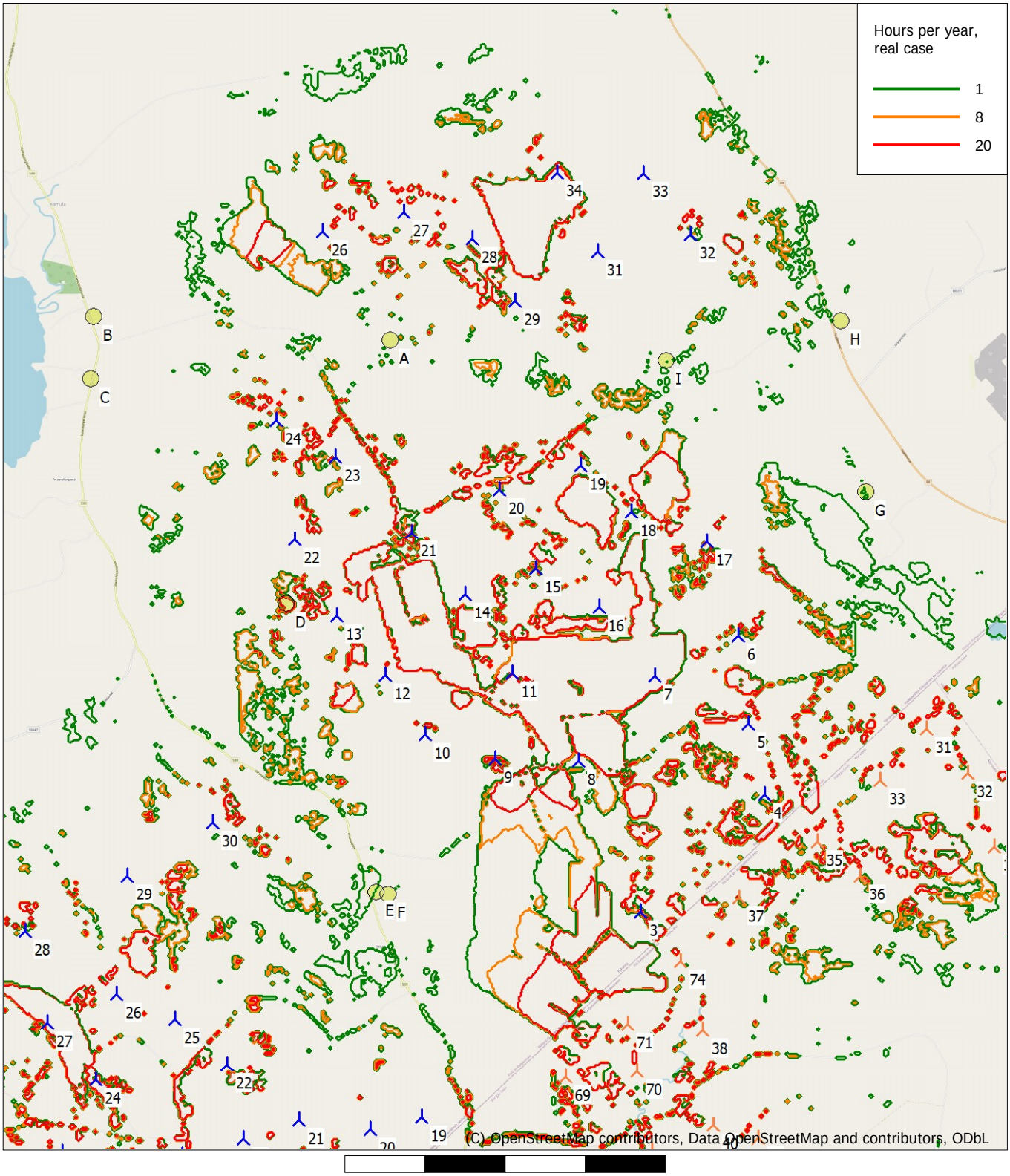
SHADOW - Map

Calculation: VE2_Yhteisvaikutus_Generic_RD200m_HH200m_Forest



Map: EMD OpenStreetMap , Print scale 1:70 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 473 103 North: 7 094 482

New WTG Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_Pyhäntä_Pilpankangas_0.wpo (1)

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