

Project:

Makikangas_MASTER

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wpd Scandinavia AB

Ferkens Gränd 3

SE-111 30 Stockholm

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Karoliina Joensuu / karoliina.joensuu@wpd.fi

Calculated:

28.7.2011 15:11/2.7.486

SHADOW - Main Result

Calculation: Shadow_minlayout_11WTG_realcase_EIAR_KJ

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
0.87	2.43	4.19	6.53	9.29	9.73	8.81	6.71	4.53	2.45	1.03	0.48

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

Default Meteo data description

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
772	532	339	400	596	801	887	1191	1601	604	483	506	8712

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

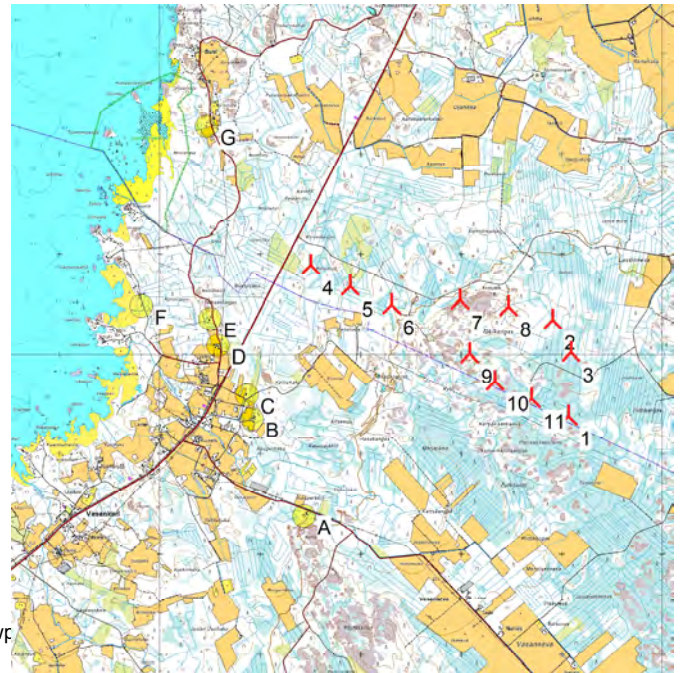
A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:

Height contours used: Height Contours: CONTOURLINE_ONLINEDATA_0.wf

Obstacles not used in calculation

Eye height: 1.5 m

Grid resolution: 10 m



Scale 1:75 000

▲ New WTG

● Shadow receptor

WTGs

KKJ Zone: 2	East	North	Z	Row data/Description	WTG type				Shadow data			
					Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Calculation distance	RPM
KKJ Zone: 2	[m]						[kW]	[m]	[m]	[m]	[RPM]	
1	2 504 067	7 139 390	25.0	WTG 7	Yes	ENERCON	E-101-3 000	3 000	101.0	135.4	2 214	14.5
2	2 503 910	7 140 349	25.0	WTG 9	Yes	ENERCON	E-101-3 000	3 000	101.0	135.4	2 214	14.5
3	2 504 094	7 140 025	25.2	WTG 8	Yes	ENERCON	E-101-3 000	3 000	101.0	135.4	2 214	14.5
4	2 501 501	7 140 887	10.0	WTG 1	Yes	ENERCON	E-101-3 000	3 000	101.0	135.4	2 214	14.5
5	2 501 894	7 140 680	14.0	WTG 2	Yes	ENERCON	E-101-3 000	3 000	101.0	135.4	2 214	14.5
6	2 502 308	7 140 499	18.3	WTG 3	Yes	ENERCON	E-101-3 000	3 000	101.0	135.4	2 214	14.5
7	2 502 987	7 140 546	22.4	WTG 11	Yes	ENERCON	E-101-3 000	3 000	101.0	135.4	2 214	14.5
8	2 503 470	7 140 480	28.3	WTG 10	Yes	ENERCON	E-101-3 000	3 000	101.0	135.4	2 214	14.5
9	2 503 083	7 140 015	30.0	WTG 4	Yes	ENERCON	E-101-3 000	3 000	101.0	135.4	2 214	14.5
10	2 503 335	7 139 737	29.8	WTG 5	Yes	ENERCON	E-101-3 000	3 000	101.0	135.4	2 214	14.5
11	2 503 700	7 139 561	25.0	WTG 6	Yes	ENERCON	E-101-3 000	3 000	101.0	135.4	2 214	14.5

