

Project:

Makikangas_MASTER

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28.7.2011 14:04 / 1

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wpd Scandinavia AB

Ferkens Gränd 3

SE-111 30 Stockholm

+46 733 99 00 40

Karoliina Joensuu / karoliina.joensuu@wpd.fi

Calculated:

28.7.2011 14:02/2.7.486

SHADOW - Main Result**Calculation:** Shadow_maxlayout 14WTG_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	802	887	1191	1602	604	484	506	8715

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

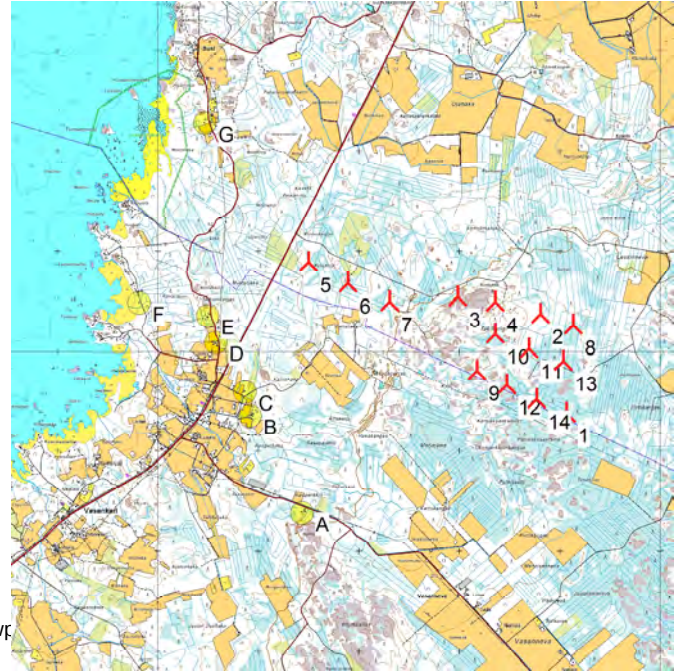
A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:

Height contours used: Height Contours: CONTOURLINE_ONLINEDATA_0.wpd

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				WTG type				Shadow data			
East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Calculation distance	RPM
KKJ Zone: 2								[kW]	[m]	[m]	[RPM]
		[m]									
1	2 504 067	7 139 390	25.0 WTG 7	Yes	ENERCON	E-82 E2-2 300	2 300	82.0	138.4	1 599	18.0
2	2 503 811	7 140 379	25.3 WTG 12	Yes	ENERCON	E-82 E2-2 300	2 300	82.0	138.4	1 599	18.0
3	2 502 987	7 140 546	22.4 WTG 14	Yes	ENERCON	E-82 E2-2 300	2 300	82.0	138.4	1 599	18.0
4	2 503 360	7 140 495	30.0 WTG 13	Yes	ENERCON	E-82 E2-2 300	2 300	82.0	138.4	1 599	18.0
5	2 501 501	7 140 887	10.0 WTG 1	Yes	ENERCON	E-82 E2-2 300	2 300	82.0	138.4	1 599	18.0
6	2 501 894	7 140 680	14.0 WTG 2	Yes	ENERCON	E-82 E2-2 300	2 300	82.0	138.4	1 599	18.0
7	2 502 308	7 140 499	18.3 WTG 3	Yes	ENERCON	E-82 E2-2 300	2 300	82.0	138.4	1 599	18.0
8	2 504 135	7 140 268	24.7 WTG 11	Yes	ENERCON	E-82 E2-2 300	2 300	82.0	138.4	1 599	18.0
9	2 503 178	7 139 811	30.0 WTG 4	Yes	ENERCON	E-82 E2-2 300	2 300	82.0	138.4	1 599	18.0
10	2 503 358	7 140 178	30.0 WTG 10	Yes	ENERCON	E-82 E2-2 300	2 300	82.0	138.4	1 599	18.0
11	2 503 695	7 140 033	28.2 WTG 9	Yes	ENERCON	E-82 E2-2 300	2 300	82.0	138.4	1 599	18.0
12	2 503 475	7 139 670	27.8 WTG 5	Yes	ENERCON	E-82 E2-2 300	2 300	82.0	138.4	1 599	18.0
13	2 504 035	7 139 907	26.0 WTG 8	Yes	ENERCON	E-82 E2-2 300	2 300	82.0	138.4	1 599	18.0
14	2 503 770	7 139 529	25.0 WTG 6	Yes	ENERCON	E-82 E2-2 300	2 300	82.0	138.4	1 599	18.0

