

Project:

Makikangas_MASTER

Printed/Page

28.7.2011 11:58 / 1

Licensed user:

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 11:57/2.7.486

SHADOW - Main Result

Calculation: Shadow_maxlayout 14WTG 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

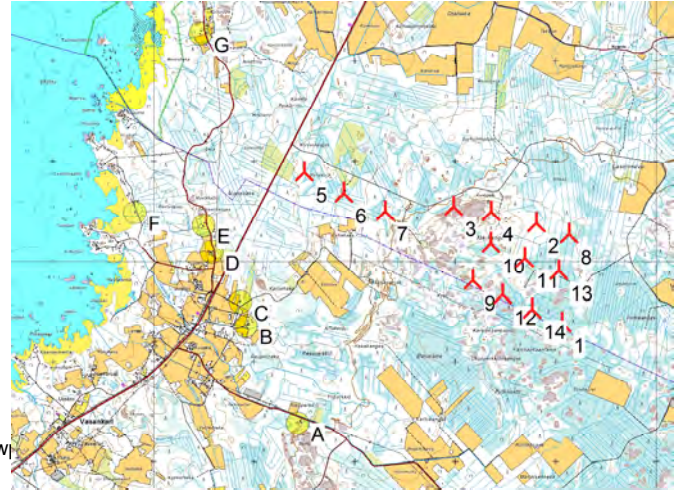
window. The ZVI calculation is based on the following assumptions:

Height contours used: Height Contours: CONTOURLINE_ONLINEDATA_0.w

Obstacles not used in calculation

Eye height: 1.5 m

Grid resolution: 10 m



▲ 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]
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

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"

Project:

Makikangas_MASTER

Printed/Page

28.7.2011 11:58 / 2

Licensed user:

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 11:57/2.7.486

SHADOW - Main Result**Calculation:** Shadow_maxlayout_14WTG_worstcase_EIAR_KJ**Calculation Results**

Shadow receptor

Shadow, worst case

No.	Name	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	0:00	0	0:00
C	Talus 1	8:53	44	0:14
D	Vainio	18:13	80	0:17
E	Tarkisenkangas	11:01	53	0:18
F	Rantavainio_holiday	0:00	0	0:00
G	Kivitolppa_holiday	0:00	0	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	
2	WTG 12	0:00	
3	WTG 14	0:00	
4	WTG 13	0:00	
5	WTG 1	21:56	
6	WTG 2	16:08	
7	WTG 3	0:00	
8	WTG 11	0:00	
9	WTG 4	0:00	
10	WTG 10	0:00	
11	WTG 9	0:00	
12	WTG 5	0:00	
13	WTG 8	0:00	
14	WTG 6	0:00	

Project:

Makikangas_MASTER

Printed/Page

28.7.2011 11:58 / 10

Licensed user:

wpd Scandinavia AB

Ferkens Gränd 3

SE-111 30 Stockholm

+46 733 99 00 40

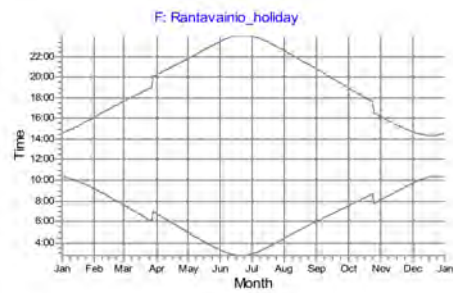
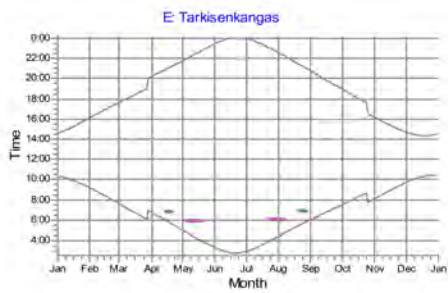
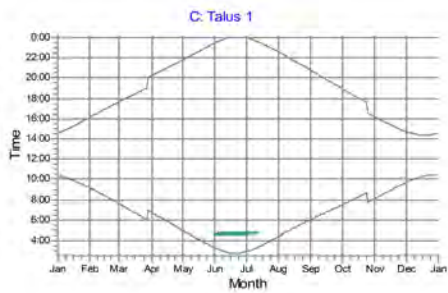
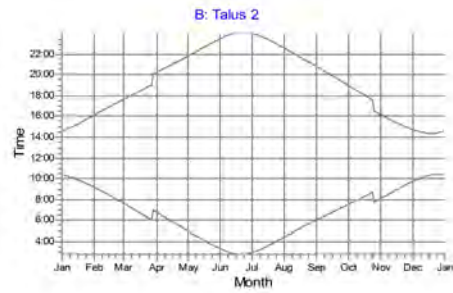
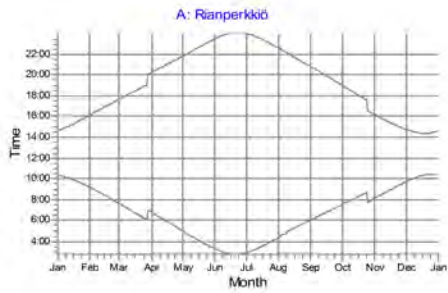
Karoliina Joensuu / karoliina.joensuu@wpd.fi

Calculated:

28.7.2011 11:57/2.7.486

SHADOW - Calendar, graphical

Calculation: Shadow_maxlayout 14WTG worstcase EIAR_KJ



WTGs



5: WTG 1



6: WTG 2

Project:

Makikangas_MASTER

Printed/Page

28.7.2011 11:58 / 11

Licensed user:

wpd Scandinavia AB

Ferkens Gränd 3

SE-111 30 Stockholm

+46 733 99 00 40

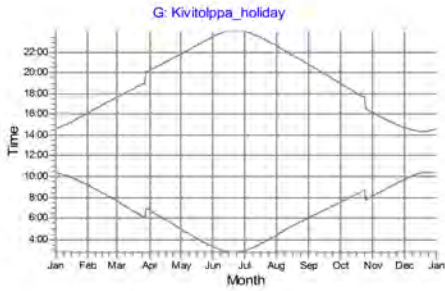
Karoliina Joensuu / karoliina.joensuu@wpd.fi

Calculated:

28.7.2011 11:57/2.7.486

SHADOW - Calendar, graphical

Calculation: Shadow_maxlayout 14WTG worstcase EIAR_KJ



WTGs

Project:

Makikangas_MASTER

Printed/Page

28.7.2011 11:58 / 26

Licensed user:

wpd Scandinavia AB

Ferkens Gränd 3

SE-111 30 Stockholm

+46 733 99 00 40

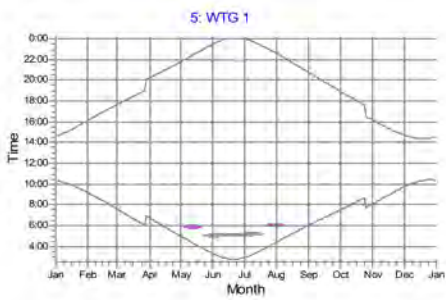
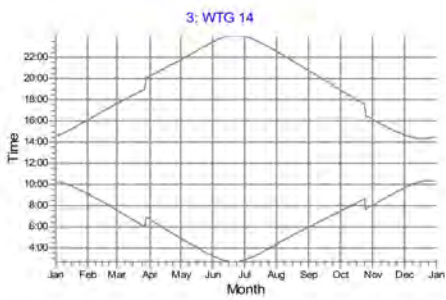
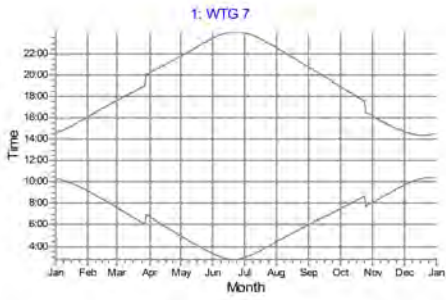
Karoliina Joensuu / karoliina.joensuu@wpd.fi