Shadow receptor-Input

No.	Name	KKJ Zone: 2			Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
		East	North	Z						
				[m]	[m]	[m]	[°]	[°]		
A	Rianperkkio	2 501 436	7 138 392	18.4	1.0	1.0	2.0	-180.0	0.0	"Green house mode"
B	Talus 2	2 500 920	7 139 360	10.0	1.0	1.0	2.0	-180.0	0.0	"Green house mode"
C	Talus 1	2 500 868	7 139 596	9.9	1.0	1.0	2.0	-180.0	0.0	"Green house mode"
D	Vainio	2 500 580	7 140 093	6.0	1.0	1.0	2.0	-180.0	0.0	"Green house mode"
E	Tarkisenkangas	2 500 500	7 140 357	5.0	1.0	1.0	2.0	-180.0	0.0	"Green house mode"
F	Rantavainio_holiday	2 499 816	7 140 485	0.9	1.0	1.0	2.0	-180.0	0.0	"Green house mode"
G	Kivitolppa_holiday	2 500 468	7 142 274	1.7	1.0	1.0	2.0	-180.0	0.0	"Green house mode"

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SHADOW - Main Result**Calculation:** Shadow_minlayout_11WTG_realcase_EIAR_KJ**Calculation Results**

Shadow receptor

No.	Name	Shadow, expected values	
		Shadow hours	
		per year	
		[h/year]	
A	Rianperkkiö	0:00	
B	Talus 2	2:18	
C	Talus 1	5:09	
D	Vainio	8:09	
E	Tarkisenkangas	5:16	
F	Rantavainio_holiday	1:17	
G	Kivitolppa_holiday	0:52	

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

No.	Name	Worst case	Expected
		[h/year]	[h/year]
1	WTG 7	0:00	0:00
2	WTG 9	0:00	0:00
3	WTG 8	0:00	0:00
4	WTG 1	38:16	10:33
5	WTG 2	29:07	7:48
6	WTG 3	16:49	4:41
7	WTG 11	0:00	0:00
8	WTG 10	0:00	0:00
9	WTG 4	0:00	0:00
10	WTG 5	0:00	0:00
11	WTG 6	0:00	0:00

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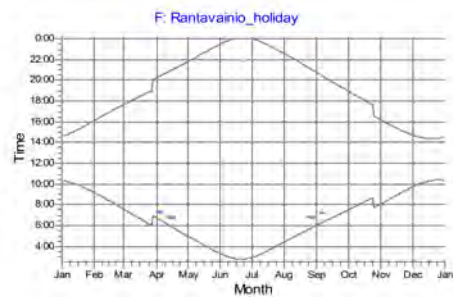
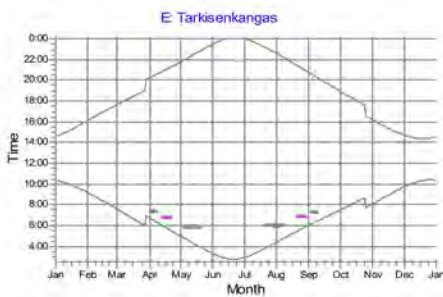
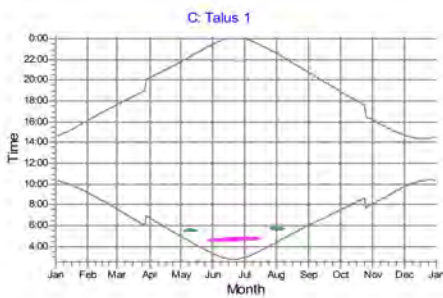
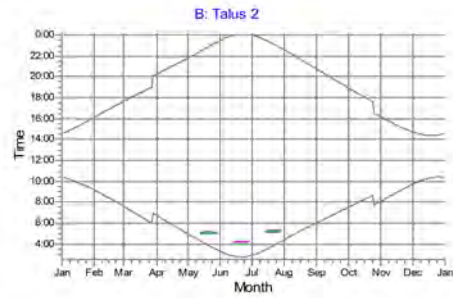
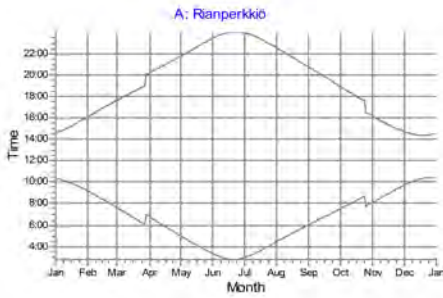
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SHADOW - Calendar, graphical

