

Project:
Makikangas_MASTER

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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 13:03/2.7.486

SHADOW - Main Result

Calculation: Shadow_minlayout_11WTG_worstcase_EIAR_KJ

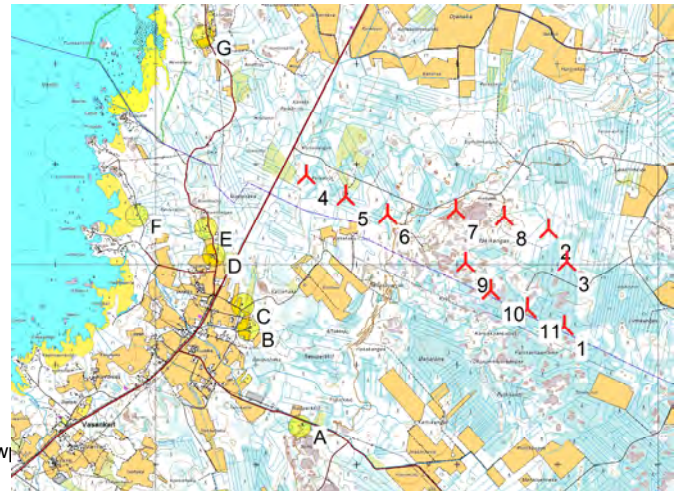
Assumptions for shadow calculations

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

The calculated times are "worst case" given by the following assumptions:
The sun is shining all the day, from sunrise to sunset
The rotor plane is always perpendicular to the line from the WTG to the sun
The WTG is always operating

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.w
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			Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
					Valid	Manufact.	Type-generator				Calculation distance [m]	RPM [RPM]
KKJ Zone: 2			[m]									
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 [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode
		East	North	Z						
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"

Calculation Results

Shadow receptor

No.	Name	Shadow, worst case		
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
A	Rianperkkiö	0:00	0	0:00
B	Talus 2	7:29	49	0:14
C	Talus 1	17:22	76	0:17

To be continued on next page...

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Shadow, worst case

No.	Name	Shadow hours	Shadow days	Max shadow
		per year	per year	hours per day
		[h/year]	[days/year]	[h/day]
D	Vainio	28:19	108	0:21
E	Tarkisenkangas	19:28	82	0:22
F	Rantavainio_holiday	5:18	32	0:14
G	Kivitolppa_holiday	6:18	25	0:25

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	
2	WTG 9	0:00	
3	WTG 8	0:00	
4	WTG 1	38:16	
5	WTG 2	29:07	
6	WTG 3	16:49	
7	WTG 11	0:00	
8	WTG 10	0:00	
9	WTG 4	0:00	
10	WTG 5	0:00	
11	WTG 6	0:00	

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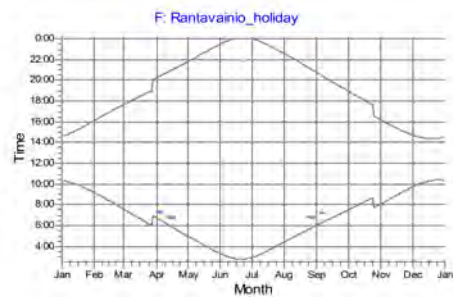
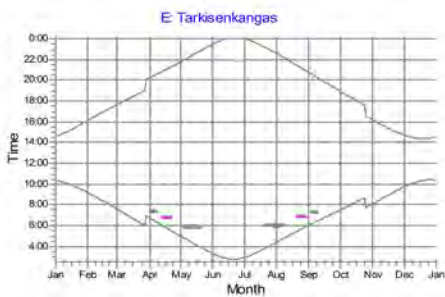
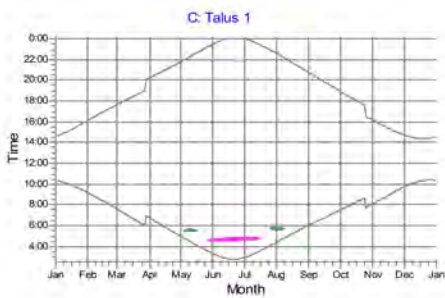
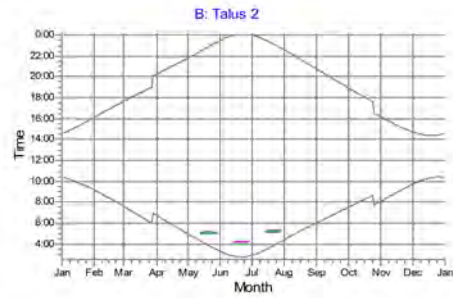
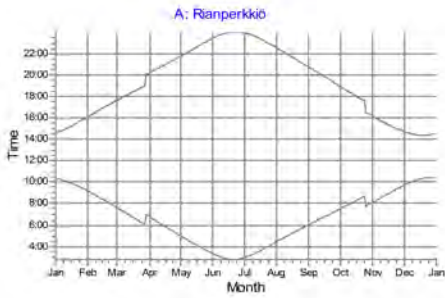
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SHADOW - Calendar, graphical