Shadow receptor-Input

KKJ Zone: 2										
No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
A	Rianperkkiö	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_maxlayout_14WTG_realcase_EIAR_KJ**Calculation Results**

Shadow receptor

Shadow, expected values

No.	Name	Shadow hours per year [h/year]
A	Rianperkkiö	0:00
B	Talus 2	0:00
C	Talus 1	2:38
D	Vainio	5:20
E	Tarkisenkangas	3:04
F	Rantavainio_holiday	0:00
G	Kivitolppa_holiday	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
1	WTG 7	0:00	0:00
2	WTG 12	0:00	0:00
3	WTG 14	0:00	0:00
4	WTG 13	0:00	0:00
5	WTG 1	21:56	6:30
6	WTG 2	16:08	4:32
7	WTG 3	0:00	0:00
8	WTG 11	0:00	0:00
9	WTG 4	0:00	0:00
10	WTG 10	0:00	0:00
11	WTG 9	0:00	0:00
12	WTG 5	0:00	0:00
13	WTG 8	0:00	0:00
14	WTG 6	0:00	0:00

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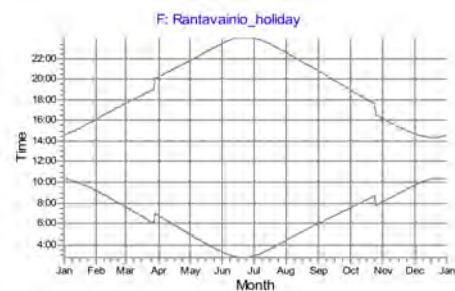
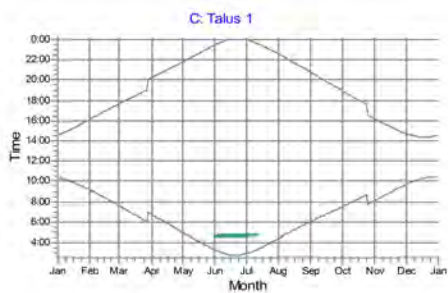
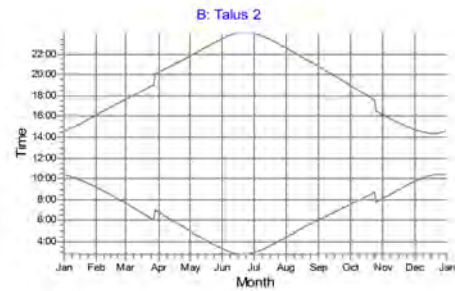
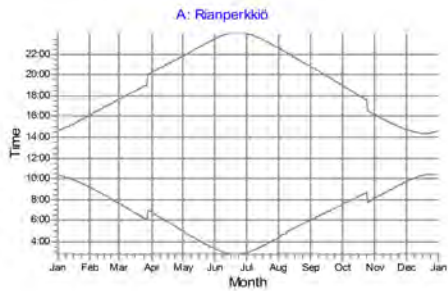
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SHADOW - Calendar, graphical**Calculation:** Shadow maxlayout 14WTG realcase EIAR KJ

WTGs



5: WTG 1



6: WTG 2

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SHADOW - Calendar, graphical**Calculation:** Shadow maxlayout 14WTG realcase EIAR KJ