Calculation: Shadow minlayout 11WTG realcase EIAR KJ



WTGs



4: WTG 1



5: WTG 2



6: WTG 3

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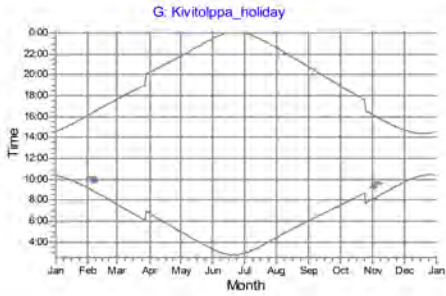
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SHADOW - Calendar, graphical

Calculation: Shadow minlayout 11WTG realcase EIAR KJ



WTGs



4: WTG 1



5: WTG 2

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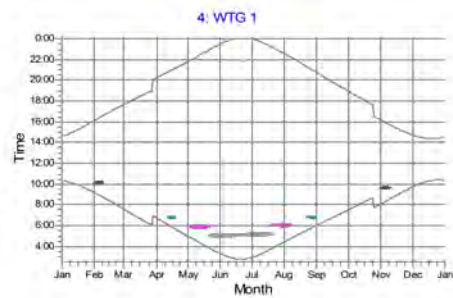
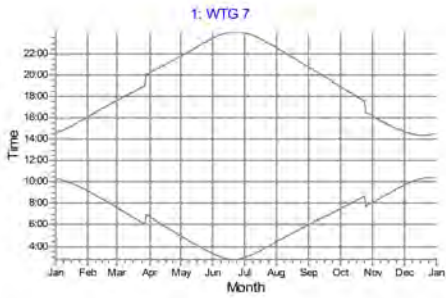
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SHADOW - Calendar per WTG, graphical

Calculation: Shadow minlayout 11WTG realcase EIAR KJ



Shadow receptor



B: Talus 2

C: Talus 1



D: Vainio

E: Tarkisenkangas



F: Rantavainio_holiday

G: Kivitolppa_holiday

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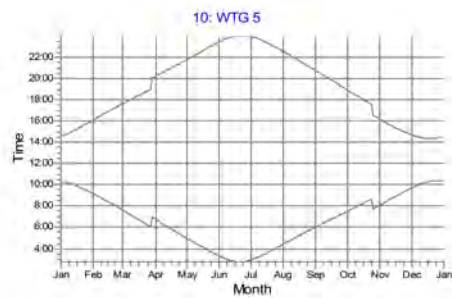
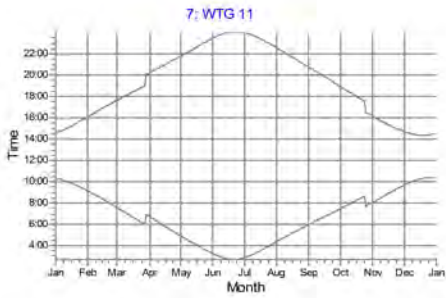
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Calculation: Shadow minlayout 11WTG realcase EIAR KJ