Calculation: Shadow_minlayout 11WTG worstcase EIAR KJ



WTGs

4: WTG 1

5: WTG 2

6: WTG 3

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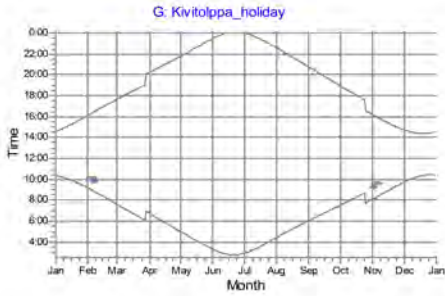
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SHADOW - Calendar, graphical

Calculation: Shadow_minlayout 11WTG worstcase EIAR KJ



WTGs



4: WTG 1



5: WTG 2

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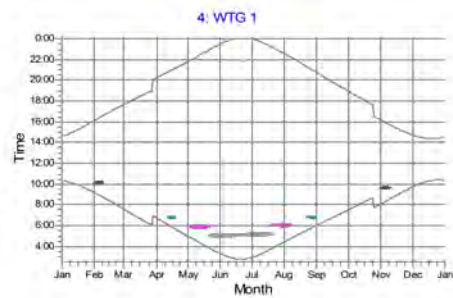
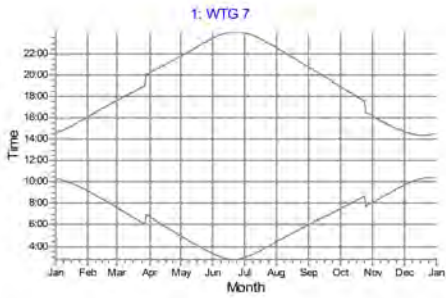
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SHADOW - Calendar per WTG, graphical

Calculation: Shadow_minlayout 11WTG worstcase EIAR KJ



Shadow receptor



B: Talus 2

C: Talus 1



D: Vainio

E: Tarkisenkangas



F: Rantavainio_holiday

G: Kivitolppa_holiday

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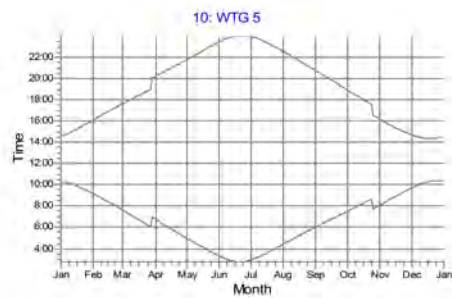
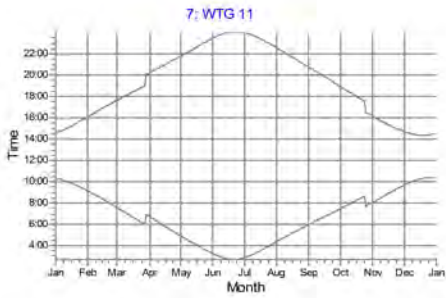
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SHADOW - Calendar per WTG, graphical