WTGs

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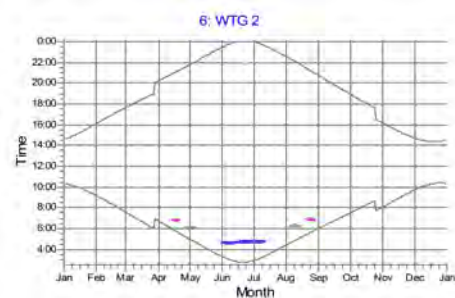
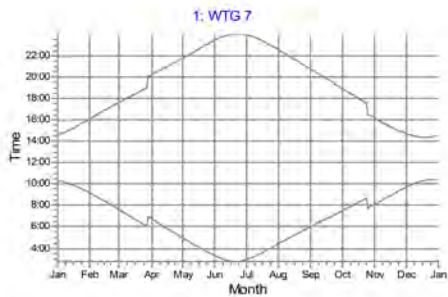
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SHADOW - Calendar per WTG, graphical**Calculation:** Shadow maxlayout 14WTG realcase EIAR KJ

Shadow receptor



C: Talus 1



D: Vainio



E: Tarkisenkangas

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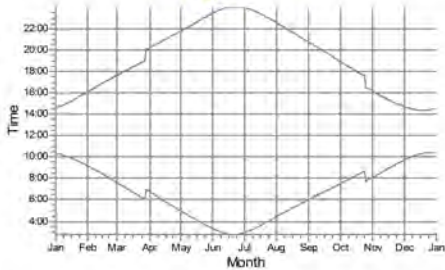
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Calculated:

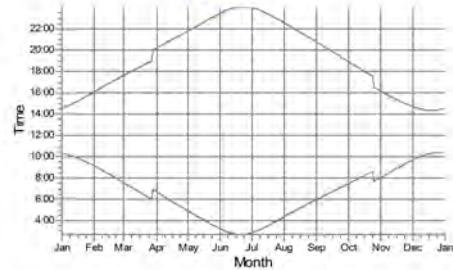
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SHADOW - Calendar per WTG, graphical**Calculation:** Shadow maxlayout 14WTG realcase EIAR KJ

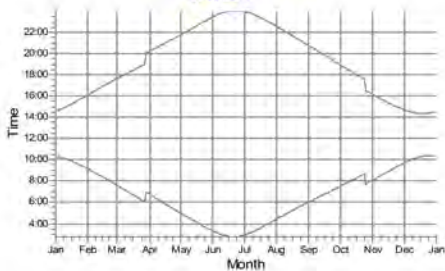
7: WTG 3



8: WTG 11



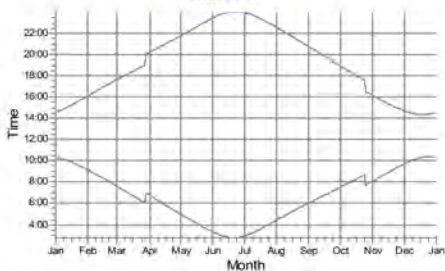
9: WTG 4



10: WTG 10



11: WTG 9



12: WTG 5



Shadow receptor

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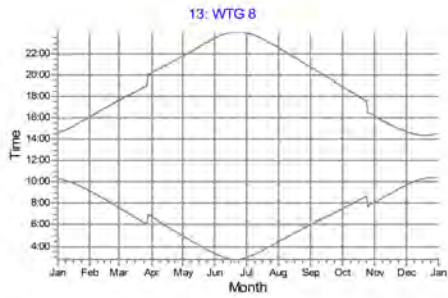
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SHADOW - Calendar per WTG, graphical**Calculation:** Shadow maxlayout 14WTG realcase EIAR KJ