Calculated:

28.7.2011 11:57/2.7.486

SHADOW - Calendar per WTG, graphical

Calculation: Shadow maxlayout 14WTG worstcase EIAR KJ



Shadow receptor

 C: Talus 1

 D: Vainio

 E: Tarkisenkangas

Project:

Makikangas_MASTER

Printed/Page

28.7.2011 11:58 / 27

Licensed user:

wpd Scandinavia AB

Ferkens Gränd 3

SE-111 30 Stockholm

+46 733 99 00 40

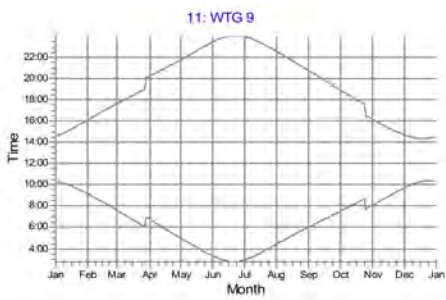
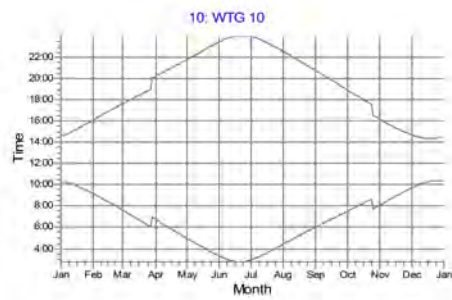
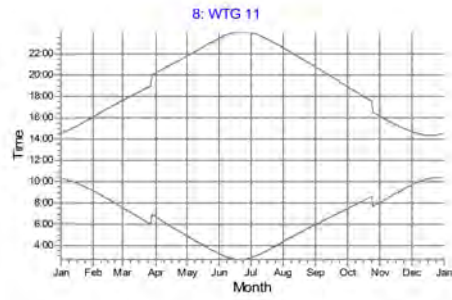
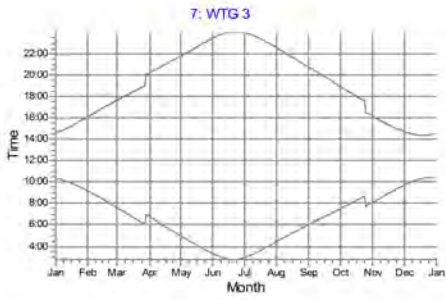
Karoliina Joensuu / karoliina.joensuu@wpd.fi

Calculated:

28.7.2011 11:57/2.7.486

SHADOW - Calendar per WTG, graphical

Calculation: Shadow maxlayout 14WTG worstcase EIAR KJ



Shadow receptor

Project:

Makikangas_MASTER

Printed/Page

28.7.2011 11:58 / 28

Licensed user:

wpd Scandinavia AB

Ferkens Gränd 3

SE-111 30 Stockholm

+46 733 99 00 40

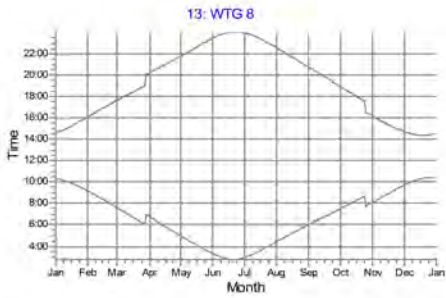
Karoliina Joensuu / karoliina.joensuu@wpd.fi

Calculated:

28.7.2011 11:57/2.7.486

SHADOW - Calendar per WTG, graphical

Calculation: Shadow maxlayout 14WTG worstcase EIAR KJ



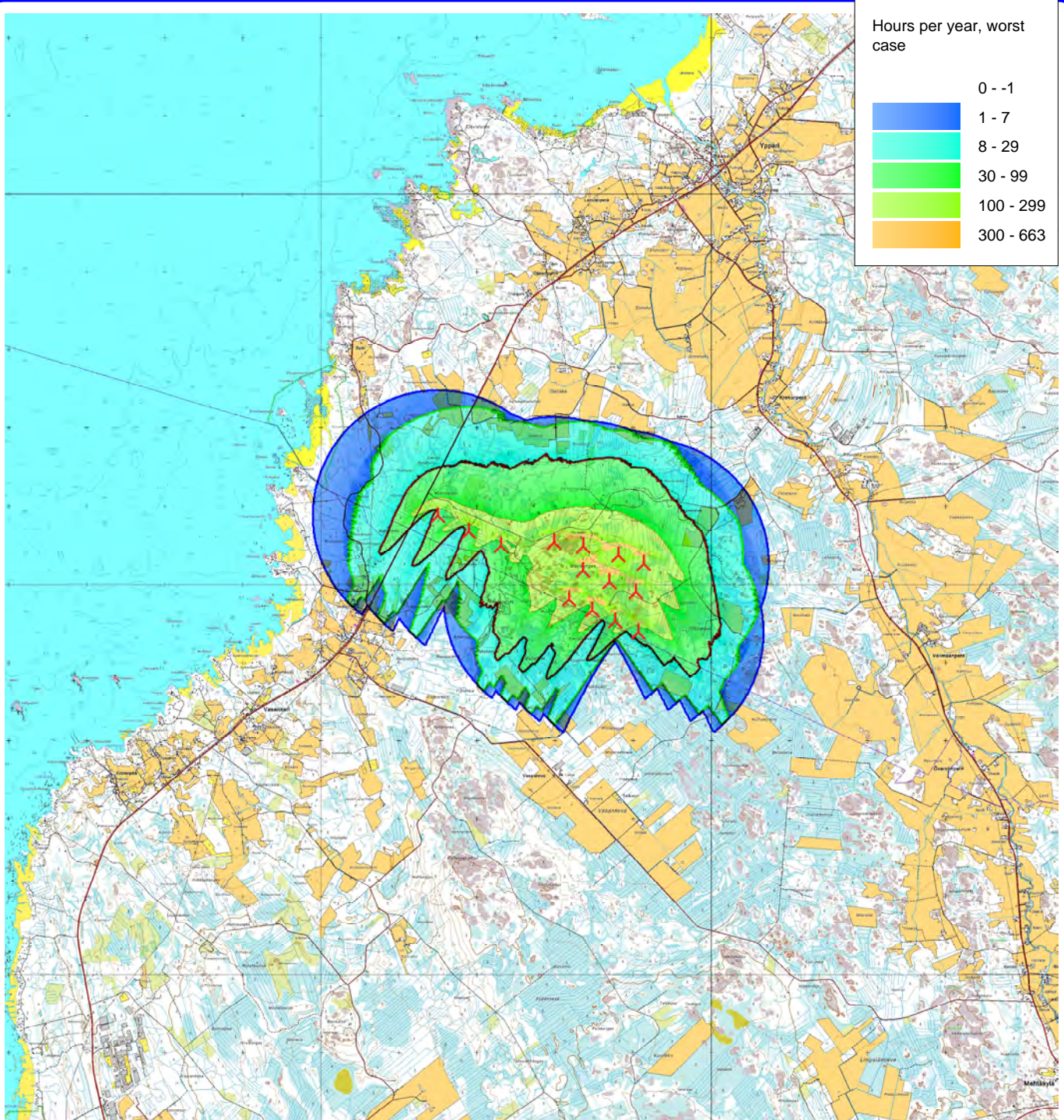
Shadow receptor

Project:
Makikangas_MASTER

Printed/Page
28.7.2011 11:58 / 29
Licensed user:
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 11:57/2.7.486

SHADOW - Map

Calculation: Shadow_maxlayout 14WTG worstcase EIAR KJ



Hours per year, worst case

0 - 1
1 - 7
8 - 29
30 - 99
100 - 299
300 - 663

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

Isolines showing shadow in Hours per year, worst case
█ 0 █ 8 █ 30 █ 100