Calculation: Shadow minlayout 11WTG worstcase EIAR KJ



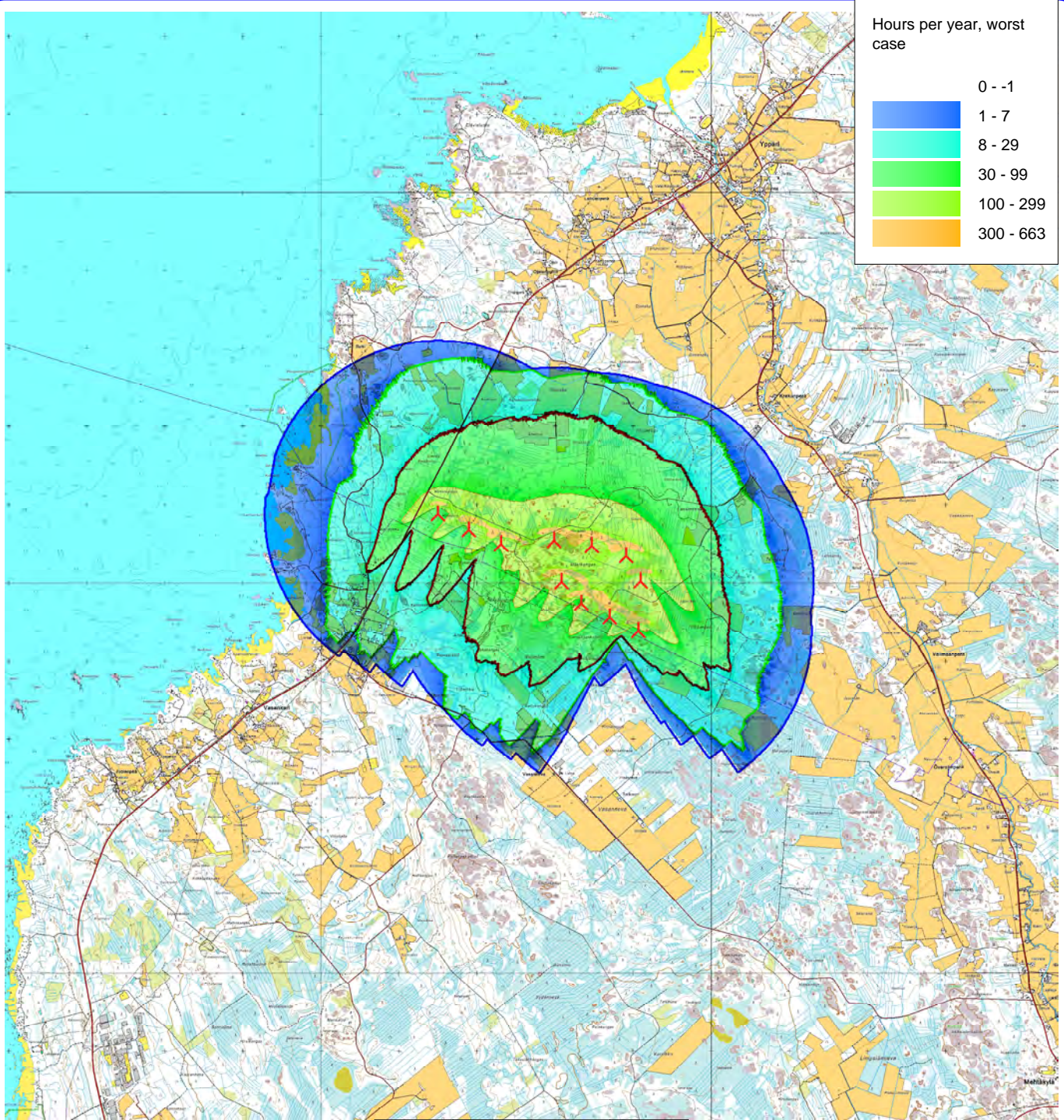
Shadow receptor

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SHADOW - Map

Calculation: Shadow_minlayout_11WTG_worstcase_EIAR_KJ



0 1 2 3 4 km

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

⚓ New WTG

0 8 30

Isolines showing shadow in Hours per year, worst case
100