Shadow receptor

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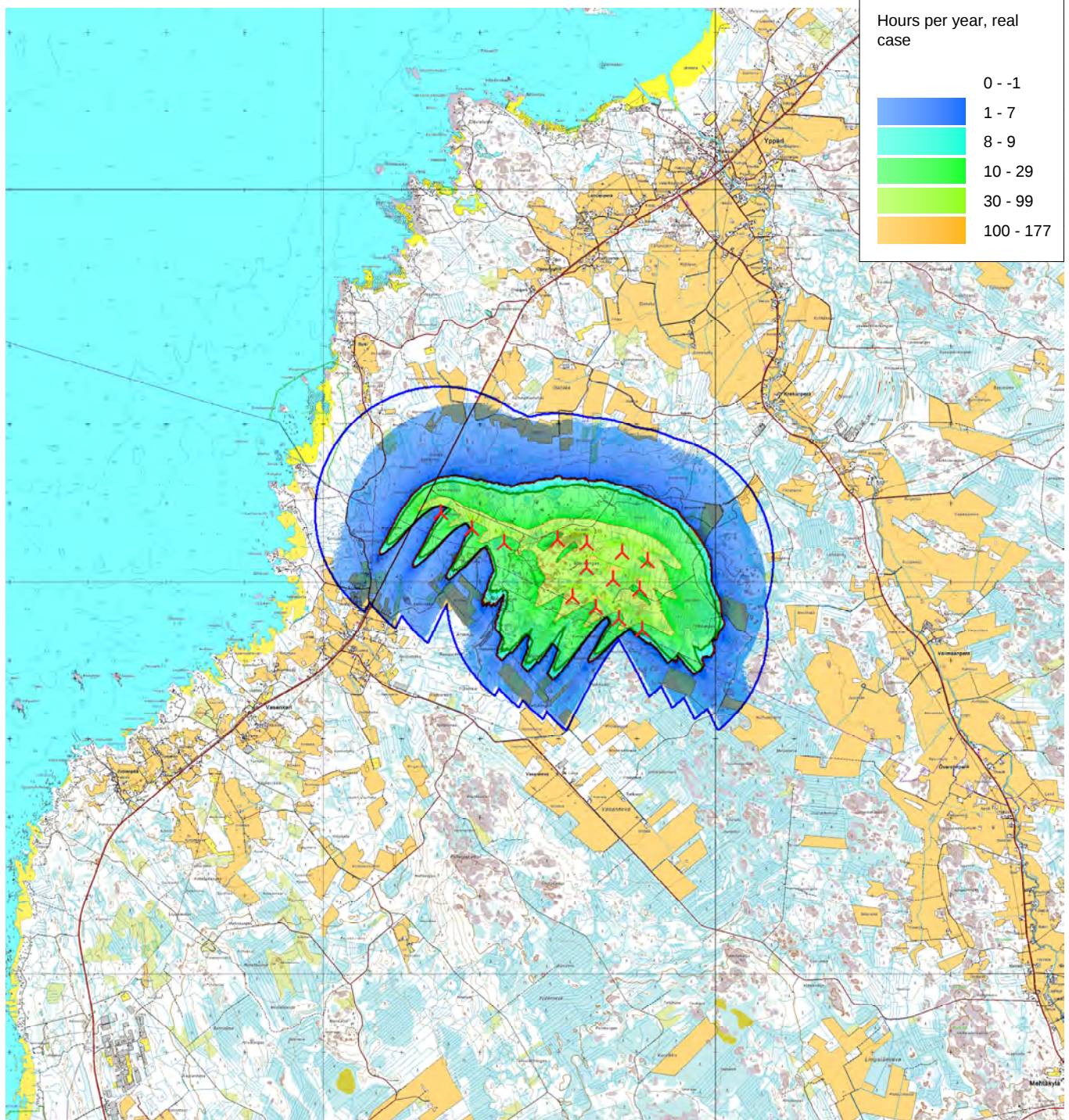
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SHADOW - Map

Calculation: Shadow_maxlayout_14WTG_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