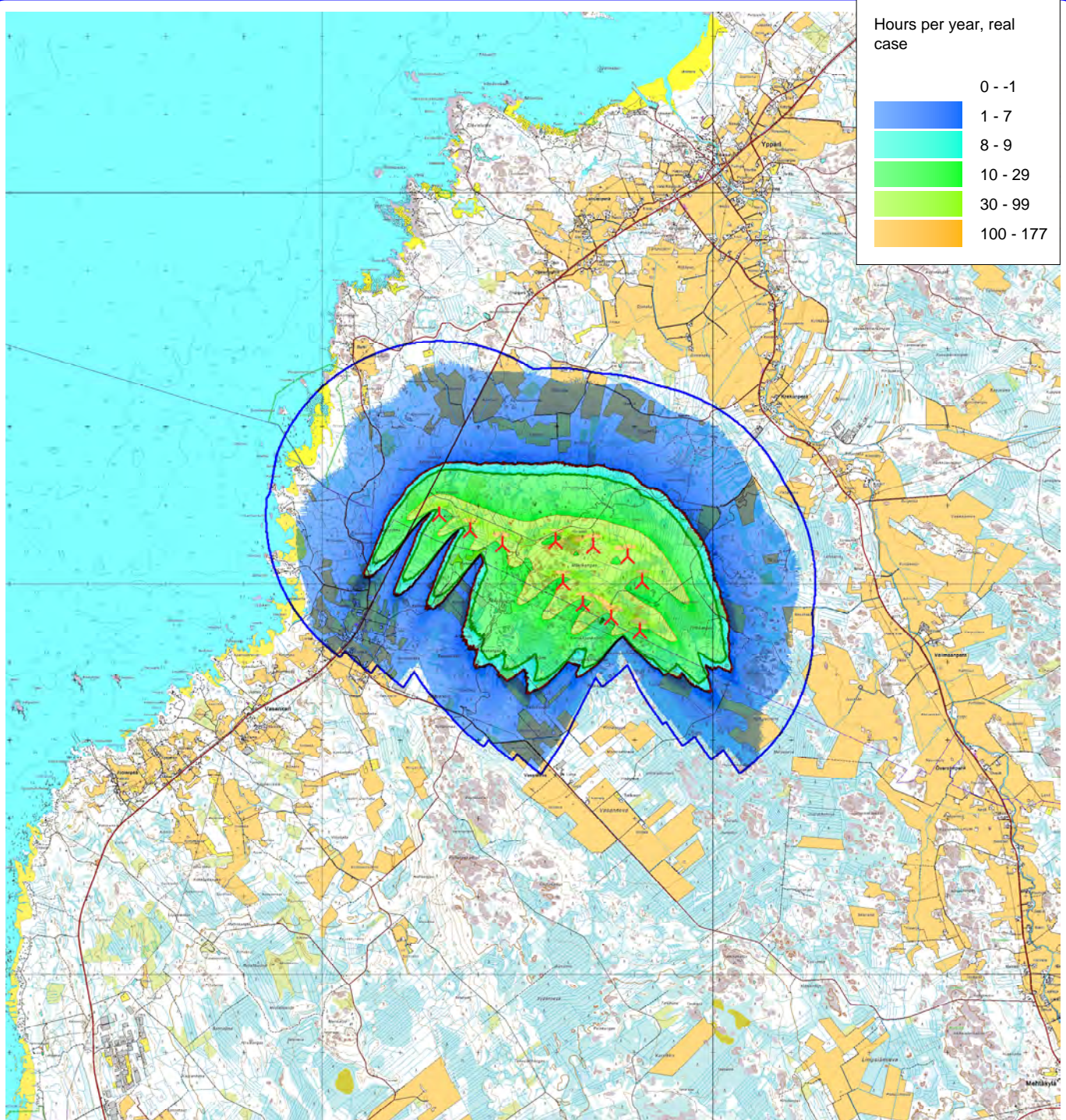
Shadow receptor

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SHADOW - Map

Calculation: Shadow_minlayout_11WTG_realcase_EIAR_KJ



0 1 2 3 4 km

Map: , Print scale 1:75 000, Map center KKJ Finland Zone: 2 East: 2 503 170 North: 7 140 544

🚧 New WTG

Isolines showing shadow in Hours per year, real case

0 8 10 30